Case No. 16-1871-EL-BGN

Icebreaker Windpower Inc.

Application-Part 1 of 13

Part 1 includes:

- Application Cover Letter
- Affidavit from Lorry Wagner, President, Icebreaker Windpower Inc.
- Application Narrative

Date Filed: February 1, 2017

Filed by:

Christine M.T. Pirik (0029759)
Terrence O'Donnell (0074213)
William Vorys (0093479)
DICKINSON WRIGHT PLLC
150 East Gay Street, Suite 2400
Columbus, Ohio 43215
(614) 591-5461
cpirik@dickinsonwright.com
todonnell@dickinsonwright.com
wvorys@dickinsonwright.com

DICKINSON WRIGHT PLLC

150 E. GAY STREET, 24TH FLOOR
COLUMBUS, OH 43215-3192
TELEPHONE: (614) 744-2570
FACSIMILE: (844) 670-6009
http://www.dickinsonwright.com

TERRENCE O'DONNELL
TODONNELL@DICKINSONWRIGHT.COM
(614) 744-2583

February 1, 2017

Ms. Barcy F. McNeal, Secretary
Ohio Power Siting Board
Docketing Division
180 East Broad Street, 11th Floor
Columbus, Ohio 43215

Re: Case No. 16-1871-EL-BGN
Icebreaker Windpower Inc.

Dear Ms. McNeal:

Accompanying this letter for filing are 5 complete paper copies and 10 USB drives containing the public version of the application by Icebreaker Windpower Inc., for a Certificate to Construct a Wind-Powered Electric Generation Facility in Cuyahoga County, Ohio. The original application was electronically filed.

Along with this filing, we also provided to the Docketing Division paper copies of the redacted portions of the application, and have filed a Motion for Protective Order and Memorandum in Support requesting protective treatment of the confidential information contained therein.

As further explained in the Application, the Applicant is working with the U.S. Department of Energy on the National Environmental Policy Act environmental assessment process and the Section 106 State Historic Preservation Office review. In addition, concurrent with this filing, the Applicant continues to work with the U.S. Army Corps of Engineers, the U.S. Coast Guard, and other state agencies in many related but separate processes involving permits and reviews.

The Applicant further notes that the only information presented in the preapplication notification letter that was revised is the date and location of the public information meeting. Subsequent letters filed in this docket rescheduled the public information meeting to November 3, 2016, and verified that the requisite notice of the new date was sent to affected entities and published in a newspaper in general circulation in Cuyahoga County.

Finally, in accordance with Rule 4906-2-04 of the Ohio Administrative Code, we provide the following information:

Name of the Applicant:

Icebreaker Windpower Inc.
1938 Euclid Avenue, Suite 200
Cleveland, Ohio 44115

Name and location of the Facility:

Icebreaker Wind Farm
Cuyahoga County, Ohio

Name of authorized representative:

Christine M.T. Pirik
Dickinson Wright PLLC
150 East Gay Street, 24th Floor
Columbus, Ohio, 43215
614-591-5461
cpirik@dickinsonwright.com

Notarized Statement:

See attached Affidavit of Lorry Wagner
President of Icebreaker Windpower Inc.

Thank you for your consideration. We look forward to working with the Ohio Power Siting Board throughout the permitting process.

Respectfully submitted,

/s/ Terrence O'Donnell
Terrence O'Donnell (0074213)
(Counsel of Record)
Christine M.T. Pirik (0029759)
William V. Vorys (0093479)
Dickinson Wright PLLC
150 East Gay Street, Suite 2400
Columbus, Ohio 43215
Phone: (614) 744-2583
Email: todonnell@dickinsonwright.com
cpirik@dickinsonwright.com
wvorys@dickinsonwright.com
Attorneys for Icebreaker Windpower Inc.

TO'D:KB Enclosures

BEFORE
THE OHIO POWER SITING BOARD

In the Matter of the Application of Icebreaker Windpower Inc., for a Certificate to Construct a Wind-Powered Electric Generation Facility in Cuyahoga County, Ohio.	))))	Case No: 16-1871-EL-BGN

AFFIDAVIT OF PRESIDENT OF ICEBREAKER WINDPOWER INC.

STATE OF OHIO :
: ss
COUNTY OF CUYAHOGA :

I, Lorry Wagner, 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 on my personal knowledge.

1. I am the President and highest ranking executive officer of Icebreaker Windpower Inc. ("Icebreaker Windpower").

2. I have reviewed Icebreaker Windpower's Application for a Certificate to Construct a Wind-Powered Electric Generation Facility in Cuyahoga County, Ohio.

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.

Lorry Wagner, President
Icebreaker Windpower Inc.

Sworn to before and signed in my presence this 27th day of January 2017.

Notary Public

CANDICE HINDERSCHIED
NOTARY PUBLIC, STATE OF OHIO

APPLICATION

TO THE

OHIO POWER SITING BOARD

FOR A

CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY & PUBLIC NEED

FOR THE

ICEBREAKER WIND FARM

Lake Erie and City of Cleveland
Cuyahoga County, Ohio

Case No. 16-1871-EL-BGN
January 2017

Applicant: Icebreaker Windpower Incorporated
1938 Euclid Avenue, Suite 200
Cleveland, OH 44115
Contact: Beth A. Nagusky, Director of Sustainable Development
216.965.0627

Prepared By: Environmental Design & Research, Landscape Architecture, Engineering & Environmental Services, D.P.C. (EDR)
217 Montgomery Street, Suite 1000
Syracuse, New York 13202
Contact: Benjamin Brazell, Principal
315.471.0688

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Exhibit Q. LimnoTech Boat Survey
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Exhibit CC. Visual Impact Assessment

COMMONLY USED ACRONYMS and ABBREVIATIONS

CDF	Confined Disposal Facility
CPP	Cleveland Public Power
dBA	Decibels, A-weighted
EDR	Environmental Design & Research, Landscape Architecture, Engineering & Environmental Services, D.P.C.
EAP	Emergency Action Plan
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Administration
FORUSA	Fred. Olsen Renewables, USA
FOWIC	Fred. Olsen Windcarrier
GIS	Geographic Information System
GLT	Great Lakes Towing
HDD	Horizontal Directional Drilling
Hz	Hertz
IEC	International Electrotechnical Commission
kV	Kilovolt
LCOE	Levelized Cost of Energy
LEEDCo	Lake Erie Energy Development Corporation
MB	Mono Bucket
MW	Megawatts
MWh	Megawatt hours
NAAQS	National Ambient Air Quality Standards
NHL	National Historic Landmark
NPDES	National Pollutant Discharge Elimination System
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NTIA	National Telecommunications and Information Administration
O&M	Operations and Maintenance
OAC	Ohio Administrative Code
OAI	Ohio Archaeological Inventory
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
Ohio EPA	Ohio Environmental Protection Agency
OHI	Ohio Historical Inventory
OPSB	Ohio Power Siting Board
ORC	Ohio Revised Code
PAR	Photosynthetic Active Radiation
PJM	PJM Interconnection, LLC
RSZ	Rotor Swept Zone
SLL	Submerged Lands Lease
USACE	U.S. Army Corps of Engineers

USFWS	U.S. Fish and Wildlife Service
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
VIA	Visual Impact Assessment

4906-4-01 INTRODUCTION

(A) REQUIREMENTS FOR FILING CERTIFICATE APPLICATIONS

Icebreaker Windpower Incorporated (hereafter referred to as the "Applicant"), is proposing to construct Icebreaker Wind, a wind-powered electric generation facility located in Lake Erie, Cuyahoga County, Ohio. 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 generation 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, D.P.C. (EDR) of Syracuse, New York. EDR has nearly 20 years of experience with siting and permitting wind-powered electric generation facilities.

As used in this Application, specific terms will have the meanings set forth below:

- Project Area – the "Project Area" consists of the total wind-powered electric generation facility, including associated setbacks.
- Facility – a "facility" or "wind-powered electric generation facility" or "wind-energy facility" includes all the turbines, collection lines, access roads, any associated substations, and all other associated equipment.

(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

The Applicant is proposing to construct the Facility in Lake Erie, Cuyahoga County, which would consist of 6 wind turbine generators, along with submerged electric collection cables, and a Facility substation. The energy generated at the Facility will deliver power to a single point of interconnection on the existing Cleveland Public Power (CPP) electric grid – 138 kilovolt (kV) Lake Road Substation.

(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. Increasing reliance on Ohio's vast offshore wind resource will add fuel diversity to the state's and region's electric supply mix, help reduce air pollution in an area that historically has been a non-attainment area for 2.5 micron particulate matter, lead, and ozone, reduce greenhouse gas emissions, and create local jobs and spur economic development. The electricity generated by the Facility will be transferred to the transmission grid owned by CPP. Two-thirds of the Facility's output has been sold to CPP under a long-term power purchase agreement. The balance of the power will be delivered to the grid operated by PJM Interconnection, LLC (PJM) and sold in the wholesale market or under bi-lateral power purchase agreement(s).

(2) Description of the Facility

The Facility turbines will be constructed on the Lake Erie lake bed, on leased submerged state land off the coast of the City of Cleveland, in Cuyahoga County, Ohio. These rights were obtained through a Submerged Land Lease with the State of Ohio. The Facility presented herein consists of 6 wind turbine generators, each with a nameplate capacity rating of 3.45 megawatts (MW) for a total generating capacity of 20.7 MW. The Facility is expected to operate for approximately 8,200 hours annually, and have an approximate capacity factor of 41.4%, generating approximately 75,000 megawatt-hours (MWh) of electricity each year. Figure 03-1 depicts the proposed Facility. A detailed description of the Facility, including each Facility component, can be found in Sections 4906-4-03(A) and 4906-4-03(B) of this Application.

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

Initially, multiple siting locations were considered for Facility siting and layout. As the Project evolved, siting constraints led to the proposed layout presented in this Application. The Project Area was selected based on

multiple factors. The Ohio Department of Natural Resources (ODNR) Office of Coastal Management 2009 Wind Turbine Placement Favorability Analysis ("Favorability Analysis") was an important resource in assessing the suitability of potential sites and was relied upon when determining potential project areas. The Favorability Analysis incorporated data including shipping lanes and navigable waterways, bird and fish habitat, commercial and sport fishery efforts, shipwrecks, restricted areas, industry and utilities. This analysis identified more extensive limiting factors closer to shore, and only minimal limiting factors further offshore. A detailed description of Project Area selection and siting constraints can be found in Section 4906-4-04 of this Application.

(4) Project Schedule

Acquisition of land rights began in January 2011 and was completed in February 2014. A public information meeting was held on November 3, 2016 to facilitate public interaction with the Applicant and expert consultants, and included information on visual/aesthetics, ecological studies, project purpose and need, and Facility component technology (e.g., wind turbine, foundation, and submerged electrical collection cables). This Certificate Application was officially submitted in February 2017, and it is anticipated that the Certificate will be issued in 2017. Construction is anticipated to begin in May 2018 and be completed by October 2018. The Facility will be placed in service by November 2018. 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

Icebreaker Wind is designed to be a demonstration-scale project, as it is the first proposed freshwater offshore wind farm in North America. The 20.7 MW Project will have the capacity to generate approximately 75,000 MWh of emissions-free electricity that will collect to an electric substation in the City of Cleveland, Cuyahoga County. Although this Facility is meant to be a demonstration-scale project to help assess the potential success for future larger-scale offshore wind farms in Lake Erie and other Great Lakes, the Applicant does not currently have future plans with respect to this point of interconnection.

(2) Description of Applicant and Operator

The Applicant was formed through the collaboration of the Lake Erie Energy Development Corporation (LEEDCo) and Fred. Olsen Renewables (FOR). LEEDCo was created by the Great Lakes Energy Development Task Force, then developed and launched by NorTech Energy Enterprise, the Cleveland

Foundation, City of Cleveland, Cuyahoga and Lorain Counties, Ohio. It was founded as a public-private, nonprofit (501(c)3) regional corporation to advance the development of a demonstration scale project in Lake Erie, and help stimulate a Great Lakes offshore wind industry. In 2010, Lake and Ashtabula Counties joined; Erie County, Pennsylvania was added in 2014, bringing together the necessary constituencies and stakeholders from Lake Erie's coastal counties.

In May 2015, FOR established its U.S. headquarters in Cleveland, Ohio under the name of Fred. Olsen Renewables USA (FORUSA), to develop, construct, and operate the Facility. FOR has been developing wind farms across Europe since 1992 and controls assets for over 2,000 MWs of generation. FOR's business model starts with an idea and develops the project all the way through operation for the life of the project and then considers either repowering or decommissioning. As such, they are the largest independent power producer in the United Kingdom (UK). FOR also has assets in France, Sweden, and Norway, and almost 25 years of experience in wind power development.

4906-4-03 PROJECT DESCRIPTION AND SCHEDULE

(A) PROJECT AREA DESCRIPTION

(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 ESRI ArcGIS Online World Topographic Map Service and includes bathymetric contours. 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

Submerged Land Lease

LEEDCo entered into a 50-year submerged land lease (SLL) with the State of Ohio, File Number SUB-2356-CU, which commenced on February 1, 2014 (see Exhibit A). The SLL covers the turbine sites, cable right-of-way, and the Cleveland Public Power (CPP) Substation. As per the SLL, the acreage to be used in the construction/operation for the Facility consists of 0.4 acre for the substation and 4.2 acres for the six wind turbine sites. The cable right-of-way leased area consists of a 100-foot-wide strip along the approximately 12.1-mile cable route (inter-array and export cables), totaling approximately 135 acres. The Applicant also obtained an upland easement from the City of Cleveland, which was a precondition to obtaining the SLL from the State of Ohio. The upland easement is a non-exclusive property easement with the City of Cleveland for 0.2085 acres of parcels adjacent to the SLL. A request to assign the SLL to Icebreaker Windpower Inc., was submitted to the ODNR on September 23, 2016 and deemed complete by the ODNR on October 1, 2016. The ODNR provided a Consent to Assignment of the SLL (the "Consent") on October 19, 2016 and the Applicant returned fully executed copies of the Consent to the ODNR for countersignature on November 10, 2016. A request to assign the SLL to Icebreaker Windpower Inc. was approved by the State of Ohio, acting by and through the ODNR, as evidenced by the attached "Consent to Assignment of Lake Erie Submerged Lands Lease File Number SUB-2356-CU" (Exhibit B) dated January 18, 2017.

Great Lakes Towing

The Applicant will lease space in an existing building from Great Lakes Towing (GLT), located on Division Road approximately 1.6 kilometers (km) from the Cleveland outer harbor on the Old River (a portion of the Cuyahoga River), to serve as the Operations & Maintenance (O&M) Center for the Facility. The entire GLT property site is approximately 6.3 acres. However, only a small portion of an existing GLT building will be leased by the Applicant. The lease will include a small space for storage of spare parts, and a condition for the Applicant to share space with GLT for access to water and locker room/bathroom facilities. It is anticipated that the area to be leased will not exceed 0.5 acre in size.

(B) DETAILED DESCRIPTION OF PROPOSED FACILITY

(1) Description Details for the Project

(a) *Type and Characteristics of Turbine*

The Facility will consist of 6 Mitsubishi Heavy Industries Vestas Offshore Wind (MVOW) - Vestas 3.45 MW offshore wind turbines (V126-3.45 MW™ – International Electrotechnical Commission [IEC] wind class IIA). Included in Exhibit C1 and Exhibit C2 (submitted under seal) are details of the Vestas V126-3.45 MW IEC IIA turbine. Each wind turbine consists of three major components: the tower sections, the nacelle, and the rotor with blades. Descriptions of each of the turbine components are provided below and illustrated in Exhibit D. 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 22.5 m/s (50.3 mph). Preliminary analysis indicates that the turbines will operate for approximately 8,200 hours annually, and have an annual capacity factor of 41.4%. Accounting for the total generating capacity of 20.7 MW, anticipated operating times, and turbine capacity factors, the Facility will generate approximately 75,000 MWh of electricity each year.

Heat rate is not applicable to wind energy facilities.

(b) *Turbine Dimensions*

Table 1 and Exhibit D present the dimensions of the V126-3.45 MW in feet and meters. Hub height is the height to the center of the rotor, as measured from the chart datum water level[1], while total turbine

[1] According to the National Oceanic and Atmospheric Administration (2015), the chart datum (low water datum) level for Lake Erie is 569.2 feet (173.5 meters).

height (tip height) is the height of the entire turbine, as measured from the chart datum water level to the tip of the blade when rotated to the highest position.

Table 1. Approximate Turbine Dimensions

Turbine Model	Hub Height	Rotor Diameter	Blade Length	Total (Tip) Height
V126-3.45 MW™ IEC IIA	83 meters (272 feet)	126 meters (413 feet)	62.9 meters (206 feet)	146 meters (479 feet)

(c) *Fuel Quantity and Quality*

The proposed Facility is a wind power facility, and as such, this section is not applicable.

(d) *List of Pollutants Emissions and Quantities*

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

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

Facility operation will not require the use of water for cooling or any other activities, nor will Facility operation involve the discharge of water or waste into streams or water bodies. Therefore, this section is not applicable.

(2) Description of Major Equipment

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

Foundation

The Mono Bucket (MB) will be utilized as the turbine foundation for the Facility. The MB combines the benefits of a gravity base, a monopile, and a suction bucket. In essence, it is a Suction Installed Caisson (SICA) or an "all-in-one" steel foundation system designed to support offshore wind turbines. The MB foundation is comprised of three sections: a steel skirt that will be embedded in the lakebed, a lid section, and a shaft that above the mudline resembles the elements of a standard offshore wind monopile (Inset 1).

The Mono Bucket is installed using both gravity and a suction pump system including skirt nozzles and internal pressure chambers. When the 500 to 600 ton foundation is placed on the lakebed, the steel skirt initially self-penetrates into the soil about 3 to 6 feet. Then water is pumped from the bucket causing the

foundation to penetrate into the lakebed due to the higher external pressure from the water outside of the bucket (Exhibit E)[2]. Once the bucket has achieved the specified penetration, the pump is stopped. At that time the bucket will have captured a large volume of lakebed sediment (approximately 3,500 tons), effectively becoming a gravity-based foundation embedded into the lakebed. This installation method eliminates the need for pile driving or dredging, thereby eliminating noise and soil disturbance. When compared with conventional monopile or jacket foundations, the MB foundation minimizes environmental impacts and eliminates significant installation steps, as well as equipment.

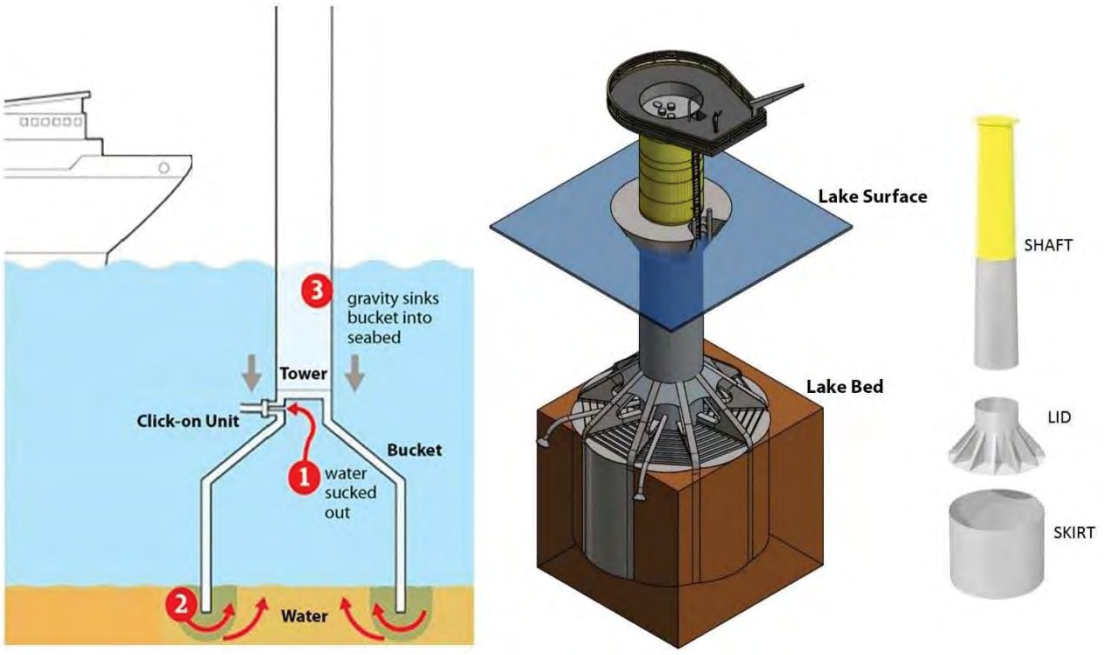
In 2002, the first turbine erected on a MB foundation, a 3 MW Vestas V90 turbine, began operation in the North Sea off the coast of Frederikshavn, Denmark. This bucket has a diameter of 14 meters and a skirt height of 6 meters, and remains operational to this day. The dynamic load performance on this turbine has been monitored continuously for 14 years, resulting in a deep understanding of dynamic and cyclic loading (UF, 2012). Since then, other MB installations in the North Sea have also performed very well, withstanding sustained waves greater than 70 feet, far in excess of extreme wave heights of 15 to 20 feet (4.5 to 6 meters) recorded in Lake Erie (National Oceanic Atmospheric Administration [NOAA], 2016). Section 4906-4-08(A) describes in detail design engineering that has been performed to ensure that MB foundations will withstand loads from waves, wind, and ice.

A full geotechnical survey was conducted in September 2015 at each of the turbine foundation sites. Preliminary designs of the MB foundation have been completed (Exhibit D), and approximate dimensions are listed below in Table 2. The portion of the foundation above the water line will be painted yellow.

Table 2. Approximate Foundation Dimensions

Foundation	Bucket Diameter	Shaft Diameter	Foundation Overall Height
Mono Bucket	17.0 meters (55.8 feet)	4.5 meters (14.8 feet)	36.9 meters (121 feet)

[2] Demonstration of this principle can be viewed at: https://youtu.be/l52K67vyGVA



Inset 1. Mono Bucket General Arrangement

The Applicant engaged Fred. Olsen Windcarrier (FOWIC) to perform the detailed installation engineering and planning work necessary prior to construction. Universal Foundation (UF), headquartered in Aalborg, Denmark, is an offshore foundation company that will be responsible for the completion of the detailed engineering design, the fabrication, and installation of the MB foundation in the lakebed. UF will subcontract the fabrication of the MB foundations to a fabricator located in the U.S. The Port of Cleveland has been selected as the quayside staging area for the project. The GLT facility on the Cuyahoga River in Cleveland, Ohio, has been identified as the best location for the O&M Center, due to the quality of the existing infrastructure and its close proximity to the Project Area.

UF has not yet selected the fabricator for the MB foundations. However, through a preliminary competitive process completed in May 2016, 4 U.S. fabricators have been qualified and short-listed to compete for the fabrication contract. The selection will be based on a final competitive bid process, and therefore, the final assembly and delivery logistics vary based on each of the fabricators. However, all 4 fall in to one of two scenarios:

- MB Scenario #1: The MB foundations will be fabricated complete and shipped complete via barge directly to the installation site.

- MB Scenario #2: Components will be fabricated and shipped to the Port of Cleveland via truck and/or barge. Final assembly will be performed at the Port of Cleveland and towed directly to the installation site.

A heavy lift crane vessel will be utilized to perform the lifting operations related to the foundation and turbine installation processes. It will consist of a barge outfitted with legs that can be raised and lowered. The legs are lowered to the lakebed and the barge is jacked-up via the legs to stabilize the barge during lifting operations. A mobile crane will be deployed on the barge. Prior to any installation work, a full mobilization of all vessels will be conducted including installation of necessary grillage (structural load distribution elements to avoid excessive local loads on the vessels) and seafastening (structural elements providing horizontal and uplift support of a component during sea transport operations).

MB foundation components will be transported to the project site per either MB Scenario #1 or MB Scenario #2 as defined above. The heavy lift crane vessel will be towed to the site where it will jack-up and wait for the feeder barge carrying the MB foundation. Following the positioning and mooring of the feeder barge, a pumping assembly that includes all of the pumps, valves, and piping necessary to control the suction process ("Click-on Unit") will be temporarily attached to the lid of the bucket. An umbilical cord connects the Click-on Unit to the power and control system located on the deck of the heavy lift crane vessel.

The MB will be lifted off the barge, and lowered to 1 meter above the lakebed. At that position, the MB is halted to allow the water column to stabilize and then afterward it is lowered until it contacts the lakebed. Once the bucket is on the lakebed, it self penetrates 3 to 6 feet due to its weight (500 to 600 tons). At this point, the installation is controlled by technicians in the control room of the heavy life crane vessel via remote operation of the Click-on Unit.

The objective of the installation process is to maintain verticality within specifications (0.5 degrees) as the bucket penetrates the lakebed. To achieve penetration, water is pumped out of the bucket through an exhaust port on the Click-on Unit into the adjacent water. As the water is pumped out of the bucket, the pressure is lowered inside, which pulls the skirt into the lakebed at a rate of approximately 60 inches per hour. The entire process is controlled by the technicians on the barge above.

To maintain verticality during the penetration process, two control mechanisms are available, water jets and clay chambers. Small water nozzles are installed along the circumference of the bottom of the skirt. The nozzles are segregated into three 120 degree control zones. The water jets can be activated zone by zone by allowing water to flow through the nozzles. When the water jets are activated, the water flowing from the nozzles loosens/lubricates the soil under the nozzles thereby allowing the bucket to penetrate more readily in that zone. The other control mechanism is a series of 3 independently controlled small clay chambers equidistant around the skirt. Suction or pressure can be applied to each chamber independently by the technicians controlling the installation process via remote operation of the Click-on Unit. This mechanism allows for raising or lowering each zone of the skirt independently to adjust the verticality of the foundation during the entire penetration process.

After the bucket reaches the desired depth and with the desired verticality, the process is complete. The Click-on Unit is detached remotely and lifted to the surface and onto the deck of the heavy life crane vessel. The entire operation is monitored by Remotely Operated Vehicles (ROV) and no divers are required. However, divers will be on standby in case the need arises (e.g., ROV stops working, water clarity is too low to see with ROV).

Since the foundation uses suction technology there is no seabed preparation necessary (dredging, leveling, or drilling) for installation, which results in minimal impact on the surrounding area. The foundation installation does not require any pile driving, which further minimizes impact on the surrounding area (salt mines, boaters, etc.) as well as aquatic life. When the Facility is decommissioned (discussed in greater detail in Section 4906-4-06(F)(5)) removal is accomplished by simply reversing the installation process, which will permit complete removal and recycling of all steel materials.

Turbine

The towers 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 majority of each turbine, including the blades, will be painted a light gray (RAL 7035) color consistent with the Federal Aviation Administration (FAA) and U.S. Coast Guard (USCG) guidance.

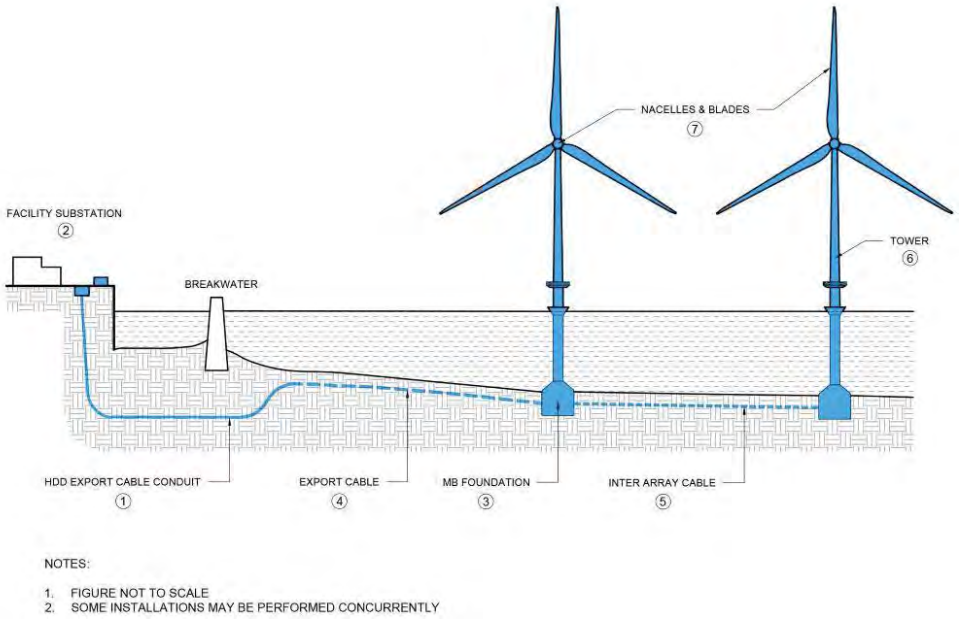
The main mechanical components of the wind turbine are housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle is housed in a steel reinforced fiberglass

shell that protects internal machinery from the environment and dampens sound. The housing is designed to allow for adequate ventilation to cool internal machinery and prevent excess moisture. The nacelle is equipped with external anemometers and wind vanes that signal wind speed and direction information to an electronic controller. 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. One red flashing FAA light (upward facing) will be mounted on the nacelle of each turbine and will flash synchronously. In addition, synchronously flashing (flashing pattern to be determined) amber marine navigation lights, visible up to 5 nautical miles, will be mounted on the platforms of turbines 1 and 6. On turbine platforms 2 through 5 the amber lights will have a visibility of 4 nautical miles, and a flash rate of 20 flashes per minute. Two lights will be installed on each of the 6 turbine platforms to provide visibility 360º around the turbines. In addition to the marine navigation lights, fog horns with visibility detectors will be installed on the platforms of turbines 1 and 6. The signal on turbine 1 will sound at 670 megahertz (MHz) once every 30 seconds and at turbine 6 the signal will sound at 670 MHz twice every 30 seconds. These will provide audible notice to vessels up to 2 nautical miles away.

A rotor assembly is mounted to the nacelle to operate upwind of the tower. Each rotor consists of 3 composite blades that will be 206 feet (62.9 meters) in length, which yields a rotor diameter (D) of 413 feet (126 meters). The blades will be painted a light gray (RAL 7035) color consistent with FAA and USCG guidance. The rotor attaches to the drive train at the front of the nacelle. Hydraulic motors within the rotor hub rotate each blade according to wind conditions, which enables the turbine to operate efficiently at varying wind speeds as well as varying rotor speeds. The wind turbines will begin generating energy at wind speeds as low as 3 meters per second (m/s) (6.7 mph), and cut out at maximum wind speeds of 22.5 m/s (50.3 mph). The Applicant has agreed to feather the turbine blades up to the manufacturer's cut in speed during certain periods of the year to reduce risk of mortality to bats (see Section 4906-4-08(B)(3)(b)).

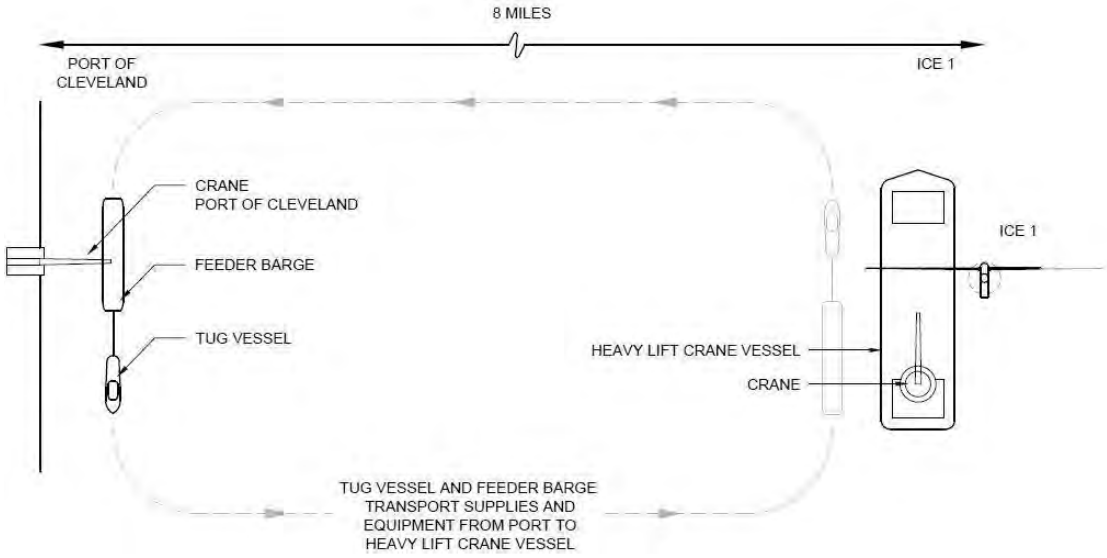
It is anticipated that the turbine components, including nacelle, blades, and tower, will be transported to the Port of Cleveland ("the Port") by barge. The same heavy lift crane vessel is planned to be utilized for both foundation and turbine installation. Installation of the turbines will follow after all of the MB foundations and the electric collection lines are installed (Inset 2). The installation vessel will already be positioned at the respective turbine site ready for turbine erection. A load-out crane in the Port will load turbine tower sections onto the feeder barge, which will then transit to the installation site (Inset 3). The tower sections will be picked off the feeder barge and then installed using the crane mounted on the

heavy lift crane vessel (Inset 4). Assembly work inside the towers will begin as the feeder barge returns to Port for the nacelle and blades. Once the feeder barge returns to the site, the nacelle and blades will be installed using the heavy lift crane. Once the turbine installation is complete, the heavy lift crane vessel will reposition to the next turbine location while the feeder barge returns to Port to repeat the process for tower and turbine installation. The heavy lift crane vessel and the feeder barge will use a tow tug to transit between the port and turbine sites.

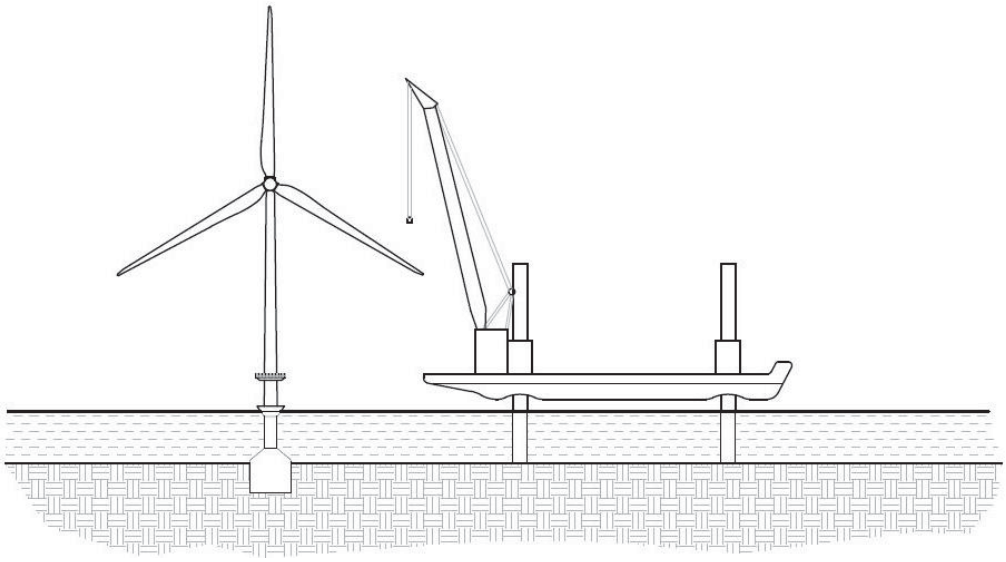


Inset 2. Project Component Installation Sequence[3]

[3] Blue components are new build Project components. Numbers under each component represent order of installation.



Inset 3. Installation Vessel Plan View



Inset 4. Turbine and Heavy Lift Crane Vessel

Turbine dimensions are listed in Table 1 in Section 4906-4-03(B)(1)(b). The majority of each turbine will be painted a light gray (RAL 7035) color. The portion of the tower between the low water datum and the platform will be painted yellow.

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

During construction, the vessels will be refueled at the Port through use of the existing fuel infrastructure at the Port. There will be fuel storage tanks onboard the installation barge to support generators necessary for operations. There will be no additional fuel storage constructed at the O&M Center or Substation.

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

Construction may generate some solid waste, primarily plastic, wood, cardboard, and metal packaging/packing materials, construction scrap, and general refuse. All waste and recyclable materials generated on installation vessels at the offshore locations will be transported back to the Port. This material will be collected from the Port of Cleveland and disposed of at a licensed solid waste disposal facility. Any materials that are able to be recycled will be sent to local recycling facilities.

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

The only aspect of the Facility that requires water supply, effluent, and sewage lines is the O&M Center at GLT on the Cuyahoga River in Cleveland, Ohio. The current building has existing water, effluent, and sewage lines in place for full facilities (restrooms, showers, etc.). There will be water and sewage from the construction vessels that will be emptied and disposed of at the Port of Cleveland. In addition, the Applicant will utilize the existing infrastructure at the Port for water and sewage from construction activities taking place at the port. The Applicant does not anticipate making any modifications to the existing water, effluent, and sewage lines at any of the above facilities.

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

The new Facility Substation, described below in subpart (g), will be connected to the existing 138 kV system at the CPP Lake Road Substation via an overhead uninsulated cable and then transitioned to an underground concrete duct bank. The transition from the duct bank to the termination structures will be through a pre-cast concrete pulling pit. The underground line will be a 3-phase, 138 kV circuit, utilizing a 1,000 thousand circular mil (kcmil) EPR or XLPE insulated, shielded, copper conductor. The circuit will run approximately 150 feet in a concrete encased conduit from an above grade termination structure in the Facility Substation to an above grade termination structure in the existing CPP Lake Road Substation. The termination structures will be placed upon slab foundations and all structures will be gray galvanized steel.

(f) *Electric Collection Lines*

Construction methods, site preparation, reclamation, and materials for the buried electric collection lines are described below. The Applicant has not yet selected an installer for the electric collection lines. The installer will be selected through a competitive bid process anticipated to begin in March 2017. The bidders will be vetted, and experience laying submarine cable will be a requirement to bid. The Applicant will not limit bidders to only those who have previously installed cable in Lake Erie; however, that may be a factor in selection of an installer for the cables.

There are two cable components for the Facility: the inter-array cables, which connect the wind turbines together electrically; and the export cable, which transmits the electricity generated by all wind turbines (windfarm output) to the shore. The cables are rated at 34.5 kV and are composed of a three-core copper conductor with cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) insulation. Optical fibers for data transmission are embedded between the cores. The cable solution designed for the Facility is a three-conductor, single armored underwater power cable, with an approximate overall diameter of 4.45 inches (Exhibit D). The Applicant has not yet selected a manufacturer for the cable. Type of cable and insulation will be dependent on manufacturer. The portion of the export cable connected to the shore will be installed before laying the remainder of the export cable.

Full geotechnical and geophysical surveys were conducted in August through October 2016 along the cable corridor envelope. As an installer has not yet been selected, the cable route is not finalized. The final route will be located within the envelope surveyed during the 2016 survey. The cable route envelope is depicted in Figure 03-1. The geophysical survey indicated that the cable route was clear of debris and any cultural resources in October 2016. If any large debris happened to settle in the cable route envelope since the survey was complete and prior to installation, it will be removed with a grapnel hook towed behind a small work boat. Ultimately, all cable installation operations will be monitored by divers and/or a mid-class ROV.

