DOE/EA-2045

Final
Environmental Assessment
LEEDCo Project Icebreaker
Lake Erie, City of Cleveland, Cuyahoga County, Ohio

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office
15013 Denver West Parkway
Golden, CO 80401

U.S. Coast Guard
Commander
U. S. Coast Guard Sector Buffalo
1 Fuhrmann Boulevard
Buffalo, NY 14203

U.S. Army Corps of Engineers
Buffalo District Regulatory Branch
1776 Niagara Street
Buffalo, NY 14207

September 2018

This page intentionally left blank.

SUMMARY

DOE Proposed Action:	Expenditure of federal funding to support the development, including design, construction, and commissioning, of an offshore wind advanced technology demonstration project.
Type of Document:	Final Environmental Assessment (EA)
Lead Agency:	U.S. Department of Energy (DOE)
Cooperating Agencies:	U.S. Army Corps of Engineers (USACE), Buffalo District U.S. Coast Guard (USCG)
Project Location:	Lake Erie, City of Cleveland, Cuyahoga County, Ohio
Comment Opportunities:	Comments on this EA are no longer being accepted.
For Further Information:	U.S. Department of Energy Golden Field Office National Environmental Policy Act (NEPA) Division 15013 Denver West Parkway Golden, CO 80401

Summary:

Lake Erie Energy Development Corporation's (LEEDCo's) Project Icebreaker (also known as Icebreaker Wind) was competitively selected for a U.S. Department of Energy (DOE) financial assistance award under Funding Opportunity Announcement *U.S. Offshore Wind: Advanced Technology Demonstration Projects* (DE-FOA-0000410). DOE is proposing to provide funding to LEEDCo to support the development of the demonstration-scale offshore wind project that would be located approximately 8 miles off the shore of Cleveland, Ohio in Lake Erie. This Environmental Assessment (EA) evaluates the potential environmental impacts of providing funding to LEEDCo to support the development of the offshore wind advanced technology demonstration project (the Proposed Action) and evaluates the impacts that could occur if DOE did not provide funding (No-Action Alternative). The Proposed Project would consist of six wind turbine generators erected on foundations constructed on the Lake Erie lakebed that would generate approximately 21 megawatts (MW) of electricity. Inter-array cables (connecting the wind turbines) and an export cable (transmitting electricity generated by the wind turbines to the shore) would be buried in the lakebed, and the export cable would be brought ashore entirely under the Cleveland Harbor and the Cleveland Harbor breakwater to a new electrical substation located at the existing Lake Road Substation. The energy generated by the Proposed Project would deliver power to a single point of interconnection on the existing Cleveland Public Power electric grid – the138 kilovolt (kV) Lake Road Substation.

ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
ACHP	Advisory Council on Historic Preservation
AIS	Automatic Identification System
APE	Area of Potential Effect
ATON	Aids to Navigation
AWOIS	Automated Wreck and Obstruction Information System
BGEPA	Bald and Golden Eagle Protection Act
BOEM	Bureau of Ocean Energy Management
BP	before present
CAA	Clean Air Act
CD	chart datum
CDF	confined disposal facility
CEI	Cleveland Electric Illuminating Co.
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CPP	Cleveland Public Power
CPP Substation	Cleveland Public Power Lake Road Substation
dB	decibel
dBA	decibel (A-weighted scale)
DO	dissolved oxygen
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DP	dynamically positioned
DSM	digital surface model
EA	Environmental Assessment
EDR	Environmental Design & Research
EERE	Energy Efficiency and Renewable Energy
EIS	Environmental Impact Statement
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
EPR	ethylene propylene rubber
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FOA	Funding Opportunity Announcement
FONSI	Finding of No Significant Impact
FR	Federal Register
GHG	greenhouse gas
GLT	Great Lakes Towing
GPS	global positioning system
HDD	horizontal directional drilling
HDPE	high-density polyethylene
Hz	hertz
I-	Interstate
IBA	Important Bird Area
IRAC	Interdepartment Radio Advisory Committee
JEDI	Job and Economic Development Impact

kg	kilogram
km	kilometer
kV	kilovolt
LCOE	levelized cost of energy
LEC	Lake Erie Connector
LEEDCo	Lake Erie Energy Development Corporation
LiDAR	Light Detection and Ranging
μPa	micropascals
μT	micro tesla units
m/s	meters per second
MB	Mono Bucket
MBTA	Migratory Bird Treaty Act
mg/L	milligrams per liter
MHz	megahertz
MOU	Memorandum of Understanding
MP/FW	monopile with a friction wheel
mph	miles per hour
MW	megawatt
MWh	megawatt-hours
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NEXRAD	next-generation radar
NHL	National Historic Landmark
NHPA	National Historic Preservation Act of 1966
NOAA	National Oceanic and Atmospheric Administration
NO_X	oxides of nitrogen
NPS	National Park Service
NREL	National Renewable Energy Lab
NRHP	National Register of Historic Places
NSPS	New Source Performance Standard
NTIA	National Telecommunications and Information Administration
NTU	nephelometric turbidity unit
O&M	Operations and Maintenance
OAC	Ohio Administrative Code
OAI	Ohio Archaeological Inventory
ODNR	Ohio Department of Natural Resources
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
OHI	Ohio Historic Inventory
OHPO	Ohio Historic Preservation Office
OPSB	Ohio Power Siting Board
ORC	Ohio Revised Code
OSHA	U.S. Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
the Port	Port of Cleveland
Proposed Action	Expenditure of federal funding to support the development, including design, construction, and commissioning of the offshore wind advanced technology demonstration project

Proposed Project	demonstration-scale offshore wind project in Lake Erie of six wind turbine generators and the necessary electrical transmission facilities to connect the wind turbine generators to a new electrical substation, located in Cleveland, Ohio, for interconnection to the regional power grid
Proposed Project Area	the area of the Proposed Project including the proposed turbine sites, the cable route, the proposed substation, the construction laydown area, and the Operation and Maintenance Center
ROV	remotely operated vehicle
SPCC	spill prevention, containment, and countermeasure
SWAP	Source Water Assessment and Protection
TSS	total suspended solids
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
USS	United States Ship
VHF	very high frequency
VIA	Visual Impact Assessment
WEST	Western EcoSystems Technology, Inc.
WNS	white-nose syndrome
XLPE	cross-linked polyethylene

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

SECTION 1 INTRODUCTION

1.1 National Environmental Policy Act

The National Environmental Policy Act (NEPA; 42 U.S. Code [USC] 4321 et seq.), the Council on Environmental Quality's (CEQ's) NEPA regulations (40 Code of Federal Regulations [CFR], 1500 to 1508), and the U.S. Department of Energy's (DOE's) NEPA-implementing procedures (10 CFR Part 1021) require that DOE consider the potential environmental impacts of a major federal action. This requirement applies to DOE's decisions about whether to provide federal funding through financial assistance agreements.

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

- Examines the potential environmental impacts of the Proposed Action and the No-Action Alternative;
- Identifies unavoidable adverse environmental impacts of the Proposed Action;
- Describes the relationship between local short-term uses of the human environment and the maintenance and enhancement of long-term productivity; and
- Characterizes any irreversible and irretrievable commitments of resources that would be involved should DOE decide to implement its Proposed Action.

DOE must meet its obligations under NEPA before making a final decision whether to proceed with any proposed federal action that could cause adverse impacts to human health or the environment. This EA provides DOE and other decision makers the information needed to make an informed decision about the Proposed Action and evaluates the potential individual and cumulative impacts of the Proposed Action. An evaluation of a No-Action Alternative is required under the DOE NEPA implementing regulations and is evaluated in this EA.

1.2 Background

The Office of Energy Efficiency and Renewable Energy (EERE) leads DOE's efforts to develop solutions for clean-energy technologies that support a strong and prosperous America powered by clean, affordable, and secure energy. On February 7, 2011, DOE released the National Offshore Wind Strategy, in partnership with the U.S. Department of the Interior (DOI). Subsequently, in September 2016, DOE and DOI developed a new National Offshore Wind Strategy. The 2016 Strategy includes and addresses three critical objectives in pursuit of overcoming barriers to commercial offshore wind development in the United States:

- Reducing the costs and technical risks associated with domestic offshore wind development;
- Supporting stewardship of U.S. waters by providing regulatory certainty and understanding and mitigating environmental risks of offshore wind development; and
- Increasing understanding of the benefits and costs of offshore wind energy.

In May 2016, the Lake Erie Energy Development Corporation's (LEEDCo's) Icebreaker Project was one of three projects that DOE identified from its offshore wind portfolio that had demonstrated significant progress toward being successfully completed. The LEEDCo Project was competitively selected for a DOE financial assistance award under the Funding Opportunity Announcement (FOA) titled, *U.S. Offshore Wind: Advanced Technology Demonstration Projects,* FOA Number DE-FOA-0000410, issued in fiscal year 2012 (DOE, 2012).