The export cable will be brought ashore entirely under the Cleveland Harbor and the Cleveland Harbor breakwater through a duct installed using horizontal directional drilling (HDD). The launch pit for the HDD will be located either at the CPP Lake Road Substation or on a barge on the north side of the breakwater. The final determination will be made by the installer for the electric collection lines (not yet selected). A horizontal drilling machine will be used to drill an approximately 18 inch (46 centimeters) diameter bore between the shore and the exit point approximately 1,150 meters offshore (Exhibit D). Drilling operations

use drilling muds to stabilize the bore hole and to lubricate the drilling process, and the process is designed to minimize the possibility of drilling mud discharging into the lake. An Inadvertent Return Contingency Plan is discussed in more detail in Section 4906-4-08(B)(2)(b)(ii). However, the drilling mud (a clay-based compound such as Bentonite) is National Sanitary Foundation (NSF) approved for drinking water applications such as water wells, so any discharge will have no effect on drinking water quality. The bore will be lined with High-Density Polyethylene (HDPE) conduit (or other commonly used lining material) that will be capped off until the start of the cable installation operations. A messenger wire will be placed in the bore to pull the export cable ashore using a pull-in winch.

The cables will be installed using a deck barge with cable installation and burial equipment mobilized on board. The proposed installation technique for the cable is bury-while-lay (typically referred to as simultaneous lay burial). The cable is buried by using either a cable plow or jetting tool. A plow is a tool that typically sits on skids (skis) and is pulled by a vessel. The plow's share cuts into the soil forming a trench into which the cable is laid. Alternatively, a jetting tool equipped with high-pressure water jets would accomplish the burial process by fluidizing the sediments within a narrow trench into which the cable is lowered. The sediments that are disturbed by the process would subsequently settle back onto the lakebed, providing most of the back-fill. See Section 4906-4-07(C)(2)(b) for additional details on sediment suspension. No reclamation would be required, and if there is a slight depression of the lakebed directly over the cable, the depression would fill in with ambient sediments over several weeks.

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

A new Facility Substation will be constructed on CPP property adjacent to the existing Lake Road Substation. The area surrounding the Substation is developed, consisting almost entirely of unpaved, but previously disturbed, outdoor storage space, with no significant ecological resources. The layout plan includes a fenced area of approximately 88 feet by 110 feet that would enclose the Facility Substation and its bus structures, switch gear, the step-up transformer, and a 14-foot by 37-foot building for control equipment (Exhibit F).

The entire Facility Substation area will be excavated to a depth of approximately 3 feet for the installation of the Substation grounding grid. All unused excavated backfill will be removed from the site for appropriate disposal upon completion of the project. Compacted backfill will be placed over the ground grid with a final 18-inch layer of coarse aggregate as the final substation surface. Bus support structures,

overhead line dead-end structure, and the control house will be placed upon drilled caisson foundations with elevated piers.

The transformer will be placed upon a slab foundation with an oil containment system piped to an underground oil/water separator located within the boundaries of the substation. During construction, major equipment, including transformer and control house, will be delivered via truck and placed on foundations using an overhead crane.

Final color of all equipment will be ANSI 70 gray. Bus support structures and dead-end H-Frame will be gray galvanized steel.

(h) *Temporary and Permanent Meteorological Towers*

A permanent meteorological tower was installed at the Cleveland Water Intake Crib (Crib) in 2005. The 125-foot (38-meter) tower was custom-engineered for installation on the Crib with a total tower height of 166 feet (50 meters) above lake level. The tower and measurement system was developed by Green Energy Ohio (GEO), in consultation with AWS Truewind, following the guidelines for wind monitoring set forth in the National Renewable Energy Laboratory's Wind Resource Assessment Handbook (National Renewable Energy Laboratory [NREL], 1997). The tower has 6 booms that are each 10 feet long: 2 of which are at 98 feet high, 2 at 131 feet, and 2 at 164 feet (30 meters, 40 meters, and 50 meters, respectively). Three booms are oriented northwest (315°) and 3 are oriented south (180°) to minimize the effect of wind speed shadowing from the tower. Each boom has an NRG-40 anemometer and an NRG-200P wind vane. The Applicant does not anticipate making any modifications to this meteorological tower or the existing Crib structure. The location of the existing meteorological tower is illustrated in Figure 03-1.

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

The Applicant does not anticipate building access roads, as a road network is only needed to support onshore components of the Facility (the O&M Center and the Facility Substation), and the Applicant intends to utilize locations and existing structures that currently have permanent road access. Depending on the selected manufacturer, the rail system will potentially be used for the transportation of turbine components and equipment other than the foundation, but the Applicant does not anticipate a need to make any modifications to the system. Depending on the selected foundation fabricator, the foundations may arrive completely by barge, and never be off-loaded, or may arrive in pieces by barge and/or truck

with final assembly at the port (see Section 4906-4-03(B)(2)(a)). Similarly, depending on the selected cable supplier/installer, the cable may arrive completely by barge, and never be off-loaded, or it may arrive by rail and be off-loaded and staged at the Port. There is no site preparation or reclamation for crane paths, as the cranes will be transported to port by trucks on existing roads and assembled at the Port.

The Applicant is working with Cuyahoga County and the affected municipalities within the County to ensure the Project does not have an adverse impact to existing roads and bridges. As mentioned, most components will arrive at the Project Site via barge. Any trucks that are needed to deliver components will meet weight requirements as posed by the Ohio Department of Transportation (ODOT). Additional traffic and road impacts are discussed in Section 4906-4-06(F)(3).

(j) *Construction Laydown Areas*

As indicated above, the Applicant will temporarily utilize space at the Port of Cleveland to stage, pre-assemble, and test the turbine components. The Applicant may also utilize the Port of Cleveland to stage and assemble the MB foundation components and completed foundations, if a fabricator is selected that will execute per MB Scenario #2, defined in Section 4906-4-03(B)(2)(a). The Applicant may also utilize the Port to stage the submarine cable. However, similar to the case with the MB foundations, based on specific plans and capabilities of the selected cable supply and installation contractor, it may not be necessary to stage the cable at the Port. The site within the Port that will be utilized by the Applicant is anticipated to be approximately 12 acres. The site currently consists of large paved and unpaved staging areas adjacent (with access) to the quayside for load-out. Site preparation will be limited to minor and temporary installation of security fencing, temporary office trailers, and secured storage areas. The materials will consist of conventional gray chain link fencing. Cranes and other material handling equipment such as fork lifts will be mobilized to the site to support the unloading of components and materials, and to facilitate storage in the staging area, movement around the staging area, and load-out onto feeder barges for transport to the turbine installation sites.

Following the completion of Facility construction, the material handling equipment will be demobilized and returned to the supplier, the chain link fencing will be disassembled and returned, and the office trailers will be returned to the supplier.

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

The O&M Center will be located at GLT on the Old River in Cleveland, Ohio, which is located approximately 1.6 miles upriver of the confluence with Lake Erie. The GLT site is approximately 6.3 acres and fully secured. However, the anticipated area to be leased will not exceed 0.5 acre in size. The Applicant does not anticipate making any modifications to the existing building (Inset 5). There will be no other buildings used for the Facility (i.e., no dedicated security building). The substation will be enclosed by chain link fencing, with access control and security cameras for 24-hour surveillance.

Inset 5. Great Lakes Towing building to be used for O&M Center

(l) *Other Pertinent Installations*

All Facility components and installations have been described in the preceding sections.

(3) Need for New Transmission Lines

As part of the interconnection process, the Applicant will construct approximately 150 feet of new 138 kV electric line to transmit electricity from the Facility Substation to the CPP Substation. See Section 4906-4-03(B)(2)(f) for details on electric collection lines.

(4) Project Area Map

The proposed layout of the Facility is illustrated on Figure 03-2. Prepared at a 1:12,000 scale using ESRI ArcGIS Online World Imagery as the base mapping, Figure 03-2 includes the following information:

(a) *An aerial photograph*

(b) *The proposed Facility*

(c) *Road names*

(d) *Property lines*

(C) DETAILED PROJECT SCHEDULE

(1) Schedule

The Project schedule is discussed below, and presented as a Gantt chart at the end of Section 4906-4-03.

(a) *Acquisition of Land and Land Rights*

Acquisition of land and land rights began in January 2011 and were completed February 2014.

(b) *Wildlife Surveys/Studies*

Preconstruction wildlife surveys/studies began in 2008 and baseline surveys are expected to continue through May of 2018. Additional details regarding wildlife surveys are included in Section 4906-4-08(B)(1)(d) and 4906-4-08(B)(1)(e).

(c) *Receipt of Grid Interconnection Studies*

Initial PJM studies were completed in May 2015. Subsequently, due to changes made by CPP, updates to the studies are required and are anticipated to be completed by March 2017. See Section 4906-4-05 for additional information regarding PJM studies.

(d) *Preparation of the Certificate Application*

Preparation of the Certificate Application began in June 2016 and concluded with its filing in February 2017.

(e) *Submittal of the Application for Certificate*

It is anticipated that the Application for Certificate will be submitted February 1, 2017.

(f) *Issuance of the Certificate*

It is anticipated that the Certificate will be issued in the third quarter of 2017.

(g) *Preparation of the Final Design*

Final designs and detailed construction drawings are expected to be completed in December 2017.

(h) *Construction of the Facility*

Construction is anticipated to begin in June 2018 and be completed in September 2018.

(i) *Placement of the Facility in Service*

The Facility is anticipated to be placed in service in November 2018, following completion of construction.

(2) Construction Sequence

Construction is proposed to begin in the spring of 2018 and be completed by the fall of 2018. Construction activities are anticipated to proceed in the following sequence:

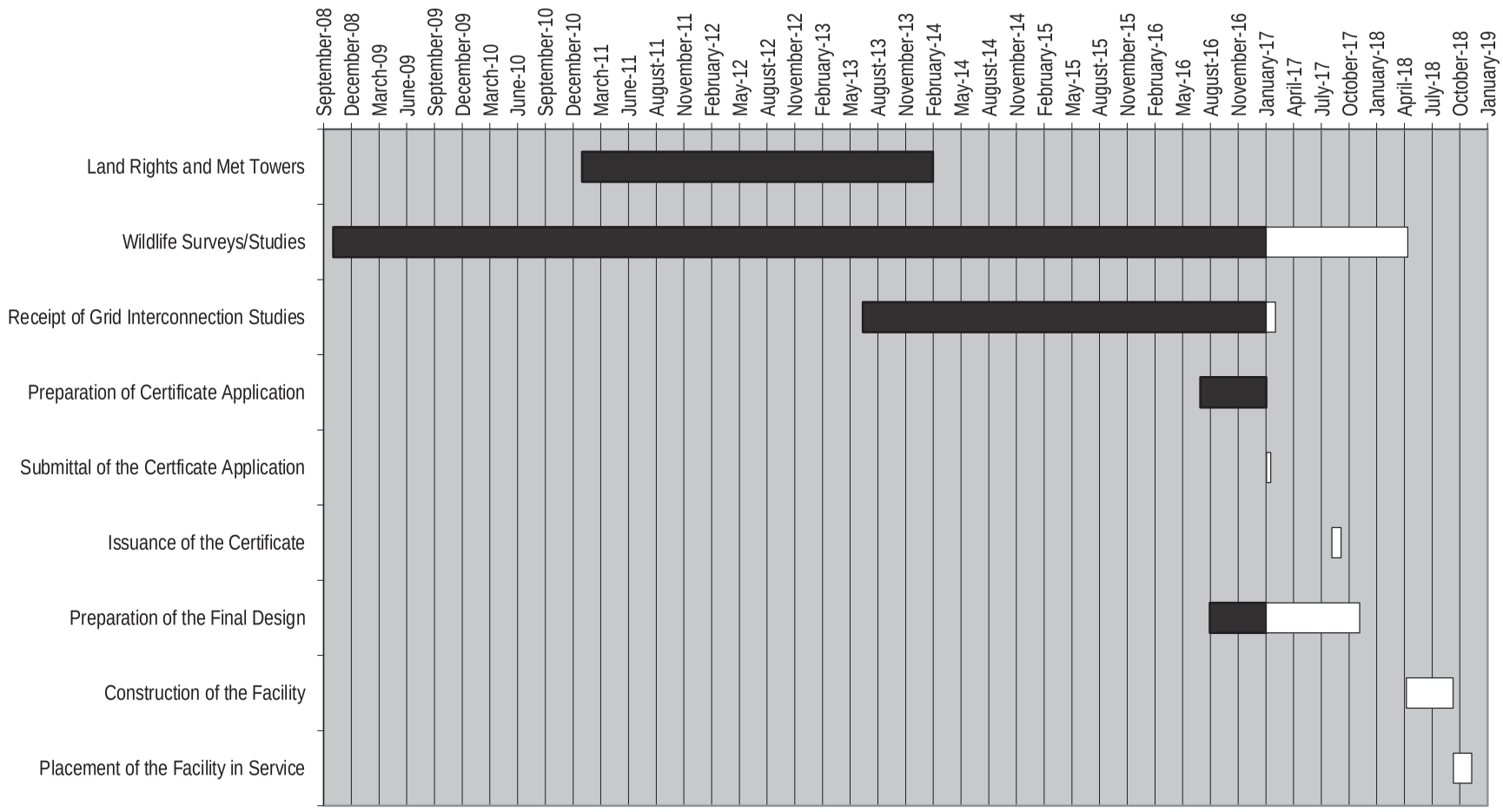
- Install HDD conduit for export cable
- Construct Facility Substation
- Mobilize floating equipment including feeder barges and heavy lift crane vessel
- Transport MB foundation to site
- Install MBs
- Install export cable
- Install inter-array cables
- Transport towers
- Install towers
- Transport nacelles and blades
- Install nacelles and blades
- Commission turbines
- Commission landside power into grid

(3) Impact of Critical Delays

Critical delays may have material, adverse effects on the Facility. Due to weather conditions on the Lake and the obvious challenges with performing construction in the Lake, the Project construction can only be completed at a specific time during the year (mid-April through mid-October). Any permitting delays will be critical to the Project and could cause the construction to be delayed up to 6 months. Permitting delays will impair the Applicant's ability to procure competitive bids in accordance with the planned timelines from

vendors who have been working with the limited window for installation due to weather conditions on the Lake. Permitting delays that stall the installation process will result in additional fees for management staff assigned to the Facility, as they will be unavailable for other activities during that time. Additional costs associated with delays could impact the rate of return for investors, which may jeopardize financing interest in the Facility. Additionally, delays may also jeopardize funding by grants received by the U.S. Department of Energy (DOE). See Section 4906-4-06(D) for additional details on cost of delays.

Icebreaker Wind Estimated Project Schedule



4906-4-04 PROJECT AREA SELECTION AND SITE DESIGN

The Applicant has provided a fully developed Project Area site selection study that includes information regarding the general site selection process for the Facility, along with associated siting constraints and requirements. This 2009 Feasibility Study (Feasibility Study) is attached to this Application as Exhibit G.

(A) PROJECT AREA SELECTION

The selection of appropriate sites for an offshore 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.

(1) Description and Rationale for Selecting Project Area

The offshore environment poses an entirely different situation than an onshore wind project, where space limitations, distance to existing transmission sources, and land use considerations narrow practical site locations. From Icebreaker Wind's conception, the desire was to build wind turbines in Lake Erie in the area around Cuyahoga County, Ohio. At the time of the Feasibility Study (see Exhibit G), the idea was to place the Facility far enough from shore to preclude interference with nearshore habitat and uses of the Cleveland Harbor area, but close enough to downtown to be visible as a symbol of Cleveland as a "green city on a blue lake." Being far enough offshore to avoid areas where waterbirds, other bird species, and bats concentrate, staying clear of airport flight traffic and commercial shipping lanes, avoiding areas generally used by recreational boaters, and avoiding sensitive bird, bat, and sensitive aquatic habitats were important considerations in the general location of the potential project areas.

Initially, potential sites 3 to 5 miles off-shore and some sites closer to shore (for greater project visibility) were evaluated by juwi GmbH and JW Great Lakes Wind LLC (2009) for the Great Lakes Wind Energy Task Force, a precursor to LEEDCo (Exhibit G). For the initial analysis, 8 potential project areas were identified, in addition to a variation on 1 site, for a total of 9 potential project areas. The location of all the sites is illustrated in Inset 6, below, and in Exhibit G. Sites 1 through 4 were each designed to have 8 turbines, with the turbines spread out 4 times the rotator diameter. Sites 5 through 8 were designed to have only 3 turbines and spread out 5 to 10 times the rotor diameter, depending on the orientation of the turbines to the prevailing wind direction. The 3-turbine arrays were placed closer to shore than the 8-turbine arrays to evaluate the potential of turbines closer than the 3-mile limit initially decided upon. Each array was meant to produce approximately 20 MW of power.

The Feasibility Study compared the 9 potential project areas with respect to important siting criteria, including shipping channels, water depth, distance to possible onshore interconnection locations, wind resource, the Cleveland Lakefront Audubon Ohio IBA, air navigation and radar, and the locations of lakebed factors such as dumping sites, artificial reefs and shoals, water intakes and sewer outfalls, shipwrecks, and the Cargill Salt Mine. Based on these criteria, the Feasibility Study recommended the Facility be sited 3 to 5 miles offshore, in the area generally between potential project areas 1 and 7 (juwi GmbH & JW Great Lakes Wind LLC, 2009).

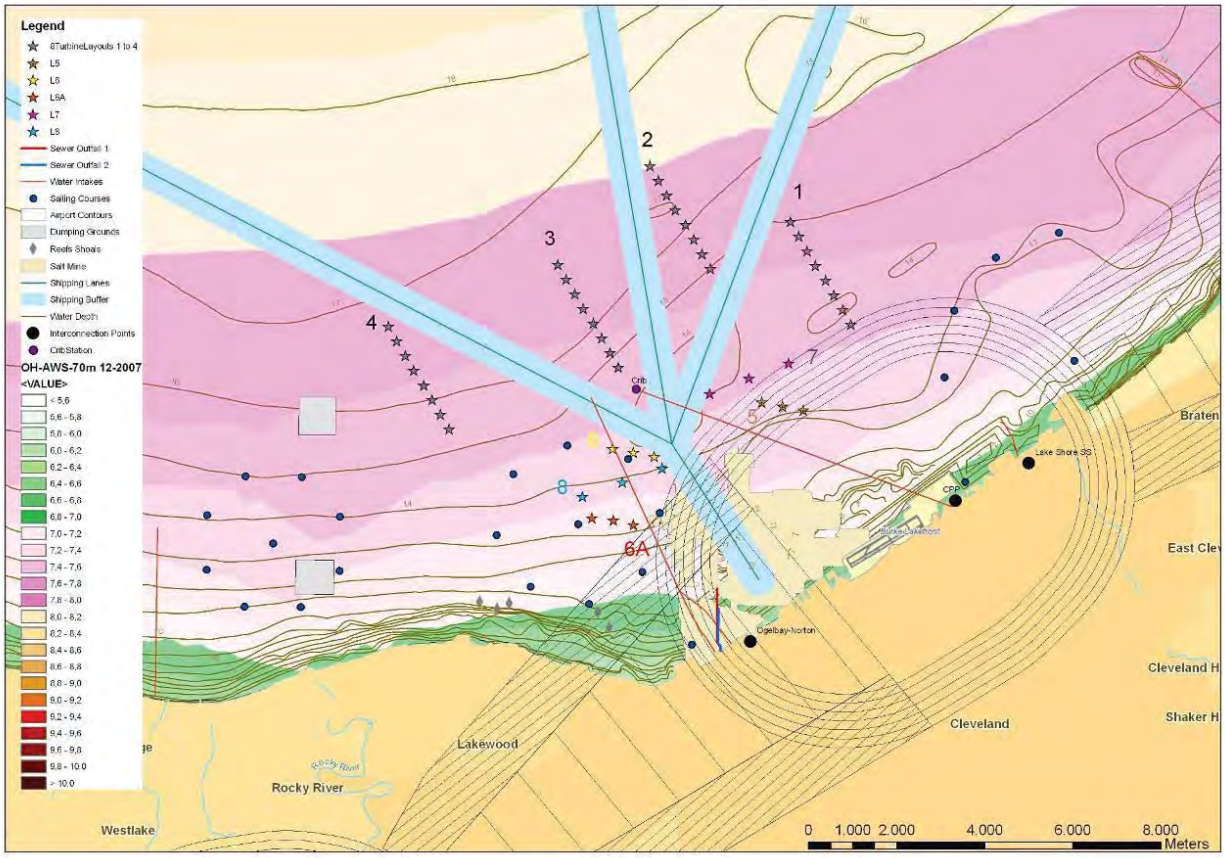
Since the Feasibility Study was completed in 2009, the project has continued to evolve. With the ODNR Office of Coastal Management's release of its 2009 Wind Turbine Placement Favorability Analysis (Favorability Analysis), the Applicant began to revise its assessment of potential project areas. The Favorability Analysis incorporated data including bird habitat, fish habitat, commercial and sport fishery efforts, lakebed sediments, distance from shore, land transportation, harbor navigation, shipping and ferry routes, shipwrecks, restricted areas, industries and utilities. In general, the resulting Favorability Map (see Exhibit H) identified more extensive limiting factors closer to shore, and only minimal limiting factors further offshore. The Favorability Map was one important resource in assessing the suitability of potential sites, and was relied upon extensively in the Applicant's decision to shift the project location farther from shore to the current site presented in this Certificate Application, which has fewer limiting factors and less ecological sensitivity.

Figure 04-1 indicates the study areas evaluated for potential Project layouts along with the final turbine locations at a 1:75,000 scale. In 2014 a layout similarly to the current Project's layout was considered 7 to 10 miles off the coast of Cleveland. Additionally, a wind turbine layout optimization study was conducted by NREL for the Project to evaluate its performance under a variety of layouts. Factors used to compare layouts include net energy production, turbine net capacity factor, and wake losses. Potential layouts studied included 11 linear layouts varying between 5 and 9 turbines, 2 2-row layouts, a 3-row layout, an optimized layout designed by OpenWind, and an Applicant supplied 6-turbine final layout. The linear 6 turbine layout supplied by the Applicant had one of the highest net energy output per turbine, and the Applicant moved forward with that layout. In 2016, a 6 turbine linear array located 8 to 10 miles offshore was selected as the final layout (Figure 04-1).

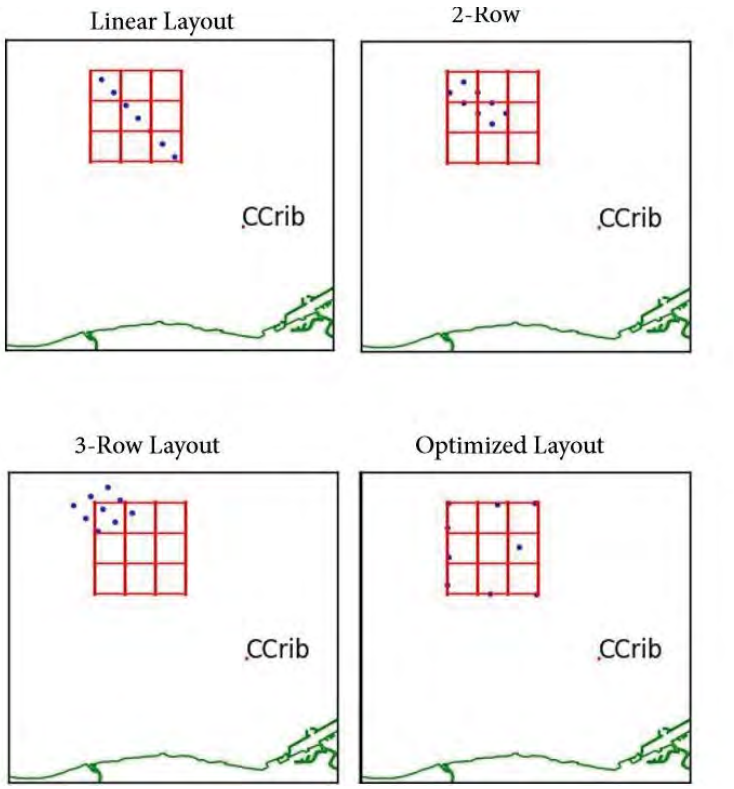
(2) Map of Study Area

As described above, the proposed Facility has been designed to be located in Lake Erie, offshore from the City of Cleveland. A map of the general area (i.e., study area) with the 9 potential project layouts from the Feasibility Study is included as Inset 6 and in Exhibit G. Examples of layouts evaluated in the NREL wind

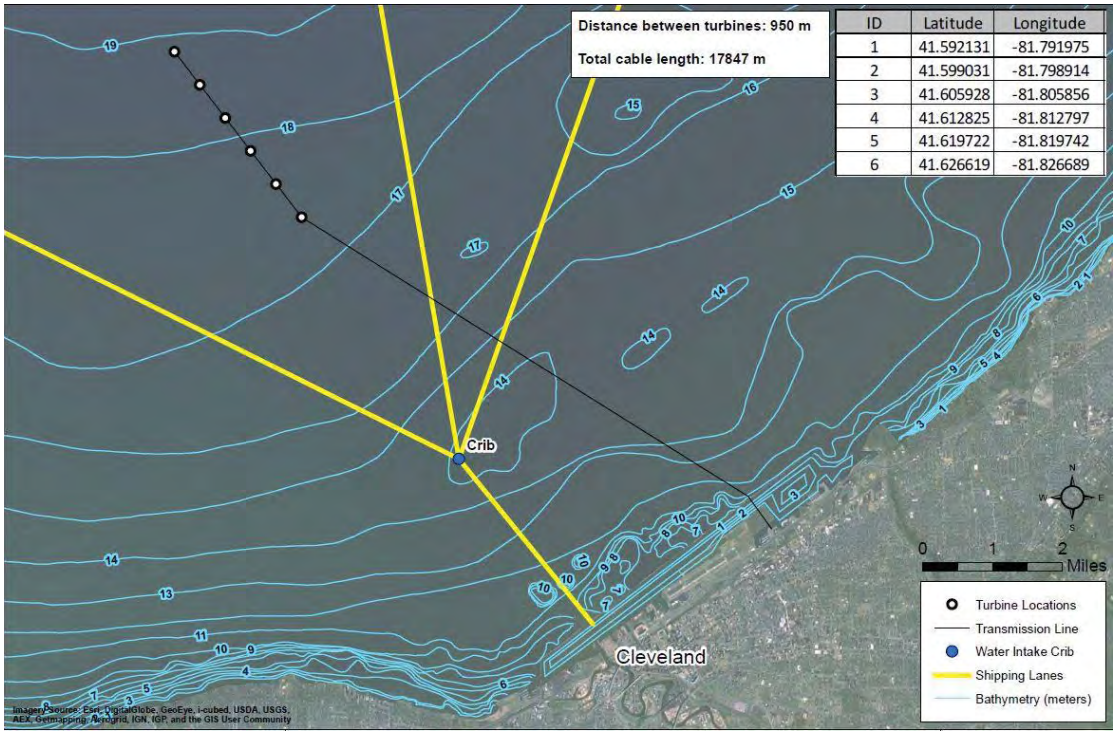
optimized study are included as Inset 7, and the map of the 2014 turbine layout (the Applicant provided layout from the NREL study), 7 to 10 miles off the coast is included as Inset 8.



Inset 6. Potential Project Areas Evaluated in the 2009 Feasibility Study



Inset 7. Typical layouts analyzed by NREL wind optimized study



Inset 8. Potential Project Layout Evaluated in 2014

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

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

- Existing uses – The Applicant evaluated existing uses of the area, including air navigation and civilian and military radar facilities; weather forecasting; commercial and recreational maritime uses, such as sailing race courses, fishing grounds, and shipping channels; reefs and shoals; dumping grounds; military practice ranges; sub-lake salt mine; distance to shipwrecks, water intake and sewer outfall pipes; the ODNR Favorability Analysis; the Feasibility Study; and existing submerged lands leases.
- Wind resources – An evaluation of wind resources from the meteorological tower installed on the Crib, combined with output from mesoscale models for the region, was done to evaluate average wind speed and the resulting turbine class for each potential location. Wind resources were determined to be favorable at the Project Area.
- Environmental conditions – Assessments of avian and bat risk, aquatic ecology, geology, water depth, and effects of icing, wind, and waves were performed by the Applicant and ODNR.
- Conceptual turbine design – Evaluations of geology, foundations, and turbine designs were done to determine the suitability of the MB foundation for Lake Erie and the Project Area.
- Interconnection and offshore cabling – Evaluations of onshore grid interconnection capacity and offshore cabling options were performed to determine location and feasibility of an interconnection point.
- Community stakeholder engagement – The Applicant has participated in over 400 meetings and presentations about the Facility since 2006, engaging local stakeholders and the local community to educate and share information. In 2013, a team of representatives made 15,000 face-to-face contacts across Northeast Ohio to determine public opinion and willingness to buy electricity generated from an offshore wind project, even at a higher price. Ninety-two percent of residents contacted expressed a favorable opinion of the project and 65 percent stated a willingness to pay more for electricity generated from the project.

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 micro-site the Facility components. Micro-siting efforts are discussed in detail below.

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

As noted above, the selection of possible sites for development of offshore wind power facilities is constrained. Particularly, projects must be located in areas with an adequate wind resource with accessibility to transmission lines, and situated in locations that can accommodate use restrictions and environmental regulations of local, state, and federal authorities. Once a project area has been selected (macro-siting), there is some ability to alter turbine and other component locations (micro-siting) within the confines of the lease agreements that the Applicant has obtained. The Project Area was selected based on the siting criteria and constraints discussed below.

Existing Uses

The Facility location was selected, in part, to avoid competing with or creating impacts upon public or existing private uses. The turbines will be located outside of commercial vessel shipping lanes and flight paths of Burke Lakefront Airport and Cleveland Hopkins International Airport. The location is not anticipated to interfere with NEXRAD weather radar (see Section 4906-4-08(A)(12) for additional detail on related correspondence). The turbines are not expected to interfere with military radar, based on preliminary Department of Defense screening, but will also be evaluated by the FAA (see Section 4906-4-08(A)(11)). The Facility will be located away from reefs, shoals, dumping grounds, the sub-lake salt mine, shipwrecks, water intakes and sewer outfalls. The turbines are outside of any high impact areas identified by the Favorability Analysis and are not near any competing SLLs. The range of water depths at turbine locations (approximately 19 meters [62 feet]) is considered ideal.

Wind Resources

Wind measurements have been collected at the meteorological tower stationed atop the Crib since 2005. The Facility location was moved further offshore than originally planned, as wind speed increases in Lake Erie with increasing distance from shore. Siting took dominant wind direction into consideration in order to maximize the power output of the turbine configuration and to reduce stress (turbulence) on turbine components. Turbines were oriented to the cross-wind direction NNW to SSE. Turbines are spaced approximately 768 meters (2,520 feet; 6 Ds) apart to minimize wake effects from the nearest turbines.

Environmental Conditions

Natural resources such as water quality, and avian, bat, and aquatic communities were evaluated. The site chosen by the Applicant was selected so that the turbines would be close to existing ODNR sampling locations, allowing for the use of existing data to support environmental studies. Avian and bat risk assessments completed in 2008, 2013 and 2016 for the Project cite the Facility's small size and distance from

the coast, rare and infrequent presence of any state or federal threatened or endangered species (T&E) or species of special concern, and the lack of nesting/roosting and foraging areas as support for the conclusion that the Facility will result in minimal impact on avian, bat, and T&E species. Aquatic communities were evaluated as part of preconstruction monitoring. From preliminary results, the location of turbines would not affect any significant aquatic habitats. The preliminary results of preconstruction aquatic monitoring, conducted by LimnoTech in 2016, suggest that impacts to aquatic resources will be minor, and limited to the localized destruction or displacement of macroinvertebrates, and temporary, localized displacement of fish. The geology of the lakebed was evaluated to ensure turbine foundations can be supported since soil properties are of high importance for the determination of the sub structure, load calculation, and the support structure design. Ice conditions and wave action were also evaluated to determine loading on the foundation and the effects on the complete foundation/turbine structure.

Conceptual Foundation Design

The Applicant performed a detailed comparative review of 5 different turbine foundations, down-selecting to 2 turbine foundation options, the Monopile with a Friction wheel (MP/FW) and the MB. After a technical assessment of the 2 best foundations, described in more detail in Section 4906-4-04(B)(2), the MB (a suction installed caisson SICA) was selected as the appropriate turbine foundation for the Facility.

Interconnection and Offshore Cabling

Offshore cabling was an important cost factor for the Facility, and cable distances are dependent on the Facility location relative to onshore interconnection location. Three potential interconnection locations were evaluated: Cleveland Electric Illuminating Co. (CEI) Lakeshore Substation, CEI Oglebay-Norton Tap, and CPP Lake Road Substation. Feasibility, cost of required equipment, and anticipated impact were elements considered. The CPP Lake Road Substation was chosen as it was the closest potential interconnection location to the Project Area, thereby reducing cabling distance and cost. This site also requires minimal upgrades to existing infrastructure, and has sufficient land to construct necessary new substation equipment.

Identification of Stakeholders

The Applicant and its predecessor have held over 400 meetings and presentations since 2006 to give members of the public an opportunity to be involved. The Applicant has secured support from key stakeholders, including environmental organizations, organized labor, businesses, and lakefront communities. The Applicant introduced the POWER Pledge in 2013 to give the Northeast Ohio community an opportunity to become directly involved in promoting offshore wind energy in the Great Lakes. By taking the POWER Pledge, members of the public pledged to buy a portion of their electricity from offshore wind once the Project

is complete. The pledge was also a tool for the Applicant to gauge community support. After 15,000 face-to-face contacts by Applicant representatives, over 8,000 pledges were collected, resulting in 65% expressing a willingness to pay more for electricity from the Project. The project received support from 92% of those visited.

(5) Description of Project Area Selected for Evaluation

The selected site is in Lake Erie, 8 to 10 miles off the coast of Cleveland, Ohio. Based on the criteria listed in OAC 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 adequate wind resources, manageable access to the bulk power transmission system, and will result in minimal impact to current land uses and environmentally sensitive areas.

The Feasibility Study was completed to evaluate the overall suitability of constructing a pilot wind energy project in Lake Erie. It focused on the evaluation of siting considerations for 9 different potential sites originally under consideration (see Inset 6). The study analyzed numerous environmental and socioeconomic siting considerations including commercial and recreational maritime uses, water depth, air navigation and radar, reefs, dumping grounds, an existing salt mine, wind resources, distance to interconnection locations, shipwrecks, water intakes and sewer outfalls, geology, and the ODNR Favorability Map. The Feasibility Study concluded that the current Project Area and cabling route offers the best location for this demonstration-scale project.

Once it was determined that the Project Area was adequate, the Applicant then worked with various consultants to conduct detailed assessments, to further evaluate the siting factors and constraints. Micro-siting (i.e., facility design), and the associated supporting site-specific studies used to inform this process, are described below in Section 4906-4-04(B).

(B) FACILITY LAYOUT DESIGN PROCESS

Through the use of geographic information system (GIS) tools and consultant assessments, the Applicant performed numerous iterations to determine the current Facility layout as presented and described in this Application. This micro-siting process was used to determine number and placement of turbines, foundation design, and general cable route. Site-specific studies that informed the micro-siting process include geophysical investigations, avian and bat surveys and risk assessments, and preliminary design evaluations. These studies are briefly described below, and are discussed in greater detail throughout this Application, where appropriate, particularly in Section 4906-4-08.

In 2010, Alpine Ocean Seismic Survey Inc. performed a geophysical investigation of the Lake Erie lakebed related to the Facility (2010 Alpine Survey). Bathymetric data, lakebed features, seismic data, and evidence of aquatic species were evaluated during the investigation. The purpose of the study was to determine bathymetry, presence of natural or man-made features on the lakebed that would impact turbine installation or stability and quantify available habitat for aquatic communities. A supplemental geophysical survey by VanZandt Engineering was done in 2015 to identify any archaeologically significant impacts that were not included in the 2010 Alpine Survey. No significant features or cultural resources were found that would pose a hazard to engineering near the turbine locations.

In 2015, a geotechnical exploration and evaluation was conducted through a combined effort of McNeilan & Associates, DOSECC (Drilling, Observation and Sampling of Earths Continental Crust), and Gardline. The work included core sample boreholes and 2 to 3 cone penetration test (CPT) soundings at each of the planned 6 turbine positions, and one alternate location. In total, the investigation examined 7 potential turbine locations and collected 10 core samples, 17 CPT soundings, and performed over 340 laboratory tests. Ohio Geological Survey was present on the vessel during some of these activities. The outcome of this study was a determination of the optimum 6 locations for turbine installation with an MB foundation (Exhibit I; submitted under seal).

In 2016, a geophysical survey of the cable route including in-Harbor, nearshore, export cable route and inter-array cable route areas was performed by Canadian Seabed Research Ltd. August 19th through September 4th, 2016 (Exhibit I). The objectives of the survey were to identify and map surficial geology, lakebed features, and sub-bottom conditions within the cable route envelope. Additionally, a geotechnical survey of the proposed cable route was conducted along the proposed inter-array and export cable routes in Lake Erie and within the Cleveland Harbor by TDI-Brooks International from September 12th through October 10th, 2016 (Exhibit I). The objective of the work was to provide suitable lake-bottom and subsurface definition to finalize cable route alignments, design and plan for the cable route installation, and design and construct the HDD shore crossing.

The Western EcoSystems Technology, Inc. (WEST) 2016 Icebreaker Wind: Summary of Risks to Birds and Bats (Exhibit J) concluded that the six-turbine pilot scale project poses low risk of adverse impacts to birds and bats. Results from TetraTech bat acoustic and avian boat surveys support the conclusions of the WEST analysis. The preliminary results of preconstruction aquatic monitoring being conducted by LimnoTech in 2016 suggest that impacts to aquatic resources will be minor, and limited to the localized destruction or displacement of macroinvertebrates, and temporary, localized displacement of fish. The Applicant has developed an Aquatic Resources Monitoring Protocol in consultation with the ODNR and U.S. Fish and Wildlife Service (USFWS), which will result in a Memorandum of Understanding (MOU) on pre-, during-, and post-construction monitoring studies and analyses for project impact on fisheries and other aquatic resources.

In 2014, after the site was selected, an evaluation of substation and cable design and installation was conducted by DNV GL. That work summarizes the preliminary design of the Substation, submarine cable system, cable routing, shore crossing, and installation for the Facility (Exhibit K). An assessment of multiple options for the cable route and shore crossing, as well as multiple installation options, is included in the report. In 2016, the cable route and shore crossing was further refined. See section 4906-4-04(B)(2) for additional details.

As the Applicant refined the micro-siting process based on these studies, the currently configured six-turbine Facility located 8 to 10 miles north of Cleveland was selected as the best option.

(1) Constraint Map

A constraint map of the Project Area showing shipping lanes, the breakwater, water intakes, and existing electric transmission lines is included as Figure 04-2. Because the Project Area is located approximately 8 to 10 miles offshore, turbine setbacks from residences, property lines, and public rights-of-way are not applicable siting constraints for the Facility, and are not illustrated in Figure 04-2.

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

Turbine Layout

The original turbine layout included 6 wind turbines, spaced 8D apart to eliminate wake effects while maximizing energy production. In 2015, the Applicant, in consultation with Natural Power, performed a sensitivity analysis to evaluate the influence of turbine spacing on energy production. Natural Power evaluated wake effect losses at 4D, 6D, and 8D spacing to discover at which spacing the effects would be measurable, but not impact the LCOE or the turbine warranty. Based on the analysis, the turbine spacing was reduced from the original 8D to 6D between units along a 323°NW diagonal array. The spacing will allow measurements of wake effects across all turbines.

Turbine Foundation Design

A monopole/friction wheel (MP/FW) foundation concept was the original foundation design chosen by the Applicant in 2013 after an examination of 4 foundation types (circular cell, tripod pile, gravity base, and MP/FW) and their performance in loose glacial till soils common to Lake Erie, specifically at the Project Area. As the Facility design progressed, the Applicant also considered a fifth foundation type, the MB suction pile. A comparative analysis between the MP/FW and MB suction pile was completed in 2015 to determine the most suitable foundation design for the proposed Facility.

The friction wheel consists of an outer steel ring with a concentric inner ring connected via structural members to form a wheel. The wheel is embedded in the top layer of soil surrounding the monopile and filled with aggregate, stabilizing the soil and increasing resistance to deformation from lateral forces, in response to loads on the monopile. The monopile is a well-developed and established design and has been widely used in Europe at approximately 70% of the existing (>85) offshore wind farms. However, there are not any wind turbines on monopiles with a friction wheel.

The MB suction pile is also a well-proven concept for offshore foundations in the oil and gas industry with more than 2,000 suction technology based installations. These range in size from relatively small suction anchors to enormous suction buckets holding the world's largest offshore oil platforms (Troll A off the coast of Norway) in place. However, MBs also support other structures, including 3 meteorological masts in which the MB diameters range from 12 to 15 meters (39 to 49 feet) as well as a jacket foundation with a 4 MW turbine at Borkum Riffgrund 1 in the North Sea. The proposal to use a single large bucket suction pile foundation for a wind turbine was developed in Norway and Denmark in the late 1990's, leading to installation of a 3 MW Vestas turbine at an offshore location in 2002. The structure consists of an open-ended steel bucket that is placed open end down on the lakebed. After a small amount of self-penetration into the soil under its own weight, the pressure within the bucket is reduced by pumping water out of the bucket. The positive external pressure provides a driving force to push the bucket into the seabed. Once installed, the foundation captures all of the soil inside the bucket and acts like an embedded gravity footing. Further attraction to this technology has been demonstrated in Europe, where 6 and 7 MW turbines are being placed on foundations using suction buckets.

The selection of the foundation considered all aspects of both technologies and while the MP/FW uses well-proven technology, its large size and pile driving equipment makes installation challenging, requiring three offshore lifts. The MB only requires the use of one offshore lift and does not require any pile driving. Therefore, the installation costs are significantly lower (33%) for the MB. While both foundations meet the technical performance requirements for Lake Erie's soil and winter weather conditions, the MB is lighter, quicker to install and can be fabricated in the U.S. By eliminating pile driving and reducing soil disturbance, the MB foundation lessens environmental impacts when compared with conventional foundations. Given these advantages, the MB was selected as the Facility foundation in March 2015. The Applicant engaged DNV GL to serve as the third party Certified Verification Agent (CVA) and it will be providing a design verification certificate covering the final design of the MB.

Buried Collection System

The Applicant retained the engineering division of DNV GL to develop a preliminary design for the Substation and submarine cable system including the layout of the buried cable system, shore crossing, and installation for the Facility. A comparative analysis was conducted to assess the benefits and risks of each cable route option (Exhibit K). Criteria considered included cable length, application of HDD, potential damage from third parties, environmental aspects, thermal bottleneck potential, permitting considerations, and potential Port, City of Cleveland, and U.S. Army Corps of Engineers (USACE) development plans near the shore crossing.

To connect the export cable to the Substation, the cable route must cross or go around the breakwater, then cross the Harbor to the Facility Substation. A man-made confined disposal facility (CDF) is located within the Harbor along the direct path to the Facility Substation. Originally, 3 different cable route options for crossing the breakwater, CDF, and Harbor were assessed:

- Option 1 is the most direct route. The route is a straight path perpendicular to the general shoreline from the Substation, crossing under the CDF and the breakwater to the open water of the lake, then continuing in a straight path to the nearest turbine (ICE1). Three different scenarios are available within Option 1, with options to: (a) route the cable completely under the Harbor, CDF, and breakwater with HDD; (b) route the cable under the Harbor and breakwater using HDD and a trench across the CDF; or (c) float out installation, trench across CDF, and HDD from CDF under the remaining Harbor and breakwater. All options would use trenching to install cable past the breakwater.
- Option 2 would have conventional landfall at the Substation, be routed around the CDF by float out installation, and an HDD duct under the breakwater. The option would use trenching to install cable past the breakwater.
- Option 3 uses conventional landfall at the Substation, bypasses both the CDF and breakwater, bending after the end of the breakwater to continue along a straight path towards ICE1.

The assessment concluded that Option 1(a) represented the best solution. While the increased cost of HDD is greater, these options require no trenching in the Harbor and the cable under the Harbor would be completely protected during its design life well under the specified dredge depth of the channel. As the project progressed, a fourth option, not originally considered, was selected as the optimal route over Option 1(a). The final route would not route the cable under the CDF, instead routing to the east and completely avoiding the CDF due to the uncertainty of the impact on the buried cable from future dredge material deposits in the CDF. An in-depth geotechnical and geophysical survey for the cable route was performed in October 2016 (Exhibit I). The total length of the export cable will be approximately 12.1 miles, depending on the exact route

selected in detailed engineering. The length of inter-array cables between each of the wind turbines is approximately 0.48 miles. The cable will be protected from ice keels through burial depth and a cable protection methodology where it transitions into each foundation. Once the cable enters the foundation, it will travel up the center of the monopile section into the bottom of the turbine tower.

(3) Description of Type of Comments Received

Written and oral comments were received at the public meeting, which was held November 3rd, 2016 at the Lakewood Park Women's Club Pavilion in Lakewood, Ohio. Comments supporting the proposed Facility specifically mentioned air quality and other environmental benefits, economic benefits, and site selection. 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).

Comments opposed to the proposed Facility indicated concerns about wildlife impacts (e.g., birds, bats, fish, endangered species), water quality impacts, visual impacts, public health and safety, noise, economic feasibility, and generating capacity. These issues are addressed in this Application. Wildlife impacts are discussed in Section 4906-4-08(B); water quality impacts are discussed in Section 4906-4-07(B); visual impacts are discussed in Section 4906-4-08(D); public health and safety is discussed in Section 4906-4-08(A)(1); sound is discussed in Section 4906-4-08(A)(3); economic impacts are discussed in Section 4906-4-06(E); and generating capacity is discussed Section 4906-4-03(B)(1).

4906-4-05 ELECTRIC GRID INTERCONNECTION

(A) CONNECTION TO THE REGIONAL ELECTRIC GRID

PJM is the Regional Transmission Operator (RTO) that coordinates the movement of wholesale electricity throughout the region that includes Ohio. The Facility will interconnect with the CPP transmission system via a tap to the CPP Lake Road 138 kV Substation, which connects to the American Transmission Systems, Inc. (ATSI) system. The majority of electricity generated will be delivered to CPP, behind the meter relative to PJM.

The electrical collection system includes the wind turbine generators and the electrical balance of the system, consisting of the inter-array cables, the 34.5 kV AC transmission cable, and the electrical components at the Facility Substation. A new Facility Substation will be situated in the northeast corner of the CPP property along the shoreline adjacent to the current CPP Substation. The Facility Substation will consist of 38 kV indoor-rated metal-clad switchgear installed in a climate-controlled building. The building will also contain the Supervisory Control and Data Acquisition (SCADA) system panels, the Data Measurement System, and a 50 kV-amps (kVA) auxiliary station service transformer for back-up and local power.

The switchgear will feed power to a new 20 megavolt amps (MVA) 34.5 kV to 138 kV step-up transformer. The Facility Substation will be connected to the existing 138 kV system and the CPP Substation via an overhead gen-tie circuit to a spare breaker location. The CPP Substation transfers power from the transmission system at 138 kV to the distribution system at 69 kV and 11.5 kV.

(B) INTERCONNECTION INFORMATION

(1) Generation Interconnection Request Information

The Applicant submitted a generation interconnection request to PJM on July 1, 2013. The Facility was accepted into the Z1 Interconnection Queue as Queue Position Z1-035, effective July 5, 2013 under the name Lake Road 69 kV. As of May 2015, PJM, together with CPP and ATSI, had completed all of the reliability studies required to complete PJM's queue-based interconnection process. The web link of the queue is http://www.pjm.com/pub/planning/project-queues/feas_docs/z1035_fea.pdf.

Since the completion of the Facilities Study in May 2015, there have been two modifications to the proposed Facility. First, the Applicant decided to change the wind turbines from 6 Siemens 3.0 MW turbines to 6 Vestas V126-3.45 MW turbines. Second, CPP decided to change the interconnect point from its 69 kV system to its 138 kV system; both within the Lake Road Substation. CPP determined that maintenance would be more

efficient and less costly with a direct connection to the 138 kV bus. PJM indicated that modifications like the wind turbine change are common and it is a straightforward process to address them. Also, since CPP decided to change the interconnection point/voltage, the Applicant's status in the interconnection queue will not be affected.

No additional impacts are anticipated from the change in interconnection voltage. The CPP 138 kV system was already included in the three completed studies. Based on the original 69 kV scenario, power flows from the Facility to the 69 kV system to the CPP 138 kV system to the ATSI 138 kV system. Thus, the impact of the Facility power on the CPP 138 kV system has already been modeled and assessed.

The Applicant updated its application accordingly and resubmitted it to PJM in July 2016. PJM will update their models and reassess the interconnection impacts based on the updated parameters. The updated PJM studies will be provided to OPSB staff upon completion.

(2) System Studies

Due to changes discussed in Section 4906-4-05(B)(1), the Applicant updated its application to PJM. The original PJM studies are included as Exhibit L and an updated 2016 Revised System Impact Study will be provided to OPSB staff upon receipt from PJM. The results from the initial PJM studies are discussed below.

Feasibility Study

The PJM Feasibility Study analyzed an 18.0 MW generating capacity wind energy facility to be injected at the Lake Road 69 kV Substation into the ATSI area. This study evaluated compliance with reliability criteria for summer peak conditions in 2017. Potential local and network impacts evaluated include generator deliverability, multiple facility contingency, short circuit, contribution to previously identified overloads, and new system reinforcements. PJM also studied the delivery of the energy portion of the interconnection request, looking for any problems likely to result in operational restrictions to the proposed facility.

No potential local or network problems were identified with the Lake Road Substation. There were also no violations identified with regard to deliverability (Exhibit L).

As previously mentioned, no additional impacts are anticipated from the change in interconnection voltage. The CPP 138 kV system was already included in the three completed studies.

System Impact Study

PJM issued the revised System Impact Study in May 2015 (Exhibit L). This report evaluated Queue Z1-035 as an 18.0 MW injection into the existing 69 kV CPP Lake Road Substation in the ATSI area. This study evaluated compliance with applicable reliability planning criteria for summer peak conditions in 2017. The Facility was studied with a commercial probability of 100%. Potential network impacts include generator deliverability, multiple facility contingency, contribution to previously identified overloads, short circuit, steady-state voltage requirements, and a stability and reactive power requirement. System reinforcements including new system reinforcements, contribution of previously identified system reinforcements, and delivery of the energy portion of the interconnection request were also assessed. A light load analysis was also done for light load conditions in 2017.

No potential network problems were identified with the Lake Road Substation. Also, no problems with system reinforcements, deliverability, or the light load analysis were identified. Midcontinent Independent System Operator (MISO) impacts were also evaluated and no violations were identified.

As previously mentioned, no additional impacts are anticipated from the change in interconnection voltage. The CPP 138 kV system was already included in the three completed studies.

Facilities Study

PJM initiated a Facilities Study to assess potential MISO impacts; however, no MISO impacts were found. Therefore, PJM determined a full Facilities Study was no longer required and issued a revised System Impact Study (2015), which is attached as Exhibit L. The System Impact Study (2015) included a MISO impact with no violations identified and closed out the study process.

After the revised System Impact Study (2015) was issued, the Facility was approved for interconnection. Updates to the Facility since the completion of these studies have been submitted to PJM in a revised application. The 2016 revised PJM System Impact Study will be provided to OPSB staff upon completion.

4906-4-06 ECONOMIC IMPACT AND PUBLIC INTERACTION

(A) OWNERSHIP

LEEDCo was the original developer and owner of the proposed Facility. During the course of LEEDCo's development efforts, LEEDCo entered into a relationship with an experienced wind energy developer, Fred. Olsen Renewables. Fred. Olsen Renewables, based in Oslo, Norway, owns and operates over 500 MW of wind farms in the UK and Scandinavia and has potential for an additional 2,200 MW in development.

The relationship progressed to an agreement between LEEDCo and Fred. Olsen Renewables, whereby a) LEEDCo transferred the ownership of the proposed Facility, including all of the related assets, to the Applicant; and b) Fred. Olsen Renewables created two new Ohio companies, based in Cleveland, to finish the engineering and permitting; procure the turbines, foundations, electrical substation, and cable; install and commission the Facility; and own and operate the Facility.

The two companies created by Fred. Olsen Renewables are 1) Icebreaker Windpower Inc., the Applicant; and 2) Fred. Olsen Renewables USA Inc., a wind energy development company and owner of the Applicant. This structure adds significant depth to the Facility through Fred. Olsen Renewables' financial resources, team of seasoned wind energy development professionals, and experience in the industry.

As the owner, the Applicant holds title to all project assets. This includes property and equipment, which as the project progresses will include turbines and foundations, transmission lines, and Facility Substation equipment required to connect power to the grid. It does not include electrical infrastructure owned by CPP.

(B) CAPITAL AND INTANGIBLE COSTS

(1) Estimated Capital and Intangible Costs

The total estimated capital and intangible cost of the Facility is approximately $[redacted] ($[redacted]/kilowatt [kW]). The costs are broken out in Table 3 below.

Table 3. Estimated Capital and Intangible Costs

Description	Cost
Tangible Costs	
Turbine (including foundation, 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

The Applicant does not have other similar facilities to which costs can be compared. Additionally, the proposed Facility is the first freshwater offshore wind project in Lake Erie and in all of North America. Consequently, there is not a sufficient basis for a meaningful comparison with similar facilities owned by entities other than the Applicant. There is only one completed offshore wind project in the U.S., Block Island Wind Farm (BIWF). BIWF is a 30 MW, 6 turbine, offshore wind farm located 3.8 miles from Block Island, Rhode Island, in the Atlantic Ocean. The total capital and intangible costs for BIWF was $290 million, resulting in $9,667/kW.

Furthermore, installed project costs compiled by the U.S. DOE NREL in September 2015 indicate that the capital costs of the Facility are in line with recent industry trends. The *2014-15 Offshore Wind Technologies Market Report* tracked the costs of numerous offshore wind energy projects in Europe, the U.S., and elsewhere. This compilation shows that installed costs of projects in 2014 averaged $5,925 per kW (NREL, 2015a). 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 the costs of development, construction design and planning, equipment, and construction. These costs will mostly be incurred within a year of the 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 could range between $[redacted] and $[redacted] per year.

(2) Operation and Maintenance Cost Comparisons

O&M costs are a large component of the overall cost of a wind projects over its life cycle, but can vary widely between facilities. The Applicant does not have other similar facilities to which costs can be compared. However, NREL compiled O&M cost data for offshore wind energy facilities in a 2015 report, based on proposed U.S. projects and market data from the existing international offshore wind industry. For the purposes of this analysis, O&M costs for offshore wind projects included labor, vessels, equipment, scheduled maintenance, unscheduled maintenance, land-based support, and project administration. The average O&M costs for 2014 were determined to be $37/MWh, with a range extending from $20/MWh to $70/MWh (NREL, 2015b). The O&M costs for the Facility are estimated to be approximately $[redacted]/MWh ($[redacted]/kW), depending on the maturity of the project in a given year of its life cycle. These costs are consistent with the range of costs compiled by NREL.

(3) Present Worth and Annualized Operation and Maintenance

The annual O&M 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. The Net Present Value of the O&M costs, using an inflation rate of 2% and a 10% discount rate over 20 years, is approximately $[redacted]. As alternative project areas and facilities were not considered in this Certificate Application, the O&M cost information in this section is limited to the proposed 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 plus the cost of maintaining the project team though the delay period. This is estimated to be about $[redacted] to $[redacted] per month. If the delay were to occur during construction, the major cost driver is associated with idle, expensive equipment

and crews. The time value of money resulting from a delay in the timing of revenue payments is also a factor, although not as significant. The estimated delay costs during construction are $[redacted] to $[redacted] per month.

Significant delays could result in a loss of $[redacted] in federal funding under the U.S. DOE financial assistance award. In addition, significant losses, approximately $[redacted], would be incurred if the delays prevented the Facility from meeting deadlines to qualify for the existing federal Investment Tax Credit (ITC). 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 primarily from the *Socioeconomic Report,* prepared by EDR (see Exhibit M). In their evaluation of economic impacts, EDR used the Job and Economic Development Impact (JEDI) Wind Model, specifically designed to assess economic impacts of wind-powered electric generation facilities. The model was developed in 2002 for the National Renewable Energy Laboratory, under the auspices of the U.S. DOE's "Wind Powering America" project. Originally developed with state-specific parameters, subsequent refinements make it possible to analyze impacts on regional and county level economies. Using this information, an input-output model with data specific to Ohio and the local economy was used to estimate the economic impacts of the proposed Facility. The model evaluates both the construction phase of the project, and the ongoing O&M phase of the project (EDR, 2016).

(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 159 on-site construction and project development personnel with estimated annual earnings of approximately $23.8 million. Facility construction labor wages for similar construction positions within the Cleveland region range from approximately $14 per hour for Pipefitters to $31 per hour for First-Line Supervisors, and around $51 per hour for Project Management occupations (Bureau of Labor Statistics, 2015). Local employment will primarily benefit those in the construction trades, including equipment operators, barge 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 are estimated to generate 9 full-time equivalent (FTE) jobs with estimated annual earnings of approximately $0.6 million. These FTE job positions are all anticipated to be administrative employees. Wage rates are projected to be

$24 per hour, consistent with statewide averages that are estimated to be around $18 per hour for administrative personnel (Bureau of Labor Statistics, 2015).

(2) Construction and Operation Employment

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 159 jobs during construction and 9 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 households and local businesses.

Turbine manufacturing and supply chain industries could in turn generate an additional 187 jobs over the course of Facility construction. In addition, Facility construction could induce demand for 150 jobs through the spending of additional household income. The total impact of 496 new jobs could result in up to approximately $41.2 million of earnings, assuming a 2018 construction start 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 11 jobs with annual earnings of around $0.7 million. In addition, it is estimated that 8 jobs with associated annual earnings of $0.4 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 28 jobs with annual earnings of approximately $1.6 million. Total economic output could increase by an estimated $6.7 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 the City of Cleveland and the Cleveland Municipal 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 20.7 MW, the increase in local tax revenues will be between $124,200 and $186,300 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 an 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 expenditures 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 $85.5 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. The Applicant and its predecessor, the Great Lakes Energy Development Task Force, have

spoken at over 400 meetings in the last 10 years in order to provide information about the project and give members of the public an opportunity to be involved. The Applicant has participated in many public events including public information meetings as a part of the state and federal permitting processes, and given presentations to dozens of community groups, including Rotary and Kiwanis clubs, environmental organizations, birding organizations, city councils, green teams, water use groups, lakefront property owners, lakefront communities, churches, student and business groups, schools, sport fisherman, and boaters. Public support has been demonstrated through the Applicant's POWER Pledge Campaign, in which over 8,000 Ohio residents pledged to buy a portion of their electricity from the Project at an increased cost. Six lakefront communities have passed council resolutions supporting the project, including Bratenahl, one of the top 100 wealthiest communities in the country.

The Applicant maintains an informational website for the Facility (http://www.leedco.org/icebreaker). This site provides project information, news releases and general information about wind power resources and the benefits of wind power. The website will be updated with new information throughout the planning and review process. In addition, Icebreaker Windpower staff will continue to be available to interact with the community and public officials during the construction and operation phases of the Project. The Applicant's offices are located at 1938 Euclid Avenue in downtown Cleveland, and can be reached via telephone at (216) 965-0627.

A complaint resolution plan will be implemented to ensure that any complaints about Facility construction or operation are adequately investigated and resolved. A hotline and website will be set up to receive and formally document all complaints, which will then be investigated by a complaint resolution designee. The complaint resolution plan is included as Exhibit N and includes plans for community engagement, information gathering, response to complaints, follow-up of complaints, further action, if necessary, and submission of any complaints and resolutions to OPSB staff in quarterly reports. The Applicant will send letters to notify affected property owners and local and county government entities about the complaint resolution plan at least 7 days prior to the start of construction.

(2) Liability Insurance

The Applicant will affect and maintain throughout the term of the SLL (encompassing all Project components including, turbines, cables, and Substation), at its sole cost, a policy of Comprehensive General Liability insurance against claims for bodily injury, personal injury, wrongful death, and property damage arising from operation of the Facility, covered together with all costs of defense. The insurance policy described will, at a minimum, insure against claims of $250,000 per person and $500,000 per occurrence for bodily injury and

$250,000 per person and $1,000,000 aggregate for property damage. The insurance policy held by the Applicant is in accordance with the terms and conditions of the SLL (see Exhibit A).

(3) Roads and Bridges

The majority of the large project components, including turbine and foundation components, are anticipated to arrive via ship, though some may arrive by rail, depending on the point of manufacture. Additional materials that do arrive at the staging area, or O&M Center, will be carried on trailers that will be well within the allowable wheel loading requirements set by the ODOT. Any impacts to roads and bridges will be extremely low for the Project. However, the Applicant commits to repair any damage to roads or bridges caused by the construction or decommissioning activity for the Project and will enter into an appropriate road use agreement (RUA) that will define the terms of this commitment.

Due to the location of the Project, the RUA will be unique from those agreements executed by wind farms in rural communities across Ohio. The difference is based on the urban nature of the roads and bridges abutting the Project. In rural communities, the county typically has jurisdiction over the use and maintenance of all impacted roadways and bridges, necessitating just one RUA between the developer and the county. However, through conversations with Cuyahoga County, the Applicant has found that the County maintains the bridges, while the municipalities maintain the roads within their jurisdiction. Therefore, the Applicant will be coordinating with both Cuyahoga County and the affected municipalities prior to construction. The RUAs will be subject to review by the OPSB staff and will address Project activity both during construction and in the event of decommissioning.

FOWIC performed an installation assessment for the Project, which included an assessment of the port facilities. As mentioned in Section 4906-4-03(B)(2)(a), the Port of Cleveland has been selected as the quayside staging area for the Project. Proposed quay area will be Pier 22N and Kenmore. Strengthening of quayside will most likely be required, and will be assessed in detail before construction begins. The northern edge of the pier is not suitable for berthing, but the western quayside of Kenmore is suitable for berthing.

Additionally, ice conditions on Lake Erie fluctuate yearly depending on water depth, position within the lake, and seasonal weather variations. Ice cover concentration of 10% or greater can begin as early as mid-December and last until mid-April. Ice formation around turbine foundations could constrain access to turbines and O&M operations during winter months and may require a vessel with ice breaking capability. When the lake freezes, the Applicant has several options to access turbines. The GLT tugs have the capability to break ice up to 6 inches thick. Additionally, the USCG maintains ice breaking vessels in the Great Lakes, 2 of which

are stationed in Cleveland to assure commercial operations in the lake during in the winter. The USCG can break almost all ice formations on the Great Lakes, and it provides vessels for these services.

(4) Transportation Permits

Construction materials that do not arrive by rail or barge will be carried on trailers. The Applicant is working with Cuyahoga County and affected municipalities on a RUA that will address Project activity both during construction and in the event of decommissioning. The Project will need wide load, but no oversized/heavy load, permits for the Substation transformer, control house, and crawler cranes. For construction materials that arrive by rail or barge, no transportation permits are required. Additionally, there will be no temporary or permanent road closures, lane closures, road access restrictions, or traffic control necessary for construction and operation of the proposed Facility.

(5) Decommissioning

The Applicant will complete decommissioning of the Facility, or individual wind turbines, within 12 months after the end of the useful life of the Facility or individual wind turbines. Unless good cause is shown by the Applicant, the Facility or individual turbines will be presumed to have reached the end of its or their useful life if no electricity is generated for a continuous period of 12 months, or if the OPSB deems the Facility or a turbine to be in a state of disrepair warranting decommissioning.

Decommissioning consists of dis-assembling the turbines by reversing the installation process. An appropriate vessel with sufficient crane capacity will be mobilized to the site. The blades will be removed one at a time. Then the turbine will be de-energized and disconnected from the transmission cable. The Facility Substation will be de-energized and disconnected and isolated from the grid interconnection. Then the nacelles will be removed followed by the tower sections.

After the Substation is completely de-energized, the submarine cable will be cut at or slightly below the lakebed thereby separating the buried portion of the cable from the portion that runs up the foundation. Once the turbines are completely removed from the foundation and the submarine cables are cut, the MB foundations will be de-installed by reversing the suction process utilized during the installation. Pressure will be applied to the bucket and water will be pumped into the bucket. The pressure inside the bucket will lift the bucket out of the soil. Once the bucket is disengaged from the soil, the MB foundation will be lifted with the crane onto a feeder barge. The portion of the cable that remains attached to the MB and will be transported with the MB.

All of the turbine and foundation components will be transported to quayside and proper disposition of the components will occur. The materials will be recycled where possible, and those that cannot be recycled will be disposed of properly. The export cable and inter-array cables will be rendered inactive and remain buried. Finally, the onshore Substation components will be de-installed and recycled where possible, those that cannot be recycled will disposed of properly.

The Applicant will enter into an RUA with Cuyahoga County and local municipalities to address Project activity use of roads in the event of decommissioning. The Applicant's decommissioning plan is subject to approval from the OPSB. The final decommissioning plan will be provided to OPSB at least 30 days prior to the preconstruction conference, and will include a description of the engineering techniques and equipment to be used in decommissioning, along with a detailed timetable for accomplishing each major step.

Financial Assurance

Prior to initiating construction, the Applicant will determine, with approval from the State of Ohio, the removal deposit amount to be set aside to the state for decommissioning activities based on the type and quantity of the improvements that the Applicant intends to install. The Applicant will post and maintain funds for decommissioning (or a surety bond, or similar financial assurance) in an amount equal to total aggregate decommissioning costs for all turbines constructed or under construction. The estimate of decommissioning costs will be updated by a registered professional engineer and submitted to the OPSB every five years once the Facility is operational. The removal deposit will be determined by the Applicant with approval from the state. The SLL requires the Applicant/Lessee to deposit with the state a removal deposit prior to initiating construction. The removal deposit may be in the form of a bond, an irrevocable letter of credit from a bank, or a cash deposit. Per the SLL, each removal deposit must be in an amount sufficient to cover the surface and subsurface restoration costs and the estimated removal cost of the respective types of improvements. In the SLL, the state reserves the right, at any time, to review each of the removal deposits, ascertain their adequacy, and require any adjustments to the amount of the removal deposits that may be necessary, such that the removal desists continue to cover the surface and subsurface restoration costs and removal of the improvements. Finally, failure to do any of the following may be construed as an Event of Default under the SLL: (i) obtain approval of the required removal deposits; (ii) post the required removal deposits prior to construction of the improvements; (iii) increase the removal deposits within 90 days of demand by the state in the event the actual quantity or type of improvements exceeds the estimated quantity and type; or (iv) increase the removal deposits within 90 days of notice by the state in the event an adjustment in the removal deposits is required. If the Applicant/Lessee fails to remove the improvements according to the terms of the

SLL, the state may use the removal deposits to cover the surface restoration costs and the actual and reasonable costs of removal of such improvements.

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

(A) PURPOSE

This section provides environmental 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 State of Ohio Environmental Protection Agency (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 2013 Annual Report* (Ohio EPA, 2014a). Included in this report are a summary of 2013 air quality data, a discussion of toxics monitoring projects, and trend studies for selected pollutants. Pollutants monitored over 13 monitoring sites in Cuyahoga County include carbon monoxide, particulate matter (2.5 micron, 2.5 micron continuous, and 2.5 micron speciation), total suspended particulate, nitrogen dioxide, ozone, lead, and sulfur dioxide. There were violations of National Ambient Air Quality Standards (NAAQSs) reported at monitoring stations in Cuyahoga County for 2.5 micron particulate matter (3 year average of annual average), ozone (4^{th} highest 8-hour concentration), and lead (highest 3-month concentration) (Ohio EPA, 2014a).

Air emissions in the area are related primarily to vehicular travel and manufacturing. The greatest sources of manufacturing emissions in the vicinity of the Facility originate from ArcelorMittal Cleveland LLC., approximately 4 miles south of the Cleveland Harbor; CEI Lake Shore Plant, located along the Cleveland Harbor; and Cleveland Thermal LLC., located less than 1 mile from the Cleveland Harbor (Ohio EPA, 2016).

(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 (CAA) of 1970, the USEPA established New Source Performance Standards (NSPSs) to regulate emissions of air pollutants from new stationary sources. The OAC regulations do 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 fired by fossil fuels. Because wind turbines generate electricity without releasing pollutants into the atmosphere, NSPSs do not apply to the proposed Facility.

The CAA, as amended in 1990, requires the USEPA to set NAAQSs (40 Code of Federal Regulations [CFR] part 50) for pollutants considered harmful to public health and the environment. The USEPA Office of Air Quality Planning and Standards has set NAAQSs for 6 principal pollutants, which are called "criteria" pollutants and include carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur dioxide. Areas not meeting the standards are designated as "nonattainment areas" and states are required by the CAA to submit State Implementation Plans (SIPs) describing how they will attain and/or maintain the NAAQSs for each criterion exceeding or that has exceeded its standard in the past. As described above, air quality monitoring occurs in Cuyahoga County. According to the Ohio EPA (2014a), violations of NAAQSs were reported for 2.5 micron particulate matter (3-year average of annual average), ozone (4th highest 8-hour concentration), and lead (highest 3-month concentration).

The 1990 CAA amendments prohibit federal entities from taking actions in nonattainment and maintenance areas that do not conform to SIPs, and require that a conformity evaluation be conducted to ensure that federal actions conform to these plans. A conformity evaluation is comprised of an applicability analysis and, if necessary, a conformity determination.

All new sources of air emissions in Ohio are required to obtain a Permit to Install (PTI) for 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 a PTIO.

Administered by the USEPA, the Acid Rain Program was established by the CAA Amendments of 1990 to reduce emission of SO_2 and oxides of nitrogen (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.

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.

(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 Rule 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, ORC, may be applicable to onshore work.

The Facility is located in an area that reported violations to NAAQS. Therefore, as explained above in Section 4906-4-07(B)(1)(c), it is within a designated nonattainment area. The Applicant conducted an applicability analysis to evaluate whether construction and operation of the Project would negatively impact state efforts to comply with NAAQS. Estimated onshore emissions of carbon dioxide, particulate matter, volatile organic compounds (VOCs) and NO_X were estimated to be less than the USEPA *de minimus* threshold values. Therefore, a conformity determination was not necessary for the pollutants. Estimated offshore emissions of the 5 pollutants during construction and operation of the Facility were 1% or less than the 2008 emission totals for Cuyahoga County.

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

The proposed Facility is located in Lake Erie, 8 to 10 miles north of the City of Cleveland. There is no required site clearing needed for construction, and any sediment disturbance during construction of turbine foundations, towers, and electrical cable will be submerged at the lakebed. Therefore, fugitive dust control will not be an issue for the Facility. The Substation will be located at an already-developed parcel. No clearing activities are anticipated.

(3) Plans to Control Air Quality During Facility Operation

As per OAC Rule 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 and approvals:

- A permit under Sections 404 and 10 of the Clean Water Act
- A Section 401 Water Quality Certification from the Ohio EPA
- Approval to Alter or Use a Federal Navigation Project Permit from the USACE under Section 14 of the Rivers and Harbors Act of 1899 and codified in 33 USC 408 (Section 408)
- A Permit for Private Aid to Navigation from the USCG
- A Section 307 Coastal Zone Management Act Consistency Determination from ODNR
- Finding of No Significant Impact pursuant to the National Environmental Policy Act

(b) *Water Quality Map*

Figure 07-1 depicts the location and sampling depths of all water monitoring and gauging stations used in collecting preconstruction survey data at a 1:24,000 scale.

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

The Facility will not be discharging to a receiving stream. Preconstruction monitoring of Lake Erie water chemistry was conducted from May 2016 to October 2016 by LimnoTech (Exhibit O).

Discrete grab sampling for water chemistry and clarity were conducted once a month from May to October 2016 at 6 reference locations and 3 turbine locations. Samples were collected for nitrogen, phosphorus, and chlorophyll-*a* analysis. A Secchi disk was used to measure water clarity, and a Li-COR meter was used to determine light extinction. Temperature, dissolved oxygen (DO), conductivity, turbidity, chlorophyll-*a*, blue-green algae, and pH were measured at 6 reference stations and all turbine locations once monthly from June through October 2016. Detailed preliminary results from LimnoTech's sampling are in Exhibit O. Final results will be provided to OPSB staff upon report completion.

Continuous water chemistry sensors were deployed at 1 reference station and 1 turbine location to monitor photosynthetic active radiation (PAR), water temperature, and DO. An additional buoy (Buoy 45164), maintained by LimnoTech, is deployed 10 miles northeast of the central turbine (ICE4) location. The buoy provides hourly water temperature from the surface to a depth of 60 feet, and hourly bottom DO and temperature measurements.

A report summarizing the results of the LimnoTech preconstruction monitoring will be provided to OPSB in early 2017.

(d) *Existing Water Quality of Receiving Stream*

The proposed turbine location is 8 to 10 miles offshore in the Central Basin of Lake Erie with a transmission cable running to the Substation on the shore of the City of Cleveland. The Facility will not discharge to a receiving stream.

The *Ohio 2014 Integrated Water Quality Monitoring and Assessment Report* summarizes water quality conditions in Ohio according to reporting requirements under Sections 303(d), 305(b), and 314 of the Clean Water Act. Available data were compared with water quality goals to determine the suitability of waters for specific uses, including aquatic life, recreation, human health impacts related to fish tissue contamination, and public drinking water supplies. Current assessment of Lake Erie is focused on attainment of standards within the coastal waters only (Ohio EPA, 2014b). The central basin of Lake Erie, where the Project is proposed to be located, is intermediate in terms of temperature, productivity, and depth when compared to the eastern and western basins (Ludsin and Hook, 2013).

The aquatic life use of the Lake Erie shoreline is currently considered impaired, due to tributary loadings of nutrients and sediment, which is aggravated by the proliferation of exotic species, algal blooms, and shoreline habitat modifications. The same nutrients that cause the aquatic life beneficial use impairments are also a major contributing factor to harmful algae blooms, which are currently one of the most serious issues in Lake Erie (Ohio EPA, 2014b). As Ohio EPA water quality data are limited for Lake Erie, the agency has collaborated with other states, federal, and local partners. Under the Great Lakes Water Quality Agreement, the phosphorus limit for the central basin of Lake Erie is 10 µg/L. The phosphorus concentration goal for the central basin of Lake Erie was met in the 1980s. The central basin is generally considered mesotrophic (a moderate range of dissolved nutrients).

Site specific water quality results from the preconstruction monitoring will be provided to OPSB staff in early 2017.

(e) *Permit Application Data*

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

(2) Construction

(a) *Water Quality Map*

Figure 07-1 depicts the location of the water monitoring stations that will be utilized during construction. As the project is in Lake Erie, and not in a stream, gauging stations will not be utilized during construction.

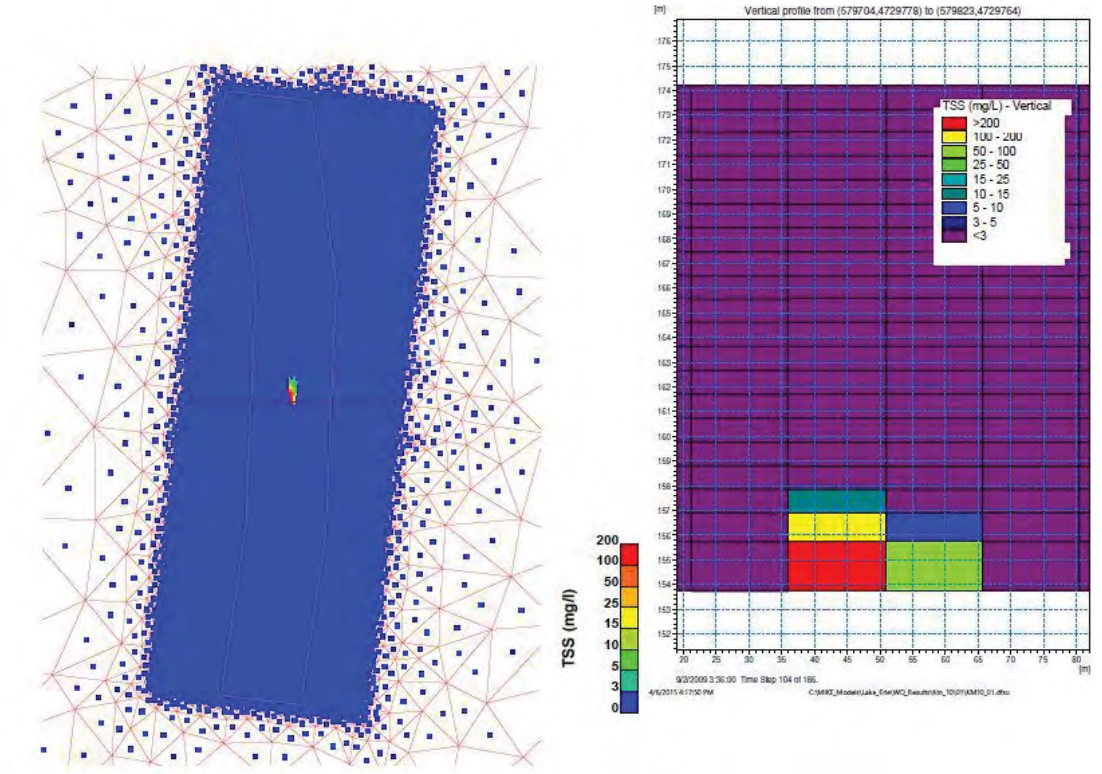
(b) *Quantity/Quality of Construction Runoff*

Potential impacts from aquatic discharges will result from the construction phase of the Facility. It is generally known that Lake Erie bottom sediments in areas offshore of Cleveland may contain elevated levels of contaminants, including metals, hydrocarbons, and polychlorinated biphenyls (PCBs). The Ohio EPA and USACE are currently engaged in discussions regarding this issue. The Applicant has collected limited bottom sediment samples in the Project Area and is in the process of evaluating the information for construction planning purposes and in the context of Ohio EPA guidance and regulations. The Applicant's construction activities such as installation of MB foundations and plow-based installation of the electric transmission cables are designed to minimize the disturbance of sediments and thus reduce potential impacts from lake bottom sediments during construction.