The primary goals of the Advanced Technology Demonstration Projects are to:

- Install innovative offshore wind systems in U.S. waters in the most rapid and responsible manner possible; and
- Expedite the development and deployment of innovative offshore wind energy systems with a credible potential for lowering the levelized cost of energy (LCOE).

By providing funding, technical assistance, and government coordination to accelerate deployment of these demonstration projects, DOE can help eliminate uncertainties, mitigate risks, and support the private sector in creating a robust U.S. Offshore Wind Energy Industry. DOE is using projects selected under this FOA to assess progress towards these national-scale goals.

DOE is proposing to provide funding to LEEDCo to support the development of a demonstration-scale offshore wind project that would be located approximately 8 miles off the shore of Cleveland, Ohio in Lake Erie. This demonstration-scale offshore wind project would consist of six wind turbine generators that would generate approximately 21 megawatts (MW) of electricity and the necessary electrical transmission facilities (i.e., underwater and underground cable or electric collection lines) to connect the wind turbine generators to a new electrical substation, located in Cleveland, Ohio, for interconnection to the regional power grid (Proposed Project). The electrical energy generated from the Proposed Project would be sold to Cleveland Public Power (CPP) and into the PJM[1] Interconnection wholesale market.

DOE has prepared this EA to evaluate the potential environmental impacts of providing federal funding to LEEDCo to support the development, including design, construction, and commissioning of the offshore wind advanced technology demonstration project (the Proposed Action). The operation, maintenance, and eventual decommissioning of the Proposed Project is considered a connected action under 40 CFR 1508.25(a)(1) and will be analyzed in this EA as part of the Proposed Action. This EA also evaluates the impacts that could occur if DOE did not provide funding (No-Action Alternative) as required by 40 CFR 1508.25(b)(1), under which scenario DOE assumes the Proposed Project would not proceed. Although this Proposed Project could proceed if DOE decided not to provide funding, the DOE has assumed, for the purposes of comparison in this EA, that the Proposed Project would not proceed without the federal funding. If the Proposed Project proceeded without federal funding, the potential impacts would be essentially identical to those under the DOE Proposed Action.

1.3 Cooperating Agencies

There are two cooperating agencies involved in the preparation of this EA: the U.S. Army Corps of Engineers (USACE) and the U.S. Coast Guard (USCG). The USACE is a cooperating agency because of its regulatory and permitting authority under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. The USCG is a cooperating agency because of its responsibility and authority related to navigation and safety in the waters of Lake Erie.

[1] PJM is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states, including Ohio, and the District of Columbia.

1.3.1 USACE Regulatory Authorities

The USACE has regulatory and permitting authority under Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) and Section 404 of the Clean Water Act (33 USC 1344). Section 10 pertains to authorization of structures or work in or affecting navigable waters of the U.S. Section 404 regulates discharges of dredged or fill material into waters of the U.S., including wetlands. The Proposed Project would require Section 10 and Section 404 permits.

Based on these authorities, USACE is working as a cooperating federal agency with the DOE and the USCG in the federal permitting process. USACE will also continue to work with interested and involved local, state, and federal agencies throughout the permit process.

In addition to the Section 10 and 404 regulatory and permitting authority described above, Section 14 of the Rivers and Harbors Act of 1899, as amended, and codified in 33 USC 408 (Section 408) requires permission for any alterations to, or temporary or permanent occupation or use of, USACE federally authorized civil works project. Specifically, the portion of the Proposed Project that is proposed to be located beneath the Cleveland Harbor Navigation Channel and breakwater is subject to Section 408 review.

1.3.2 USCG Regulatory Authorities

The USCG has regulatory responsibilities under the Ports and Waterways Safety Act of 1972 to conduct studies to ensure safe access routes for vessel traffic in U.S. waters. This requirement is further detailed in the USCG Navigation and Inspection Circular No. 02-07, *Guidance on the Coast Guard's Roles and Responsibilities for Offshore Renewable Energy Installations* (USCG, 2007). This circular advises the USCG to review and evaluate the potential impacts of the Proposed Project with respect to both vessel navigation and USCG missions. The USCG will follow these guidelines and continue to assist the DOE and the USACE as a cooperating agency in the federal permitting process for the Proposed Project.

1.4 Purpose and Need

1.4.1 DOE Purpose and Need

The Energy Policy Act of 2005, per 42 USC 16231(a)(1), directs DOE to conduct programs of renewable energy research, development, demonstration, and commercial application, which considered certain objectives, including but not limited to:

> **(A)** Increasing the conversion efficiency of all forms of renewable energy through improved technologies.
>
> **(B)** Decreasing the cost of renewable energy generation and delivery.
>
> **(C)** Promoting the diversity of the energy supply.
>
> **(D)** Decreasing the dependence of the United States on foreign energy supplies.
>
> **(E)** Improving United States energy security.
>
> **(F)** Decreasing the environmental impact of energy-related activities.
>
> **(G)** Increasing the export of renewable generation equipment from the United States.

More specific to the Proposed Action, the Energy Policy Act of 2005 specifically directed that the DOE renewable energy programs must include offshore wind energy (42 USC (a)(2)(B)(ii)). Offshore wind energy can help the nation reduce its GHG emissions, diversify its energy supply, provide cost-competitive electricity to key coastal regions, and stimulate revitalization of key sectors of the economy. However, if the nation is to realize these benefits, key challenges to the development and deployment of offshore wind technology must be overcome, including the relatively high current cost of energy, technical challenges surrounding installation and grid interconnection, and the untested permitting or approval processes. As identified in DOE's and DOI's National Offshore Wind Strategy, to overcome barriers to commercial offshore wind development in the United States, there is a need to reduce:

- The cost of energy through technology development to ensure competitiveness with other electrical generation sources; and
- Deployment timelines and uncertainties limiting U.S. offshore wind project development.

To address these needs, DOE issued the *U.S. Offshore Wind: Advanced Technology Demonstration Projects* FOA to provide support to regionally diverse offshore wind advanced technology demonstration projects to verify innovative designs and technology developments and validate full performance and cost under real operating and market conditions. By providing federal funding to accelerate deployment of advanced technology demonstration projects, DOE can help eliminate uncertainties, mitigate risks, and support the private sector in creating a robust U.S. Offshore Wind Energy Industry. In particular, the Proposed Action would provide performance, engineering, environmental monitoring, operations, and cost data to further the existing knowledge base for the benefit of the wind industry, which will further efforts to overcome to the key challenges in the development and deployment of offshore wind technology.

1.4.2 USACE Purpose and Need

For purposes of NEPA analysis, USACE considers and expresses the Proposed Project's underlying purpose and need from a public interest perspective when appropriate, but generally focuses on LEEDCo's purpose and need statement. CEQ regulations at 40 CFR 1502.13 stipulate that the purpose and need statement "shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action." The USACE exercises independent judgment in defining the purpose and need for the Proposed Project from both LEEDCo's and the public's perspectives. The project **purpose**, as described by LEEDCo, and defined by the USACE is as follows:

- The construction of a freshwater offshore wind energy project, in order to demonstrate the technical feasibility of wind energy in Lake Erie; and
- The production of wind-powered electricity that would maximize energy production from local wind resources, in order to deliver clean, renewable electricity to the Ohio bulk power transmission system.

The Proposed Project would help meet the following LEEDCo-described and USACE-defined **needs**:

- Serve the needs of electric utilities and their customers;
- Help reduce air pollution in an area that historically has been in non-attainment for 2.5-micron particulate matter, lead, and ozone;
- Reduce greenhouse gas emissions; and
- Create local jobs and spur economic development.

As part of its review of a Department of the Army permit application, USACE is required to evaluate the LEEDCo proposal regarding the U.S. Environmental Protection Agency (EPA) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (“EPA Guidelines”) at 40 CFR 230.

The USACE has determined that the **basic project purpose** for the LEEDCo proposal is: “energy generation.” The overall project purpose is used by the USACE to evaluate whether there are less environmentally damaging practicable alternatives available. The Clean Water Act 404(b)(1) guidelines state that an alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics considering overall project purpose (40 CFR 230.10(a)(2)). This evaluation applies to all Waters of the U.S., not just special aquatic sites.

Determination of the overall project purpose is the USACE’s responsibility; however, LEEDCo’s needs and the type of project being proposed are considered by the USACE in reaching this determination. The **overall project purpose** is defined by the USACE as: “the development of a small-scale off-shore wind energy demonstration project in Lake Erie.” This definition is specific enough to define LEEDCo’s needs, but not so restrictive as to constrain the range of alternatives that must be considered under the EPA Guidelines.