The potential sediment disturbance for the cable installation will be approximately 15 feet wide. Bottom sediment will become suspended within the water column; however, the impact will remain local. Lake Erie has very low current velocities, and suspended bottom sediments associated with the plow technology used for cable burial are expected to settle back to the lake bottom. Suspended sediment levels are expected to be at background levels shortly after construction is complete. Inset 9 depicts a picture of the ocean floor (in the Bahamas) 1 day after jet-plow cable installation. One week after installation of the cable, the path was barely discernible. Water quality parameters associated with the suspension of sediments from jet-plow cable burial were modeled for a cable installation in Lake Erie. Inset 10, below, displays water quality (total suspended solids [TSS]) modeling results at a site in Lake Erie similar to the site for the Project export cable installation. Elevated sediment levels are only seen 3 meters (10 feet) above the lakebed at a width of 30 meters (100 feet) and 4 meters (13 feet) above the

lake bed at a width of 15 meters (50 feet; HDR, 2015). Additionally, the model predicted that at all 5 modeled locations along the cable, the suspended sediments would remain localized and return to background levels in less than 4.8 hours (HDR, 2015).

Inset 9. Total Suspended Solids (TSS) Modeling Levels Along Submerged Cable Route.



Source: HDR, 2015

Inset 10. Total Suspended Solids (TSS) Modeling Levels Along a Lake Erie Submerged Cable Route

Additionally, the heavy lift crane vessel used during installation of foundations, towers, nacelles and blades will have a temporary impact on the lakebed. The heavy lift crane vessel will have jack-up legs or pads that will secure its position in the lakebed. Depending on the vessel used, legs or pads typically range from 10 to 20 feet (3 to 6 meters; U.S. DOE, 2012). Movement of jack up legs can result in the suspension of lakebed sediments. Once the vessel is moved from a turbine site, the location of legs will remain as a small depression, that will fill in over a period of time. The impacts will be minor, localized, and short-term in nature.

The MB foundation requires no site clearing, dredging, or drilling. The MB installation process will extract approximately 810,000 gallons of water from inside the bucket. Sediments from the top 0.1 to 0.3 meters of the lakebed could become sucked into the pump and become entrained in the discharge water during approximately the last meter of the penetration process. However, water and sediment removed during the MB installation will be pumped from the inside of the bucket back into the lake in the immediate vicinity of the MB. The water and sediment pumped out will remain under the surface of the Lake and any sediment will subsequently settle back to the lakebed.

The Substation facility will be installed at an already-developed parcel. All construction activities will occur on an existing gravel parking lot. No clearing, dredging, or filling activities resulting in aquatic discharges are anticipated.

(c) *Mitigation*

As per the Ohio EPA, construction activities disturbing less than 1 acre of land are not required to obtain a National Pollution Discharge Elimination System (NPDES) Construction Storm Water General Permit. The Facility Substation construction will disturb less than 1 acre, and as it is the only terrestrial construction activity associated with the Project, no permit will be required. Additionally, due to the MB technology, there will be very little sediment disturbance and impacts to Lake Erie surface waters associated with foundation installation. Sediment dispersion from cable burial plow technologies are anticipated to be localized and short term, as sediment will resettle and return to background levels after construction is complete. Even though a Storm Water General Permit is not required for the site, the Applicant will utilize Best Management Practices (BMPs), such as silt fences, to minimize sediment runoff into local waterways.

(d) *Changes in Flow Patterns and Erosion*

As there is no need for site clearing during the construction phases, the Applicant does not anticipate any changes to flow patterns or erosion for the Facility.

(e) *Equipment for Control of Effluents*

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

(3) Operation

The operation of the Project is not anticipated to generate any sources of pollutants to Lake Erie. In order to make sure that no discharges of any fluids (oil, hydraulic, cooling, etc.) occur even under abnormal circumstances, the turbine is designed for three levels of containment. Each primary system, i.e. gearbox, is a sealed system with multiple sensors that monitor fluid performance and containment, with each of these inspected at regular maintenance intervals. The secondary system is in the nacelle itself, where fluid containment reservoirs are designed to capture any leaks from a primary system failure. In the event that both primary and secondary containment fails, the bottom of the tower has a reservoir to contain any fluids originating from the nacelle. However, in the extremely rare incident of failure of all three containment systems,

any fluid that may leak into the environment is inherently biodegradable. In addition, service vessels will be equipped with oil spill handling materials adequate to control or clean up any accidental spill.

(a) *Water Quality Map*

Figure 07-1 indicates the location of the water quality monitoring and gauging stations to be utilized during Facility operation.

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

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

(c) *NPDES Permit Schedule*

Since a NPDES permit is not required for this project, this section is not applicable.

(d) *Quantitative Flow Diagram*

(i) Sewage

The O&M Center will generate sewage and wastewater comparable to a typical small business office. These waterborne wastes will be disposed of through use of an existing septic system or municipal sewage treatment system. No other Facility components will discharge measurable quantities of wastewater. Therefore, flow diagram information is not applicable.

(ii) Blow-down

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

(iii) Chemical and Additive Processing

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

(iv) Waste Water Processing

Besides sewage generated at the O&M Center covered in Section 4906-4-07(C)(3)(d)(i), the Facility will not generate waste water requiring processing. As such, this section is not applicable.

(v) Run-off and Leachates

The Facility is not expected to generate any run-off or leachates. Therefore, this section is not applicable.

(vi) Oil/water Separators

The Facility will not utilize any oil/water separators. This section is not applicable.

(vii) Run-off from Soil and Other Surfaces

Any stormwater runoff from the Substation will be compatible with the existing facility design, and consistent with CPP and PJM requirements.

(e) *Water Conservation Practices*

The O&M Center will use water at a rate comparable to a typical small business office. No other Facility components will use measurable quantities of water. Therefore, water conservation practices are not applicable.

The U.S. DOE, 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 21 MW windfarm such as the proposed Facility will conserve approximately 33 million gallons of water annually because wind-powered electric generation facilities do not consume water, as do conventional thermal power plants such as coal or natural gas power electric facilities (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 that would require removal for Facility development.

(b) *Plans for Waste Removal*

No waste removal is necessary or planned.

(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 O&M Center. Any waste generated on installation vessels during Project construction will be brought back to Port for disposal. Waste will be recycled when possible, and if it is not recyclable it will be disposed of at dumpsters located at the O&M Center. A private contractor will empty the dumpsters on an as-needed basis, and dispose of the refuse at a licensed solid waste disposal facility.

(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 Center could include wood, cardboard, metal packing/packaging materials, used oil, general refuse, universal waste, and used antifreeze. The O&M Center offices will generate solid wastes comparable to a typical small business office.

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

The O&M Center will utilize local solid waste disposal and recycling services. Used oil 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

The wind turbines for the Facility are located 8 to 10 miles offshore in Lake Erie, so there are no airports, or landing strips within 5 miles of those components. However, there are airports, helipads, and landing strips within 5 miles of the existing CPP Substation.

- Burke Lakefront Airport is less than 2 miles from the substation.
- The Cleveland Clinic Foundation Heliport is approximately 2.5 miles from the Substation.
- The 4th District Police Station Heliport is less than 5 miles from the Substation.
- Metro Health Medical Center Heliport is approximately 5 miles from the Substation.
- The University Hospitals of Cleveland Heliport is less than 4 miles from the Substation.
- The Cleveland Police Department 1st District Heliport is approximately 7.5 miles from the Substation
- Deaconess Hospital Heliport is approximately 6.5 miles from the Substation
- St. Vincent Charity Medical Center is approximately 1 mile from the Substation.

Figure 07-2 shows all public use airports, helicopter pads, and landing strips within 5 miles of the Project Area and known private use airports, helicopter pads, and landing strips adjacent to the Project Area at a 1:24,000 scale.

The Applicant has notified the airports, helipads, and landing strips within 5 miles of the Facility Substation of the proposed construction. The Facility Substation will be constructed alongside the existing CPP Lake Road Substation, will not be any taller than existing substation facilities, and will therefore have no greater impact on these aviation facilities than currently exists. The Applicant is working with 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 FAA is the organization in the U.S. government responsible for evaluation and issuance of determination on petitions on objects that penetrate the nation's airspace. The FAA conducted aeronautical studies of the proposed turbine layout under the provisions of Title 49 of the U.S. Code, Section 44718, and applicable Title 14 of the CFR, part 77 and Section 4561.32, ORC, respectively. The FAA can issue two types of determinations, one that identifies a hazard and another that identifies no hazard. Often as a part of this process, an interim letter is issued called a Notice of Presumed Hazard. This notification identifies a potential issue that must be mitigated in some manner. Mitigation could include changes by the Applicant, such as

relocating a turbine or reducing turbine height, or by the government, such as changing flight procedures, cancelling underutilized approaches, or a number of other methods.

Proposed structures over 200 feet must undergo an Obstruction Evaluation by the FAA and be permitted through a form 7460-1 filing prior to construction. The Applicant prepared FAA Form 7460-1 to satisfy requirements of the FAA and the ODOT, Office of Aviation. Form 7460-1 was submitted July 22, 2016. The application status was updated in December of 2016, but a final determination has not been issued. The final determination from the FAA will be sent to OPSB staff upon receipt.

(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, vessels, equipment, and materials; (2) falling overhead objects; and (3) 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. However, the risk of construction related injury will be minimized through weekly safety meetings, regular safety training, and the use of appropriate safety equipment. The Applicant will employ Occupational Health and Safety Administration (OSHA) measures to ensure worker safety during construction and operation. Construction contractors will follow safety procedures and best practices for offshore wind construction as specified by the Applicant's project partner, FOWIC, and outlined in Fred. Olsen Ocean's (FOO, parent of FOWIC) Construction Phase Health, Safety and Environmental Plan (CPHSEP). See Exhibit P, submitted under seal.

The general public could also be exposed to construction-related hazards due to unauthorized access to work sites (on foot, by motor vehicle, or boat). The latter could result in collision with construction equipment (barges, cranes) and with turbine towers. However, exposure risk to the public is anticipated to be minimal, as there will be buoys marking a site exclusion zone during construction, and guard vessels to keep out errant vessels. Vessels involved in the construction phase will be properly marked, lighted, and outfitted with sound signals in accordance with navigational rules. Notices to Mariners (as well as Icebreaker Windpower website notices) and/or Radio Navigational Warnings will be broadcast prior to and during construction. Turbines will be fitted with safety lighting to satisfy FAA and USCG standards. The lowest tip of the turbine blade will be 20 meters (65 feet) above the surface of Lake Erie (Exhibit Q). A recreational boat study was performed in 2016 to count and classify power and sail boats in recreational harbors, marinas, and yacht clubs in Lorain, Cuyahoga, and Lake Counties. Of all the sailboats classified in the study, 99% of boats had a mast height below 65 feet. Additionally, a study of location of boats offshore found that only 2% of the boats counted in all of the surveys were within 3 miles of the turbine sites (Exhibit O). The Applicant is working with the USCG, and has prepared a preliminary

Navigational Risk Assessment (Exhibit R) to assure all navigational hazards are appropriately addressed.

Due to their height, physical dimensions, complexity, and location, the wind turbines 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 gearbox oil does create the potential for fire or a medical emergency within the tower, nacelle, or on the turbine platform. This, in combination with the elevated location of the nacelle, enclosed space of the tower interior, and remote/offshore location of the Facility, 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. The Applicant is consulting with local first responders including the chief of training of the Cleveland Fire Department for the purpose of responding to incidents. The Applicant will conduct training to instruct operating staff, as well as local first responders on the procedures to be implemented in the event of an incident. In addition to training, the Applicant will equip fire and emergency responders with proper equipment to enable them to respond to emergency situations.

All turbines and electrical equipment will be installed and tested according to National Fire Protection Association (NFPA) 70E code standards prior to being brought on line. This, along with the built-in fire suppression 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.

The nacelles will be equipped with a fire suppression system. In the unlikely event that a wind turbine was to catch fire, it would typically be allowed to burn itself out while O&M personnel and/or the USCG maintain a safety area around the turbine to protect against human harm from sparks or falling material. Power to the turbine circuit will also be disconnected. Events generally do not last long enough to warrant attempts to extinguish fire from the air or boat. Due to the location of the turbines, 8 to 10 miles offshore the City of Cleveland, exposure of the general public to fire-related risk/hazard is expected to be essentially non-existent.

In accordance with OSHA Part 1926.35, the Prime Contractor shall develop and implement a Project Emergency Action Plan (EAP) for the construction phase. Additionally, the Applicant will work with local fire departments and other emergency responders to provide training for response to emergency situations related to the project and equipment.

(b) *Equipment Reliability*

Equipment reliability is an important criterion in turbine selection. As described in Section 4906-4-03(B)(1), the turbine model chosen for the Facility is the Vestas 126-3.45 MW IECIIA. Vestas has more than 57,000 wind turbines installed in 75 countries, generating more than 200 million MWh of energy per year. The Vestas 126-3.45 MW turbine is independently certified as meeting international design standards by independent product safety certification organization DNV GL, and conforms to IEC standards. These certifications require that the wind turbines have a design life of at least 20 years for the specified wind regime and climatic characteristics. The design criteria consider factors such as 50-year weather extremes, average wind speed, wind gusts, turbulence intensity, waves, and ice loads. 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 will be regularly maintained by certified technicians on a preventative maintenance schedule to ensure continued operation.

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

Exhibit S, submitted under seal, includes the safety manual for the Vestas 126-3.45 MW turbine proposed for the Facility, submitted under seal. It addresses 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*

Once permits are received, the Applicant will notify NOAA and the USCG regarding navigational topics such as construction dates, design information, and as-built drawings so that navigational charts can be updated.

During construction, a 500-meter (1,640 foot) safety avoidance zone shall be requested around the installation vessels and a 100-meter (328 foot) safety avoidance zone around each wind turbine and Substation. During installation of the export cable, a 500-meter safety avoidance zone shall be requested around the cable-lay vessel. In addition, security will be maintained by 24-hour presence of the site safety craft. Vessels will be warned to maintain a safe clearance from the work site by means of Notices to

Mariners and radio navigational warnings broadcast by the USCG at regular intervals. At the onshore Substation, the site shall be cordoned off with fencing to prevent access. The site will also be manned by a dedicated security company.

During Facility operation, turbine platforms may serve as a place of refuge for stranded boaters. However, the turbine's operational equipment will be secured (i.e., will be housed within internal areas of the turbines that will be locked and not accessible to the public). The locked entrance to the interior of the turbines will prevent public access in the rare likelihood that a stranded boater will need to seek refuge on a platform.

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

Each contractor involved with the Facility is required to produce and implement a Project Emergency Action Plan (EAP). The 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 is working with the Chief of Training from the Cleveland Fire Department to develop annual training for local first responders and operating staff on the procedures to be implemented in the event of fire. 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 Air Pollution Control Equipment

Wind turbines generate electricity without combusting fuel or releasing pollutants into the atmosphere. They do not need pollution control equipment. Therefore, this section is not applicable.

(3) Noise

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

Construction of turbines will primarily take place at the turbine site, 8 to 10 miles offshore in Lake Erie. Consequently, there are no anticipated noise impacts to the nearest onshore property associated with turbine construction. The inter-array and export cable will be installed under water, and as such will not produce noise that would have impacts to onshore properties. Construction of the Facility Substation will occur at the CPP Lake Road Substation site. The equipment used for the construction of the Facility Substation will be varied. Some of the louder pieces of equipment are shown in Table 4, below, along with the approximate maximum sound pressure levels at 50 feet (Resource Systems Group, 2013).

However, the CPP property and adjacent parcels are located within a heavily urbanized and industrial area that is regularly exposed to elevated ambient noise. Construction of the HDD conduit will also occur on the CPP Lake Road site. Noise impacts from the HDD construction are discussed in 4906-4-08(A)(3)(a)(iii).

The Facility Substation parcel is located adjacent to Interstate 90 (I-90). The I-90 corridor in the vicinity of the Facility Substation parcel has 4 lanes for westbound traffic and 5 lanes for eastbound traffic with ordinary 2-lane roads adjacent to the north and south. In 2013, the annual average daily traffic count for I-90 was 114,280 vehicles (ODOT, 2013). In general, traffic noise increases with increasing traffic volume, higher speeds, and increasing numbers of trucks. The typical sound level of highway traffic is about 70 dBA at a distance of 50 feet (15 meters), while heavy traffic sound levels are typically 85 dBA, and light traffic levels are approximately 53 dBA (United States Department of the Interior [USDOI], 2008). Additionally, vehicle noise is produced by the engine, exhaust, and tires, and can be increased by faulty equipment. Traffic loudness typically drops about 3 dBA for every doubling of distance from the road (USDOI, 2008). As the Facility Substation parcel is located immediately adjacent to ordinary 2-lane roads and less than 100 feet from I-90, the area would be constantly exposed to elevated noise levels.

Table 4. Maximum Sound Levels from Various Construction Equipment

Equipment	Sound Pressure Level at 50 feet (dBA)
Excavator	83
Dump Truck Being Loaded	86
Dump Truck at 25 mph accelerating	76
Tractor Trailer at 25 mph accelerating	80
Concrete Truck	81
Bulldozer	85
Rock Drill	100
Loader	80
Backhoe	80

(i) Blasting activities

The section is not applicable as no blasting activities will be conducted during construction of any Facility component.

(ii) Operation of earth moving equipment

No earth moving equipment will be used for turbine construction. Noise levels from potential earth moving equipment from Facility Substation construction and HDD are listed in Table 4, above.

(iii) Driving of piles, rock breaking or hammering, and horizontal drilling

Pile driving is not required for installation of any Facility component. Rock breaking may be necessary for construction of the Facility Substation. Noise levels of potential construction equipment used in rock breaking are listed in Table 4, above. Elevated construction noise is expected during construction of the HDD of the cable conduit. Potential sources of sound resulting from the HDD are included in Table 5, below (Stantec, 2012). However, the CPP property and adjacent parcels are located within an industrial area that is regularly exposed to elevated ambient noise. It is not expected that HDD operations will produce any underwater significant noise since the noise generating equipment will all be onshore with the exception of the drill bit and string, which will be under the lakebed floor (Xodus, 2015).

Table 5. Sound Levels from HDD

Equipment	Sound Pressure Level (dBA)
Drilling Rig	104
Rig HPU	115
Mud Pumps/Generator Engines	112
Engine Exhausts	109
Mud Pump	98
Mud Cleaner	102
Shaker	108

(iv) Erection of structures

No turbine construction noise is expected at the nearest property boundary during the construction of the turbines, as all turbine structure erection activities will take place 8 to 10 miles offshore. Due to the industrial and urbanized area surrounding the Facility Substation, construction noise is expected to be negligible at the nearest property boundary during the construction of the Substation and the HDD of the cable conduit.

(v) Truck traffic

Sound levels from potential construction truck traffic are listed in Table 4, above. However, onshore areas, including the Facility Substation and the Port, associated with the proposed project are located within heavy industrial areas and are regularly exposed to industrial noise and elevated ambient sound levels. Additionally, as described in Section 4906-4-08(A)(3)(a), the area also experiences high levels of ambient noise due to traffic from nearby Interstate 90. In addition, existing heavy traffic areas are adjacent to the onshore areas, which contribute to the current elevated noise levels. No residents are located near the proposed onshore or nearshore activities. The nearest property owner is the City of Cleveland, whose CPP Substation will serve as the interconnection point for this project.

Shipping induces higher underwater sound intensities than wind turbines (Wahlberg & Westerberg, 2005). There will be additional boat traffic associated with construction of the turbines and foundation. However, since Lake Erie already experiences frequent boat traffic, the additional effects to aquatic communities are expected to be negligible. For additional discussion of underwater sound impacts, see Section 4906-4-08(A)(3)(b)(i) below.

(vi) Installation of equipment

Minimal construction noise is expected at the nearest property boundary during the construction of the substation and the HDD of the cable conduit. No turbine installation noise is expected at the nearest property boundary, as turbine installation will take place 8 to 10 miles offshore. As discussed above, the interconnection cable will be installed using HDD as the cable approaches the nearest property boundary.

Pile-driving activities are the main concern in terms of underwater windfarm related noise, as they generate very high sound pressure levels and are relatively broad-band (Thomsen et al., 2006). However, due to the new technology behind the MB foundation, no pile driving is necessary for the installation of the turbine foundation. The noise from MB foundation is anticipated to be minimal when compared to noise from installation barges or recreational boaters.

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

(i) Operational noise from generation equipment

The impacts of operational noise from the wind turbines will be negligible at the nearest property boundary, as the turbines are sited 8 to 10 miles offshore. Some noise will be generated by the

Facility Substation transformers. Transformer noise is generally described as a low humming, and is generated at a rate dependent on transformer dimensions, voltage rating, and design. The nearest noise sensitive area to the Facility Substation is Kirtland Park, located approximately 900 feet to the southwest of the Substation. Interstate 90 passes between the Facility Substation and the park, and as such, noise impacts to Kirtland Park from the Facility Substation are anticipated to be negligible. Due to the highly urbanized and industrialized areas around the Facility Substation, the expected high ambient noise levels, described in Section 4906-4-08(A)(3)(a), and the lack of noise sensitive areas nearby, the Facility Substation is not anticipated to result in any adverse noise impacts.

Human-generated underwater noise is potentially becoming another threat to fish. Although humans have engaged in all sorts of activities in, on, and near water bodies for a long time, only recently have these activities expanded in an increasingly noisy manner (Slabbekoorn et al., 2010). Sound propagation underwater differs from that of sound in the air, due to differences in the density and impedance of the medium (Ingemansson, 2003). While there is some research on underwater sound-fields surrounding offshore wind turbines, there is little knowledge of how it affects fish behavior and health, particularly in freshwater ecosystems. To date, most of the research surrounding marine sound levels has been done to investigate pile driving. Extreme noise from pile driving is highly likely to cause mortality and tissue damage in fish (Bergstrom et al., 2014). However, gravity foundations like the MB result in considerably lower noise levels. Fish may react to the low intensity noises associated with gravity foundation installations by leaving the area, but the intensity of disturbance is low, and animals are likely to return soon after exposure has ended (Bergstrom et al., 2014). While knowledge on how freshwater fish hear is well documented, impacts to fish as a result of increased noise in field conditions is unclear.

Available data only allow a first approach towards an assessment of how operating wind farm noise will affect fish (Thomsen et al., 2006). Wind turbine type has a large effect on the sound intensities generated, and, therefore, on the range at which fish may be affected. Additional factors, especially the number of wind turbines, and water depth and bottom type may cause the detection and masking ranges calculated to vary considerably between different wind turbine parks (Wahlberg & Westerberg, 2005). Aggregation of fish species near the foundations of wind turbines has been documented (Bergstom et al., 2014). Overall, it seems most likely that noise impacts to fish are limited to high wind speeds at short distances from the foundation (Bergstrom et al., 2014).

The underwater sound from operating wind turbines is mainly generated by vibrations in the tower. The towers have a large contact area with water, which transmits the sound propagation effectively (Ingemansson, 2003). Underwater sound from operating turbines will also be influenced by the turbine's coupling with the bottom. Gravity foundations are expected to emit sound within a lower interval of frequency than monopile foundations (Hammar et al., 2014). A review of the current knowledge on detection of, and reaction to, sound by fish with special emphasis on underwater noise from offshore wind farms was done by Wahlberg and Westerberg (2005). The review looked at sound impacts due to wind farm noise on fish in terms of masking of acoustic communication, consistent triggering of alarm reactions, and temporal or permanent hearing damage. Sound measurements form a European offshore wind farm (with seven 1.5 MW turbines) were taken across low, medium, and high wind speeds from November 2002 to February 2003. The review predicted that goldfish, Atlantic salmon, and cod can detect offshore wind turbines at distances of 0.4 km (0.25 mile) to 25 km (15.5 miles). There was no evidence that wind turbine noise causes temporary hearing loss in fish even at a distance of a few meters. Wind turbines produce sound intensities that may cause permanent avoidance by fish within ranges of approximately 4 meters (13.1 feet), but only at high wind speeds. The wind turbine noise may have a significant impact on the maximum acoustic signaling distances by fish. However, it is not known to what degree this actually reduces the fitness of the fish (Wahlberg & Westerberg, 2005).

Additionally, shipping induces considerably higher sound intensities than wind turbines (Wahlberg & Westerberg, 2005). Commercial ships are a dominant source of radiated underwater noise at frequencies less than 200 hertz (Hz), which is within the hearing range of many fish (Hildebrand, 2009 & Slabbekoorn et al., 2010). Offshore wind farms can create low-frequency noise at high source levels during their construction (e.g., pile driving), but only at moderate source levels during their operation (Hildebrand, 2009). A cargo vessel (173 meters in length, at 16 knots) will produce a source level of 192 dB re 1 µPa @ 1 m, a small boat outboard engine (at 20 knots) will produce a source level of 160 dB re 1 µPa @ 1 m, and an operating wind turbine will produce a source level of 151 dB re 1 µPa @ 1 m (Hildebrand, 2009). Based on the information above, the proposed Facility is not expected to result in significant impact to the fish community. The Applicant will monitor underwater noise levels as pre-, during- and post-construction. Details of the monitoring are discussed in Section 4906-4-08(A)(3)(e).

(ii) Processing equipment

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

(iii) Associated road traffic

There will be minimal road traffic associated with operation of the Facility. The onshore areas, including the Substation and the Port, associated with the proposed project are located within heavy industrial areas and are regularly exposed to industrial noise and elevated ambient sound levels. In addition, existing heavy traffic areas are adjacent to the onshore areas (e.g., I-90), which contribute to the current elevated noise levels. There will be increased boat traffic due to O&M activities at the turbines. However, since Lake Erie experiences frequent boat traffic from commercial shipping and fishing and recreation, no significant additional underwater noise impacts are anticipated.

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

There are no terrestrial noise-sensitive areas within 1 mile of the Facility, as the onshore components are located within heavy industrialized areas. On the water there will be no permanent human receptors of noise within the turbine area or along the transmission route, and therefore no noise-sensitive areas within one mile of the facility. Depending on the location and time of year, numerous species of fish, zooplankton, phytoplankton, and macroinvertebrates can be found in the nearshore waters of Lake Erie (ODNR, 2015) along the cable route. However, there are no anticipated noise effects on fish or other organisms from HDD construction operations since the noise generating equipment will all be onshore, with the exception of the drill bit and string, which will be dozens of feet under the sea floor (Xodus, 2015). Noise from HDD will be short-term with impacts only during HDD activities, which are expected to last approximately one month. Post-construction, no noise is expected in the nearshore area, as the cable will be buried several feet below the sediment surface. Additionally, the wind turbines, as the turbines are located several miles from all identified spawning areas, and other organisms including zooplankton, phytoplankton, and benthic macroinvertebrates are not sensitive to noise levels (Exhibit O). As such, any noise generated by the turbines are not expected to have an impact to noise sensitive areas.

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

In order to mitigate noise emissions and impacts to aquatic communities during construction and operation, the Applicant is working with ODNR in an effort to time activities to avoid sensitive fish spawning periods. As described above, the use of HDD in the nearshore area will minimize potential effects to sensitive underwater nearshore habitats as the generating equipment is either onshore or

beneath the lakebed. The Applicant will monitor underwater noise levels as part of its pre-, during-, and post- construction activities to validate site specific estimates of anticipated noise levels. Additional information on the underwater noise study to be carried out by LimnoTech is detailed in the next section.

(e) *Preconstruction Background Noise Study*

Some research has been done to determine the effects of offshore wind turbine noise on fish, and lower trophic levels of aquatic communities. Sources of anthropogenic sound are extensive and include boating, shipping, seismic exploration devices, construction activities, and sonar used by the shipping industry, commercial and recreational fishers, military, and research communities. Pre-, during-, and post-construction surveys are critical to assessing any potential impacts of offshore wind farms on aquatic habitats. Unlike the ocean environment, freshwater species of fish and other organisms do not rely on sound as much as marine animals. However, the Applicant, under contract with LimnoTech and Cornell Bioacoustics and in coordination with the ODNR, has conducted site specific assessments of underwater ambient noise levels.

Underwater background noise production monitoring was conducted continuously from May through October, 2016. Two underwater sound recorders were deployed using Ocean Instruments Smart Hydrophone Soundtraps. One Soundtrap was installed at proposed turbine location 4 and the other was installed at a reference station, 1 mile west of the turbine location, both 2 meters above the lake bottom. The Soundtraps recorded 30 minutes every hour at 72 kHz. This monitoring provides an assessment of underwater background noise at the proposed turbine location, which can be used as a comparative tool for any noise monitoring during- and post-construction.

Results from preconstruction noise monitoring will be provided to OPSB staff upon completion of the final report. Noise monitoring will continue through all phases of the Project including construction and post-construction. Additionally, LimnoTech completed preconstruction surveys on fish behavior and fish community/lower trophic levels. These studies will be compared to noise monitoring results and serve as a benchmark to assess potential impacts or behavioral adaptions due to the turbines on the aquatic communities. The results of these preconstruction studies will be provided to OPSB staff upon completion of the final report.

(4) Water Impacts

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

The Project will not have any impact on public or private water supplies. See Section 4906-4-08(A)(4)(d) below for additional information.

(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. They do not require pollution control equipment. Therefore, this section is not applicable.

(c) *Water Resources Map*

Figure 08-1 shows water wells, intakes, source water protection areas, and aquifers in relation to the Project. The proposed facility will not directly affect any aquifers, water wells, or drinking water source protection areas. See Section 4906-4-08(A)(4)(d) for additional information.

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

The Source Water Assessment and Protection (SWAP) program helps public water suppliers protect sources of drinking water, including streams, rivers, lakes, reservoirs, and aquifers from contamination. In Ohio, the SWAP program addresses more than 4,500 public water systems (Ohio EPA, 2003). Two intakes for the City of Cleveland Division of Water that are considered Source Water Protection Areas are located near the proposed Facility. The intakes are approximately 4 miles offshore, and approximately 2.5 miles west of the Facility's proposed export cable route. Lake Erie waters in the vicinity of the intakes generally flow from west to east (Ohio EPA, 2003), so any sediment disturbance would not affect water quality at the intakes. The cable route is outside of the Source Water Critical Assessment Zone, which is a 1,000-foot radius around the intake location.

Installation of the proposed Facility export cable and foundations will create temporary localized sediment suspension; however, as described in Section 4906-4-07(C)(2)(b), sediment levels associated with jet plow cable burial only result in elevated sediment levels within 30 meters (98 feet) of installation. Additionally, sediment levels are only elevated for about 5 hours before water conditions return to background conditions. None of the intakes or their Critical Assessment Zones are within 100 feet of the cable or foundation installation sites. The general flow of Lake Erie in the vicinity of the Project and the intakes is east to west. Three of the four intakes located in and around Cleveland are to the east of the cable and foundation installations. The other intake is located over 2 miles away from installations of

Project components. As there is a large distance from the export cable and foundations to the intakes and the general Lake Erie flow direction from the Facility is away from the intakes, there is no anticipated contamination to Source Water Protection Areas.

(e) *Prospects of Floods in the Area*

A floodplain is flat land adjacent to a lake, 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 proposed structure (ODNR, 2016a).

Surface water bodies in the area include Lake Erie, along with the Cuyahoga River, and the Old River. The Cuyahoga River flows northwest, discharging into Lake Erie through a man-made channel. The Old River is a short tributary draining into the Cuyahoga near the outlet to Lake Erie. Information on floodplains in the vicinity of the Project Area was obtained from the Federal Emergency Management Agency (FEMA).

The Facility Substation will be located on CPP property adjacent to the existing Lake Road Substation. The waters of Lake Erie are designated as Zone AE, indicating there is a 1% annual chance of flooding. However, while the Facility Substation site is located adjacent to Lake Erie, it is located outside the FEMA-mapped boundaries of the 100-year floodplain and associated floodways (FEMA, 2010). The Facility Substation will be consistent with CPP and PJM requirements. Work performed at the Substation will not alter existing grading, draining, or flood risks.

The O&M Center will be located in an existing building on land leased from Great Lakes Towing, on Division Road approximately 1.6 km (1.0 mile) from the Cleveland outer harbor. This site abuts the Old River, which is also designated as Zone AE. However, as with Lake Erie in the vicinity of the Facility Substation, the FEMA-mapped 100-year floodplain does not extend beyond the banks of the river (FEMA,

2010). The Applicant does not anticipate making any modifications to the existing building. Consequently, there will be no change to existing flood risks.

The prospect of floods does not apply to the wind turbine component of the Facility, as the turbines will be located in Lake Erie, 8 to 10 miles offshore. Any increase in the depth of water around the turbines would be negligible compared to the current water depth of approximately 62 feet chart datum (CD) at the proposed turbine locations.

(5) Geological Features Map

A preliminary geophysical survey was conducted by Alpine Ocean Seismic Survey in September 2010. The survey included: (1) bathymetry data collection using a dual-frequency, single-beam, echo-sounder; (2) side scan sonar data collection to identify and describe seafloor features and obstructions pertinent to performing a geotechnical site investigation; (3) magnetometer data collection to identify and describe magnetic anomalies; and (4) a single-channel seismic data collection, using a mechanical "boomer" sound source to image the stratigraphy and thickness of sediments above the shale bedrock (Exhibit I; submitted under seal). Subsequent to this, a more focused survey was conducted in 2015, which is discussed in detail below.

In 2015, a geotechnical exploration and evaluation was conducted at the proposed six turbine sites, and one alternate location. The work was performed by a combined effort of McNeilan & Associates, DOSECC (Drilling, Observation and Sampling of Earths Continental Crust), and Gardline. The work included sample borings plus two or three cone penetration test (CPT) soundings at each of the seven locations. The total work included 17 CPTs, 10 boreholes, 6 surficial samples, and over 340 lab tests. The exploration included an alternate site in order to allow the option to shift the project alignment and reduce the number of turbine positions underlain by sediments containing gravel, while staying within the permitted area. The study determined the optimum 6 locations for turbine installation with a mono-bucket foundation. The geotechnical report and field survey report are included as Exhibit I.

From August through September, 2016, a geophysical survey of the Project Area cable route was completed by Canadian Seabed Research Ltd. (CSR) and TDI Brooks to identify and map surficial geology, lakebed features and sub-bottom conditions within the route corridor of the proposed submerged export and inter-array cables. The survey involved data collection through the use of sidescan sonar, high-resolution chirp profiler, marine magnetometer, dual frequency single beam echosounder system, multibeam sonar system, boomer shallow seismic system, and grab samples (Exhibit I).

A geotechnical survey was performed within the corridor of the proposed submerged export and inter-array cables from September through October, 2016 by TDI Brooks. The survey consisted of the collection of 11 piston cores, 4 box cores, and 44 gravity CPT piezocone penetration tests. The work will be used to provide lake-bottom and subsurface definition to finalize cable route alignments, design and plan for the cable route alignments, design and plan for the cable route installation, and design and construction of the HDD shore crossing once a cable installer is selected. Factual data from the survey and an initial draft of the interpretive report are included as Exhibit I. A final draft of the interpretive draft will be provided to OPSB staff upon receipt from TDI Brooks.

Figure 08-2 shows the proposed Facility, geological features of the proposed facility site, topographic contours, and oil and gas wells.

(a) Geologic Suitability

Existing Conditions

The proposed turbine location is located in an area of relatively uniform lakebed topography that slopes downward from southeast to northwest. The uniformity of the lakebed is due to the presence of extremely soft to very soft sediments present on the lakebed. Water depth increased linearly with increasing distance from shore. Recent, Holocene-aged sediments blanket the lake bottom in the proposed Project Area. The sediments are predominantly extremely soft to soft, fine-grained, and unconsolidated to normally consolidated deposits. Within the Project Area, the lake-bottom sediment is predominantly composed of clay-sized particles with a lesser percentage of silt-sized particles, which increase with depth. The lake-bottom sediment overlays a sequence of late Pleistocene glacial and post glacial sediments. Bedrock beneath Lake Erie may consist of shale, siltstone, sandstone, and limestone. Bed rock beneath Lake Erie ranges from exposed, to shallowly buried, to buried by more than [redacted] meters of sediment. Borings at two sites indicated approximately [redacted] meters of sediment over the bedrock. Sediment thickness over other sites is not known because borings did not encounter bedrock.

Earthquakes of moderate to low intensity have been reported near the Project Area. Most seismic activity in the area is less than magnitude (M) 4, however, events greater than 4 have been recorded. The average elapsed time between earthquakes is much longer in the eastern United States compared to the western United States. The largest seismic event, 4.9 M, below the Lake Erie region occurred in Lake County, Ohio in 1986 (Ahmad & Smith, 1988). The epicenter was approximately 30 miles east of the proposed Facility. According to the United States Geological Survey (USGS) hazard map peak ground

acceleration associated with a 2% probability of occurrence over a 50-year period is between 0.10 to 0.14g (Exhibit I).

Analyses were performed by Universal Foundation to determine if site soil conditions would meet a safe design standard for the MB foundation. The analyses included penetrability of the bucket foundation, bearing capacity, deformation, and cyclic analysis. Data from the geotechnical investigation was used to optimize the bucket diameter and skirt length of all six mono-bucket foundations. This resulted in a basis of design (BOD) with no geotechnical items considered Non-Compliant by DNV GL.

Ice

Ice in Lake Erie normally begins to form at the western end of the lake during early December. The amount of ice cover begins to accelerate in early January and is usually at its maximum in February. There is a large variation of ice cover at Lake Erie, ranging from less than 25% cover of the lake surface in a mild year to 100% cover during severe winters (Daly, 2016). Ice cover in Lake Erie has the potential to produce two different types of loading on the turbine towers. Surface ice can grow to be several feet thick and when driven by winds and currents the ice can cause steady and periodic loads on the wind-turbine tower. Loading can also come from ice pressure ridges when ridges and keels are formed as the ice moves during the winter. Ice load data were investigated using multiple approaches, including Eranti Engineering (ice/turbine designer), the USACE's Cold Regions Research Engineering Lab (CRREL), DNV GL, and Allyn & Croasdale (freshwater ice engineers).

The Applicant contracted with the USACE CRREL to analyze all historical ice thickness data in existence for Lake Erie. The results provided an extensive data set for sheet ice thickness, frequency of ridges and keels, and the maximum possible thickness of consolidated ice (Exhibit T).

The Applicant also contracted with the Arctic Ice team from DNV GL to review Eranti Engineering's (ESA) methodology previously developed for the Project (Exhibit U, submitted under seal). The Eranti ice analysis estimated dynamic ice forces and their significance in the fatigue limit design of the turbine foundations. Comparisons of dynamic ice loads and wave loads were made. Dynamic forces were also estimated for ice loads coupled with wind. The average annual number of weeks with ice present at the Project Area is about 10, ranging from zero to 20 weeks. The main driving forces of ice are wind and current. Considering the prominent wind directions, the Project Area does not have dynamic ice and extensive ice ridge build up connected to events when strong winds blow from the same direction for a

long time. Eranti Engineering concluded that, based on the ice forces coupled with wind, little impact on the design is anticipated.

Ice forces and dynamic response can be cut by up to an order of magnitude with the help of a cone at the water line (Eranti, 1992). The foundation shall be equipped with a downward icebreaking cone to reduce ice loads and eliminate ice-induced vibrations. Preliminary design of the ice cone can be seen in Inset 1 in Section 4906-4-03(B)(2)(a).

The Design Load Cases (DLC) performed for ice loads are consistent with IEC 61400-3 Design requirements for offshore wind turbines.

The final ice analysis was performed by Norman Allyn and Ken Croasdale, designers of the world's longest bridge in icing conditions and leading experts in engineering designs for freshwater icing conditions. Their work analyzed all previous calculations and data to confirm that the Icebreaker project foundation design would meet design requirements and be able to withstand Lake Erie ice loadings.

(b) Soil Suitability

Soil grading, compaction, and drainage are not necessary for the turbines or cable route, which are located in an offshore environment. Since there will be no dredging, drilling, or modification of the lakebed, there is no need for post-construction reclamation. The Facility Substation will be located on an already-developed parcel. Construction activities related to the substation will occur on an existing gravel parking lot.

(c) *Plans for Test Borings*

The McNeilan & Associates 2015 geotechnical survey, described in Section 4906-4-08(A)(5) included 10 sample borings drilled to 1.3 to 24.5 meters below the lake-bottom. The samples were taken between August 28, 2015 and September 9, 2015. The soil borings were drilled and sampled by DOSECC. Moisture content and torvane tests were performed on board, and additional laboratory tests were performed at four geotechnical laboratories. Tests of samples (including borings) collected from the geotechnical survey were performed for 15 different parameters. Each test was conducted according to its respective American Society for Testing and Materials standard. A CS-14 model rotary drilling rig and open-hole mud rotary drilling methods were used for the project. Due to the underwater location of the borings, bore holes will naturally fill in with sediment and no bore closures are needed. Boring logs are included in Exhibit I, submitted under seal.

(i) Subsurface soil properties

Different sediment layers encountered during the geotechnical exploration, from lake bottom to bedrock, include Lacustrine (lake-bottom) deposits, upper glacial outwash deposits, upper glacio-lacustrine deposits, lower glacial outwash, lower glacio-lacustrine, and bedrock. Lacustrine deposits are extremely soft, unconsolidated, fine-grained sediments that encompass the lake bottom sediments and range from about [redacted] meters to [redacted] meters thick. Upper glacial outwash deposits consist of sand and gravel ranging from [redacted] to [redacted] meters in thickness. The upper glacio-lacustrine layer is fine-grained with traces to few angular to sub-angular gravel. The layer ranges in thickness from [redacted] to [redacted] meters. The second glacial outwash layer is the same composition as the upper glacial outwash layer, and is [redacted] to [redacted] meters thick. The lower glacio-lacustrine layer is a thick clay with traces to few sub-angular to angular gravel. Bedrock was only encountered at 2 locations, so layer thickness is not known across the sampling area. At the two locations bedrock was reached, the lower glacio-lacustrine layer was approximately [redacted] meters thick. The upper [redacted] to [redacted] meters is mixed with the overlying coarse-grained and silty sediments, while the bottom [redacted] to [redacted] meters have an increased gravel content. Additional detail on subsurface soil properties can be found in Exhibit I, submitted under seal.

(ii) Static water level

The surface water levels at the borings can be found in borehole logs in Exhibit I.

(iii) Rock quality description

Rock quality designation (RQD) is a commonly used index for the description of rock mass fractured state. It is the measure of the degree of jointing or fractures in a rock mass, measured as a percentage of the drill core in lengths of 10 cm or more. High quality rock has an RQD of more than 75%, low quality of less than 50% (Lucian & Wangwe, 2013). The detailed RQD of samples collected from borings is in Exhibit I.

(iv) Percent recovery

Details on boring percent recovery are in Exhibit I.

(v) Depth and description of bedrock contact

Bedrock was encountered by sample borings at two locations. At the first location, the recovered bedrock consisted of shale, where at the second location the bedrock consisted of sandstone

overlying mudstone. The bedrock was encountered at an elevation of approximately [redacted] meters (International Great Lakes Datum [IGLD] 85). At the other boring locations, the borings were stopped prior to reaching the bedrock. See Exhibit I for further detail.

(6) Prospects of High Winds in the Area

International standards for wind turbines are developed by working groups of Technical Committee-88 of the IEC, a world-recognized body for standards development. The proposed turbine for the Facility is designed to meet the standards of the IEC-61400 series, and are rated to specific IEC wind classes. As indicated in the turbine brochures included in Exhibit C (submitted under seal), the Vestas 126 is certified for class IIA winds, which are defined by the totality of the conditions detailed below:

- Turbulence intensity,
- Average annual wind speed,
- Average inclined flow,
- Wind speed distribution (Weibull),
- Wind profile,
- Turbulence model,
- Hub height extreme wind speeds – 1 and 50 year,
- Extreme gust speeds,
- Extreme directional change, and
- Extreme wind shear.

For example, during its design life, Class IIA turbines will withstand average wind speeds of up to 8.5 m/s (19 mph) and 18% turbulence as measured at hub height. It is important to note that these IEC standards represent minimum design values.

The Applicant performed a wind classification analysis, including an extreme wind analysis. Based on those results, MVOW (Vestas) determined that the wind regime was suitable for a Class IIA turbine, namely the V126-3.45. Highlights of this report indicated that long-term mean annual wind speeds at turbine hub height and location is [redacted] m/s ([redacted] mph), the maximum 10-minute average wind speed (for a 50-year return period) was calculated to be [redacted] m/s ([redacted] mph), the maximum 10-minute average wind speed for a 1-year return period was calculated as [redacted] m/s ([redacted] mph), and the IEC turbulence category for the site is [redacted]. The proposed turbine has a cut out speed, based on 10-minute exponential average, of [redacted] m/s ([redacted] mph). The Applicant will be able to adjust the pitch of the turbine blades (i.e., blade feathering) to protect the turbine from high

winds. The nominal withstand speed is [redacted] m/s ([redacted] mph), which is significantly higher than winds speeds documented in Lake Erie, the highest of which was recorded in 1969 at 100.1 mph (NOAA, 2015).

(7) Blade Shear

Another potential public safety concern is the possibility of a rotor blade dropping or being thrown from the nacelle. Due to the location of the proposed turbines, 8 to 10 miles offshore in Lake Erie, any impacts to the public would be confined to people boating on Lake Erie (i.e., for recreational and commercial uses). While rare, such incidents can be dangerous. The Applicant is unaware of any reported instances of a member of the public having been injured as a result of a blade failure of a wind turbine. However, the Applicant will post signs on the turbine platforms or on the turbines themselves, warning the public of the risk of blade shear in the vicinity of the turbines.

The reasons for a blade throw vary depending on conditions and tower type. Past occurrences of these incidents have generally been the result of design defects during manufacturing, poor maintenance, control system malfunction, or lightning strikes. Evidence suggests that the most common cause of blade failure is human error in interfacing with control systems. Manufacturers have reduced that risk by limiting human adjustments that can be made in the field. 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 (Garrad Hassan, 2007).

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 (American Society of Civil Engineers [ASCE] & American Wind Energy Association [AWEA], 2011). The engineering standards of the wind turbines proposed for this Facility are of the highest level and meet all applicable federal, state, and/or local codes. In the design phase, state and local laws require that licensed professional engineers review and approve the structural elements of the turbines. State of the art braking systems, pitch controls, sensors, and speed controls on wind turbines have greatly reduced the risk of blade throw. The wind turbines proposed for the Facility will be equipped with fully independent braking systems that allow the rotor to be brought to a halt under all foreseeable conditions. In addition, the turbines will automatically shut down at wind speeds over the manufacturer's threshold, 22.5 m/s (50) mph for the Vestas 126 IIA. See Section 4906-4-08(A)(6) for additional information regarding structural integrity as it relates to wind speeds. Even in the unlikely occurrence that the braking system fails, people will not be in the vicinity of the turbines during high winds as wave and boating conditions would be unsafe.

Although the risk of blade throw is minimal, the Applicant will have site-specific safety procedures in place in the event of a blade throw incident. The procedures will include emergency shutdown procedures, post-event site security measures, immediate notification of state and local officials, and the implementation of manufacturer specific safety precautions. The Applicant will conduct training to instruct employees of potential hazards. 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.

(8) Ice Throw

Ice shedding refers to the phenomena that can occur when ice accumulates on rotor blades, and subsequently breaks free and falls to the ground. Under certain weather conditions, ice may build up on the rotor blades and/or sensors, slowing the rotational speed, and potentially creating an imbalance in the weights of the individual blades. Field observations and studies of ice shedding indicate that most 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. Although less common, ice can potentially be "thrown" when ice begins to melt and stationary turbine blades begin to rotate again (although turbines usually do not restart until the ice has largely melted and fallen straight down near the base). There has been no reported injury caused by ice being "thrown" from an operating wind turbine (Garrad Hassan, 2007; Baring-Gould et al., 2012).

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 Wind Energy in Cold Climates research collaborative studied ice throw at operational wind farms throughout Europe. The data gathered shows 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 noticed ice build-up on the turbine. No ice pieces were found on the ground further than 328 feet (100 meters) from the base of the turbine, with most found within 164 feet (50 meters) (Garrad Hassan, 2007). Studies conducted in the Swiss Alps found that almost 40% of ice fragments were within 66 feet (20 meters) of the wind turbine and the maximum throwing distance was 302 feet (92 meters). Almost 50% of the ice fragments weight 0.1 pounds or less and the heaviest ice fragment weighted nearly 4 pounds (Cattin et al., 2008).

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. The turbines proposed for the Facility will utilize appropriate ice detection equipment. For example, systems will 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. As ice builds up on the blades of an operating wind turbine, it can lead to vibration, caused by both the mass of the ice and the aerodynamic imbalance. 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, not restarting until after the ice has dropped from the blades.

The Facility's proposed location and distance from permanent residents and adjacent property lines will protect the public from falling ice. The primary risk from ice throw would be related to commercial and recreational uses of Lake Erie. However, there is minimal recreational boating in Lake Erie between December 1 and April 1. Marinas in the area close between October and November and do not reopen until April or May, so the number of boats on the water when conditions are favorable for ice formation would be minimal.

(9) Shadow Flicker

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, 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 (Parsons Brinckerhoff, 2011; Sustainable Energy Authority Victoria, 2009). Furthermore, OPSB has previously used 30 annual hours of shadow flicker as a threshold of acceptability in reviewing and approving other commercial land-based wind projects in Ohio (OPSB, 2014). At distances beyond roughly 10 rotor diameters, approximately 1,260 meters (4,134 feet) based on the rotor proposed for this Project, shadow-flicker effects are generally considered negligible (Business Enterprise & Regulatory Reform [BERR], 2009; Department of Energy and Climate Change [DECC], 2011). The Facility will have no shadow flicker impacts on residential or other sensitive structures within 1,260 meters (4,134 feet) of the turbines, as the proposed turbines are located 8 to 10 miles offshore.

(10) Radio and Television Reception

Previous siting studies for proposed wind energy projects have noted that wind turbines are capable of partially blocking radio frequency signals from a broadcast facility (e.g., FM and AM radio stations) to a radio frequency user, especially if the user is using a portable or indoor antenna (DOE, 2012). The blockage can reduce the signal level, or can cause the signal to vary in strength as the turbine blades rotate. Signal blockage can be avoided by using turbine blades manufactured from dielectric materials and siting turbines at least 1 mile away from fixed receivers and transmitters (3 miles away for a medium frequency [MF] transmitter site). An AM/FM study performed by Comsearch for a land-based wind energy facility in Ohio indicates that potential problems with AM broadcast coverage are only anticipated when AM broadcast stations with non-directive antennas are within 2 miles of wind turbine towers, and within 0.5 miles for directive antennas (Comserach, 2011). Most anomalies caused by wind turbines to communications facilities are benign, and relatively easily mitigated.

Off-air television stations broadcast signals from terrestrially-based facilities directly to television receivers. Off-air reception does not include cable or satellite television reception, neither of which are affected by the presence of wind turbines. For television and FM radio frequencies (very high frequency [VHF] and ultra-high frequency [UHF]), the primary effect of turbines is to cause a local rhythmic change in field intensity. This effect is most pronounced close to the turbine and is generally compensated for by the receiver's automatic gain control (DOE, 2011). The coverage of FM stations, when the stations are at distances of greater than 2.5 miles from wind turbines, is not subject to degradation (Comserach, 2011).

The proposed wind turbines will be located 8 to 10 miles offshore in Lake Erie, and will be at least 8 miles from fixed transmitter sites and onshore receiver sites. Due to the distance between the Facility's turbines and transmitter/receiver sites, the Facility is not anticipated to affect TV and radio reception.

VHF radio is the most frequently used radio for commercial and recreational boating vessels and has designated channels for commercial ships to confirm passage and communicate actions, mayday distress calls, storm warnings and boat to boat communication. Studies on the Horns Rev wind farm in Denmark and the North Hoyle wind farm in the UK concluded that there were no significant effects on VHF communication in the vicinity of the wind farms. Those wind farms ranged from 30 to 80 turbines (Elsam, 2004; MCA and QinetiQ, 2004). Additionally, a modeling study by the University of Texas at Austin confirmed that the effect of wind farms on communication systems, including VHF, is anticipated to be low (Ling et al., 2013). In comparison to the Horns Rev and North Hoyle wind farms, Icebreaker Wind is a much smaller wind farm, with only 6 turbines. Therefore, Facility-related impacts on VHF communication is not anticipated.

(11) Military Radar Systems

Wind farms located within radar line of sight of an air defense radar have the potential to degrade the ability of the radar to perform its intended function (Department of Defense [DOD], 2006). The large radar cross section of a wind turbine combined with the Doppler frequency shift produced by the rotation of the turbine blades can affect the ability of a radar system to differentiate between a turbine and an aircraft (DOD, 2006). Turbines also have the potential to degrade target detection and tracking performance. The magnitude of the impact depends on the number and location of turbines (DOD, 2006). However, not all cases of turbine-radar proximity lead to interference.

Due to the potential for wind turbines to affect the operational capabilities of military air defense radar systems, the DOD has put in place a procedure for a developer of renewable energy to follow (i.e., request that the DOD conduct a mission compatibility review of its project). These DOD Siting Clearinghouse Reviews apply to energy projects filed with the Secretary of Transportation under 49 U.S.C. § 44718 (FAA obstruction evaluation process). The Applicant has filed its FAA Notice of Alteration or Obstruction forms 7460-1, which will trigger the DOD Siting Clearinghouse Review to confirm that military radars will not be adversely impacted. The DOD's Preliminary Screening Tool indicated that "preliminary review of your proposal does not return any likely impacts to military airspace."

Comsearch was contracted to send written notification of the proposed Facility to the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce (DOC). 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 DOD, the Department of Education, the Department of Justice, and FAA. 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 radar systems, this conflict would be identified during IRAC review.

The notification letter was sent to NTIA on August 11, 2016. A response letter was received October 13, 2016 and is attached as Exhibit V. Only the DOC identified concerns regarding the Project impacting its radar systems. The main concern from the DOC was the degradation of the detection of lake effect snow. However, the DOC proposed a mitigation strategy whereby the Applicant shares near-real time wind turbine meteorological tower data to compensate contaminated radar data with "ground truth" wind and precipitation data. The Applicant will work with the DOC toward this mitigation. There were not concerns from any other IRAC agencies.

(12) Microwave Communication Paths

Microwave telecommunication systems are wireless point-to-point links that communicate between two antennas and require clear line-of-sight conditions between each antenna. These systems are the telecommunication backbone of the country, providing long-distance and local telephone service, backhaul for cellular and personal communication service, data interconnects for mainframe computers and the Internet, network controls for utilities and railroads, and various video services. Microwave bands that may be affected by the installation of wind turbine facilities operate over a wide frequency range (900 MHz – 23 GHz).

A Licensed Microwave Report, Exhibit W, was prepared for the Project. Comsearch identified no microwave paths in the vicinity of the Project Area. Therefore, no degradation of microwave telecommunications is anticipated.

(B) ECOLOGICAL IMPACT

Several literature surveys of the Project Area, which are based on scientific field surveys of the Cleveland, Ohio shoreline and Lake Erie, were conducted beginning in 2008 to determine the environmental impact on wildlife (both terrestrial and aquatic) from the proposed project. Studies included, but were not limited to, radar, boat-based surveys acoustic monitoring, water chemistry, hydrodynamic surveys, noise studies, and aerial surveys. Three risk assessments (two avian and one bat) and an Aquatic Ecological Resource Characterization and Impact Assessment were prepared. A new avian and bat risk analysis was prepared in 2016. Each of the assessments concluded that the turbines are sited in an area where a low number of species will be exposed to turbines, and therefore, risk to wildlife from the construction, operation, and maintenance of the Project is low. These studies and assessments are discussed in Sections 4906-4-08(B)(1)(c) and 4906-4-08(B)(1)(d).

While state and federal agencies have agreed that the information regarding the impact to fish and wildlife supports a finding that the permitting processes at the state and federal levels can move forward, they have requested that the Applicant conduct additional field surveys prior to construction in order to provide a direct comparison with post-construction survey information, as a means to assess the level of wildlife impact during the operational phase of the project. The Applicant held several meetings with the ODNR and USFWS, many of which were joined by the OPSB, DOE, USACE, and the USCG, regarding the avian and bat studies done to date, the proposed post-construction monitoring plan, and any additional baseline studies needed to provide a point of comparison with post-construction monitoring, including:

- Meeting with the agencies on August 17th, 2016 in Columbus to discuss written responses to questions raised by the wildlife agencies in 2014 related to birds and bats;

- Two webinars hosted by the Applicant and WEST on December 6th and 9th, 2016 with agency representatives to review and respond to questions regarding the November WEST Summary of Risk to Birds and Bats;
- A two day meeting (December 13th and 14th, 2016) in Columbus to discuss proposed post-construction monitoring and additional baseline studies; and
- January 5th, 2017 meeting in Columbus with the agencies to discuss the Applicant's proposed matrix of post-construction monitoring options and additional baseline studies and responses to ODNR protocol for land based wind energy facilities.

In accordance with this suggestion, the Applicant is committed to performing additional field surveys prior to construction of the Project and has been working closely with the state and federal wildlife agencies to ensure that these field surveys will provide the requested information. The monitoring plan for birds and bats is being prepared by WEST, in coordination with ODNR and USFWS. Additional surveys may include radar studies, bat acoustic monitoring, waterfowl surveys, and collision monitoring (post-construction). The monitoring plan for aquatic resources and fisheries is being prepared by LimnoTech, in coordination with ODNR and USFWS. Details on additional surveys to be completed prior, during, and subsequent to construction are discussed in Sections 4906-4-08(B)(1)(e) and 4906-4-08(B)(3)(c).

(1) Ecological Resources in the Project Area

In support of the preparation of this Application, environmental experts and scientists from various firms have made numerous site visits to the proposed Facility location, and have conducted extensive on-site surveys to identify ecological resources and assess potential project impacts both above and below the water's surface. LimnoTech led the assessment of all aquatic aspects of the Project. TetraTech conducted preconstruction bird and bat surveys. WEST performed an assessment of all avian and bat risks and will prepare additional baseline and post-construction monitoring plans for the Project. This section describes the background information known about the Project Area and identifies the studies carried out to document the ecological resources.

A detailed Aquatic sampling plan was prepared in 2016 in coordination with ODNR and USFWS (Exhibit O) to characterize ecological resources in the Project Area and to lay out monitoring requirements for pre-, during- and post- construction monitoring. LimnoTech performed an Aquatic Ecological Resource Characterization and Impact Assessment in 2016 to evaluate physical, nutrient, and biological data at both the Project and reference sites to determine fish and lower trophic level community structure and habitat in the Project Area. Monitoring was conducted from May to October 2016 at turbine sites and reference sites around the turbines.

A summary of the 2016 study results are included throughout this application in Sections 4906-4-08(B)(1)(d) and 4906-4-08(B)(1)(e). The Applicant has prepared a Lake Erie Monitoring Plan for aquatic resources. A Memorandum of Understanding (MOU) memorializing the sampling plan (Exhibit O) will be prepared by ODNR, USFWS, and the Applicant and will be presented to OPSB staff upon completion. The MOU is anticipated to contain details regarding the monitoring plan and include a process for reporting, annual review, and revising/updating the monitoring plan.

TetraTech conducted preconstruction bird and bat surveys to determine the abundance of birds and bats in the vicinity of the Project Area. Surveys were conducted during the spring and fall of 2010. An avian and bat risk analysis was prepared by WEST in 2016 to identify the relevant ecological resources in and around the Project Area and evaluate the level of risk to birds and bats posed by the Project. The risk analysis includes a review of existing literature regarding species and species densities in the Project Area. The risk analysis will be described in greater detail in Section 4906-4-08(B)(1)(d).

(a) *Open Spaces and Facility Map*

Figure 08-3 shows the Facility and lands within a 0.5-mile radius of the proposed Facility. This mapping was developed from ESRI ArcGIS Online aerial imagery. 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*

No wetland or stream resources were delineated for this Project. As such, a figure of delineated wetland or stream resources is not applicable.

Geophysical surveys including substrate mapping of the proposed turbine locations were performed by Alpine (2010) and VanZandt Engineering (2015). Bathymetric and side scan sonar results showed a generally uniform and smooth lake bottom comprised of soft, silty sediments. No evidence of ripples or other sedimentary features were observed along the survey route. An additional side scan sonar survey of the proposed transmission line path was completed in 2016 (Exhibit I). The side scan sonar showed

a generally uniform and smooth lake bottom. No features or artifacts of historical or cultural significance were identified by the survey that would pose a hazard to the construction activities at the Project Site. The analyzed data also showed no areas of benthic significance. Results of side scan surveys will be provided to OPSB staff upon completion of the aquatics sampling report.

Vegetative surveys within 100 feet of the potential construction impact area of the Facility are not applicable for this project. The depth to the lakebed at the location of the proposed turbines is approximately 19 meters (62 feet). Photosynthetically Active Radiation (PAR), radiation that can be used as the source of energy for photosynthesis of green plants (Mõttus *et al.,* 2012), is essentially nonexistent at a depth of 16 meters (52 feet) as shown by LimnoTech in their 2016 study of water clarity (Exhibit O). Based on findings from the Alpine survey and the depth to the lakebed at the proposed turbine locations, there is no reason to expect that rooted aquatic vegetation exists within 100 feet of the proposed Facility Area.

The area within a 100-foot radius surrounding the substation is water or developed land. The substation property contains some ornamental trees and shrubs around the buildings and a narrow row of trees lining much of the immediate lakeshore (which is hardened shoreline). Based on aerial imagery, the narrow vegetated area between the substation buildings and the lakeshore is less than 40 feet wide.

There are no wetlands or streams within 100 feet of the Facility Area, including the Facility Substation. The Old River flows alongside the Great Lakes Towing property, a portion of which will be leased for use as the O&M Center. However, the Applicant does not anticipate making any modifications to the existing building or grounds.

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

The Facility Substation is located on a parcel of developed land in downtown Cleveland. The only terrestrial wildlife species that could occur at the Substation site include species adapted to human activity (e.g., squirrels, woodchucks, skunks, robins, crows, gulls, etc.). These species provide no commercial or recreational value to the area. The only terrestrial organisms that have the potential to be affected by the proposed turbines are birds and bats. Potential impacts to these organisms are addressed in Sections 4906-4-08(B)(1)(d) and 4906-4-08(B)(1)(e).

Birds and bats are located at the Facility Substation as well as above the water over Lake Erie. Review of the USFWS lists indicate the potential occurrence of 5 federally-listed bird and bat species in the vicinity

of the proposed Facility: Indiana bat (endangered), Northern long-eared bat (threatened), Red Knot (threatened), Piping plover (endangered), and Kirtland's warbler (endangered) (USFWS, 2015). Each of these species is briefly described below:

- Indiana bat (*Myotis sodalis*): The Indiana bat is a migratory species that hibernates in caves and mines in the winter. In spring, reproductive females emerge from their hibernacula and migrate, forming maternity colonies in wooded areas to bear and raise their young. Trees (dead, dying, or healthy) with exfoliating or defoliating bark, or trees containing cracks or crevices, provide suitable summer roosts. Indiana bats require a mosaic of habitats for feeding, preferring to forage along streams/rivers and above water bodies, but also utilizing upland forests, clearings with successional old field vegetation, the borders of croplands, wooded fencerows, and pastures (USFWS, 2007). TetraTech biologists conducted a bat acoustic survey offshore at the Cleveland Intake Crib and a surrounding 4-mile radius and at select sites along the shoreline of Lake Erie during the spring, summer, and fall of 2010 to quantify bat use onshore and offshore near the proposed Facility. This data was then used to assess potential risk associated with building and operating the Facility. The Indiana bat occurs in Ohio but is unlikely to occur in the vicinity of the proposed Facility. The key findings of the report were that there is one known Indiana bat maternity colony and no known hibernacula in Cuyahoga County (USFWS, 2007). Undisturbed forested habitat typically occupied by Indiana bats was not observed in the vicinity of the proposed Facility. There are no known colonies of Indiana bats in Ontario, so it is highly unlikely that these bats migrate across the lake or are present near the Facility.
- Northern long-eared bat (*Myotis septentrionalis):* The northern long-eared bat is a medium sized bat with long ears, weighing between 0.2-0.3 ounces. This bat hibernates in caves and mines during the winter (NYNHP, 2015). The range of this bat is typically associated with mature interior forests. Although they are most often found in cluttered or densely forested areas including in uplands and at streams or vernal pools, northern long-eared bat may also use small openings or canopy gaps as well.
- Red knot (*Calidris canutus rufa*): The red knot is a migratory bird that travels yearly between breeding grounds in the Arctic and wintering grounds in North, Central, and South America. In Ohio, the species is scarce in the spring. Ohio gets small numbers of the species, with most moving through in the fall (ODNR, 2012). The red knot does not nest in Ohio, but instead passes through during migration.
- Kirtland's warbler (*Dendroica kirtlandii)*: Kirtland's warblers are known to migrate along the Lake Erie shoreline through Ohio in late April to May and late August through early October (USFWS,

2015). According to the ODNR, probably or nearly all of the population passes through Ohio during migration (ODNR, 2007).

- Piping plover (*Charadrius melodus)*: Piping plovers are small shorebirds (wingspan approximately 18 cm) found along the Atlantic and Gulf coasts, as well as inland in the northern Great Plains and the Great Lakes region. The species used to nest on the larger Lake Erie beaches, but due to the disturbance of their habitat, the species has disappeared as an Ohio breeder. The piping plover is now considered only a migrant species in Ohio (ODNR, 2012).

In a March 24, 2014 correspondence to the OPSB, the USFWS stated, in relevant parts: *"While Indiana bats have been documented to fly over Lake Erie (Niver 2013, personal communication), given that no maternity colonies are known to occur in Canada, and that the majority of their hibernacula are to the south of the project area, it is unlikely that Indiana bats will encounter the LEEDCo project..."* (emphasis added). *"Though historically abundant, the northern long-eared bat has rarely been found during mortality surveys at onshore wind facilities. Since this facility is not located near any forested area and because northern long-eared bats seem to be less susceptible to collision mortality from wind turbines, it is unlikely that northern long-eared bats will encounter the LEEDCo project"* (emphasis added). *"Piping plovers, red knots, and Kirtland's warblers all migrate through Ohio... The proposed location for the facility does not have suitable habitat for these species. Most observations of these species occur in the western basin of Lake Erie, where there is more stopover habitat. Finally, given the scale of the project, it is the Service's believe [sic] at this time that it is unlikely these species will encounter the LEEDCo project."* (emphasis added)

The USFWS recently reinforced these conclusions in an October 2016 letter submitted to the U.S. DOE in relation to its National Environmental Policy Act review. "*The LEEDCo project area does not provide suitable summer or hibernation habitat for Indiana bats or northern long-eared bats. Thus, no impact to these species is anticipated during the summer or winter* (emphasis added). *The only potential risk periods for either of these species are during spring and fall migration…The Indiana bat range does not extend into Canada north of the project area. Thus, there is no reason to expect that Indiana bats would be flying across Lake Erie during spring or fall migration. Therefore we do not anticipate that this species will be impacted by the proposed project* (emphasis added)*....The range of the northern long-eared bat does include Canada north of the project area. However, northern long-eared bats are thought to be short distance migrants. Thus it is unlikely that northern long-eared bats would be migrating long distances across the open waters of Lake Erie* (emphases added). *Piping plovers, red knots, and Kirtland's warblers all migrate through Ohio but none are known to overwinter here…It is unknown if they [Piping*

plovers] migrate across the open waters of Lake Erie, or if their migration path would take them through the proposed project area…Individual birds [Kirtland's warblers] have been banded during spring and fall migration, and geo-locators have indicated at least some of these birds are likely to have migrated across open waters of Lake Erie...The proposed location for the facility does not have suitable habitat for these [red knot] species. Most observations of these [red knot] species in Ohio occur along the shoreline of the western basin of Lake Erie where there is more stopover habitat."

State-listed threatened and endangered species within Cuyahoga County are listed in the table below (Table 6). The ODNR lists 16 mammals, 8 birds, 4 insects, 4 fish, 6 invertebrates, 2 reptiles, 1 amphibian, and 17 plants considered threatened, endangered, or species of concern in this county.

Table 6. State-Listed Species that Occur in Cuyahoga County

Scientific Name	Common Name	Habitat	Ohio Status[1]
Reptiles and Amphibians			
Clemmys guttata	spotted turtle	variety of wetlands	T
Emydoidea blandingii	Blanding's turtle	variety of wetlands	T
Hemidactylium scutatum	four-toed salamander	variety of wetlands	SC
Fish			
Notropis dorsalis	bigmouth shiner	stream pools, sandy substrates	T
Percina copelandi	channel darter	shorelines	T
Rhinichthys cataractae	longnose dace	rocky streams/shorelines	SC
Salvelinus namaycush	lake trout	deep waters, western basin	SC
Insects			
Chimarra socia	a black caddisfly	rapidly running waters	E
Euphyes bimacula	two-spotted skipper	variety of wetlands	SC
Speyeria idalia	regal fritillary	prairies	E
Tricholita notata	marked noctuid	prairies	E
Aquatic Invertebrates			
Alasmidonta marginata	elktoe	streams, small/medium rivers	SC
Lasmigona compressa	creek heelsplitter	creeks, small rivers	SC
Ligumia recta	black sandshell	medium/large rivers	T
Orconectes propinquus	Great Lakes crayfish	rapidly running streams	SC
Orconectes virilis	northern crayfish	rocky streams	SC
Ptychobranchus fasciolaris	kidneyshell	medium/large rivers	SC
Birds			
Accipiter striatus	sharp-shinned hawk	woodlands	SC
Charadius melodus	piping plover	migrant only	E[2]

Scientific Name	Common Name	Habitat	Ohio Status[1]
Dendroica kirtlandii	Kirtland's warbler	migrant only	E[2]
Dolichonyx oryzivorus	bobolink	grasslands, prairies, pastures	SC
Falco peregrinus	peregrine falcon	variety	T
Gallinula chloropus	common moorhen	marshes	SC
Rallus limicola	Virginia rail	marshes	SC
Sphyrapicus varius	yellow-bellied sapsucker	wet deciduous forests	SC
Mammals			
Condylura cristata	star-nosed mole	low wet areas near lakes or streams	SC
Eptesicus fuscus	big brown bat	woodlands	SC
Lasionycteris noctivagans	silver-haired bat	woodlands	SC
Lasiurus borealis	red bat	woodlands	SC
Lasiurus cinereus	hoary bat	woodlands	SC
Microtus pinetorum	woodland vole	woodlands	SC
Mustela erminea	ermine	variety	SC
Myotis lucifugus	little brown bat	woodlands	SC
Myotis septentrionalis	northern long-eared bat	woodlands	SC[3]
Myotis sodalis	Indiana Bat	woodlands	E[2]
Napaeozapus insignis	woodland jumping mouse	brushy areas near water	SC
Peromyscus maniculatus	deer mouse	variety	SC
Sorex fumeus	smoky shrew	birch and hemlock forests	SC
Synaptomys cooperi	southern bog lemming	low damp bogs and meadows	SC
Taxidea taxus	badger	variety	SC
Ursus americanus	black bear	woodlands	E
Plants			
Calopogon tuberosus	grass-pink	open wet areas	T
Carex louisianica	Louisiana sedge	forested swamps, alluvial areas	E
Cyperus schweinitzii	Schweinitz's umbrella-sedge	open sandy areas	T
Cypripedium reginae	showy lady's-slipper	open wet areas	T
Elymus trachycaulus	bearded wheat grass	variety	T
Epilobium strictum	simple willow-herb	open wet areas	T
Hieracium umbellatum	Canada hawkweed	open, dry, sandy areas	T
Juncus platyphyllus	flat-leaved rush	various open	E
Juniperus communis	ground juniper	various open	E
Melampyrum lineare	cow-wheat	variety	T
Monarda punctata	dotted horsemint	open, dry, sandy areas	E
Oryzopsis asperifolia	large-leaved mountain-rice	open, well-drained areas	E
Plagiothecium latebricola	lurking leskea	swamps, marshy areas	T
Sisyrinchium montanum	northern blue-eyed grass	open wet areas	T

Scientific Name	Common Name	Habitat	Ohio Status[1]
Solidago puberula	dusty goldenrod	open dry areas	E
Solidago squarrosa	leafy goldenrod	rocky woods, thickets	T
Viburnum alnifolium	hobblebush	moist woods	T

Source: ODNR, 2016b, 2016c, 2016d; DLZ, 2008.
[1] E = Endangered, T = Threatened, SC = Species of Concern.
[2] This species is also federally-listed as Endangered.
[3] This species is also federally-listed as Threatened.

The state-listed species that occur in Cuyahoga County are generally found in rivers/streams, wetland, woodland, and prairie habitats, which do not occur within the Project Area. As described above in Section 4906-4-08(B)(1)(b), the only water features in or adjacent to the Project Area are Lake Erie, the Cuyahoga River, and the Old River. The Lake Erie shoreline is hardened in the vicinity of the Facility Substation and the HDD boring pit, and does not provide habitat for threatened and endangered species. This is the only area subject to onshore construction activities; there will be no modifications required at the Great Lakes Towing site along the Old River, to be leased for the O&M Center. Therefore, Facility-related impacts to state-listed species are not anticipated.

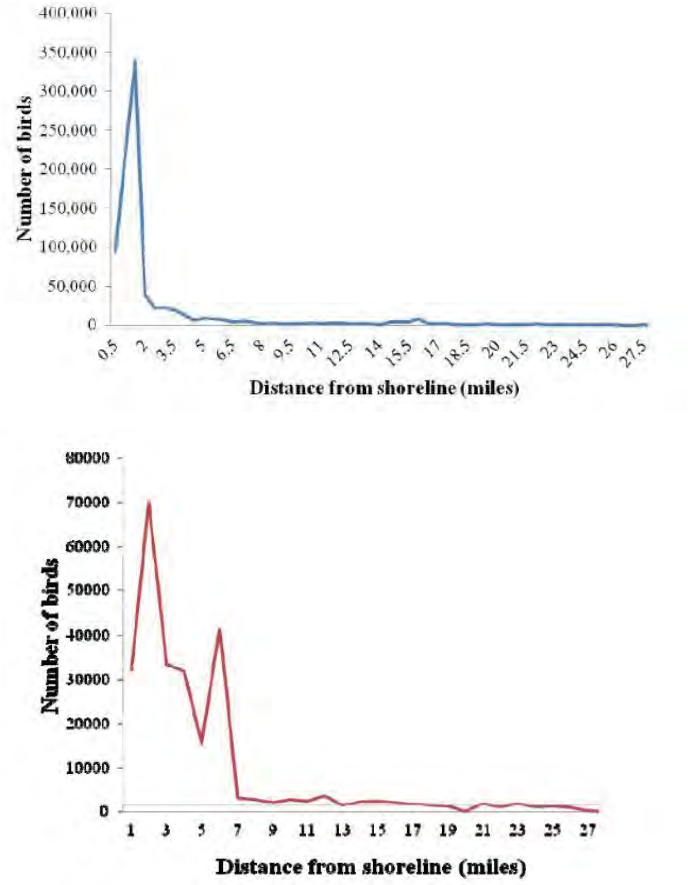
An important reason that the Project poses low risk to birds and bats is that it is only a 6 turbine project. The turbines are also located in an area where existing studies indicate relatively low use by wildlife in general. Because the turbines are proposed to be sited 8-10 miles offshore, they are well removed from any habitat that supports terrestrial species. Thus, wildlife species that might typically occur at a wind project, including mammals, reptiles, amphibians, nesting birds, and roosting bats, are not found at the proposed Project Site. The only species that could be exposed to the turbines are flying birds and bats and water birds (ducks, geese, and gulls) that could be present on the water surface. The 2016 WEST Icebreaker Wind: Summary of Risk to Birds and Bats (Exhibit J) analyzed potential risks to birds and bats from the Project based on published literature and studies performed at the Project Site. A discussion of existing conditions data included in the Risk Analysis is presented below.

Birds and Bats

A region-wide analysis of NEXRAD radar study was done to study nocturnal bird migration patterns for the entirety of spring and fall migratory periods. The study demonstrated that density of nocturnally migrating birds was 2.72 times higher over land than it was over water in the central Lake Erie basin, where the turbines are proposed to be located, during the spring migration period and 2.13 times higher over land than over the lake during the fall migration period (Diehl et al., 2003). Given that nocturnal migrant bird density recorded over the central basin of Lake Erie was less than half of the density recorded

over land during both spring and fall migration, substantially fewer birds will be exposed to the offshore turbines, when compared to typical land-based wind farms. In 2017, WEST completed a new analysis of nocturnal migrant bird movements over the Project area in relation to comparison areas using NEXRAD radar (Exhibit J). The results of this study were consistent with the Diehl et al. (2003) study in showing that migrant densities were approximately twice as high (average 2.5 times higher) over land as they were over water in the central Lake Erie basin. However, the new NEXRAD study substantially strengthened the conclusion of low risk to nocturnal migrant birds from the Project relative to the Diehl et al. study in three principal ways, as follows: 1) the area of study was the actual Project Area, whereas Diehl et al. analyzed an area that was larger and located further offshore in the central Lake Erie basin; 2) the new study used more recent data, from 2013-2016, whereas Diehl et al. used data from 2000; 3) the new study analyzed three years (six migratory seasons) of data, whereas Diehl et al. analyzed a single year (two migratory seasons) of data.