1.4.3 USCG Purpose and Need

The USCG is responsible for maritime safety, security, and environmental stewardship in U.S. ports and waterways. USCG’s purpose and need is to review and analyze potential impacts of the Proposed Project with respect to navigational safety and possible impacts on USCG missions and to ensure that the Proposed Project would not impede the maritime transportation system on Lake Erie, while facilitating new energy generation possibilities with the development of an offshore wind energy demonstration project.

1.5 Public Input and Agency Involvement

NEPA requirements help ensure that information is made available to the public during the decision-making process and prior to decisions and actions being taken. The premise of NEPA is that the quality of federal agency decisions will be enhanced if federal agencies provide information to the public, including stakeholders, and involve the public in the planning process. Stakeholders include federal, tribal, state, and local governments, interested organizations, and individuals within and near the Proposed Project.

As part of the NEPA process, there were two opportunities for public input on the EA. First, to inform the scope of the draft EA, there was a Public Scoping Period which included a public comment period and a public scoping meeting. Second, to seek public input on the published draft EA, there was a Draft EA Public Comment Period which included a public comment period and an informational open house. Public outreach efforts conducted by DOE, USACE, and USCG during this period are described as follows.

1.5.1 Public Scoping Period

A notice of scoping and notification of public scoping meeting (Scoping Notice) was issued on September 14, 2016 to request public input on the scope of the Draft EA for the Proposed Project. The Scoping Notice stated that DOE, USACE, and USCG would hold a public scoping meeting on September 28, 2016 and that public input was welcome on the proposed scope of the EA. The Scoping Notice requested that all comments be provided on or before October 21, 2016.

The Scoping Notice was published in the Federal Register and the Cleveland Plain Dealer and sent to federal, state, and local agencies. A postcard with a summary of the Scoping Notice and a link to additional online information was mailed to approximately 5,200 recipients, including individuals and organizations who had expressed an interest in the Proposed Project. The Scoping Notice was also distributed by email to the DOE Wind and Water Technology Office list serve distribution list. On September 20, 2016, the USACE Buffalo District Public Affairs Office posted the Notice of Public Scoping Meeting for Project Icebreaker on the Great Lakes Information Network announcement service, and various Buffalo District social media sites. The USACE Buffalo District Public Affairs Office also forwarded the announcement to various USACE media contacts in the Cleveland area. And, the USCG released the Scoping Notice using the USCG 9th District Public Affairs' Twitter and Facebook accounts. The public scoping meeting was held on September 28, 2016, as described in the Scoping Notice. At the public scoping meeting, DOE, USACE, USCG, LEEDCo, and subject matter experts presented posters summarizing the Proposed Project and the proposed scope of the EA and answered questions about the Proposed Project, the proposed scope of the EA, and the NEPA process. Approximately 60 people attended the public scoping meeting. DOE accepted written comments at the public scoping meeting and for the duration of the public scoping period (September 14, 2016 to October 21, 2016). A total of 95 comments were received from the public during the public scoping period. Agency comments were received from the National Oceanic and Atmospheric Administration (NOAA) Great Lakes Environmental Research Laboratory; U.S. Fish and Wildlife Service (USFWS) Ecological Services Office, Columbus, Ohio; and EPA, Region 5. A copy of agency comments received during the public scoping period, as well as a comment response matrix summarizing public comments received is attached in Appendix A-1.

1.5.2 Draft EA Public Comment Period

The Notice of Availability and Informational Open House (Notice of Availability) was issued on August 18, 2017 to request public comments on the Draft EA for the Proposed Project. The Notice of Availability stated that DOE, USACE, and USCG would hold a public informational open house on September 6, 2017. The Notice of Availability requested that all comments on the Draft EA be provided on or before October 10, 2017.

The Notice of Availability and Informational Open House was published in the Cleveland Plain Dealer and sent to federal and state agencies and tribes. A postcard with the Notice of Availability, including a link to the Draft EA, and notice of the informational open house, was mailed to approximately 4,600 recipients, which included individuals or organizations who had expressed an interest in the Proposed Project. Notice was also distributed by email to the DOE Wind and Water list serve distribution list. The USACE concurrently issued a public notice on September 13, 2017 announcing the availability of the Draft EA and the review of the application for permits under authority of Section 10 of the Rivers and Harbor Act of 1899 and Section 404 of the Clean Water Act (refer to Section 2.5.1 for additional information on USACE permitting). On September 20, 2016, the USACE Buffalo District Public Affairs Office posted the Notice of Public Scoping Meeting for Project Icebreaker on the Great Lakes Information Network announcement service, and various Buffalo District social media sites. The Buffalo District Public Affairs Office also forwarded the announcement to various USACE media contacts in the Cleveland area. And, the USCG posted Notice of Availability on the USCG 9th District Public Affairs' Facebook account on August 23, 2017 and sent a media release to local newspapers in Cleveland.

The informational open house was held on September 6, 2017, as described in the Notice of Availability. At the open house, DOE, USACE, USCG, LEEDCo, and subject matter experts who contributed to the draft EA presented posters summarizing the information and analysis presented in the draft EA and answered questions about the Proposed Project, the potential impacts, and the NEPA process. The informational open house was attended by approximately 100 members of the public. DOE accepted written comments during the informational open house and for the duration of the public comment period (August 18, 2017 to October 10, 2017).

A total of 80 comment letters were received from the public during the public comment period. Agency comments were received from the USFWS Ecological Services Office, Columbus, Ohio; EPA, Region 5; Ohio Department of Natural Resources (ODNR); and Ohio Environmental Protection Agency (OEPA). A copy of agency and organization comments received during the public comment period, as well as comment response tables summarizing public comments received is attached in Appendix A-2.

1.6 Tribal Consultation

On September 2, 2016, USACE, DOE and USCG sent jointly signed letters to 25 tribes describing the Proposed Project and inviting consultation and seeking input on the Proposed Project. These 25 tribes had previously received letters from USACE regarding the Proposed Project in November and/or December of 2013. In the two weeks after sending the letters in September 2016, DOE followed up with a phone call to each tribe, again inviting all tribes to engage in consultation. Three tribes requested follow-up contact with DOE. After following up with each of the three tribes, DOE did not receive any additional responses or requests for consultation. On August 21, 2017, DOE sent the Notice of Availability by letter to all 25 tribes informing the tribes that the Draft EA was available for review and requesting comments on the Draft EA by October 10, 2017. DOE did not receive any feedback from tribes on the Draft EA.

On April 13, 2018, the Ohio Historic Preservation Office (OHPO) suggested that DOE contact four additional tribes who had not previously been contacted regarding the Proposed Project. DOE reached out to each of the four additional tribes by letter and phone call to invite consultation and request input on the Proposed Project. None of the four tribes expressed interest in further consultation with DOE or concern about the Proposed Project.

SECTION 2 PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

DOE is proposing to authorize the expenditure of federal funding by LEEDCo to support the development, including design, construction, and commissioning of the offshore wind advanced technology demonstration project (the Proposed Action) as described in the following section. The operation, maintenance, and eventual decommissioning of the Proposed Project is considered a connected action under 40 CFR 1508.25 and will be analyzed in this EA as part of the Proposed Action. DOE has authorized LEEDCo to use federal funding for preliminary activities, which include EA preparation, information gathering, site analysis, design simulations, permitting, and environmental surveys. Such activities are associated with the Proposed Action and do not significantly impact the environment, nor do they represent an irreversible or irretrievable commitment by DOE in advance of its completion of the EA and subsequent decision to issue a Finding of No Significant Impact (FONSI) or to recommend the preparation of an Environmental Impact Statement (EIS).

2.2 Project Icebreaker - Proposed Project

2.2.1 Description of the Proposed Project

The Proposed Project would consist of the construction, operation, maintenance, and eventual decommissioning of a 21 MW (approximate) offshore wind advanced technology demonstration project, consisting of six wind turbine generators, submerged electric collection cables, and a substation (Figure 2-1)[2]. The energy generated by the Proposed Project would deliver power to a single point of interconnection on the existing CPP electric grid – 138 kilovolt (kV) Lake Road Substation (Figure 2-2).

The turbines would be erected on foundations constructed on the Lake Erie lakebed, on leased submerged state lands approximately 8 miles off the coast of the City of Cleveland, in Cuyahoga County, Ohio. These rights were obtained through a Submerged Lands Lease with the State of Ohio. The onshore components, including an underground transmission line, underground concrete duct bank, underground cable, and new substation (collectively, Proposed Substation) would be in Cleveland, Ohio. Construction would be supported by the temporary use of the Port of Cleveland (the Port) to stage, pre-assemble, and test the turbine components and potentially to stage and assemble the foundation components, completed foundations, and submerged electric collection cables.

[2] Figure 2-1 shows seven potential wind turbine generator sites. The Proposed Project would include six wind turbine generators. The seventh site is an alternate site. The alternate site would only be used if an unforeseen problem was encountered at one of the six primary sites.

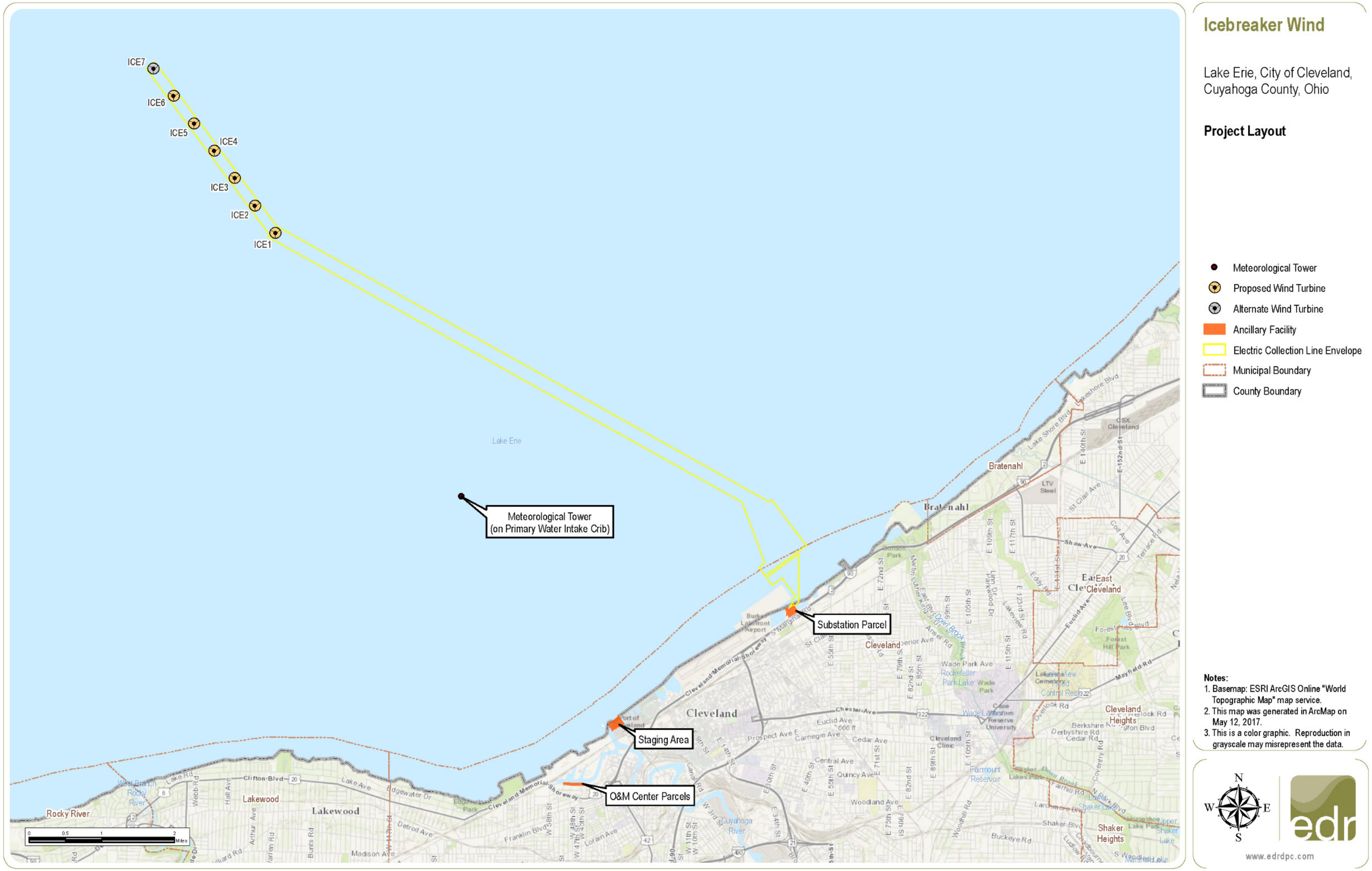


Figure 2-1. Proposed Project Icebreaker Layout

Figure 2-2. Proposed Substation Location

Each turbine would have a name plate capacity of approximately 3.5 MW for a total generating capacity of approximately 21 MW. The blade rotor diameter would be approximately 413 feet. The turbine array would be arranged in a single row generally oriented southeast to northwest. Spacing between the turbines would be approximately 2,480 feet. Each of the wind turbines would be supported by a Mono Bucket (MB) foundation. The MB foundation would be comprised of three sections: a steel skirt embedded in the lakebed, a lid section, and a shaft that resembles the elements of a standard offshore wind monopile above the mudline. The Proposed Project would expect to operate for approximately 8,200 hours annually, and have an approximate capacity factor of 41.4 percent, generating approximately 75,000 megawatt-hours (MWh) of electricity each year.

The inter-array cables that would connect the wind turbines together electrically would be linked to the export cable to transmit electricity generated by the wind turbines to the shore at a landfall in Cleveland, Ohio and then continue underground to the Proposed Substation. The Proposed Substation would be connected to the existing 138 kV system at the Lake Road Substation with an underground transmission line and then transitioned to an underground concrete duct bank.

The total lake area considered as the Proposed Project Area includes the proposed turbine sites and the cable route. The area of the proposed turbine sites is approximately 4.2 acres (an approximately 98.4-foot [30-meter] radius around each turbine; the submerged state lands leased by LEEDCo). The area of the proposed cable route is approximately 135 acres, which consists of a 100-foot wide band along the approximately 12.1-mile cable route. The turbines and inter-array cables would be in water depths of approximately 57 to 61 feet chart datum (CD), depths on a chart from a low-water surface or a low-water datum selected so that the water level will seldom fall below it. The export cable would be in water depths of approximately 60 to no shallower than 30 feet CD and buried at least 12 feet below both the breakwater and the authorized dredge depth of the Outer Harbor Navigation Channel.

2.2.2 Foundation and Wind Turbine Design

2.2.2.1 Foundation Design

LEEDCo proposes to use the MB as the turbine foundation. The MB combines the benefits of a gravity base, a monopile, and a suction bucket. In essence, it is a suction-installed caisson 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 would be embedded in the lakebed, a lid section, and a shaft that, above the mudline, resembles the elements of a standard offshore wind monopile (Figure 2-3).