Aerial avian surveys were conducted by the ODNR over a 2-year period over a large portion of the south-central Lake Erie basin, including the Project Area. The survey involved weekly flights during fall (mid-October through mid-December) and spring (mid-March through mid-May) in 2009-2010 and 2010-2011. In total, 725,785 individual bird observations were collected, representing 51 species (Norris and Lott, 2011). Data from the survey indicated that bird abundance drops rapidly at distances 2 miles (year 1) and 5 to 7 miles (year 2) from the Lake Erie shoreline and was negligible (year 1) or minimal (year 2) at distances between 8 and 10 miles from shore, where the turbines are proposed to be sited. Inset 11 shows results of total bird observations in relation to distance from shoreline. Based on the data, the only species that may occur in the vicinity of the Project Area on a somewhat consistent basis are red-breasted merganser (*Mergus serrator)*, common loon (*Gavia immer*), horned grebe (*Podicpes auritus*), Bonaparte's gull (*Chroicocephalus philadlphia*), and ring billed/herring gull (*Larus delawarensis/L. argentatus*). The merganser, loon, and grebe densities were roughly 1 bird per survey or lower. The gulls may have been present at a density up to 5 birds per survey (Norris and Lott, 2011). Due to the minimal to negligible utilization of the Project Area by waterbirds, exposure of these species to the proposed turbines will be minimal.



Inset 11. Total bird observations in relation to distance from Lake Erie shoreline from fall 2009 to spring 2010 (top) and fall 2010 to spring 2011 (bottom) (Norris and Lott, 20111)

Eagles and other raptors are also not anticipated to be found near the Project turbines. Bald eagles and osprey regularly forage over water for fish, but typically within several miles of shore (Buehler, 2000; Poole et al., 2016). This was confirmed by the boat-based avian baseline surveys conducted in nearshore waters near the Project Site during 2010 (Svedlow et al., 2012) and the aerial avian surveys conducted by the ODNR (Norris and Lott, 2011). Neither of the studies resulted in any observations of raptors within 10 miles of the Project Area. Additionally, raptor migration, specifically within the Great Lakes region (HMANA, 2016), tends to be heavily concentrated along shorelines and at narrows and peninsulas, as raptors tend to avoid migrating over large water bodies (Kerlinger, 1989). As bald eagles and other raptors are not expected at the Project Site in significant numbers, exposure of these species to the proposed turbines is anticipated to be low.

Night migrating passerines will pass over the site during spring and fall migrations. The NEXRAD analyses by Diehl et al. and WEST show that the numbers of nocturnal migrants will be much lower over

the Project site than over land, and much lower over the central basin than over the eastern basin of Lake Erie. Consequently, there is no reason to believe that nocturnal migrants would be exposed to greater, or even comparable, risk when compared to land-based wind projects. In addition, fatality rates of nocturnally migrating songbirds have been well-characterized and are known to be low, on the order of 3-4 birds/MW/year in the Great Lakes region (Exhibit J).

As indicated above, the existing body of literature indicates that very few species of birds and bats use the area proposed for construction of the Icebreaker Wind turbines. Use by waterfowl in the area is low, and migratory pathways for hawks, as well as foraging areas for nesting eagles, tend to be concentrated along the immediate shoreline, well removed from the Project location.

Aquatic Communities

The proposed Project extends from 10 miles offshore through the nearshore to the Lake Erie shoreline. Lake Erie, being the shallowest and warmest Great lake, has the highest primary production, biological diversity, and fish production of all the Great Lakes (Allinger and Reavie, 2013). Specifically, Lake Erie's biological and physical processes are strongly influenced by the lake's topography and the division of the three basins (Ludsin and Hook, 2013; Munawar and Munawar, 2000). The central basin, the location of the Project, is the intermediate of the three basins in terms of temperature, productivity and depth (Ludsin and Hook, 2013), and is dominated by cool-water species including (i.e., perch and walleye) with warm and colder water species present to some degree. The lake provides a valuable commercial and sport fishery, including walleye and yellow perch. Other fish groups present in the central basin of Lake Erie include white bass, white perch, lake whitefish, trout, smelt, catfish, carp, herring, drum, minnows, and sunfish.

Risk factor maps for offshore turbines were created by the ODNR. The turbine sites chosen for the Project are located in areas identified as having low-moderate limiting factors. The area selected for the turbines is in a Dead Zone where there is minimal fish activity due to hypoxic conditions that are reached in the late summer. The ODNR fish habitat analysis indicated that as well as being in the Dead Zone, the area is well away from any fish spawning reefs or key habitat. Therefore, there will be a low exposure of fish and macroinvertebrates to the turbine sites (Exhibit O). Additionally, Ludsin et al. (2014), identified the spawning habitats for 24 fish species, including the most harvested commercial and/or recreational fish in Lake Erie as well as important prey species. None of these fish species have preferred spawning habitat in the offshore region, except lake trout, which had a near-offshore presence.

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

The Applicant's surveys have focused on those organisms potentially placed at risk by the construction and operation of this project, including benthic (sediment dwelling) macroinvertebrates, fish, and mobile terrestrial organisms like birds and bats. No surveys were conducted for rare plants because the proposed Facility will not disturb any potential habitat for these species due to its location in deep waters, 8-10 miles offshore.

LimnoTech was retained by the Applicant to perform aquatic monitoring from May 2016 through October 2016. The surveyed area includes three stations within the turbine array and six reference stations, determined in consultations with ODNR. The monitoring effort documented fish and lower trophic level communities, as well as physical habitat characteristics. The results from preliminary sampling (May through October) are included as Exhibit O. Fish community/lower trophic levels are discussed below, while habitat impacts and fish behavioral impacts are discussed in section 4906-08-(B)(1)(e). The final preconstruction monitoring results will be provided to OPSB staff upon receipt of the final report from LimnoTech.

Fish Community/Lower Trophic Level

Data were collected on fish, zooplankton, phytoplankton, and benthos abundance and composition to provide a better understanding of the food web within and near the project location. Samples were collected during the preconstruction phase to serve as a baseline for comparison to data collected during and after construction. Hydroacoustic monitoring to assess fish size, distribution, and abundance in an area was performed once monthly from May through October 2016 along three transects. Exhibit O provides a thorough analysis of the aquatic communities.

Larval fish sampling was conducted once monthly in May, June, and July of 2016 at three locations. Larval fish contribute both to recruitment and to the food base of adult fish. None of the samples from May or July sampling contained any larval fish, and only five larval fish (across nine trawls) were collected during the June sampling event. LimnoTech also sampled a site near the Cleveland Water Intake Crib in June. The sample collected near the Crib contained 16 larval fish (Exhibit O). The lack of fish in the study area is expected as the Project Area is offshore, where there are no spawning grounds, and minimal nearshore mixing.

Juvenile fish sampling was conducted in May, August, and October 2016 at three locations. Sampling results from May indicated a species composition that is relatively consistent across all locations and

replicates. White perch, yellow perch, and rainbow smelt dominated the samples, while walleye, goby, and emerald shiner were collected in low numbers. During August sampling, only seven total fish were caught (six yellow perch all 3 or 4+ years in age and one large 2+ year old freshwater drum). In October, species composition was relatively consistent across all locations and replicates. The trawls caught mainly smelt, followed by white perch, and yellow perch. Freshwater drum, walleye, goby, ghost shiner, and white bass were collected in low numbers (Exhibit O). This is consistent with yearly trawls completed by the ODNR, which were dominated by white perch, rainbow smelt, and yellow perch.

Hydroacoustics utilizes sonar technology for the detection, assessment and monitoring of underwater objects. Active hydroacoustics sensing involves listening for the echo from sound via an echo sounder. Acoustic monitors were used to assess whether there are any unique fish densities at the Project Site and to later compare whether the turbines and cable have had any impact on fish size, distribution, abundance, and movement in the Project Area. Hydroacoustic monitoring was performed once monthly in the months of May through October 2016 on three transects, one transect down the center of the Project location and two transects in nearby areas to serve as a reference. While density among the transects were similar within months, there was a significant decline in total density across months. There was a considerable (5 to 30 fold) reduction in fish density in August and September compared to the other months (Exhibit O). This trend is consistent with the lack of fish observed in the August juvenile trawls and follows the depletion in dissolved oxygen.

Juvenile fish sampling was conducted in May, August, and October 2016 at three locations. Sampling results from May indicated a species composition that is relatively consistent across locations and replicates. White perch, yellow perch, and rainbow smelt dominated the samples, while walleye, goby, and emerald shiner were collected in lower numbers. During August sampling, only seven total fish were caught (six yellow perch all 3 or 4+ years in age and one large 2+ year old freshwater drum). Based on the severe bottom water hypoxia present during this sampling, it was likely that these fish were caught when the net was moving up or down through the water column. In October, species composition was relatively consistent across all locations and replicates. The trawls caught mainly smelt, followed by white perch, and yellow perch. Freshwater drum, walleye, goby, ghost shiner, and white bass were collected in lower numbers (Exhibit O). This is consistent with yearly trawls completed by the ODNR, which were dominated by several species including white perch, rainbow smelt, and yellow perch (ODNR, 2016e).

Zooplankton are a vital component of freshwater food webs. Zooplankton sampling was conducted once monthly from May through October 2016 at the six reference stations and three turbine stations. In

general, while biomass and numbers were variable, the species composition was similar across all sites and months. Species composition included mostly calanoid and cyclopod copepods, rotifers, water fleas, and the larval crustaceans (nauplii). The native predatory water flea (*Leptodora kindtii*) was present in May and August samples and the invasive, predatory spiny water flea (*Bythotrephes longimanus*) was present in June, July, September, and October samples (Exhibit O). The samples collected at the site indicated the zooplankton population at the proposed turbine locations is typical for Lake Erie.

Phytoplankton are primary producers that form the base of many food webs. Phytoplankton samples were collected in conjunction with the zooplankton samples. In May, August, and October the Bacillariophyta (diatoms) were the dominant plankton. In June, cyanobacteria (blue-green algae) were dominant, Cryptophyta were the dominant plankton in July, and Pyrrophyta (dinoflagellate) were dominant in September. Cyanobacteria were present in all months, with microcystis only present in September and October (Exhibit O). The samples collected at the site indicated the phytoplankton population at the proposed turbine locations is typical for Lake Erie.

Benthic macroinvertebrates are very sensitive to water quality and often reflect changing environmental conditions and serve as an important food source for fish. Benthic samples were collected in conjunction with zooplankton and phytoplankton sampling at three locations (two turbine locations and one reference location) once in May and once in October. All benthos collected in May fell into three main groups (bivalves, Insecta, and Oligochaeta [worms]). The majority of benthos collected in October fell into the same three groups as May sampling with a few crustaceans and nematodes. The densities of benthos were relatively consistent across the three sampling locations during the May and October sampling events (Exhibit O). The invasive *Dreissena* mussels have generally changed the structure of most Lake Erie benthic communities, and certain pockets of the central basin are devoid of the species due to regular hypoxic events in the Dead Zone. However, the species found at the turbine sites are more tolerant to oxygen depletion and can readily re-populate areas.

Birds and Bats

TetraTech was hired by the Applicant to conduct a preconstruction migration study using marine radar (Svedlow, et al., 2012). The radar unit was installed at the Cleveland Water Intake Crib, approximately three miles off shore in Lake Erie. This was the closest the unit could be placed to the proposed turbine sites, and was the only site that could provide a representation of offshore migration characteristics. However, due to technical difficulties, a very limited amount of data from the TetraTech study was usable. As stated previously, existing studies suggest the use of the Project Site by night migrating birds and bats

will be no greater than, and likely less than, what has been documented at other land-based wind power sites in Ohio. All post-construction fatality studies at land-based wind projects in the region show very low mortality for birds.

TetraTech also conducted boat-based visual observation surveys in the early morning, early evening, and night during spring and fall 2010 migration periods to determine species composition, spatial and temporal distribution, relative abundance, and behavior of avifauna in the area. Surveys were done along a single "saw-tooth" transect that covered an 11.1 square km area within an offshore area around the Crib, approximately 3 miles off the coast of Cleveland. Species diversity during the 2010 surveys was minimal, consisting primarily of common and abundant species around Lake Erie. No state or federally listed rare, threatened, or endangered species were observed. Ring-billed and herring gulls accounted for 97% of birds recorded during the spring surveys, and 58% of recorded birds during fall surveys.

TetraTech biologists also conducted a bat acoustic survey offshore at the Crib and at select sites along the shoreline of Lake Erie during the spring, summer, and fall of 2010 to quantify bat use of the area (Svedlow et al., 2012). During spring 2010 monitoring periods, five bat species were detected, including: hoary bat, silver-haired bat, big brown bat, eastern red bat, and little brown bat. Two of these species (big brown bat, and little brown bat) were only identified at the onshore detectors and were not detected offshore. Summer/fall monitoring identified six bat species at both onshore and offshore detectors, including hoary bat, silver-haired bat, big brown bat, eastern red bat, tri-colored bat, and little brown bat.

TetraTech's bat acoustic monitoring showed that peak nights of bat activity occurred during late April and early May at the onshore detector locations in the spring, while spring offshore acoustic calls peaked mid-May. Summer and fall monitoring had peak nights of bat activity during late July and early August at the onshore detector locations, while peak activity at offshore detectors occurred later in the survey period, mid-to late August. Migratory tree-roosting species, big brown bats, and *Myotis* species were recorded at offshore detectors during all summer and fall months. At onshore locations, all species were recorded during each month of the summer and fall survey period.

Long distance migratory bats, including the eastern red bat, hoary bat, and silver-haired bat, are state-listed as species of concern (Table 6), and were all positively identified in the recordings from both the spring and fall 2010 monitoring periods. However, calls of these bats were recorded onshore nearly two times greater than they were offshore. The spring, summer, and fall acoustic survey indicated that the Lake Erie shoreline, and to a lesser extent the offshore Crib location, are used during migration by some

bat species, primarily eastern red bat, hoary bat, and silver-haired bat. The offshore study area and shoreline habitat is also used by non-migratory and migratory species during the summer residency period. The peak activity periods and the high proportion of migrant species recorded suggest migration occurs along Lake Erie's shoreline and to a lesser extent over Lake Erie. However, the relatively low number of call sequences suggests that the area is not likely a major migratory corridor for bats.

The acoustic study also demonstrated that bat activity level, based on call rate, was roughly 10 times greater on land than offshore during the spring and summer/fall study periods. This study may be an overestimate of offshore bat activity at the proposed turbine sites since the offshore call rates were recorded at the Crib, roughly three miles from shore. Because there were low levels of bat activity three miles from shore when compared to onshore activity, and the proposed turbine site location is 8 to 10 miles offshore, small numbers of bats are anticipated to encounter the Project turbines. Due to the low level of exposure of bats to the turbine sites, especially compared to land-based wind farms, there is no reason to anticipate the proposed turbines would pose a greater risk than land-based wind farms. Nonetheless, because of the possibility that turbines may attract bats as they fly over an otherwise inhospitable environment over the Lake, the possibility that bat fatality rates at the Project could be comparable to fatality rates at land-based wind farms cannot be ruled out. However, because of the small size of the Project, the overall risk to bats would be low, even if per-megawatt fatality rates at the Project were comparable to those at land-based wind farms in the region.

The ODNR and USFWS have published an On-Shore Bird and Bat Pre- and Post- Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio. Where applicable and viable, the Applicant has performed preconstruction studies consistent with the protocol, such as radar monitoring and bat acoustic monitoring as discussed in Section 4906-4-08(B)(1)(d). Due to the offshore location of the turbines for the Project, some of the surveys typically required by the ODNR are not applicable or feasible, and as such were not performed for the Icebreaker Project. Table 7 includes information on how the Applicant proposes to comply with the ODNR protocol, or why a particular protocol is not applicable. For example, because of its offshore setting, owl surveys, nocturnal marsh bird surveys, sandhill crane migration studies, breeding bird surveys, raptor nest surveys, and migrating shorebird surveys were not applicable to the proposed Project Site because suitable habitat for most of these species is not present 8 to 10 miles offshore. Additionally, known sandhill crane migration areas are not located within the Project Area.

The Applicant has developed a matrix of options (including new technologies to monitor collisions, aerial surveys, radar, etc.) that can be used pre- and post-construction to assess the Project's impacts on birds and bats, and is currently engaged in discussions with ODNR and USFWS to design a bird and bat monitoring plan that will achieve the goals of the ODNR protocol to the greatest extent possible (Exhibit J). The Applicant is working with the agencies to reach an agreement on details of the plan, to be memorialized in a Memorandum of Understanding that will be provided to OPSB staff upon completion.

Table 7. ODNR and USFWS On-Shore Bird and Bat Pre- and Post- Construction Monitoring Protocol for Commercial Wind Energy Facilities in Ohio

ODNR Monitoring Protocol	Purpose	Applicability to Offshore Wind (the Project)		Comments
		Yes	No	
Radar	Estimate numbers/density, direction, hourly changes in activity and altitude	x		Applicant has committed to doing additional radar baseline studies prior, and subsequent to construction (Table 8)
Passerine Migration	Assess the potential impact of tall structures on migrating birds		x	Protocol suggests one point count/100 hectares of forest, shrub, and wooded wetland. Point count surveys not applicable at offshore sites, radar studies used as substitute
Diurnal Bird/Raptor Migration	Assess potential wildlife/wind turbine interactions during day light hours		x	Day long surveys offshore are not applicable at offshore sites. No nesting, wintering, foraging habitat for raptors offshore.
Owl Playback Surveys	Assess owl presence and species type		x	Due to offshore location, no forested areas are around the Project Area. Owls are not expected to be present at Project Site.
Bat-Mist Netting	Determine species diversity and locate potential concentrations of activity		x	Mist netting is not viable offshore.
Nocturnal Marsh Bird Surveys	Assess the presence and types of marsh birds at or nearby the Project Area		x	Project Site is not within or adjacent to marsh/wetland habitat.
Barn Owl Surveys	Identify and document active Barn Owl nesting locations to avoid impacts to and protect this species.		x	No barn structures, nest boxes, or suitable habitat in the Project Area.
Sandhill Crane Migration	Assess number of Sandhill cranes migrating in the Project Area		x	The Project Area is located outside the ODNR required Sandhill Crane survey area.
Waterfowl Surveys	Assess migration and over-wintering habitats of waterfowl	x		Boat-based surveys performed by Tetra Tech, 2-year aerial survey conducted by ODNR. Applicant has committed to additional waterfowl surveys prior, and subsequent to construction (Table 8).
Shorebird Migration	Estimate use of Lake Erie basin as stopover habitat for migratory songbirds		x	The offshore location does not provide suitable stopover habitat for migratory songbirds.
Breeding Birds	Identify breeding bird species that may be impacted through habitat disturbance or avoidance		x	The offshore location does not provide suitable nesting habitat for any bird species. Breeding birds are not expected to be present at the Project Site.
Raptor Nest Searching	Determine number and location of nesting raptors on and near Project Site		x	The offshore location does not provide suitable habitat for nesting raptors.

ODNR Monitoring Protocol	Purpose	Applicability to Offshore Wind (the Project)		Comments
		Yes	No	
Raptor Nest Monitoring	Assess activity patterns to determine the degree to which nesting raptors use the proposed Project Site		x	The offshore location does not provide suitable habitat for nesting raptors. There are no raptor nests located at or near the Project Site.
Bat Acoustic Monitoring	Assess bat activity levels at or near project site, potential attractant issues, and correlate the number of detections with bat mortalities	x		Acoustic monitoring performed at Crib (see Section 4906-4-08(B)(1)(d). The Applicant has committed to additional baseline surveys prior, and subsequent to construction (Table 8).

(e) *Summary of Additional Ecological Impact Studies*

Aquatic Physical habitat

Discrete water chemistry sampling was collected once monthly from May through October 2016 in conjunction with the zooplankton, phytoplankton, and benthos sampling at six reference stations and three turbine stations. Data were collected on temperature, dissolved oxygen, total phosphorus, total nitrogen, chlorophyll-a, light extinction, and water clarity. Continuous water chemistry monitors were also deployed throughout the field season (May through October) at two locations to monitor water temperature, DO, and photosynthetic active radiation. Additional DO and temperature sensors were installed later in the field season, at three other turbine stations. The primary purpose of this sampling is to assemble a dataset that provide an indication of the productivity, light transmission, habitat, and key water quality parameters at and around the Facility location. These data will be used as a baseline for comparison to post-construction conditions. Detailed results can be seen in Exhibit O and complete results will be provided to OPSB staff upon LimnoTech's completion of the final report.

Hydrodynamic surveys were done to determine how the Project might affect local and regional lake circulation patterns, and how a potential change in currents could affect water quality and the food webs. Sensors were deployed at two locations throughout the field season of May to October 2016 and are being deployed throughout the winter of 2016-2017. The monitoring will be used with modeling of the lake to provide an understanding of localized current velocity and direction at and around the Facility location. The Project is utilizing a circular foundation that minimizes potential impacts to currents and sediment scour. The circular shape of the foundation and tower minimizes eddy formation and allows currents to easily travel past the turbine with minimal interruption and disturbance (Exhibit O). Detailed results are provided in Exhibit O and a full report will be provided to OPSB staff upon completion.

Fish Behavior

Hydroacoustics utilize sonar technology for the detection, assessment and monitoring of underwater objects, including fish. Fixed hydroacoustic sampling was performed at one reference and one turbine station. Fixed acoustic sampling began in August 2016 and was collected once monthly through October. Future preconstruction, during construction and post-construction fixed acoustic sampling will be conducted once monthly from May through October. Detail on the fixed acoustic sampling is provided in Exhibit O and full results will be provided to OPSB staff upon completion of the LimnoTech report.

Potential effects on fish from anthropogenic sounds could include behavioral changes and increased stress. As mentioned in Section 4906-4-08(A)(3)(e), existing noise production was monitored

continuously throughout the field season from May to October 2016. This provides an assessment of background noise in the project location, which can be compared to during-construction and post-construction conditions.

Birds and Bats

As indicated in Sections 4906-4-08(B)(1)(c) and 4906-4-08(B)(1)(d), review of the existing literature and on-site surveys clearly indicate that the proposed Icebreaker Wind Project is sited in an area that receives limited use by a small number of wildlife species. This use is largely restricted to migrating birds and bats, and as indicated in the WEST Icebreaker risk analysis (Exhibit J), the low exposure of birds and bats to the proposed Project, in combination with the limited number of turbines proposed, results in a Project that presents minimal risk to these species, relative to other land-based wind projects in Ohio and the Great Lakes region. The Applicant has committed to undertake rigorous post-construction monitoring to validate this conclusion, as well as collection of additional baseline data needed as a point of comparison. The Applicant has prepared a matrix with details on specific monitoring methods, locations, objectives and designs, to determine the most appropriate sampling strategy for future data collection (Exhibit J). This matrix has been shared with the ODNR and USFWS and a monitoring plan is being developed cooperatively with ODNR and USFWS. The plan will potentially utilize a combination of monitoring techniques including, but not limited to, bat acoustic surveys, nets, aerial surveys, and radar monitoring. Details on additional baseline studies to be used as a point of comparison proposed by the Applicant are included in Table 8.

Table 8. Additional Baseline Bird and Bat Studies Proposed by the Applicant to be Completed Prior to Construction[4]

ODNR Monitoring Protocol	Description of ODNR Monitoring Protocol	Proposed Monitoring
Radar	Marine radar to monitor nightly passage rates, 5 nights per week from April 15th through May 31st and August 15th to October 31st	Applicant will monitor nightly passage rates 5 nights/week between April 15th through May 31st and August 15th through October 31st, 2017 using one or more of the following options: • Marine radar from Crib (contingent on obtaining permission to use Crib as platform) • Marine radar at the Project Site placed on moored boat (weather could preclude monitoring 5 nights/week) • Additional NEXRAD analysis of past 3 years of radar data covering site and comparable offshore and onshore locations Target density and altitudes will be assessed concurrently to greatest extent possible. Hourly weather data recorded; monitoring suspended during heavy rain, fog, or waves.
Waterfowl Surveys	Twice monthly static or driving waterfowl surveys should be conducted from April 1st to September 1st, if the project includes ≥3 hectares of wetlands, rivers, lakes or fields where waterfowl are known to feed	Applicant proposes to conduct twice-monthly aerial surveys from October 15th through April 15th to characterize use of the site by waterfowl and other birds, including irregular patterns that may occur during ice-over conditions in mid-winter. *Note that the period of interest is fall through spring, not spring through fall, because the primary concern at the site is migrating and overwintering, not breeding birds, as well as any impact of icing over of the Lake on bird activity near the Project site
Bat Acoustic Monitoring	Conduct one full season (March 15 through November 15) of acoustic monitoring by attaching ODNR specified equipment to meteorological towers, with 1 unit at 5 meters off the ground and 1 unit within or as close as possible to the rotor swept area. Acoustic monitoring should continue through the conclusion of post-construction monitoring	The Applicant completed acoustic monitoring from the Crib in 2010, which informed the WEST Icebreaker Wind: Summary of Risk to Birds and Bats. The Applicant proposes to conduct additional acoustic monitoring prior to construction using acoustic monitors deployed at the Project Site on 2-3 buoys for at least 1 full season (March 15th – November 15th, 2017).

[4] Proposed baseline monitoring plans are subject to change. The final monitoring plans will be developed in consultation with ODNR and USFWS and documented in an MOU, which will be provided to OPSB staff upon completion.

(2) Construction Impacts

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

The Facility Substation will be constructed on developed land, and will not require vegetation clearing at the site. The Applicant does not anticipate any impact on plant or animal life resulting from construction of the Substation. The O&M Center will also not have any impacts on ecological resources as it will make use of an existing structure (to be leased by the Applicant), which will not require modification or construction.

The MB foundation that will be used for the Facility does not require any excavation, pile driving, dredging, or drilling. Thus siltation, sedimentation, and noise impacts will be minimal. Additionally, noise levels at the site will be temporary and similar to noise levels experienced consistently in the region by up to 1,000 passing lake freighters traveling into and out of the Port of Cleveland on an annual basis. Foundation construction will have no impacts on aquatic vegetation due to the location of the turbines 8 to 10 miles offshore, where the water is 19 meters (62 feet) deep and rooted vegetation is absent.

Approximately 12.1 miles (73,920 feet) of buried transmission cable will be laid from the proposed turbine location to the Facility Substation. A limited number of macroinvertebrates will likely be displaced or destroyed during the construction process. ODNR ranks mud as the most favorable sediment type for wind turbine placement as it is a poor substrate to sustain aquatic biodiversity and offers little to no value for spawning. Any disturbances to a silt/clay sediment will have little to no impact on the ecological resources of Lake Erie (Exhibit O).

Areas along the export cable route will only temporarily disturb the bottom sediments and will eventually be completely restored to preconstruction conditions after the sediment settles and macroinvertebrates repopulate the region. The jet plow installation method, is considered the industry standard for minimal impact to the surrounding area during installation compared with open trench cable laying. As discussed in Section 4906-4-07(C)(2)(b), suspended sediments are expected to follow a similar fate as those of another submerged Lake Erie cable, which were estimated to remain suspended for only a few hours and travel less than a few hundred meters. Fish may also be temporarily affected by construction of the Facility. The primary effect on fish would be displacement, but the effects are anticipated to be localized and small in scale, as the Project Site is far from identified fish spawning, areas, larval nursery areas, areas of enhanced fish habitat, and critical habitat areas. LimnoTech was retained by the Applicant to provide preconstruction, during construction, and post-construction monitoring to assess fish and lower

tropic level community composition and abundance, physical characteristics, fish behavioral surveys, and fisheries surveys at the proposed location. Results of the preconstruction monitoring are discussed in 4906-4-08(B)(1)(d) and 4906-4-08(B)(1)(e).

Additionally, as this Facility is located 8 to 10 miles offshore in Lake Erie, there will be no stream or wetland crossing.

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

(i) Site restoration and stabilization of disturbed soils

No temporary or permanent access roads will be created for the Facility, as all terrestrial components are on currently developed land. The Facility Substation area will be excavated to a depth of approximately 3 feet. Compacted backfill will be placed over the ground grid. All unused excavated backfill will be removed from the site for disposal upon completion. Geoenvironmental testing was completed as part of a geotechnical exploration program to inform the design of the Substation (Exhibit X). The results of the geoenvironmental testing completed indicated that there were no actionable levels of anolytes present.

There will generally be no soil disturbance (drilling, dredging, or clearing) during the MB foundation installation. During the last meter of the MB installation, fine-grained sediments can become dislodged and captured in the discharge water, and will be suspended in the water being pumped out of the foundation bucket. Lakebed sediment will be disturbed during the construction of the buried transmission line. Localized suspension of sediments during MB and cable installation will be temporary, as sediment will quickly settle back to the lakebed. The use of HDD will minimize disturbance of the lakebed in the nearshore areas. Pre-, during- and post-construction water quality monitoring, including turbidity will be performed by LimnoTech, as described in Section 4906-4-08(B)(1)(e).

(ii) Frac out contingency plan

As mentioned previously, HDD will be used during transmission cable construction to cross the Cleveland Harbor. While this technique will minimize disturbance to the lakebed and the existing breakwater, it does carry the risk of an unanticipated return or “frac-out” of bentonite drilling mud. The Applicant has prepared an Inadvertent Return Contingency Plan (Exhibit Y) to avoid, minimize, and remediate potential environmental impacts resulting from and inadvertent return of drilling fluids

during HDD operations. The document includes plans for HDD design, drilling fluids, notification procedures, and containment and remediation.

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

Outside of Lake Erie, the Cuyahoga River, and the Old River, there are no surface waters or wetlands near the Facility. The Old River flows alongside the Great Lakes Towing property, a portion of which will be leased for use as the O&M Center. However, the Applicant does not anticipate making any modifications to the existing structures or grounds, so there will be no construction near the river. The boundary between Lake Erie and the shoreline is apparent, and does not require demarcation. No construction equipment or material storage or disposal will occur beyond the Lake Erie shoreline.

(iv) Inspection procedures for erosion control measures

As per the Ohio EPA, construction activities disturbing less than 1 acre of land are not required to obtain a NPDES Construction Storm Water General Permit. The Facility Substation construction will disturb less than 0.5 acre, and as it is the only terrestrial construction activity associated with the Project, no permit will be required.

(v) Measures to divert stormwater runoff

The area of disturbance for Facility Substation construction will be less than 0.5 acre. The site of the proposed Facility Substation is flat, currently developed land. As such, stormwater impacts are not anticipated, and measures to divert stormwater are therefore not required.

(vi) Measures to protect vegetation

No vegetation will be disturbed at the onshore components of the Facility (Facility Substation), as it is already a developed parcel. The use of HDD will prevent impacts to submerged aquatic vegetation that may be found along nearshore areas of the export cable. There are no mature trees, wetland vegetation, or woody vegetation near the proposed Facility location.

(vii) Options for clearing methods and disposing of brush

There will be no clearing prior to or during Facility construction that would result in downed trees or brush. Therefore, there will be no use of heavy equipment for site clearing, and no brush requiring disposal.

(viii) Avoidance measures for major species and their habitats

Major species are defined by the OPSB as species of commercial or recreational value, and species designated as endangered or threatened in accordance with the state and federal threatened and endangered species lists. Construction of the Facility can be timed to minimize or avoid impacts to major fish species and their habitats. Mitigation measures include avoiding fish spawning periods in early spring (April through mid-May), and monitoring underwater noise during construction to minimize disturbance to fish during construction. The MB foundation utilizes an installation method that minimizes disturbance and impacts to the lakebed and fish. Using HDD to minimize impacts to nearshore areas and monitoring turbidity and additional water quality parameters would minimize impacts to benthic macroinvertebrates and fish as the lakebed would not be disturbed along the HDD route. Construction is not anticipated to have any impacts on wildlife other than temporary disturbance resulting from construction activity. This disturbance will be temporary, affect a relatively small area of the lake, and result in only minor relation of a few common species.

(3) Operation Impacts

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

All of the terrestrial components of the Facility occur on already developed land in a highly urban area in the City of Cleveland. The proposed turbine foundation locations 8 to 10 miles offshore in Lake Erie are in an undeveloped area. However, each MB foundation has a diameter of 17.0 meters (approximately 56 feet), resulting in a disturbed area of 227 square meters (0.06 acre) per turbine. The proposed Facility includes 6 turbines, resulting in a total area of disturbance from turbine foundations of 0.3 acre. The total disturbed acreage represents an insignificant amount of area in terms of potential habitat in Lake Erie. Operational impacts to wildlife are expected to be limited to possible displacement of wildlife due to the presence of the wind turbines, and a minimal level of avian and bat mortality as a result of collisions with the wind turbines. Each of these potential impacts is described below.

<u>Birds and Bats</u>

The WEST Risk Analysis (Exhibit J) categorized potential impacts from the Project into three effects: displacement, avoidance/attraction, and collision. The principal conclusion of the assessment was that the Project poses low risk of adverse impacts to birds and bats (Gordon and Erickson, 2016). A more detailed discussion of conclusions drawn from the WEST Summary of Risk to Birds and Bats is included below.

Displacement Effect: Displacement effect is defined by WEST as the transformation of an area from being suitable habitat to being unsuitable habitat for one or more wildlife species. This refers to use or avoidance of foraging, roosting, breeding, or wintering habitats. Displacement effects for land-based wind farms in the U.S. have focused on grassland and shrub-steppe obligate species, whereas for offshore wind displacement effects have focused on waterfowl and other waterbirds that regularly forage in marine areas. Data from a two-year aerial baseline survey conducted by ODNR indicated that the number of birds on Lake Erie was negligible or minimal at distances between 8 and 10 miles offshore, which is where the turbines are proposed to be sited. Only 6 species; red-breasted merganser (*Mergus serrator*), common loon (*Gavia immer*), horned grebe (*Podiceps auritus*), Bonaparte's gull (*Chroicocephalus philadelphia*), and Ring-billed/herring gull (*Larus delawarensis/L. argentatus*), occurred in the Project Area on a somewhat consistent basis. These species occur at very low densities in the area (<1 to 5 birds per survey; Norris and Lott, 2011). At these low densities, a significant displacement from the Project would be difficult to detect and any effect would not be biologically significant for any of the six species occurring in the Project Area. There is minimal potential for the Project to result in displacement effects, as there is minimal to negligible utilization of the Project Area by any species for anything other than transit.

Behavioral Avoidance/Attraction Effects: Behavioral avoidance effects are defined by WEST as the avoidance of a constructed facility by wildlife species whose only utilization of the Project area would be strictly for transit. Behavioral avoidance may have the beneficial effect of reducing collision risk, but it also may have an adverse impact of increased energy expenditure required to avoid the turbines. Previous studies on large offshore wind farms indicate that additional energetic expenditure required for migrating birds to circumvent the wind farms was found to be negligible in relation to the overall energetic cost of their migratory journey (Masden et al., 2009). With only six turbines, the Project will occupy a relatively small above-water footprint, and the turbines will be spaced at a large enough interval for birds to fly between them. As such, the potential for adverse effects on wildlife from behavioral avoidance is negligible.

The Project does have the potential to generate attraction effects for some species of birds and/or bats, as the turbine platforms may attract species as potential places to perch and roost. Previous studies indicate that cormorants, gulls, and some species of bats may be attracted to turbines under some circumstances (McAlexander, 2013; Cryan et al., 2014; and Krijgsveld et al., 2011). Several species of cormorants, gulls, and bats occur regularly on and around Lake Erie, and may be attracted to the Project turbines. Beneficial attraction effects may include increased availability of roosting and/or foraging sites in an otherwise inhospitable or unfavorable environment. However, adverse attraction impacts may

include increased exposure to collision risk. Flashing red aviation obstruction lighting, which previous studies indicated does not appear to attract migrating birds, will be installed on the nacelles of the turbines, which would minimize the attraction of substantial numbers of nocturnally migrating birds to the Project Site.

Collision Effects: Bird and bat collision fatality rates at land based wind energy facilities have been particularly well-studied in North America. For birds, recent reviews of fatality estimates indicate an overall average U.S. rate of 4 to 5 birds killed per MW of installed wind capacity per year (4.11 birds/MW/year; Loss et al., 2013). Collision susceptibility has been found to be highly taxon- or guild-specific for both birds and bats. Bird susceptibility appears to be most closely related to species' overall abundance and the amount of time a species spends flying within rotor swept altitudes. Nocturnal migrants make up the majority of bird fatalities at land-based wind energy facilities in North America. For bats, there is a greater degree of variation in fatality rates, and generally higher rates than birds. Three species of migratory, tree-roosting bats (eastern red bat, silver haired bat, and hoary bat) are among the most commonly found bat fatalities at U.S. wind energy facilities with most fatalities occurring in late July through late September, corresponding to fall migration and initiation of mating activities.

The level of collision risk for eagles or other raptors for the Project is low, primarily because no eagles or raptors regularly utilize offshore environments 8 to 10 miles from shore. While species like bald eagle and osprey regularly forage over water for fish, both species are typically restricted to within several miles of the shore. Boat based avian baseline surveys conducted in nearshore waters near the Project Area (Svedlow et al., 2012) and aerial avian baseline surveys along the shore of Lake Erie, including the Project Area, conducted by ODNR from 2009-2011 (Norris and Lott, 2011) did not result in observations of any raptors within 10 miles of the Project Area. The potential for Bald Eagles and raptors to encounter the turbines is limited to migratory transits of the species across Lake Erie. However, most species tend to migrate along the shoreline and at narrows and peninsulas. A recent review indicated that there have been only 85 eagle fatalities at wind energy facilities throughout the U.S. between 1997 and 2012 (excluding one wind farm in California). Of those 85 mortalities, 79 were golden eagles and only 6 were bald eagles (Pagel et al., 2013). Raptor collision risk does exist for the Project; however, due to the small amount of exposure at the offshore location and, the small size of the Project, that risk is anticipated to be low.

Similar to raptors, the level of collision risk for waterfowl, or other water-affiliated bird species at the Project is low. Based on aerial avian surveys conducted by ODNR from 2009-2011, only a few species

of gulls were found to use the Project Area at densities greater than one bird observed per survey (Norris and Lott, 2011). However, gulls tend to have a low susceptibility to collisions with wind turbines as they are agile and acrobatic flyers and possess a high degree of visual acuity. The collision risk to waterfowl and similar species is low because of low levels of exposure and low wind turbine collision susceptibility. The double-crested Cormorant may be found in the Project Area in greater numbers than other water birds. However, the species has recently been actively managed as a pest species in the Great Lakes region. Therefore, some collision risk for this species from the Project does not represent a significant concern from a biological or conservation perspective. An exception to the overall pattern of low exposure could occur if waterfowl and water birds are attracted to ice-free refuges around the Project turbines. However, open water areas will still exist closer to shore than the turbines during extreme ice cover, and ice-free wakes near the turbines will be rare, small, and fill in rapidly. Therefore, ice-related bird risk is still considered to be low.

Additionally, European studies have demonstrated a strong tendency for flying ducks to avoid offshore wind facilities (Desholm and Kahlert 2005, Pettersson 2005, Desholm 2006, Larsen and Guillemette 2007, Masden et al. 2009). Studies at U.S. land-based energy facilities near waterfowl concentration areas have also demonstrated low wind turbine collision susceptibility (Derby et al. 2009, 2010, Jain 2005, Niemuth et al. 2013). Due to the tendency for ducks and waterfowl to avoid turbine locations, and the low abundance of birds near the turbine sites, the level of collision impact to these birds is anticipated to be low.

The level of collision risk for bats at the Project is also low due to the small size of the Project. Low levels of exposure for the Project are also anticipated, as indicated by the level of bat acoustic activity recorded offshore in the central basin of Lake Erie during a baseline study. The use of the Project Area by bats is expected to be limited to migratory flights. It is anticipated that the level of bat fatality from the Project will be toward the lower end of the distribution of bat fatality rates from land-based projects in the region, on the order of one to four bats/MW/year (Gordon and Erickson, 2016). However, the possibility of bat fatality rates nearer to the middle, or upper portion of the distribution of bat fatality rates from land-based projects in the region, in the vicinity of 5-25 bats/MW/year cannot be ruled out, because of the possibility of an attraction effect. Nonetheless, within this range, the overall level of bat fatality would be moderate, at worst, in relation to land-based wind energy projects in the Great Lakes, due to the Project's small size.

The collision risk level for nocturnally migrating birds at the Project is low. This conclusion is based on the observations that: 1) nocturnally migrating birds are primarily terrestrial, and expected activity in the

Project Area will be limited to migratory transits; 2) nocturnally migrating birds exhibit a well-known tendency to avoid flying over large bodies of water if possible (Diehl et al., 2003, Exhibit J); and 3) numerous studies of bird fatality rates at land-based wind energy facilities have demonstrated that fatality rates of nocturnal migrant birds are sufficiently low that there is no likelihood of a population-level impact to any nocturnal migrant species. Given that studies found that nocturnal migrant bird passage density recorded in the offshore environment in the central Lake Erie basin (Diehl et al. 2003), and specifically over the Project site (Exhibit J) were half of the level recorded at sites over land during spring and fall migrations, nocturnal migrant bird fatality generated by the Project is expected to be lower than typical land-based facilities in the region.

Bird fatality rates at wind energy facilities in the Great Lakes region across 42 studies range from less than 1 bird/MW/year to approximately 7.5 birds/MW/year (Gordon and Erickson, 2016). Even if bird fatality rates were at the highest end of distribution of fatality rates for the Great Lakes region, due to the small size of the Project, there would be no population level impact on nocturnal migrant songbird species. However, given that the nocturnal migrant bird passage density recorded in the offshore Lake Erie central basin and specifically at the Project site was roughly half of the level recorded at comparable sites over land during migratory periods, the nocturnal migrant bird fatality generated by the Project will likely be lower than typical land-based facilities in the region, most likely at a range of one to two birds per MW/year. At this rate, the Icebreaker Wind Project would result in 21 – 42 total bird fatalities per year. At this level, there is no reasonable likelihood that the Project would have a population level impact on any species of nocturnal migrant bird.

Aquatic Communities

Potential effects on fish from anthropogenic sounds, like turbines, could include behavioral changes, such as moving towards or away from the sound source or leaving a feeding or breeding site, or increased stress. Data from the 2016 LimnoTech survey suggest that the Project presents minimal risk to the aquatic ecosystem. However, as part of an MOU with ODNR and USFWS, the aquatic community monitoring described in Sections 4906-4-08(B)(1)(d) and 4906-4-08(B)(1)(e) will be continued through additional phases of the Project to confirm the predicted level of impact.

When considering the impact of operating submarine cables on aquatic environments, there are two major concerns -the electric field and the magnetic field. To determine the potential significance of this impact, LimnoTech conducted a literature review of electromagnetic fields (EMF) related to fish (Exhibit Z). The electric field is produced by stationary charges, and the magnetic field is produced by moving

charges. Impacts from electric fields are not anticipated for this Facility as the cable conductors are shielded and jacketed with an insulator, which is designed to virtually eliminate any electric field losses outside the cable. The magnetic field on the other hand cannot be contained by the cable shielding and can travel through sediment and water, to some degree. However, the estimated magnetic field from the Facility transmission line is low in comparison to other underwater transmission lines and should be less than background levels (Exhibit Z). LimnoTech reviewed a study involving lake sturgeon, which are benthic feeding and considered and electro-sensitive species. The study indicated that the threshold for behavioral response was 1,000 to 2,000 μT, when located 4 to 8 inches away from the full-strength EMF. The EMF from the buried transmission cable will be well below the strength threshold for behavioral response in lake sturgeon because the transmission cable will be buried at a depth of approximately 5 feet (Exhibit Z).

It is worth noting that electric transmission lines within Lake Erie, the Great Lakes, or in coastal regions of the United States, are not unique and have been permitted and installed for many decades. Multiple large electric transmission lines are already in place not far from the project site (e.g., transiting from Port Clinton to Put-in-Bay, Catawba to South Bass Island, and over 25 miles of electric cable transmission from the Ontario mainland to Pelee Island). The Bureau of Ocean Energy Management conducted a study to more fully understand the potential effects of energized, seabed deployed, power cables on marine organisms. The study found that there were no biologically significant differences among fish and invertebrate communities in the vicinity of energized cables, pipes, and natural habitats. The EMF produced by energized cables diminishes to background levels about one meter away from the cable. Given the rapidity with which the EMF produced by energized cable diminishes, and the lack of response to that EMF by fish and invertebrates, cable burial is not actually necessary for biological reasons. Cable burial prevents EMF emissions from being present at the seafloor (Love et al., 2016).

Based on the low expected EMF levels to be generated by the Facility and current research regarding EMF impacts on fish behavior, the Applicant does not anticipate any impacts to aquatic communities due to EMF. Despite the extremely low risk posed by EMFs, the Applicant has agreed to study potential impacts on fish behavior. This analysis is incorporated into the LimnoTech monitoring protocol and the MOU, which will be provided to OPSB Staff upon completion.

As discussed in Section 4906-4-08(A)(3), noise impacts from operating turbines is anticipated to be low as low levels of noise emitted by turbines won't transmit a significant distance and low numbers of fish are anticipated to be around the turbine sites due to the seasonal hypoxia.

As discussed in Section 4906-4-08(B)(1)(c), the Project Site is far from ODNR identified fish spawning and larval nursery areas, reefs, or shoals that offer advanced habitat. Fish trawls, acoustic survey data, and DO monitoring in 2016 indicated that prior to construction there was a low number of fish around the turbines in summer and early fall months due to seasonal hypoxia. Due to these factors, combined with the insignificant loss of habitat (0.3 acre) compared to the total area of Lake Erie, no adverse impacts to fish or macroinvertebrates are anticipated (Exhibit O).

Hydrodynamic surveys of Lake Erie were conducted by LimnoTech (Exhibit O). Surface currents were greater at the surface than at the bottom and velocity was generally below 0.3 meters per second (1 feet/second) The 2016 current velocities and wave data correspond with previous measurements collected in the lake. The data all indicated that wind was the main driver for current in Lake Erie. Due to the small scale of the proposed Project, and circular shape as discussed in Section 4906-4-08(B)(1)(e), currents are not anticipated to be affected by the turbines (Exhibit O).

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

Once the Facility is operating, there are mitigation measures the Applicant can use to minimize impacts to ecological communities. The use of a shielded transmission cable will minimize electromagnetic field impacts to benthic macroinvertebrates and fish. The use of HDD in the nearshore area will minimize impacts to nearshore habitats of fish and macroinvertebrates. Additionally, the burial of the transmission cable will further minimize any potential impacts from EMF.

The Applicant is also proposing means of minimizing operational impacts on birds and bats. Bat collision impacts at turbines are most frequent on calm nights when winds are low, especially during the late summer when migrating and swarming bats are most active. As per request of the USFWS, the turbines will be curtailed up until the manufacturer's cut-in speed is reached at night during the fall migration. The Facility's turbines will not start rotating until winds reach at least 6.7 miles per hour. Additionally, the Applicant will follow lighting recommendations per the USFWS 2012 land-based wind energy guidance documents. Bird collision risk at communication and other towers has been shown to increase dramatically with particular types of lighting. Fatality rates at towers with steady burning lights were higher when compared to towers with flashing lights. The Applicant will minimize the number of lights on the turbines to one flashing red light for bird safety. Additionally, the types of lights used on the work platforms on the base of the turbines will not attract birds and will be in compliance with USCG requirements.

Onshore Substation lights will be down-shielded, equipped with motion sensors, or turned off when not in use, as to not attract birds.

The Applicant will also develop a Bird Bat Conservation Strategy (BBCS) and a post-construction monitoring plan to monitor actual Facility impacts, and will undertake adaptive management measures if warranted based on the results of post-construction monitoring studies. Mitigation and adaptive management measures will be implemented if actual impacts exceed expectations. Post-construction monitoring is discussed in more detail in Section 4906-4-08(B)(3)(c). The final BBCS and post-construction monitoring plan will be submitted to OPSB Staff upon completion of the MOU between the Applicant and state and federal agencies.

(c) *Post-Construction Monitoring Plans*

The Facility is proposed as a demonstration-scale project, in part to provide the opportunity to measure wildlife impacts. A diverse and rigorous post-construction monitoring plan is essential to evaluate any potential impacts.

Post-construction aquatic monitoring will be conducted by LimnoTech. The details of the program have been determined in cooperation with the ODNR and USFWS. The focus of the post-construction monitoring program will be on fish community/lower trophic level impacts, physical habitat impacts, and fish behavioral impacts. Monitoring the health of the fish community and lower food web will be accomplished through routine sampling of the benthos and water column. Physical and chemical characteristics of the lake will be sampled using a variety of methods. Depth integrated water samples will be analyzed for phosphorus and nitrogen on a monthly basis, and vertical temperature, oxygen, pH, conductivity, and turbidity profiles will be collected monthly. Continuous measurements of water currents, wind, and waves will also be recorded at the project site. Fish behavior will be monitored through an array of acoustic receivers to monitor the movement of tagged fish, which will give insight into how fish interact with the various elements of the project. Underwater microphones will collect noise levels to monitor for any sound/acoustic impacts the project might have on migration patterns. A breakdown of the location, frequency, and project phase when sampling will take place for each category of sampling is listed in Table 9, below. The data can then be correlated with preconstruction baseline data, and ultimately predict the impact of future offshore, or more specifically, Great Lakes wind power projects. The full post-construction monitoring plan is included as Exhibit O.

Table 9. Summary of Aquatic Sampling and Frequency

Task Description		Frequency	Phases of Project[1]
Fish Community	Hydro acoustic	Monthly (May-Oct)	All
	Larval fish	May, June, July	All
	Juvenile fish	May, August, November	All
	Zooplankton	Monthly (May-Oct)	All
	Phytoplankton	May-Oct	All
	Benthos	Spring and Fall	All
Physical	Chemistry (discrete)	Monthly (May-Oct)	All
	Chemistry (continuous)	May-Oct	All
	Substrate mapping	Once	Pre and Post
	Hydrodynamic	May-Oct, Nov-Apr	All
Fish Behavior	Acoustic telemetry	Annually	All
	Fixed acoustic	Monthly (May-Oct)	All
	Noise	May-Oct	All
	Aerial Surveys	2 days every 3 wks. May-Oct	All

[1]All = preconstruction, during construction, and post-construction phases of the Project.

A post-construction avian and bat fatality monitoring program will be implemented by the Applicant. The purpose of the post-construction monitoring program will be to determine if avian and/or bat displacement, avoidance/attraction, and collision fatalities are occurring as a result of Facility operation. This data can then be correlated with baseline data collected prior to construction (Table 8), and ultimately this information can help to develop models that will more precisely predict the impact of future offshore, or more specifically, Great Lakes wind power projects. Potential post-construction monitoring protocols are described in Table 10. Discussions with the agencies are ongoing and the final plan will be determined in consultation from ODNR and USFWS and submitted to OPSB staff upon agreement. The goal is development of a Memorandum of Understanding (MOU), similar to the one being prepared for fisheries.

Table 10. Potential Post-Construction Monitoring Protocols[5]

ODNR Monitoring Protocol	Proposed Monitoring Option
Radar	Applicant will monitor nightly passage rates 5 nights/week between during spring and fall migratory periods using marine radar from a turbine platform Target density and altitudes will be assessed concurrently to greatest extent possible. Hourly weather data recorded; monitoring suspended during heavy rain, fog, or waves. *Data to be compared to 2017 baseline radar monitoring
Waterfowl Surveys	Applicant proposes to conduct twice-monthly aerial surveys from the fall through spring (dates to be determined) to characterize use of the site by waterfowl and other birds, including irregular patterns that may occur during ice-over conditions in mid-winter. *Note that the period of interest is fall through spring, not spring through fall as indicated in ODNR protocol, because the primary concern at the site is migrating and overwintering, not breeding birds **Data to be compared to 2017 baseline waterfowl surveys
Bat Acoustic Monitoring	The Applicant proposes using acoustic monitors deployed at the Project Site for 1 full season (March 15th – November 15th, 2018). *Data to be compared to 2017 baseline bat acoustic monitoring
Bird and Bat Collision Monitoring	Bird and bat collision monitoring will be finalized in consultation with ODNR and USFWS. Potential methods of monitoring collisions include, but are not limited to: • "Thunk" detection – using vibration sensors to detect the collisions of birds and bats with turbine rotors and cameras to further document collisions. • Bat fatality monitoring nets – aerially suspended nets to collect bats. Data would be gathered via remote sensing.

(C) LAND USE AND COMMUNITY DEVELOPMENT

(1) Land Use

(a) *Land Use Map*

Land uses within the 1-mile study area of the Facility are shown on Figure 08-5. The land use mapping was developed from the Cuyahoga County GIS Department FTP site. Figure 08-5 includes the following:

(i) The proposed Facility

(ii) Land use

(iii) Structures

(iv) Incorporated areas and population centers

[5] Proposed baseline monitoring plans are subject to change. The final monitoring plans will be developed in consultation with ODNR and USFWS and documented in an MOU, which will be provided to OPSB Staff upon completion.

(b) *Structures Table*

(i) Distance between structures and the nearest turbine (for structures within 1,000 feet)

There are no structures within 1,000 feet of a proposed turbine.

(ii) Distance between structures and associated facility (for structures within 250 feet of access road, collection line, or other associated facility)

Table 11 presents the distance between existing structures and the nearest Facility component for those structures located within 250 feet of the collection line, Substation, or O&M Center. There are no existing structures located within 250 feet of the staging area.

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

See Table 11, below.

Table 11. Structures Table

Structure Type[1]	Distance to Facility	Closest Facility Component	Lease Status of Underlying Parcel
Utility	171 feet	O&M Center[2]	Non-Participating
Industrial	95 feet	O&M Center[2]	Participating
Industrial	174 feet	O&M Center[2]	Participating
Utility	59 feet	O&M Center[2]	Non-Participating
Utility	145 feet	O&M Center[2]	Non-Participating
Utility	5 feet	Substation[3]	Participating
Utility	81 feet	Substation[3]	Participating
Utility	157 feet	Substation[3]	Participating
Utility	158 feet	Substation[3]	Participating
Utility	226 feet	Substation[3]	Participating
Utility	248 feet	Substation[3]	Participating
Utility	103 feet	Collection Line[4]	Participating
Utility	120 feet	Collection Line[4]	Participating
Utility	149 feet	Collection Line[4]	Participating
Utility	151 feet	Collection Line[4]	Participating
Utility	176 feet	Collection Line[4]	Participating
Utility	200 feet	Collection Line[4]	Participating

[1] Structure type assigned based on Land Use shapefile obtained from Cuyahoga County GIS. For example, a structure located on a parcel with industrial Land Use is considered an industrial structure.

[2] The Applicant will lease space from Great Lakes Towing to serve as the O&M Center for the Facility. Other structures located on the same parcel are considered participating. The Applicant does not anticipate making any modifications to the existing building.

[3] The Facility Substation will be located adjacent to the existing CPP Lake Road Substation. Other structures located on the same parcel are considered participating. Since final substation design is not yet complete, values presented here are based off a representative 88 x 110-foot polygon, and should be considered approximate.

[4] The final cable route has not yet been designed, but will be located within the electric collection line envelope. Distances are measured between nearby structures and the boundary of the collection line envelope, and therefore, present a worst-case scenario. Actual distances from the as-built Facility will likely be greater.

(c) *Land Use Impacts*

The Applicant has leased 4.2 acres of open lakebed in Lake Erie for turbine foundations. However, the footprint of each foundation will be less than 0.06 acres, with a total footprint from all 6 turbines totaling 0.34 acres. Compared to the total area of Lake Erie (over 9,900 square miles), this foundation represents an extremely small amount of the lake. The Facility Substation will have a footprint of 88 feet by 110 feet (0.22 acres). The Substation will be constructed on industrial land, adjacent to the existing CPP Lake Road Substation. While there is an impact from the Substation of 0.22 acres, the land use will not be changed. The buried collection cable will result in a temporary disturbance of land use, but once buried and covered by the sediment, there will be no permanent impacts. There will be no land use impacts as a result of the O&M Center. The Applicant will lease an existing building from Great Lakes Towing to serve as the O&M Center. Other structures located on the same parcel are considered participating and the Applicant does not anticipate making any modifications to the existing building.

(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

Due to the siting of the turbines 8 to 10 miles offshore in Lake Erie, there are no residences or parcel boundaries within a half-mile of the turbines. Figure 08-6 illustrates that there are no proposed facilities, habitable residences, or parcel boundaries of all parcels within a half-mile of the turbines.

(a) *Setback to Wind Farm Property Line*

Section 4906-17-08(C)(2)(a) requires that "the distance from a wind turbine base to the property line of the wind farm property shall 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 its highest blade." The height of the turbine proposed for the Facility is 479 feet (146 meters), which yields a property line setback of 527 feet (161 meters). All turbine locations will comply with these setbacks.

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

Section 4906-4-08(C)(2)(b) requires that "the wind turbine shall be at least 1,125 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." All turbine locations will comply with these setbacks as the distance between the proposed turbines and nearest adjacent property ranges from 7 to 9 miles.

(c) *Setback to Electric Transmission Line, Gas Pipeline, Hazardous Liquid Pipeline, or State or Federal Highway*

Section 4906-4-08(C)(2)(c) requires that "the distance from a wind turbine base to any electric transmission line, gas pipeline, hazardous liquid pipeline, or state or federal highway shall 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." The height of the turbine proposed for the Facility is 479 feet (146 meters), which yields a setback to transmission lines, gas or hazardous liquid pipelines, and state or federal highways of 527 feet (161 meters). The turbine locations will comply with these setbacks as the minimum distance between the proposed turbines and nearest transmission line, pipeline, or state/federal highway is over 7 miles.

(d) *Setback Waivers*

No setback waivers will be required for the proposed turbine sites.

(3) Land Use Plans

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

The City of Cleveland Planning Commission recently adopted the Connecting Cleveland 2020 Citywide Plan. The development of the proposed Facility is compatible with the Citywide Plan in a number of ways. In terms of economic development, the Facility will offer an opportunity for the use of local goods and services, including labor, equipment, and maintenance. The proposed Facility also aligns with the policy and strategy goal of the plan to make Cleveland a national leader in the development and application of renewable energy and sustainable technologies (Cleveland City Planning Commission, 2016).

(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.

(c) *Impact on Regional Development*

The regional economy surrounding the Project area is shaped in large part by the metropolitan economy of Cuyahoga County, including, but not limited to the City of Cleveland. Although the post-industrial economy within this region has seen significant changes in the past several years, the area has made substantial progress toward stabilization and growth as it emerges from the recent recession.

This section describes the impact of the proposed facility on regional development, including housing, commercial and industrial development, schools, transportation system development, and other public services and facilities. Information provided in this section was obtained primarily from *Socioeconomic Report,* prepared by EDR (see Exhibit M).

Housing

As with all sectors of the economy, the housing market throughout the region has felt the impact of population loss. In the local region, the housing unit vacancy rate is higher for rental properties than those that are owner-occupied. Owner-occupied vacancy rates in this region are slightly higher than the statewide average (0.3% higher), while the 8.5% rental vacancy rate in Cuyahoga County is substantially higher than the statewide average of 7.2%.

Cuyahoga County features a median $736 monthly gross rent level, which is above the statewide average of $729/month, and a higher proportion of renters whose rent accounts for more than 35% of their household income (44.1%). In addition, Cuyahoga County's median housing value of $123,300 is below the statewide average of $129,600.

It is estimated that more than 85,142 housing units within Cuyahoga County are currently vacant. Given these figures, it is not expected that the development of the Project will have a significant impact on the regional housing market. While the Project 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 Project 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 and greater fuel diversity. The Environment Ohio Research & Policy Center estimates 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 advance 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 3.9% of the total investment (Sterzinger & Svrcek, 2004). By way of comparison, the American Wind Energy Association estimates that the State of Ohio alone has enough wind resources to generate onshore wind energy to the magnitude of nearly 359 MW at 80 meter hub height and 110,439 MW at 110 meter hub height (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 (Environmental Law & Policy Center [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).

Schools

The proposed Facility will have a 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, specifically the City of Cleveland and the Cleveland Municipal School District. It is important to note that the proposed Facility will make few, if any, demands on local government services. Therefore, payments made to local taxing jurisdictions will be net positive gains, and represent an important economic benefit to the local schools.

Transportation System Development

The region surrounding the Project area features numerous Interstate, U.S, and state highways, as well as county and local roadway networks, in addition to freight rail lines and small airports. These facilities are described in further detail below.

The main transportation route to the Project area is Interstate 90 (Cleveland Memorial Shoreway/Innerbelt), which runs adjacent to the CPP Substation Site, and US Route 20/State Route 2 (which is the western branch of designated the Cleveland Memorial Shoreway) runs adjacent to the Port of Cleveland, the location of the O&M Center and main port to the turbines. Interstates 77 and 71 converge downtown from the south and southwest, respectively. US Routes 480 and 271 provide bypass routes that avoid the congestion near downtown Cleveland. 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 Interstate 90 and, if bound for the O&M Center, US Route 20/State Route 2. Construction traffic bound for the substations will likely use Exit 175 as the primary route, while traffic bound for the Operations and Maintenance area will most likely use the W 45th St exits from US Route 20/State Route 2. The proposed Project is not expected to cause any substantial disruption to major transportation corridors serving the Project area, as most transportation of turbine components and equipment will occur via barge.

Due to its proximity to the Port of Cleveland and other major Great Lakes ports, the proposed Project is well-positioned to take advantage of barge transportation where necessary or appropriate. There are three known shipping channels within the study area, two of which cross over the underwater transmission cable that connects the turbines to the substations. Because the transmission cable will be buried, it is not anticipated to cause disturbance to shipping commerce. Nearly all of the project suppliers will be shipping via barge.

Freight rail lines connect several of the municipalities throughout the Project area, nearly all converging near the site of the O&M Center in downtown Cleveland. CSX and Norfolk Southern operate the majority of Ohio's freight rail system, although smaller operators such as Amtrak, Rail America and the Wheeling & Lake Erie Railway also operate in the area. Project area municipalities connected to freight rail lines include the Cities of Cleveland and East Cleveland and the Villages of Bratenahl and Cuyahoga Heights. 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 system.

The proposed Facility is also in proximity to the Cleveland Hopkins International Airport and the Cleveland Burke Lakefront Airport, the closest airport facilities to the proposed Project. Construction and operation of the Project will be designed according to FAA standards and are not expected to result in any adverse

impacts to the regional air transportation network. See Section 4906-4-07(E) for further discussion of aviation facilities and compliance with aviation regulations.

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.

(d) *Regional Plan Compatibility*

The Project Area falls within the local jurisdiction of the Port of Cleveland. The Board of Directors of the Port has considered and approved a resolution concluding that the land requested by the Applicant in its SLL application is in accordance with the permissible land use under the waterfront plan of the Port. The project also creates potential for the Port to be redeveloped to handle product delivery, staging, assembly, and vessel loading.

Initially, LEEDCo was formed out of public support for an offshore wind installation in Lake Erie. LEEDCo is transitioning the Project to Icebreaker Windpower Inc. Since 2009, the Project developers have had the support of local jurisdictions demonstrated through the leadership presence of Cuyahoga County, Lake County, Lorain County, Ashtabula County, and the City of Cleveland on its board. These regional representatives are supportive of the Project and believe it is compatible with and will incentivize regional development plans.

As part of the process for ensuring that the Project is compatible with the City of Cleveland's development plans, the Applicant has appeared before the Cleveland City Council on numerous occasions. Additionally, as previously indicated in Section 4906-4-08(C)(3)(a), the proposed Facility aligns with the goals of the City of Cleveland Planning Commission's Connecting Cleveland 2020 Citywide Plan.

(e) *Current and Projected Population Data*

As shown in Table 12, the total population of Cuyahoga County was 123,856 in 2010, marking a decrease of 9% over the course of the previous two decades. Populations decreased each of the two decades across 1990 to 2010, with the sharpest decrease occurring between the years of 2000 and 2010.

Table 12. Countywide Population Trends

County	1990 Population	2000 Population	2010 Population	% Change 1990-2010
Cuyahoga County	1,412,140	1,393,978	1,280,122	-9.3%

Source: U.S. Census Bureau, Decennial Census

Populations in the villages and cities within 5 miles of the Project Area mostly decreased between 2000 and 2010. Of the seven municipalities, only the Village of Bratenahl experienced a population increase (+2%) over the same span. The City of Cleveland is the largest of these municipalities, and along with the City of East Cleveland, has experienced the greatest decline of growth of all the affected municipalities (Table 13). The trends experienced by each community between 2000 and 2010 are expected to continue regardless of whether the proposed Facility is built. Over the next decade, the population within five miles of the Project Area is projected to decrease by 27% between 2020 and 2030, from 439,047 to 370,169. Meanwhile, county population projections are only expected to decline 8% between the same time span, from 1,209,550 in 2020 to 1,179,030 in 2030 (Table 13).

Table 13. Population Projections

Jurisdiction within 5-Miles Radius of Facility	2000 Pop.	2010 Pop.	% Change 2000-2010	Est. 2020 Pop.	Est. 2030 Pop.	% Change 2010-2030
Cuyahoga County	1,393,978	1,280,122	-8.2%	1,209,550	1,179,030	-8%
City of Cleveland	478,403	409,221	-14%	350,043	290866	-29%
City of Cleveland Heights	49,958	46,797	-6%	43,836	40875	-13%
City of Shaker Heights	29,405	28,458	-3%	27,541	26625	-6%
City of East Cleveland	27,217	19,426	-29%	13,865	8304	-57%
Village of Cuyahoga Heights	599	547	-9%	500	452	-17%
Village of Newburgh Heights	2,389	2,108	-12%	1,860	1612	-24%
Village of Bratenahl	1,337	1,369	2%	1,402	1435	5%
Total	589,308	507,926	-14%	439,047	370,169	-27%

Note: Totals calculated by formula, may reflect rounding errors.
Source: U.S. Census Bureau, 2016 (2000 and 2010 population figures), Ohio Development Services Agency (2020 and 2030 projections for Cuyahoga County), Municipality projections based on their respective 2000-2010 growth rates.

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 area. The potential short- and long-term employment opportunities associated with the construction and operation of the Facility are discussed in further detail above in Section 4906-4-06(E).

(D) CULTURAL AND ARCHAEOLOGICAL RESOURCES

(1) Landmarks of Cultural Significance Map

Figure 08-7 depicts formally adopted land and water recreation areas, recreational trails, scenic rivers, routes or byways, and registered landmarks of historic, religious, archaeological, scenic, natural, or other cultural significance within 5 miles of the project area.

Gray & Pape staff conducted a cultural resources review through online resources from the Ohio Historic Preservation Office (OHPO) (Exhibit AA). 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:

- National Register of Historic Places (NRHP)
- National Historic Landmark (NHL)
- Ohio Archaeological Inventory (OAI)
- Ohio Historical Inventory (OHI)

Due to the siting of the turbines 8 to 10 miles offshore in Lake Erie, the 5-mile assessment in not applicable to the turbine component of the Facility. However, the literature review did include NRHP-listed and NHL properties within 1 mile of the Lake Erie coast, and OAI and OHI properties within one-half mile of the Lake Erie coast. These review areas were larger than the recommended Area of Potential Effects (APE) to ensure that any adjacent significant properties could be identified. The APE for direct effects was limited to those areas that will be physically affected by the installation and operation of the turbine area, including the footprint of the turbines and any associated construction workspace, corridor of disturbance from the cables, and any onshore construction. The only object in the lake that could potentially block the view of turbines is the Cleveland water intake crib. As such, the APE extended parallel to the shoreline for 29.6 miles on either side of the Project Area to ensure navigation markers, lights, and traditional use areas within the lake that might

have a view of the turbines are included. Due to the amount of development along the lakeshore, views of the lake are fragmentary or non-existent beyond the first road south of the lakeshore. Accordingly, the APE along the shore has been limited to the area immediately adjacent to the lake, as bounded by easily identifiable roads.

The records review of the OHPO online GIS mapping revealed that 46 NRHP-listed properties have been recorded within the literature review area. Of the 46 properties listed, 23 fall within the proposed APE, including 1 NHL property, the USS Cod, a submarine docked at the USS Cod Submarine Memorial in Cleveland.

The records review also identified the following cultural resources within the literature review area: over 450 OHI properties were identified and 14 archaeological resources recorded in the OAI in the study area. These properties are listed in Tables 3-3 and 3-4 of Exhibit AA. Of the over 450 previously identified historic structures, nearly half consist of single dwellings and other residential complexes. The remainder consists of retail store/shops, churches/religious structures, industrial/engineering, warehouse, commercial, and mill/processing/manufacturing. The OHI properties are spread across three counties (Cuyahoga, Lorrain, and Lake), but are concentrated in the center of Cuyahoga County, near Cleveland. The 14 archaeological sites consist of 4 historic, 1 middle woodland, 1 early woodland, 1 late woodland/late prehistoric, and 7 unassigned (4 woodland, 1 archaic, 2 prehistoric) periods. The majority of the OAI properties are located within Cuyahoga County. Additional information about these resources can be found in Exhibit AA. The Project is not anticipated to affect any of the OAI properties.

NOAA maintains a record of vessel losses and obstructions to shipping, the Automated Wreck and Obstruction Information System (AWOIS). The NOAA AWOIS lists 13 wrecks and obstructions in the Cleveland area (Exhibit AA), two of which lay in Lake Erie beyond the outer breakwater of Cleveland harbor near the CPP landfall for the cable, but outside of the cable route envelope.

Data from the 2016 geophysical survey of the cable route envelope was evaluated by VanZandt Engineering according to requirements from Section 106 of the National Historic Preservation Act (NHPA) of 1966 (Exhibit BB). APEs that were evaluated included areas around the proposed turbine locations, the export cable, and the inner Cleveland Harbor. Due to the shallow penetration depths of the turbine foundations and the inter-array and export cable burial depth, the impact of the Project's construction on prehistoric archaeological sites would be negligible. Sidescan sonar data, magnetometer data, and sub-bottom data analyses indicated that

no historic structures (such as shipwrecks) or potentially significant artifacts were present within the survey areas.

VanZandt Engineering also consulted with the OHPO online mapping system to locate any inventoried cultural resources identified within the survey area. This included a review of the OAI, OHI, and NRHP, Ohio Sea Grant Shipwreck map, the Cleveland Underwater Explorers shipwreck database, and the Cleveland Underwater Explorers historical Lake Erie nautical chart collection. No properties or districts listed in the OAI, OHI, NRHP are present within the survey area. Though four shipwrecks are located within 3.5 nautical miles of the survey area, no shipwrecks from the Ohio Sea Grant Shipwreck map, Cleveland Underwater Explorers Shipwreck Database, or Cleveland Underwater Explorers Historical Lake Erie Nautical chart collection are present within the survey area.

Impacts to culturally significant structures or potentially significant artifacts will be negligible since no structures or potentially significant artifacts were identified in the geophysical survey and associated literature review (Exhibit BB).

(2) Impact to Landmarks and Mitigation Plans

Gray & Pape, Inc. concluded that none of the properties listed on the OAI have the potential to be affected by the Project, and that the likelihood of locating submerged prehistoric resources in the APE is very low. If sediments are over 10 feet (3 meters) in thickness, prehistoric materials should not be disturbed by cable laying activities. Additional geophysical surveys were conducted in 2015 that indicated there were no additional underwater resources, including shipwrecks and obstructions that would be impacted by construction.

As no properties of historical or archaeological significance were identified along the cable route or at the turbine sites during the geophysical survey or the literature review, there will be no impacts to landmarks and no proposed mitigation at those sites. The USACE is also conducting a consultation with federally recognized Indian Tribes.

(3) Impact to Recreational Areas and Mitigation Plans

As discussed in Section 4906-4-08(D)(1), the 5-mile requirement is not applicable. Visual impacts on recreation sites are discussed below in Section 4906-4-08(D)(2). The Project is not anticipated to have any negative impacts on recreation. Project construction impacts will be temporary and short term and operational impacts are anticipated to be negligible to safe navigation. Additionally, Automatic Identification System (AIS)

vessel traffic patterns indicate that the areas around the turbines are infrequently used by any types of commercial or recreational boaters (Marine Cadastre, 2016). If the site becomes a tourism, sailing, or fishing destination, the public will not be excluded. Due to the existing amount of industrial development along the lakeshore, the minor modifications that will be made to the existing CPP Lake Road Substation will be entirely consistent with existing industry and activities at the location.

(4) Visual Impact

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

- describe the appearance of the visible components of the proposed Facility,
- define the visual character of the Facility study area,
- inventory and evaluate existing visual resources and viewer groups,
- evaluate potential Facility visibility within the study area,
- identify key views for visual assessment, and
- assess the visual impacts associated with the proposed action.

The VIA was prepared with oversight provided by a registered landscape architect licensed in the State of Ohio and experienced in the preparation of visual impact assessments. It is also consistent with the policies, procedures, and guidelines contained in established visual impact assessment methodologies.

A 10-mile radius study area around all of the proposed turbines (including the Alternate Turbine) was used for the Icebreaker visual study area, due to the location of the turbines 8 to 10 miles off-shore in Lake Erie. The 10-mile radius study area encompasses a total of approximately 370.6 square miles, and the landward portion of this area includes 24.7 miles of Lake Erie shoreline and 28 square miles of Cuyahoga County. Additional communities that occur within 10 miles of the proposed Facility include six cities (Bay Village, Cleveland, Fairview Park, Lakewood, Rocky River, and Westlake) and one village (Bratenahl). The location and extent of the visual study area is illustrated in Figure 4 in Exhibit CC.

Within the 10-mile radius visual study area, eight major landscape similarity zones (LSZ) were defined, including medium-density residential, high-density residential, developed open space, undeveloped open space, industrial, commercial, institutional, and transportation corridors. Additionally, the area of each LSZ that occurs along the Lake Erie waterfront (defined as areas within 200 feet of the Lake Erie shoreline) is quantified, as these areas generally have a heightened degree of visual sensitivity. Waterfront areas are further split into lake-level waterfront (less than 600 feet above mean sea level [amsl] in elevation) and elevated waterfront (greater than 600 feet amsl in elevation). Elevated waterfront areas are likely to offer the

most open and expansive views of Lake Erie and, therefore, are likely associated with the highest sensitivity to visual quality and visual change with respect to lake views within the landward study area. These areas of waterfront elevation properties include a small subset (<1% of the landward study area) of the medium-density residential zone and the undeveloped open space zone. For more information about LSZ, including representative photos of each, see Section 3.2 of Exhibit CC.

(a) *Project Visibility and Viewshed Analysis*

The Facility has been sited 8 to 10 miles out into Lake Erie, in part to minimize visual impacts onshore. Given the amount of existing development along the lake shore, however, views of the lake are fragmentary or non-existent beyond the first road south of the lake shore. Additionally, according to the National Weather Service (NOAA et al., 2015), the City of Cleveland has an average of 66 days per year that are clear (0-30% cloud cover), 97 days that are partly cloudy (40-70% cloud cover), and 202 days that are cloudy (80-100% cloud cover). Thus, clear skies occur approximately 18% of the time, while cloudy/overcast conditions typically occur about 55% of the time and partly cloudy conditions occur 27% of the time. National Weather Service data also indicate that during a typical year in Cleveland, 156 days (43%) will have precipitation of 0.01 inch or more (NOAA et al., 2015). While cloudy skies and precipitation do not necessarily preclude Project visibility, under such conditions long-distance views (i.e., from the City of Cleveland and adjacent shoreline areas) will be substantially reduced, and the white color of the sky and lack of strong shadows will decrease the turbines' color contrast even from closer viewpoints on the lake. The difference between views of the Facility on clear days versus overcast days can be seen in Inset 12. 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. It should be noted that the City of Cleveland has a number of high-rise buildings situated in the urban core that will have extended views of Lake Erie. While the viewshed does not take this visibility into account, subsequent field data collection, where possible, did consider elevated vantage points from within the city. A figure of the study area is included in the VIA (Exhibit CC).

<u>Viewshed Analysis</u>

Topographic viewshed maps for the Project were prepared using a bare earth digital elevation model (DEM) derived from the Ohio Statewide Imagery Program's 2006 Light Detection and Ranging (LiDAR) data for Cuyahoga County, the location and height of all proposed turbines (see Figures 2 and 3 in Exhibit CC), an assumed viewer height of six feet, and ESRI ArcGIS® software with the Spatial Analyst extension. To provide a conservative analysis of potential Facility visibility, all of the viewshed analyses

included an extra turbine at the most distant Alternate Turbine site. Two 10-mile radius topographic viewsheds were mapped; one to illustrate "worst case" daytime visibility (based on a maximum blade tip height of 479 feet above existing grade) and the other to illustrate potential visibility of turbine lights (based on an assumed FAA warning light height of 282 feet above existing grade). The FAA warning light (i.e., 282-foot) viewshed analysis was based on the assumption that all of the turbines would be lit.

The ArcGIS program defines the viewshed (using topography only) by reading every cell of the bare earth (or ground surface) DEM data and assigning a value based upon the existence of a direct, unobstructed line of sight to turbine location/elevation coordinates from observation points throughout the 10-mile study area. The resulting topographic viewshed maps define the maximum area from which any turbine within the completed Facility could potentially be seen within the study area during both daytime and nighttime hours (ignoring the screening effects of existing vegetation and built structures). Because the screening provided by vegetation and buildings is not considered in this analysis, the topographic viewsheds represent a "worst case" assessment of potential Facility visibility.

An additional, second-level analysis was conducted to better illustrate the potential screening effect of structures and vegetation, as captured in the Ohio Statewide Imagery Program's 2006 LiDAR data for Cuyahoga County. A digital surface model (DSM) of the study area was created from the LiDAR data, which includes the elevations of buildings, trees, and other objects large enough to be resolved by LiDAR technology. This DSM was then used as a base layer for the viewshed analysis, as described above (using the blade tip and FAA warning light heights as input data). Once the viewshed analysis was completed, a conditional statement was used to set turbine visibility to zero in locations where the DSM elevation exceeded the bare earth elevation by six feet or more, except in locations of known bridges (which were obtained from the Cuyahoga County Geographical Information Systems Department). This was done for two reasons; 1) because in locations where trees or structures are present in the DSM, the viewshed would reflect visibility from the vantage point of standing on the tree top or building roof, which is not the intent of this analysis and 2) to reflect the fact that ground-level vantage points within buildings or areas of vegetation exceeding 6 feet in height will generally be screened from views of the Facility. However, it should be noted that where high rise buildings occur in areas indicated as being screened from views of the Facility, views may be available from upper stories that have views of Lake Erie. Generally, this will include the taller office and residential buildings scattered throughout the study area.