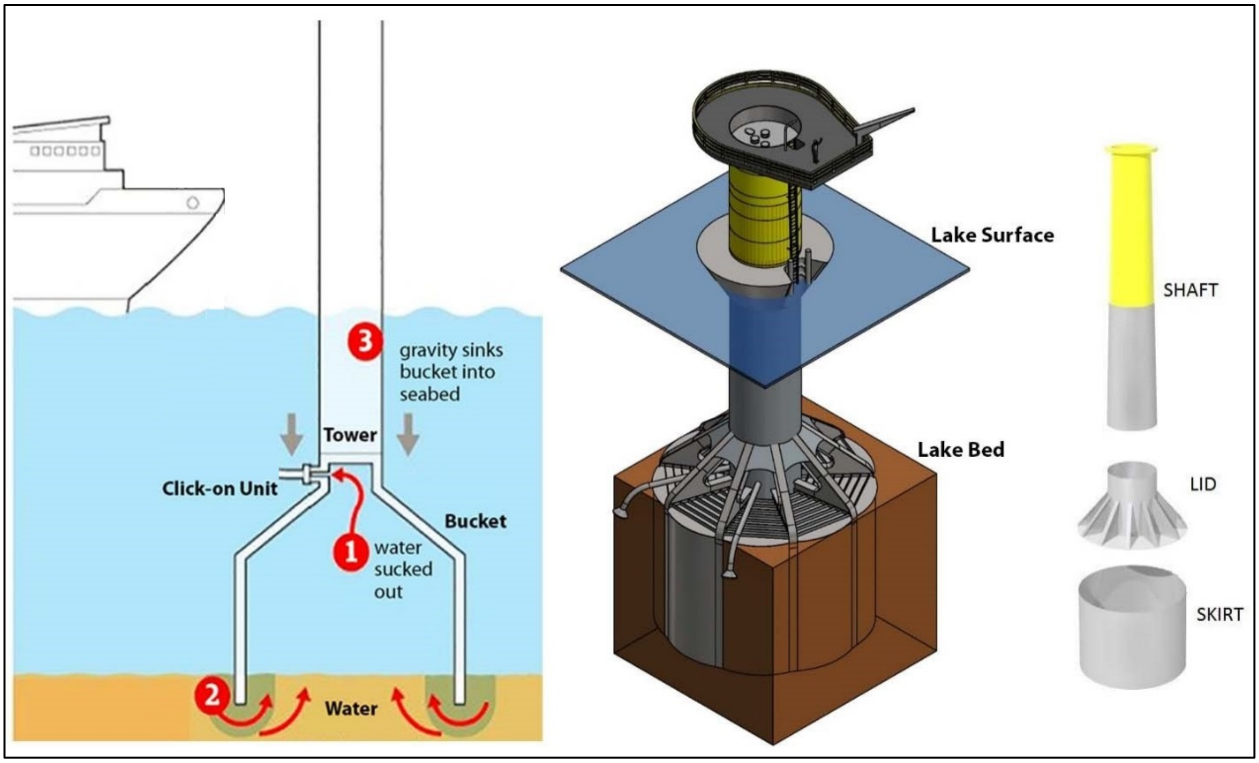


Figure 2-3. Mono Bucket General Arrangement

The design criteria consider factors such as 50-year weather extremes, average wind speed, wind gusts, turbulence intensity, waves, and ice loads. The first turbine erected on a MB foundation, a 3 MW Vestas V90 turbine, began operation in the North Sea in 2002. This MB foundation remains operational and the dynamic load performance has been monitored continuously for 15 years, resulting in an understanding of dynamic and cyclic loading (Universal Foundation, 2012). Three MB installations in the North Sea are also operational and have sustained waves greater than 70 feet, as compared to wave heights of 15 to 20 feet recorded in Lake Erie (NOAA, 2016a).

Preliminary designs of the MB foundation have been completed (Figure 2-4), and approximate dimensions are listed in Table 2-1. The portion of the foundation above the low water surface to the maintenance platform, or approximately 36 feet (11 meters) above the low water surface, would be painted yellow.

Table 2-1. 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)

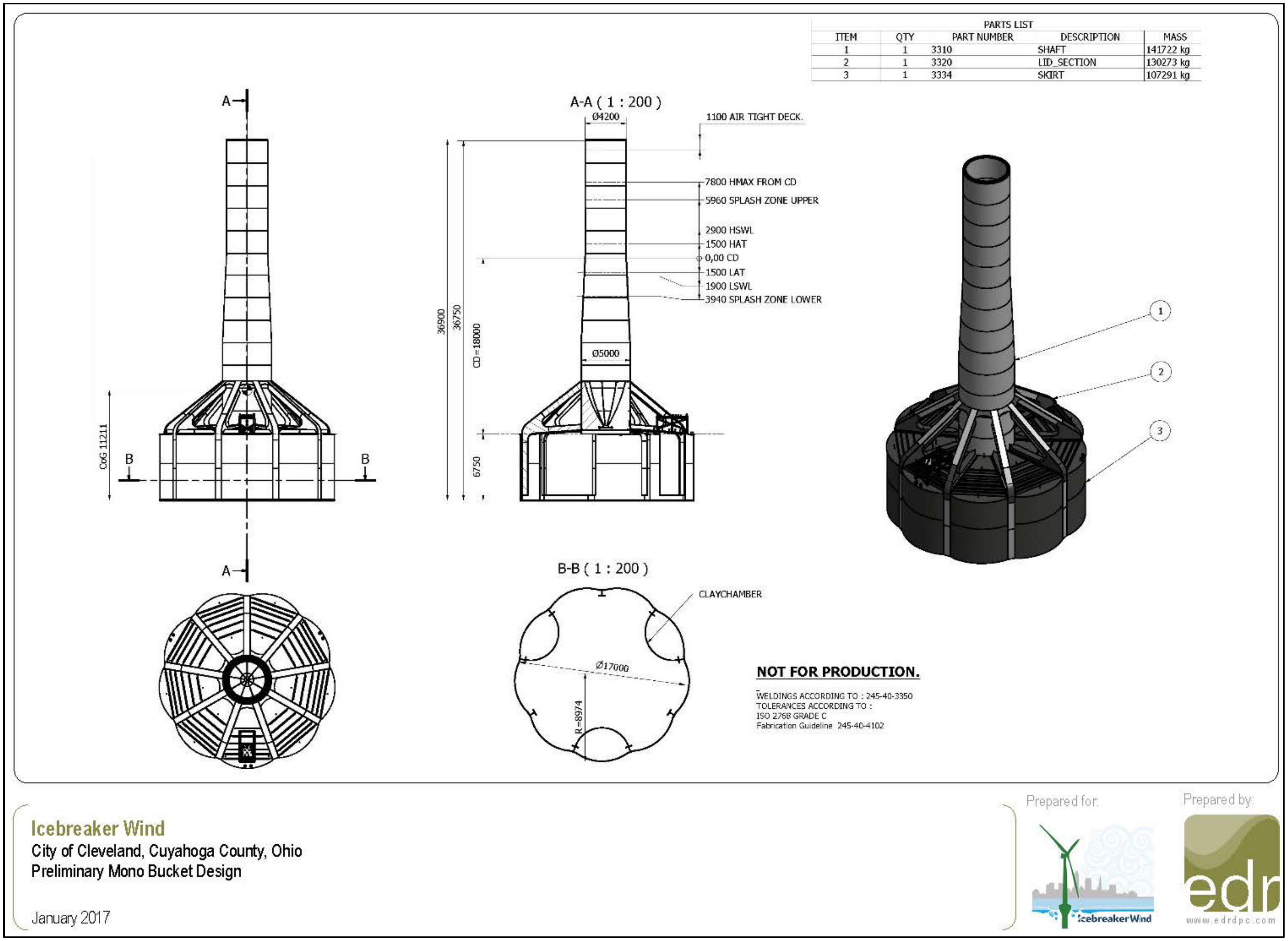


Figure 2-4. Preliminary Mono Bucket Design

2.2.2.2 Wind Turbine Design

The Proposed Project would consist of six MHI Vestas offshore wind turbines of approximately 3.45 MW. Each wind turbine would consist of three major components: 1) the tower, 2) the nacelle, and 3) the rotor with blades. Descriptions of the major turbine components are provided as follows and illustrated in Figure 2-5. Preliminary analysis indicates that the turbines would operate for approximately 8,200 hours annually and have an approximate capacity factor of 41.4 percent. Accounting for the total generating capacity of approximately 21 MW, anticipated operating times, and turbine capacity factors, the Proposed Project would generate approximately 75,000 MWh of electricity each year.

Table 2-2 and Figure 2-5 present the approximate dimensions of the 3.45 MW turbines in feet and meters. Hub height is the height to the center of the rotor, as measured from the chart datum water level, while total turbine 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 2-2. Approximate Turbine Dimensions

Turbine	Hub Height	Rotor Diameter	Blade Length	Total (Tip) Height
3.45 MW	83 meters (272 feet)	126 meters (413 feet)	62.9 meters (206 feet)	146 meters (479 feet)