Because it accounts for the screening provided by structures and trees, this second-level analysis is a more accurate representation of potential Facility visibility. However, it is worth noting that because

characteristics of the proposed turbines that influence visibility (color, narrow profile, distance from viewer, etc.) are not into taken consideration in the viewshed analyses, being within the vegetation viewshed does not necessarily equate to actual Facility visibility.

Potential turbine visibility, as indicated by the viewshed analyses, is illustrated in Figure 8 of Exhibit CC, and summarized below in Table 14. As indicated by the topographic blade tip analysis, the proposed Facility could potentially be visible from approximately 99.0% of the 10-mile study area, or 86.5% of the landward study area, if the screening effect of existing vegetation and structures is not considered in the analysis. However, this is not representative of real life conditions, which include screening from vegetation and structures. Since topography within the study area generally slopes toward Lake Erie, it provides very little screening of views toward the Facility. Areas where there is no possibility of seeing the Facility due to intervening topography are restricted to portions of the Rocky River and Cuyahoga River valleys, much of the I-90 corridor (except in the eastern portion of the study area, where I-90 is adjacent to Lake Erie), portions of the Norfolk Southern Railroad, and a few scattered low-lying areas. Areas of potential nighttime visibility based on the topographic viewshed analysis cover approximately 98.8% of the 10-mile radius study area (84.1% of the landward study area) and are indicated in roughly the same locations shown by the blade tip analysis.

Factoring structures and vegetation into the viewshed analysis does not affect the open views that will be available from Lake Erie, but it drastically reduces potential Facility visibility within the landward portion of the study area, and is a more accurate reflection of what the actual extent of Facility visibility is likely to be. This analysis indicates that the proposed turbines could potentially be visible during the daytime from approximately 92.8% of the 10-mile study area as a whole, but from only 5.9% of the landward study area (i.e., 94.1% of the landward study area will be screened from view of the Project). Visibility within the landward study area is concentrated along the shoreline and drops off dramatically just a short distance inland due to the extensive screening provided by intervening vegetation and structures. In general, Facility visibility extends further inland in the City of Cleveland and is more limited in the Cities of Lakewood, Rocky River, and Bay Village. Relatively larger areas of potential visibility along the shoreline occur at Lakewood Park, Edgewater Park, Whiskey Island, and Gordon Park; the East 55th Street Marina; the Port of Cleveland; and Burke Lakefront Airport. Further inland, larger areas of potential Facility visibility are indicated along portions of I-90 (in the eastern portion of the study area); portions of the Norfolk Southern Corporation Railroad; along several bridges that occur within the visual study area (particularly those crossing the Cuyahoga River); portions of the Cleveland Memorial Shoreway; Kirtland

Park; and areas south of the Burke Lakefront Airport, the Port of Cleveland, and the East 55th Street Marina.

Table 14. Viewshed Results Summary

Type of Viewshed	Potential Visibility			
	10-Mile Study Area		Landward Study Area	
	Square Miles[1]	Percent	Square Miles[1]	Percent
Blade Tip Visibility - Topography Only	366.4	99.0%	24.5	86.5%
FAA Warning Light Visibility - Topography Only	365.8	98.8%	23.9	84.1%
Blade Tip Visibility – Topography, Vegetation & Structures	343.6	92.8%	1.7	5.9%
FAA Warning Light Visibility – Topography, Vegetation & Structures	343.5	92.8%	1.5	5.4%

[1]The 10-mile radius study area is approximately 370.3 square miles in size, which includes approximately 28.4 square miles within the on-shore portion of the study area and 341.9 square miles within the off-shore portion of the study area.

As with the topographic viewshed analysis results, there is a minimal difference between daytime (blade tip) and nighttime (FAA warning light) visibility with the screening effects of vegetation and structures factored into the analysis. According to this analysis, the turbine FAA warning lights will be potentially visible from 92.8% of the 10-mile study area, or 5.4% of the landward study area. Nighttime visibility is indicated in roughly the same areas as daytime visibility, but to a slightly lesser extent.

It is important to note that the viewshed analysis results do not necessarily equate to actual Facility visibility. The use of LiDAR data allows for consideration of structures and vegetation in the analysis. However, the LiDAR data is from 2006, and therefore, the analysis does not reflect any changes that have occurred since that time. The results should be considered an accurate preliminary evaluation of Facility visibility, which was further evaluated during field review, as discussed below.

Field Verification

Visibility of the proposed Facility was evaluated in the field on August 3, 4 and 17, 2016. The purpose of the site visits was to verify potential turbine visibility within the landward portions of the study area, and obtain photographs for subsequent use in the development of visual simulations. Weather conditions in the field on all three days were sunny and clear with low humidity and no cloud cover. The weather conditions were ideal for depicting the highest visibility conditions, and therefore, the potential worst case visual impact of the Facility. As stated above, these viewing conditions occur on just 18% of the time in

Cleveland. Consideration was also given to viewer orientation and time of day by strategically capturing a variety of lighting conditions (front lit, side lit and backlit) in the photographs.

During the field verification, an EDR field crew drove public roads and visited public vantage points within the 10-mile radius study area to document points from which the turbines would likely be visible, partially screened, or fully screened. This determination was made based on the visibility of Lake Erie and the water intake Crib, which served as locational and scale references. Photos were taken from 56 representative viewpoints within the study area. Viewpoint locations were determined using hand-held global positioning system (GPS) units, high resolution aerial photographs (digital ortho quarter quadrangles), photographs taken of the viewpoint location, and high resolution LIDAR data (to determine elevation). The time and location of each photo were documented on all electronic equipment (camera, GPS unit, etc.) and noted on field maps and data sheets (see Appendix B of Exhibit CC). Where views existed, viewpoints photographed during field review generally represented the most open, unobstructed available views toward the turbines.

Field review suggested that visibility of the Facility would be largely restricted to the waterfront and open water portions of the visual study area, as suggested by the viewshed analysis. In residential areas in Westlake, Bay Village, and Cleveland, visibility of the Facility will be fully or substantially screened from inland areas by densely situated homes and vegetation along the shoreline. These shoreline residences will all likely have some level of Facility visibility due to the fact they have been purposely situated to take advantage of lake views. In most cases, visibility does not extend beyond shoreline residences, except in circumstances where an undeveloped cul-de-sac or public ROW exists, making water views possible from public vantage points. Multiple parks and developed open space along the lake shore also capitalize on open water views, and therefore will have views toward the Facility, but again, vegetation and structures at these sites limit unobscured off-shore views to the shoreline and immediate inland areas. In eastern Bay Village, several high-rise residential buildings are concentrated along the Lake Erie shore. These structures provide elevated views of the lake, but effectively block inland ground-level views.

Within the City of Cleveland, an abundance of waterfront facilities such as parks, marinas, and ports will generally have open views of the Facility. Areas inland of the shoreline offered limited open water views due to interceding features along the shoreline (e.g., buildings, industrial facilities, and vegetation). However, elevated portions of Interstate 90 and parks such as the City Mall will have intermittent framed views of the Facility turbines. Additionally, many of the inland high-rise structures will have visibility of the Facility from upper floors. The field crew was able to visit two high-rise buildings within the City of

Cleveland (the Key Building and the Hilton Hotel) and both had expansive lake views. From the elevated vantage points, it was also apparent that many other buildings were situated in such a way that views toward the Facility would be available from the upper floors. The field review confirmed a general lack of visibility from street level views within the inland portion of downtown Cleveland.

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

The Project site is located 8 to 10 miles out into Lake Erie. The proposed location is a broad expanse of open water that is devoid of islands or man-made structures, buoys or navigational aids. Consequently, the turbine sites are completely unscreened by foreground vegetation, topography or structures. However, given the amount of existing development along the lake shore, views of the Project site from on-shore locations are typically fragmentary or non-existent beyond the first road south of the lake shore.

The proposed turbines are positioned in an area of the lake where the water is approximately 63 feet deep. This area is characterized by relatively uniform lakebed topography that slopes downward from southeast to northwest. Recent, Holocene-aged sediments blanket the lake bottom in the proposed Project Area. The sediments are predominantly soft, fine-grained, and unconsolidated to normally consolidated deposits composed of clay-sized particles with a lesser percentage of silt-sized particles. The lake-bottom sediment overlays a sequence of late Pleistocene glacial and post glacial sediments. Borings at two proposed turbine sites indicate approximately [redacted] feet of sediment over the bedrock beneath Lake Erie. Photosynthetically Active Radiation (PAR) is used as the source of energy for photosynthesis of green plants (Mõttus *et al.,* 2012). Data collected by LimnoTech (2016) at the turbines sites indicates that PAR is essentially nonexistent at depths beyond 26 feet. As such, there is no reason to expect vegetation to grow on the lakebed in the vicinity of the proposed turbines.

The area surrounding the proposed Project Substation is either waterfront, open water (Cleveland Harbor), or developed land. Adjacent development includes the CPP Lake Road Substation and Generating Station, Lake Side Yacht Club to the west, Forest City Yacht Club to the east and Burke Lakefront Airport to the north. The proposed substation property contains some ornamental trees and shrubs around the buildings, and a narrow row of trees lining much of the immediate lakeshore (which is hardened shoreline). The narrow, vegetated area between the existing substation buildings and the lakeshore is less than 40 feet (12.2 meters) and contains sparse trees, shrubs, and herbaceous growth.

A portion of the underwater cable and Project Substation fall within the local jurisdiction of the Port of Cleveland. The Board of Directors of the Port has considered and approved a resolution concluding that

the land requested by the Applicant in its SLL application is in accordance with the permissible land uses identified in the Port's waterfront plan. The Project also creates potential for the Port to be redeveloped to handle product delivery, staging, assembly, and vessel loading. In addition, the proposed Facility aligns with the goals of the City of Cleveland Planning Commission's Connecting Cleveland 2020 Citywide Plan.

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

High-resolution computer-enhanced image processing was used to create realistic photographic simulations of the completed Facility. The criteria for selecting which viewpoints should be used for the simulations, and the methodology used to prepare the simulations, are described below in Section 4906-4-08(D)(4)(e). To evaluate the visual changes associated with the proposed Facility, the photographic simulations of the completed Facility were compared to photos of existing conditions. These "before" and "after" photographs, identical in every respect except for the Facility components shown in the simulated views, were prepared as 11 x 17-inch color prints. A registered landscape architect was asked to determine the effect of the proposed Facility on the existing visual conditions in terms of its contrast with existing components of the landscape. For each simulated viewpoint, the landscape architect provided a numerical score indicating the level of contrast for each view in the categories of landform, vegetation, land use, water, sky, and viewer activity. Contrast scores ranged between 0 and 4, with a score of 0 indicating no contrast, 1 indicating minimal contrast, 2 indicating moderate contrast, 3 indicating appreciable contrast, and 4 indicating strong contrast. The scores for each category (landform, vegetation, etc.) were then averaged to generate an overall contrast rating for each viewpoint. The landscape architect also provided comments on variable factors that may have affected the rating (such as atmospheric conditions or the season) as well as comments regarding the perceived effect of the Project on scenic quality and/or viewer enjoyment.

The viewpoints selected for development of visual simulations were broken down into five groups, based on the character of the available views and the visual context of the viewpoints: open water views, shoreline views with built features, beach/shoreline recreational views, developed shoreline views, and elevated city views. Review of the simulations, 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. Results of this evaluation are presented below.

Open Water Views

Several of the selected viewpoints feature existing views that essentially include nothing but open water extending from the immediate foreground to the horizon line. These types of views are represented by the existing conditions photos from viewpoints 8, 12, 14, and 37. These selected views are from the Undeveloped Open Space, Developed Open Space and Suburban Residential LSZs immediately adjacent to the shoreline, where lack of structures and trees offers unobstructed views out to Lake Erie. Several of these views are from designated overlooks, and in some cases, are also representative of what boaters in near shore areas would experience as they look off-shore toward the proposed Project site. The existing views are characterized by a broad expanse of open water that is generally dark blue color, with some variability introduced by ripples, swells, and small breaking waves. With the exception of some minor foreground features around the edges, these views generally lack any man-made or natural features that would either obscure the view or serve as focal points that draw the viewer's eye to a particular location. The one exception is Viewpoint 8 from Edgewater State Park. In this view the Cleveland Water Intake Crib can be seen off-shore on the horizon line. However, at this distance, the Crib appears very small and is not a significant focal point in the view. In all of these views, the viewer's eye is carried to the horizon line where the dark blue lake meets a lighter blue sky, forming an unbroken horizontal line. The expansive nature of these views and the lack of developed features result in relatively high aesthetic quality. In addition, because these views are typical of what will be available from public park land or waterfront residences, viewer sensitivity to visual quality is assumed to be high.

With the proposed Facility in place, the Facility's six turbines can be seen on the horizon line where the water meets the sky. The turbines appear in a straight line, but depending on their distance from the viewer and the orientation of the view, their scale and spacing are variable from viewpoint to viewpoint. The turbines are the only features extending above the horizon line, and under the cloudless blue sky conditions represented in the photos, the turbines white color presents clear contrast with the color of the sky. This contrast is also present when the turbines are backlit and appear dark against a lighter sky as is the case in the simulation from Viewpoint 37 (Lakeshore Drive). However, contrast would be greatly reduced (in some cases to the point where the turbines would not be visible at all) under more overcast sky conditions. The turbines' vertical line and man-made form also present contrast with the strong horizontal line of the horizon and the lack of other developed features in the view. Because of their novel, man-made form in an otherwise undeveloped view, and their unusual off-shore location, the turbines will also be a new focal point in the view. Although mitigated somewhat by their distance from the viewer, the turbines could have a moderate to appreciable impact on scenic quality and viewer enjoyment of these types of views.

As described in Section 4906-4-08(D)(4)(a), cloudy or partly cloudy conditions occur in Cleveland on an average of 82% of the time (NOAA, 2015). While cloudy skies and precipitation do not necessarily preclude Project visibility, under such conditions long-distance views (i.e., from the City of Cleveland and adjacent shoreline areas) will be substantially reduced, and the white color of the sky and lack of strong shadows will decrease the turbines' color contrast even from closer viewpoints on the lake. Inset 12 shows a visual simulation of the Project from Lakewood Park on a clear day versus a cloudy day. The turbines are substantially less visible on the cloudy day, compared to the clear day.

Inset 12. Visual Simulations from Lakewood Park on a Cloudy Day[6] Compared to a Clear Day.

[6] Cloudy day photograph was taken by Environ in 2013.

Shoreline Views with Built Features

Another common type of view toward the proposed turbines that is available throughout the visual study area is similar to the open water views described above, but also includes some distinct near shore built features that add a sense of development and focal points to the view. Representative examples include Viewpoints 4, 7, 25, and 52, all of which are dominated by broad expansive open water, but also include man-made features such as lighthouses, docks, and breakwaters that reinforce their working waterfront character and draw the viewer's attention. In some cases, such as Viewpoint 52 from the Cleveland Harbor Coast Guard Station, these features are more centrally located in the view and block significant portions of the horizon line. In others, such as Viewpoint 4 from the Cleveland Lakefront Nature Preserve, these built features are more minor, peripheral components of the view. All the selected viewpoints are in public locations where viewers gather specifically to enjoy the waterfront setting and views of the lake. Thus, viewer sensitivity to visual quality, especially in outward views toward the lake, is considered relatively high. The presence of waterfront related focal points in the view tends to add interest but decrease the undeveloped aesthetic quality of these open water views.

With the proposed Facility in place, the proposed turbines add an additional built off-shore feature to the view. As with the previous open water views, on clear days in Cleveland the turbines present contrast with the color of the sky and will draw viewer attention due to their novel form and unusual location in an off-shore setting. The degree to which they become a new focal point in these views varies based on distance and orientation of the view, as well as competition for viewer attention presented by other built features. In views, such as those available from Viewpoint 4 (Cleveland Nature Preserve) and Viewpoint 25 (Edgewater Drive Overlook), where the turbines appear more widely spaced and there are relatively few competing landscape features in the view, the new turbines will become a significant focal point and present moderate contrast with existing elements of the view. In others, such as Viewpoint 7 (the USS COD) and Viewpoint 52 (USCG Cleveland Harbor Station), where the turbines appear more compact and are viewed along with other existing off-shore features, they are less of a focus in the view. The presence of existing built features in a view generally reduces the contrast presented by the Facility, especially when the Facility is viewed at distances at excess of 8 miles, as illustrated in this group of simulations. When viewed at these distances, the turbines do not appear out of scale with other built features in the view. In addition, the limited number of turbines, their clean, delicate lines, and their orderly arrangement do not significantly increase visual clutter, or decrease scenic quality. Under more overcast sky conditions,

turbine visibility, color contrast, and competition as a focal point in these types of views will be further reduced.

Beach/Shoreline Recreational Views

A somewhat unique type of view is represented by Viewpoint 9 at the Edgewater State Park Beach. This view includes the open water of Lake Erie, but is dominated by a broad sand beach and beach-related human activity in the immediate foreground. In this type of view, the lake serves as a backdrop to the foreground features, which are the focus of viewer attention. A similar scenario would arise in other settings where recreational or residential facilities and activities occur between the viewer and the lake. In the view from Viewpoint 9, some off-shore built features, including the Crib and a stone break water, are visible in the lake but do not really act as focal points due to the competing elements on the beach in the foreground. As in most relatively open off-shore views the intersection of the lake and the sky forms a strong horizontal line that spans the view. In this particular view, the distinct shoreline where the lake meets the edge of the beach, and the lack of any tall landscape features, reinforces the strong horizontal lines in the view. Aesthetic quality of this view is relatively high, and the state park setting and recreational use suggest that visitor sensitivity to visual change may also be high.

With the proposed Facility in place, six turbines are visible on the horizon line on the left side of the view. As in previous simulations, the white color of the turbines contrasts with the blue sky in the background, but their prominence is limited due to the effects of distance. In this view, the human activity on the beach remains the focus of viewer attention. However, the turbines will serve as a focal point for beach-goers when looking out to the lake. Somewhat like the crib, which is also visible in this view, their location in a lake setting, their novel form, and the lack of other interesting off-shore features will draw the attention of beach-goers. They could be perceived as having a moderate impact on scenic quality, but should not affect viewer enjoyment of beach activities.

Developed Shoreline Views

Because the Lake Erie shoreline within the visual study area includes an abundance of developed land (urban, suburban, industrial), a typical view out to the lake often includes some level of shoreline development in the immediate foreground. Examples of this type of view are provided by Viewpoints 2 and 19. Both of these are from shoreline park settings, but represent the type of views that are available at a variety of public vantage points in developed open space settings. In some of these views, such as Viewpoint 2 from the Cahoon Memorial Park Boat Launch, the developed features

are restricted to the immediate foreground (in this case a dock structure) with nothing but the open water of Lake Erie in the mid-ground and background. In other instances, such as Viewpoint 19 from Bicentennial Park near the Rock and Roll Hall of Fame, the views include developed features not only at the water's edge, but also in the lake in the mid-ground or background (in this case a stone break water and the crib). Prominent developed features in the foreground of these views are focal points in the views and provide evidence of the broader developed landscape context of these viewpoints. Visual quality and viewer sensitivity to visual change in such settings will be variable, but in most parks and other public venues will likely be at least moderate.

From developed shoreline settings, such as Viewpoint 2 and 19, the proposed Facility will add a relatively minor new developed feature to the existing views. Despite the fact that the turbines are very large structures, at the distance at which they are being viewed in these simulations (7.5 to 11.5 miles), they appear relatively small compared to the other developed features along the shoreline and in the near shore area. The turbines will interrupt the skyline and are unexpected in an off-shore setting. As these simulations illustrate, the extent of the view occupied by the Facility and the prominence of the turbines will vary based on distance, orientation of the view, and sun/sky conditions. In Viewpoint 2 from the Cahoon Memorial Park Boat Launch, the turbines appear widely spaced and occupy approximately a third of the visible horizon line in the selected photo. However, at the time of day that the photo was taken, and under the sky conditions at the time, the contrast of the turbines against the sky is relatively low. Conversely, in the simulation from Viewpoint 19 at Bicentennial Park, the contrast presented by the backlit turbines is substantially greater, but the orientation of the view makes the Facility appear much more compact. Under both scenarios, the turbines would be a focal point in the view, but would also compete with other on shore and off-shore features for viewer attention. Because they are viewed in the context of other developed features, their land use contrast and effect on scenic quality are minimal. Due their distant off-shore setting, and the presence of competing features and activities occurring along the developed shoreline, the presence of the turbines should not adversely affect viewer activity or enjoyment of the view.

Elevated City Views

A somewhat unique type of view that is available within the visual study area is an elevated view of the lake available from within the City of Cleveland. These types of views are exemplified by Viewpoint 17 from the Cleveland Mall, and Viewpoint 28 from the 28th floor of the Key Building. Unlike ground-level views toward the lake within the city, which are generally fully or substantially screened by intervening structures, these elevated vantage points allow for views over foreground

development out to the open water of the lake. These foreground features will vary widely depending on the specific location of the given viewpoint. In both selected views, a variety of structures are visible including First Energy Stadium, the Port of Cleveland, and the Great Lakes Science Center. From other viewpoints, different commercial, residential, institutional, and industrial structures would be visible in the foreground of such views.

The dominance of the lake in these views is largely related to viewer height. At the Cleveland Mall, a viewer is approximately 83 feet above lake level, and the lake is viewed as a mid-ground and background feature between and above developed foreground features that dominate the view. From the 28th floor of the Key Building the viewer is approximately 599 feet above lake level. At this height, foreground features are relegated to the lower portion of the view, and a broad expansive open water is visible to the horizon. In such higher elevation views, the lake itself becomes the focal point and the character defining element of the view. Regardless of viewer height, these elevated city views include a variety of buildings and man-made structures that define the landscape context as an urban setting. Even if the developed features in the view do not contribute to the overall aesthetic value, the presence of the lake in these views enhances scenic quality and adds interest. Viewer sensitivity will be highly variable based on the activity in which the viewers are engaged and the aesthetic quality of other developed features in the view.

In elevated city views, with the proposed Facility in place, the turbines may or may not be clearly visible, as shown in the simulations from Viewpoints 17 and 28. Under clear sky conditions and strong sunshine, as illustrated in the view from Viewpoint 17 at the Cleveland Mall, the turbines are clearly visible on the horizon line. However, in this view, with an abundance of built features in the foreground (including a wind turbine) the Facility does not present significant contrast in terms of line, form, color, or existing land use. The distance of the turbines from the viewer minimizes scale contrast, and the limited extent of open uninterrupted horizon visible from this viewpoint reduces the prominence of the turbines. In the view from Viewpoint 28, on the 28th floor of the Key Building, less development is visible in the foreground and a much larger expanse of open water and horizon line are visible. However, any resulting increase in Facility contrast that might result from this is off-set by the decreased turbine visibility and contrast with the background under the sky conditions illustrated in this photo. Despite relatively clear skies, haze at the horizon largely obscures the proposed turbines. Their visibility and contrast would be even less under overcast conditions. Regardless of weather conditions, Facility-related impacts on scenic quality and viewer activity in elevated city settings are likely to be minimal.

Evaluation of the simulations of the proposed Facility by an EDR landscape architect indicated that the overall degree of Project contrast and potential impact on scenic quality is variable, and largely dependent on the orientation of the view, lighting/sky conditions, and the presence or lack of other developed features in the view. Of the 13 simulations evaluated, two simulations had an average contrast rating greater than 3.0 (appreciable) on a scale of 0 (insignificant) to 4 (strong). Five viewpoints received scores indicating a moderate visual contrast (range of 1.9 to 2.5), while the remaining six views had an average contrast rating of less than 1.3, indicating a minor to insignificant impact (see Table 3 in Exhibit CC).

All of the highest contrast ratings (range = 2.4-3.25, average = 2.8) were received by viewpoints that represented Open Water views with essentially no evidence of human development (i.e., Viewpoints 8, 12, 14 and 37). The unbroken expansiveness of these views, the lack of developed features, and the potential sensitivity of viewers in these park and residential settings resulted in relatively high contrast scores, particularly in terms of the Facility's contrast with the water, sky, land use and viewer activity. Other views in a recreational setting that included relatively few developed features, such as Viewpoints 2, 4 and 26 received the next highest average contrast scores (range = 1.9 – 2.25, average = 2.1) indicating a moderate visual impact. At the other end of the scale, those viewpoints that received overall contrast scores indicating a minimal to insignificant visual impact (range = 0 – 1.3, average = 0.6) were generally characterized by substantial existing developed features off-shore and/or along the shoreline. These features, along with site-specific conditions such as viewer orientation and lighting/sky conditions, tended to reduce the Facility's visual contrast with the existing landscape and its potential impact on scenic quality and viewer activity. However, the degree of Project visibility and contrast with the existing landscape will be substantially reduced under cloudy and partly cloudy conditions that occur on 82% of the days during a typical year in Cleveland (NOAA et al., 2015).

It is worth noting that wind turbines are unlike most other energy/infrastructure facilities, such as transmission lines or conventional power plants, which are almost universally viewed as aesthetic liabilities. Wind turbines have a clean sculptural form that is considered attractive by some viewers (Pasqualetti et al., 2002). Operating wind power projects in a variety of settings have been documented as receiving a generally positive public reaction following their construction. For instance, a survey conducted in Lewis County, New York (location of the 195-turbine Maple Ridge Wind Power Project in operation since 2006) revealed that a majority of residents surveyed indicated that wind farms have had a positive impact on Lewis County (70.7% of participants), and that wind farms should be expanded in the county (79.2% of participants). The survey further characterized the individuals that were able to see

and/or hear turbines from their homes to reveal that 77.1% of these individuals indicated that the wind farms have had a positive impact on Lewis County. Additionally, only 7.5% of participants who lived within 1 mile of the nearest wind turbine felt that wind farms have had a negative impact (Jefferson County Community College, 2008).

These results are consistent with the results of a study of public perception of wind power in Scotland and Ireland (Warren et. al., 2005), which concluded the following:

> *"A remarkably consistent picture is emerging from surveys of public attitudes to wind power, and the case studies provide further evidence that this picture is a representative one. Large majorities of people are strongly in favour of their local windfarm, their personal experience having engendered positive attitudes. Moreover, although some of those living near proposed windfarm sites are less convinced of their merits, large majorities nevertheless favour their construction. This stands in marked contrast with the impression conveyed in much media coverage, which typically portrays massive grassroots opposition to windfarms."*

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

The 10-mile radius visual study area includes numerous sites that could be considered scenic resources of statewide significance. All inventoried scenic/sensitive resources are listed in a large format table in Appendix A of Exhibit CC. For each scenic resource, this table provides the location, distance to the nearest turbine, associated viewpoint number, and project visibility, based on both viewshed analyses and field review. The location of mapped visually sensitive resources within the visual study area is illustrated in Figure 6 of Exhibit CC.

Historic sites that could be considered sensitive include sites and districts listed on the NRHP, 81 potentially eligible NRHP sites, and 24 State Historic Markers. There are 122 NRHP-listed sites and 25 NRHP-listed districts within the 10-mile study area, of which 111 NRHP-listed sites and 23 NRHP-listed districts occur within the City of Cleveland. These sites include 16 houses, nine apartment buildings, eight churches, one hospital, two hotels, four schools, one library, one country club, three bridges, one submarine, two pierhead lights, and one USCG station. The remaining 73 NRHP-listed historic sites are buildings used for industrial/engineering, warehouse, commercial, and mill/processing/manufacturing. There are eight residential historic districts (Birdtown Historic District, Clifton Park Lakefront District, Franklin Boulevard-West Clinton Avenue Historic District, Franklin Boulevard Historic District, Ohio City Preservation District, Prospect Avenue Row House Group, Scranton South Side Historic District, and Tremont Historic District), 13 commercial historic districts, one recreational historic district (Rockefeller

Park and Cleveland Cultural Gardens Historic District), one set of bridges (Rockefeller Park Bridges), one school district (West Technical High School), and one archaeological district (Irishtown Bend Archaeological District). Many of these are also Designated Cleveland Landmarks and Districts.

NRHP-listed sites and districts likely to experience the most uninterrupted views of the Project, are those located along the Lake Erie shoreline. These include the Universal Terminal Company Dock and Warehouse, USS COD (submarine), USCG Cleveland Harbor Station, and Cleveland East and West Pierhead Lights, as well as the Clifton Park Lakefront District, all of which are described in Section 3.4 of Exhibit CC.

There are no State Parks, State Forests, National Wildlife Refuges, National Park Service Lands, National Natural Landmarks, State Wildlife Management Areas, State Nature Preserves, federally designated trails, or state or federally designated wild, scenic, or recreational rivers, within the visual study area. However, there is also one national heritage area (Ohio & Erie Canalway National Heritage Area), two national scenic byways (Lake Erie Coastal Ohio Scenic Byway and Ohio & Erie Canalway Scenic Byway), one scenic overlook (Stinchcomb-Groth Memorial Scenic Overlook), and one state designated bike trail (Ohio & Erie Canal Towpath Trail) that could also be considered resources of statewide significance. Each of these resources is described in Section 3.4 of Exhibit CC.

Beyond these scenic resources of statewide significance, the 10-mile radius study area also includes areas that could also be considered regionally or locally significant/sensitive, due to the type or intensity of land use they receive. These include the designated Cleveland landmarks and districts previously mentioned, as well as various golf courses, local parks, local bike routes, water bodies, schools, hospitals, libraries, cemeteries, areas of concentrated human settlement (Cities of Cleveland, Lakewood, Westlake, Bay Village, Fairview Park, and Rocky River, as well as the Village of Bratenahl), and heavily traveled highways.

One unique local resource is Lakefront Reservation, which is managed by Cleveland Metroparks through a 99-year lease agreement with the City of Cleveland (the property owner). Lakefront Reservation is comprised of six lakefront parks, four of which are located within the visual study area: Edgewater Park, Whiskey Island, E. 55th Street Marina, and Gordon Park (located 8 miles, 8.2 miles, 8.9 miles, and 9.3 miles from the nearest proposed turbine, respectively). The six properties consist of about 511 acres scattered along 14 miles of Lake Erie lakefront property. The areas were once known as Cleveland Lakefront State Park, during which time the Ohio Department of Natural Resources leased the properties

from the City of Cleveland in an effort to improve the parks. During this time shorelines were protected, new concessions and a new park office were built, beaches and picnic facilities were improved, and historic features were renovated (ODNR, 2016f). In 2013, Cleveland Metroparks took over management of the parks and the area was renamed Lakefront Reservation. There are a number of amenities and activities available at the lakefront properties including walking and biking trails, piers for fishing, boat launch ramps, picnic areas, marinas, bird watching, playgrounds, grills, sandy beaches, swimming, and scenic views of Lake Erie, the downtown Cleveland skyline, and sunsets (Cleveland Metroparks, 2016).

Based on blade tip height and the screening effect of topography alone, only six of the identified visually sensitive resources are indicated as being fully screened from views of the proposed Project: NRHP-listed Charles Olney House and Gallery, the Tremont Designated Cleveland Landmark District, three NRHP-eligible properties, and Clark Elementary School. Factoring structures and vegetation into the viewshed analysis reveals that Facility visibility will be eliminated from over 400 of the inventoried resources, and that visibility will be reduced (partially screened) from the vast majority of the remaining resources. The only inventoried visually sensitive resources indicated as having full/unscreened views of the Project from all locations within their mapped boundary are three waterfront NRHP-listed sites: the Cleveland East and West Pierhead Lights and the USCG Cleveland Harbor Station.

In summary, the visibility and visual impact of the wind turbines will be highly variable, based primarily on the presence of other man-made features in the view, and sensitivity of the viewpoints and viewers in question. However, the Facility's distance from shoreline viewpoints substantially mitigates this impact. The closest point to shore from the turbines is 7.1 miles and is represented in the view from Lakewood Park (see Figure 11, Exhibit CC). Even at this closest distance, the Facility will occupy a relatively small portion of an expansive lakeward view, and thus will not dominate the horizon. Studies have shown that significant visual effects of wind power projects are generally concentrated within 3.5 miles (6 kilometers) of a project site (Eyre, 1995).

(e) *Photographic Simulations*

EDR selected 13 viewpoints for development of visual simulations from the photo documentation conducted during field verification. These viewpoints were selected based upon the following criteria:

1. They provide clear, unobstructed views of the Facility (as determined through field verification).
2. They illustrate Facility visibility from sensitive sites/resources with the visual study area.

3. They illustrate typical views from landscape similarity zones where views of the Facility will be available.
4. They illustrate typical views of the proposed Facility that will be available to representative viewer/user groups within the visual study area.
5. They illustrate typical views from a variety of viewer distances, orientations, and elevations.
6. They illustrate turbine visibility/contrast under different lighting conditions, to illustrate the range of visual change that will occur with the Facility in place.

Location of the selected viewpoints is indicated in Figure 9 in Exhibit CC. Locational details and the criteria for selection of each simulation viewpoint are summarized below in Table 15.

Table 15. Viewpoints Selected for Simulation and Evaluation

VP	Location	Township	Landscape Similarity Zone	Elevation[1]	Distance to Nearest Turbine	Distance to Furthest Turbine	Direction of View	Date Taken	Time Taken
2	Cahoon Memorial Park Boat Launch	Bay Village	Developed Open Space	579.72	10 mi.	10.8 mi.	Northeast	8/3/2016	8:25
4	Cleveland Lakefront Nature Preserve	Cleveland	Undeveloped Open Space	593.474	9.3 mi.	11.5 mi.	Northwest	8/3/2016	10:28
7	USS COD (Submarine)	Cleveland	Harbor Waterfront	586	8.4 mi.	10.8 mi.	Northwest	8/3/2016	12:12
8	Edgewater State Park Pier	Cleveland	Developed Open Space/Open Water	581.979	8.1 mi.	10.4 mi.	North Northwest	8/3/2016	12:44
9	Edgewater State Park Beach	Cleveland	Developed Open Space	581.241	8.4 mi.	10.7 mi.	North Northwest	8/3/2016	13:13
12	Lakewood Park (John Honam House)	Bay Village	Developed Open Space/Open Water	630.429	7.1 mi.	9.2 mi.	North	8/3/2016	15:58
14	Rocky River Park Overlook Platform	Bay Village	Developed Open Space/Open Water	625.1	8.1 mi.	9.7 mi.	North	8/3/2016	17:25
17	Cleveland Mall	Cleveland	Urban Core Zone	652.176	8.5 mi.	10.9 mi.	North Northwest	8/3/2016	18:43
19	Bicentennial Park	Cleveland	Urban Core Zone	584.185	8.2 mi.	10.5 mi.	Northwest	8/3/2016	19:37
25	Upper Edgewater Drive Overlook	Cleveland	Suburban Residential Zone	611.1	8.2 mi.	10.4 mi.	North	8/4/2016	10:43
28	Euclid Avenue Historic District. Key Building	Cleveland	Urban Core Zone	1168.039	8.8 mi.	11.2 mi.	North Northwest	8/4/2016	14:07
37	Lakeview Drive	Bay Village	Suburban Residential Zone/Open Water	628.1	9.3 mi.	10.4 mi.	North Northeast	8/4/2016	9:02
52	U.S. Coast Guard Cleveland Harbor Station	Cleveland	Industrial Zone	578.69	8.1 mi.	10.5 mi.	North Northwest	8/17/2016	9:11

[1] Feet above mean sea level.

The photographic simulations were developed by constructing a three-dimensional computer model of the proposed turbine and the six-turbine layout (using the six primary wind turbine locations) based on specifications and survey coordinates provided by Icebreaker Windpower. Simulations were created by

aligning each photographic viewpoint with the computer model of the proposed turbines, and superimposing the models on the photograph. This step involves utilizing aerial photographs and GPS data collected in the field to create an AutoCAD Civil 3D® drawing. The two-dimensional AutoCAD data were then imported into AutoDesk 3ds MAX® and three-dimensional components (cameras, modeled turbines, etc.) added. These data were superimposed over photographs from each of the viewpoints, and minor camera changes (height, roll, precise lens setting) made, as necessary, to align all known reference points within the view. This process ensures that Facility elements are shown in proportion, perspective, and proper relation to the existing landscape elements in the view. Consequently, the alignment, elevations, dimensions, and locations of the proposed structures will be accurate and true in their relationship to other landscape features in the photo.

At this point, a "wire frame" model of the facility and known reference points are shown on each of the photographs. The proposed exterior color/finish of the turbines is then added to the model and the appropriate sun angle is simulated based on the specific date, time and location (latitude and longitude) at which each photo was taken. This information allows the computer to accurately illustrate highlights, shading and shadows for each individual turbine shown in the view. All simulations show the turbines with rotors oriented toward the southwest, which is generally the prevailing wind direction in the area.

The photographic simulations of the completed Facility from the 13 selected viewpoints are provided in Figures 10 through 22 in Exhibit CC. The simulations are presented alongside the original photos of the existing condition, so as to allow direct comparison of "before" and "after" views of the Project Area, identical in every respect except for the turbines shown in the simulated views.

(f) *Impact Minimization Measures*

Mitigation options are limited, given the nature of the Facility (i.e., wind turbines are tall structures). However, various mitigation measures were considered. These include Project Area location, lighting, turbine layout, visual screening, and facility coloration. Each of these measures are discussed below.

Project Area Location

The proposed turbines are located in excess of 7 miles from the nearest shoreline location within the visual study area, in part, to minimize visual impacts onshore. This distance was noted as an important factor in limiting the Facility's visual impact. Given the amount of existing development along the lake shore, views of the lake are fragmentary or non-existent beyond the first road south of the lake shore.

Lighting

Turbine lighting will be kept to the minimum allowable by the FAA and USCG. Medium intensity red strobes will be used at night, rather than white strobes or steady burning red lights. Lighting at the proposed substation should be kept to a the minimum necessary to assure facility safety and security.

Turbine Layout

The specific location of the turbines correlates with certain wind conditions, water depths, substrate conditions, shipping lanes, and other siting considerations that essentially preclude significant relocation of the proposed turbines. The process by which the Project Area was selected and the turbine layout designed is described above in Section 4906-4-04.

Visual Screening

Because most of the views that will be affected by the Facility are designated or designed to provide open views of Lake Erie, screening to block views of the turbines would likely have a greater adverse visual impact than the turbines themselves. In addition, these viewpoints are widespread, and providing screening along significant portions of the shoreline is not practical. However, if adequate natural screening is lacking at the Facility Substation site, a screening or planting plan could be developed and implemented to minimize the visibility of this component of the proposed Facility.

Facility Coloration

The off-white/light gray color of the 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 and under overcast conditions. Consequently, this color is proposed to be utilized on the Icebreaker Project. Where possible, non-reflective paints and finishes will be used on the wind turbines to minimize reflected glare. Where this is not feasible, natural weathering/dulling of any glossy surfaces (on turbine or substation components) will typically occur within one year following installation.

(E) AGRICULTURAL DISTRICT IMPACTS

The proposed Facility will not impact any agricultural districts or agricultural land. Therefore, this section is not applicable.

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Summary: Application In the matter of the application of Icebreaker Windpower Inc. for a certificate to construct a wind-power electric generation facility in Cuyahoga County - Application- Part 1 of 13, Letter, Affidavit, Application Narrative electronically filed by Christine M.T. Pirik on behalf of Pirik, Chris M.T. and Icebreaker Windpower Inc.