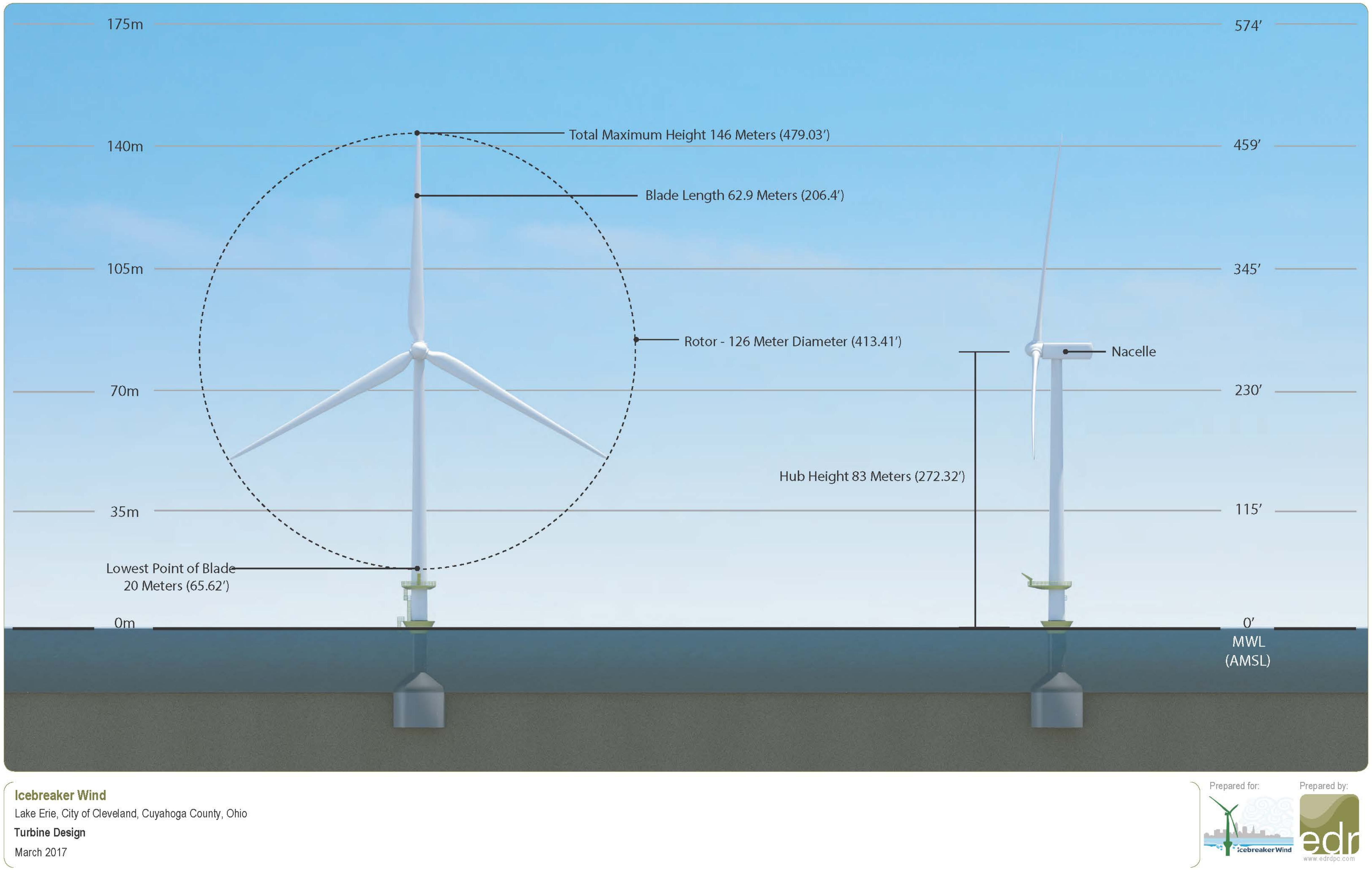


Figure 2-5. Anticipated Turbine Design

The towers are tubular conical steel structures manufactured in multiple sections. Each tower would have an access door in the base section and internal lighting, along with an internal ladder and/or mechanical lifts to access the nacelle. Most of each turbine, including the blades, would be painted a light gray color (RAL 7035) consistent with the Federal Aviation Administration (FAA) and USCG guidance. The portion of the tower where it is joined to the foundation between the low water datum, or low water surface, and the platform would be painted yellow.

The main mechanical components of the wind turbine would be housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle would be 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 would be equipped with external anemometers and wind vanes that signal wind speed and direction information to an electronic controller. The nacelle would be mounted on a yaw ring bearing that would allow it to rotate ("yaw") into the wind to maximize wind capture and energy production. One red flashing FAA light (upward facing) would be mounted on the nacelle of each turbine and would flash synchronously. In addition, synchronously flashing amber marine navigation lights, visible up to 5 nautical miles, would be mounted on the platforms of turbines 1 and 6. The flashing pattern for these amber marine navigation lights would be determined in consultation with the USCG. On turbine platforms 2 through 5, the amber lights would have a visibility of 4 nautical miles, and a flash rate of 20 flashes per minute. Two lights would be installed on each of the six turbine platforms to provide visibility 360 degrees around the turbines. In addition to the marine navigation lights, fog horns with visibility detectors would be installed on the platforms of turbines 1 and 6. The signal on turbine 1 would sound at 670 megahertz (MHz) once every 30 seconds and at turbine 6 the signal would sound at 670 MHz twice every 30 seconds. These would provide audible notice to vessels up to 2 nautical miles away.

A rotor assembly would be mounted to the nacelle to operate upwind of the tower. Each rotor would consist of three composite blades that would be 206 feet (62.9 meters) in length, which would yield a rotor diameter of approximately 413 feet (126 meters). The rotor would attach to the drive train at the front of the nacelle.

The turbine would be designed for three levels of containment to minimize risk of any fluid discharges (oil, hydraulic, cooling, etc.). Each primary system, i.e. gearbox, would be a sealed system with multiple sensors that monitor fluid performance and containment, with each of these inspected at regular maintenance intervals, a minimum of once per year. The secondary system would be in the nacelle itself, where fluid containment reservoirs would be designed to capture any leaks from a primary system failure. If both primary and secondary containment fails, the bottom of the tower would have a reservoir to contain any fluids originating from the nacelle.

2.2.3 Installation of Foundations and Turbines

LEEDCo proposes to use the Port as the quayside staging area for the Proposed Project. The final assembly and delivery logistics would be developed by the fabricator selected for the Project. Foundation components would either be fabricated complete and shipped complete via barge directly to the installation site or fabricated and shipped via truck and/or barge to the Port, where they would undergo final assembly prior to being loaded onto a feeder barge and towed to the installation site.

Prior to any installation work, a full mobilization of all vessels would be conducted, including installation of necessary grillage (structural load distribution elements to avoid excessive local loads on the vessels) and sea-fastening (structural elements providing horizontal and uplift support of a component during transport operations).

A heavy lift crane vessel would be used to perform the lifting operations related to the foundation and turbine installation process. One of the two vessel configurations described below would be selected. In every case, the MB foundations and all turbine components would be transported to the site on a feeder barge that would be towed to the site.

- Configuration A: A jack-up vessel would perform the heavy lift operations for both the foundation and turbine installation. A crane would be deployed on the vessel. A tug boat would be used if the vessel is not self-powered. The jack-up vessel would be a barge or hull outfitted with three to six legs that could be raised and lowered. The legs would be lowered to the lakebed and the vessel would be jacked-up via the legs to stabilize the vessel during lift operations. Each leg may have a pad on the bottom of the leg that contacts the lakebed. The need for pads on each leg would be determined at the time of construction based on detailed geotechnical analysis. The maximum pad dimension anticipated is 34 feet by 18 feet (612 square feet). Assuming six pads, the maximum area that would contact the lakebed is just under 4,000 square feet per turbine.
- Configuration B: In this scenario, a non-jack-up vessel would perform the foundation heavy lift operations while a jack-up vessel would perform the turbine installation heavy lift operations. The configuration and specifications of each of the two vessels would be optimized for its specific purpose. The turbine jack-up vessel would be as described in Configuration A and would function in the same manner. The non-jack-up foundation vessel would be self-powered and would not include legs. The vessel would maintain position via anchors or dynamic positioning (DP). DP vessels maintain their position with the use of thrusters instead of anchors. A DP vessel would eliminate the need for anchor placement and would not make direct contact with the lake bottom.

2.2.3.1 Mono Bucket Foundation Installation

Following the positioning and mooring of the feeder barge, a pumping assembly that includes all the pumps, valves, and piping necessary to control the suction process (Click-on Unit) would be temporarily attached to the lid of the bucket. An umbilical cord would connect the Click-on Unit to the power and control system located on the deck of the heavy lift crane vessel.

The MB would be lifted off the barge and lowered to 1 meter (3.3 feet) above the lakebed. At that position, the MB descent would be halted to allow the water column to stabilize and then it would be lowered until it contacts the lakebed. Once the bucket is on the lakebed, it is expected that it would self-penetrate 3 to 6 feet because of its weight (500 to 600 tons). At this point, the installation would be controlled by technicians in the control room of the heavy life crane vessel via remote operation of the Click-on Unit.

To achieve penetration, water would be pumped out of the bucket through an exhaust port on the Click-on Unit into the adjacent water. The water pumped out of the bucket through the exhaust port would be released back into the lake. The exhaust port would be directed toward the lid of the bucket so that any water and the vast majority of the associated sediment would be deposited on the bucket lid (Figure 2-6).

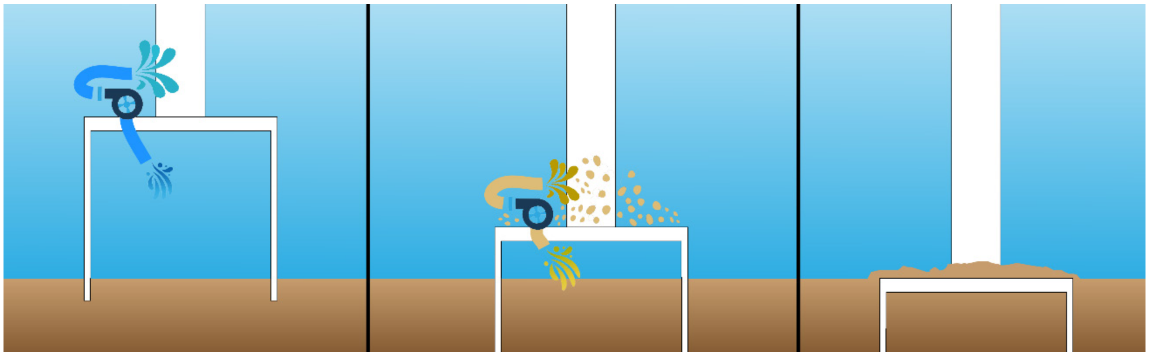


Figure 2-6. Sediment Deposition on to MB Foundation Lid

As the water is pumped out of the bucket, the pressure inside the bucket would decrease, which would pull the skirt into the lakebed at a rate of approximately 60 inches per hour. The entire process would be controlled by technicians on the heavy lift crane vessel. After the bucket reaches the desired depth and with the desired verticality, the process would be complete. The Click-on Unit would be detached remotely and lifted to the surface and onto the deck of the heavy lift crane vessel.

The foundation would be embedded into the sediment up to a depth of 40 feet. During the installation process, approximately 4,000 cubic yards of water would be extracted from inside the foundation bucket and released back into the lake. Sediment from the top 0.1 to 0.3 meter (0.3 to 1.0 foot) of the lakebed could be sucked into the pump and mixed with the discharge water during the last approximately 1 meter (3 feet) of the penetration process. Water and the vast majority of suspended sediment removed during the MB installation would be pumped from the inside of the bucket back on to the lid of the MB. The quantity of sediment that would be pumped out may vary by location and the particular composition of the sediment at each of the six turbine sites. Finer grained sediments would become more easily entrained in the discharge water when compared to coarser grained sediments. The amount of sediment that could become entrained in the discharge water and released from the exhaust port is anticipated to be up to 69.8 cubic meters (91.3 cubic yards) per MB, or an estimated total of 419 cubic meters (548 cubic yards) for the six MB foundations. The vast majority of the sediment would return to the lakebed on top of the MB lid, with a small amount possibly falling beyond the lid's diameter (Figure 2-6). This fallback of sediment onto the lid would reconstitute portions of the benthic habitat that would be lost because of the installation of the MB.

The entire operation would be monitored by remotely operated vehicles (ROVs) and no divers would be required. However, divers would be on standby in case the need arises (e.g., ROVs stop working, water clarity is too low to see with ROVs).

Because the foundation uses suction technology, no lakebed preparation (i.e., dredging, leveling, or drilling) would be necessary for installation. The foundation installation would not require any pile driving.

To maintain verticality within specifications (0.5 degrees) as the bucket penetrates the lakebed, two control mechanisms are available, water jets and clay chambers. The water jets are small water nozzles embedded in the wall of the bucket along the bottom of the skirt. The nozzles would be installed in the center of the 1-inch thick skirt and segregated into three 120-degree control zones. The water jets could be activated zone by zone and allow short pulses of water to flow through the nozzles if necessary. When the water jets are activated, the water flowing from the nozzles would loosen/lubricate the lakebed under the nozzles, thereby allowing the bucket to penetrate more readily in that zone. The other control mechanism would be a series of three independently controlled small clay chambers equidistant around the skirt. Suction or pressure could be applied to each chamber independently by the technicians controlling the installation process using remote operation of the Click-on Unit. This mechanism would allow for raising or lowering each zone of the skirt independently to adjust the verticality of the foundation during the entire penetration process.

2.2.3.2 Turbine Installation

It is anticipated that the turbine components, including nacelle, blades, and tower, would be transported to the Port by barge. An approximate sequence of construction anticipates that the installation of the turbines would occur after all the MB foundations and the electric collection lines are installed (Figure 2-7). The installation vessel would locate at the site and position at the respective proposed turbine site ready for turbine erection. A load-out crane in the Port would load turbine tower sections onto the feeder barge, which would then transit to the installation site (Figure 2-8). The tower sections would be picked off the feeder barge and then installed using the crane mounted on the heavy lift crane vessel (Figure 2-9). Assembly work inside the towers, including but not limited to bolting the tower sections together, assembling the ladders, and running the cables up the tower, would 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 would be installed using the heavy lift crane. Once the turbine installation is complete, the heavy lift crane vessel would 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 would use a tow tug to transit between the Port and proposed turbine sites. If a DP vessel is used, a tow tug is not required.

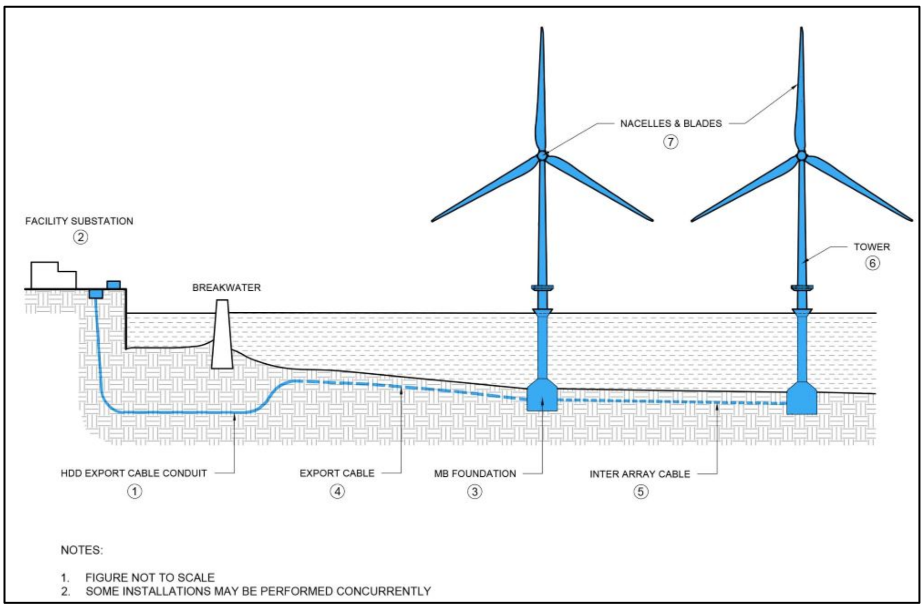


Figure 2-7. Anticipated Project Component Installation Sequence[3]

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

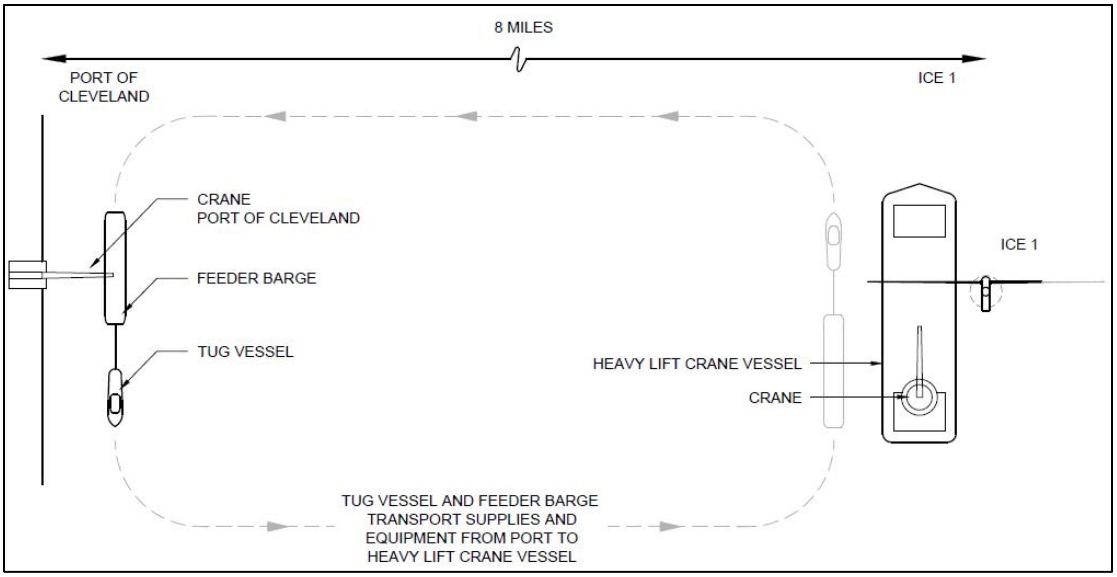


Figure 2-8. Anticipated Installation Vessel Plan View

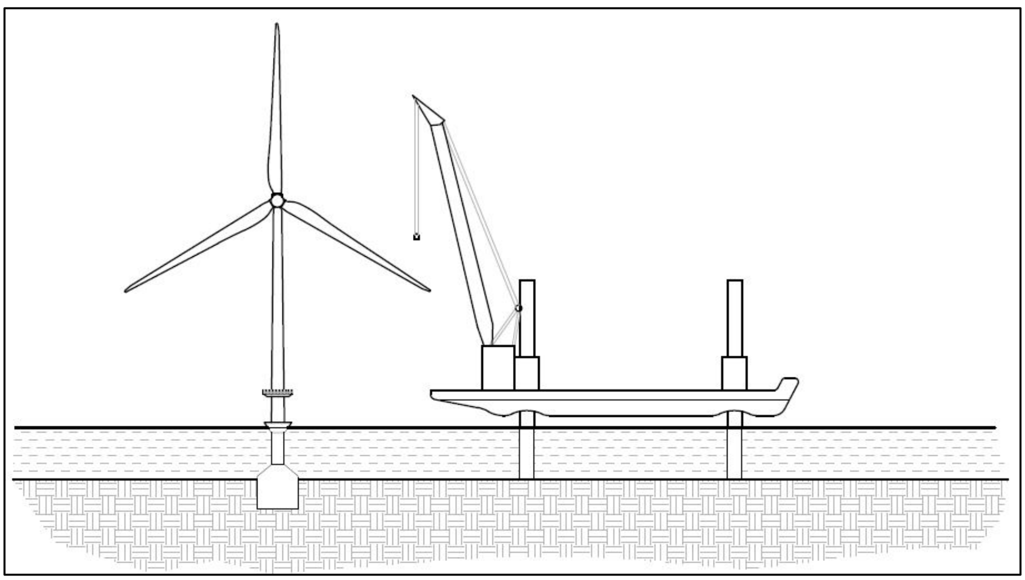


Figure 2-9. Turbine and Heavy Lift Crane Vessel

2.2.4 Submerged Electric Collection Cable Route and Installation

There would be two cable components for the Proposed Project: the inter-array cables, which would connect the wind turbines together electrically; and the export cable, which would transmit the electricity generated by all wind turbines (wind project output) to the shore. The proposed cables would be 34.5 kV alternating current cables and would be composed of a three-core copper conductor with cross-linked polyethylene (XLPE) or ethylene propylene rubber (EPR) insulation (insulation would be dependent on manufacturer). Optical fibers for data transmission would be embedded between the cores. The cables would be a single armored underwater power cables, with an approximate overall diameter of 11.3 centimeters (4.45 inches) (Figure 2-10).

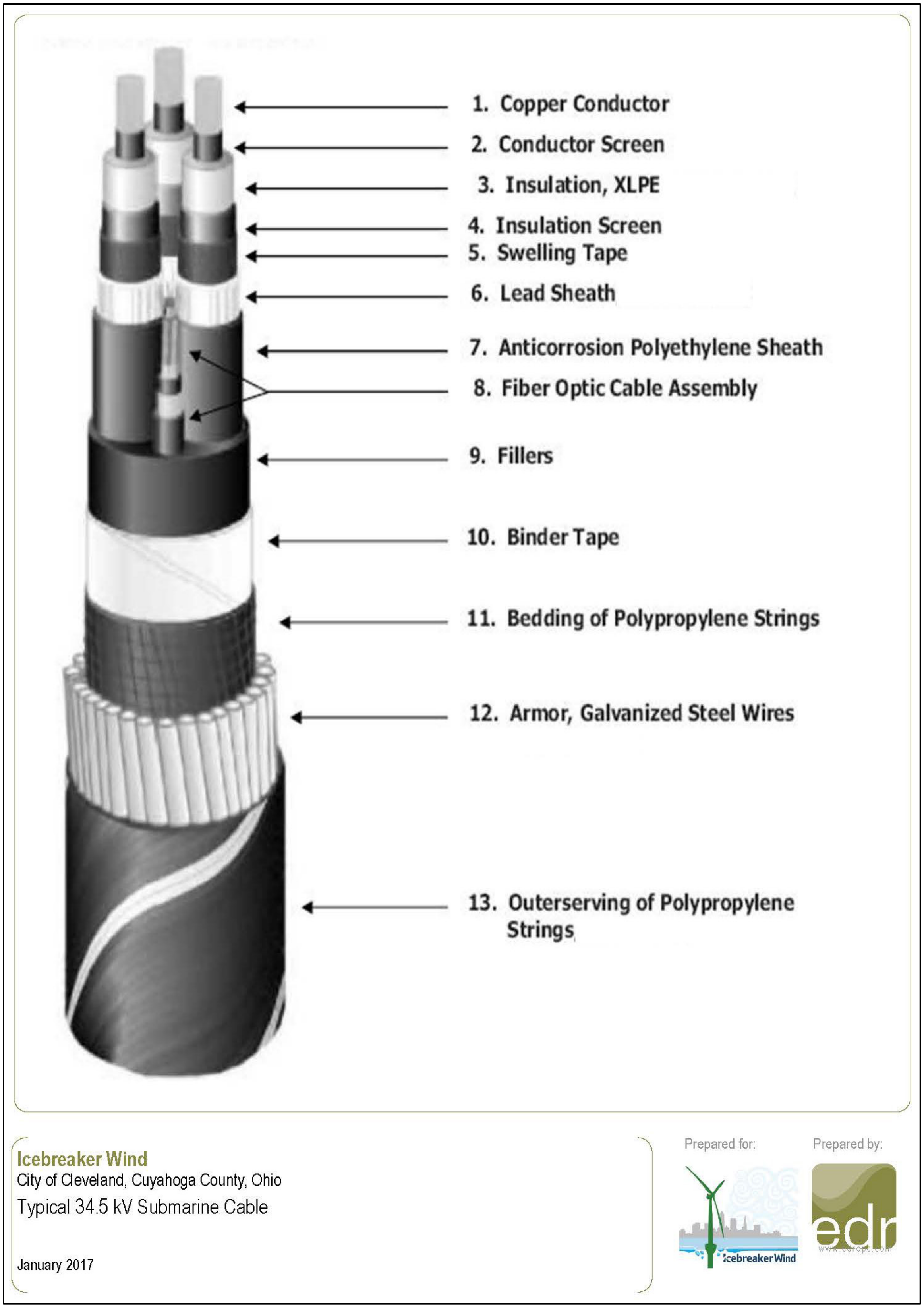


Figure 2-10. Typical 34.5 kV Submarine Cable

Full geotechnical and geophysical surveys were conducted in August through October 2016 along the cable corridor envelope. The final route would be located within the envelope surveyed during the 2016 survey. 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 prior to installation, it would be removed with a grapnel hook towed behind a small work boat. Cable installation operations would be monitored by divers and/or a mid-class ROV.

The portion of the export cable connected to the shore would be installed before laying the remainder of the export cable. The export cable would be brought ashore entirely under the Cleveland Harbor and the Cleveland Harbor breakwater through a duct installed using horizontal directional drilling (HDD) (Figure 2-11). HDD is a method of trenchless technology commonly used in the installation of various utility pipelines and conduits. It is a common way of getting utility lines from one point to another by directionally boring under obstacles or environmentally sensitive areas. The launch pit for the HDD would be located either at the Lake Road Substation or on a barge on the north side of the Cleveland Harbor breakwater. The final determination would be made by the installer for the electric collection line (not yet selected). Following drilling of the initial pilot hole, the "bottom hole assembly" (the drill bit and the non-magnetic drill pipe encasing the survey instrument at the end of the drill string) would be lifted to the deck of a work barge and removed. At this point, the hole would be pre-reamed to approximately 12 inches larger than the outside diameter of the proposed high-density polyethylene (HDPE) conduit (i.e., to approximately 28 to 30 inches in diameter). The driller would most likely do this by progressing the reamer (a 30-inch diameter cutter) through the drilled hole from the onshore end towards the offshore exit. By going in that direction, most of the pre-ream cuttings and drilling fluid would be transmitted back to the surface at the onshore drill site, rather than being emitted at the exit. The HDPE conduit would be prefabricated in a single string prior to it being pulled back through the drilled and reamed hole. It is anticipated that the HDPE string would be towed out to the exit point where, on the deck of the barge, it would be attached to the drill pipe by way of a pull-head at the front of the HDPE pipe, along with a swivel and a reamer. That assembly would be lowered overboard, and the onshore drilling rig would then pull the HDPE pipe through the drilled and reamed hole and into the drilling pit onshore. The exit would be capped off until the start of the cable installation operations (Figure 2-12). A messenger wire would be placed in the bore to pull the export cable ashore using a pull-in winch.

Drilling operations use drilling muds to stabilize the bore hole and to lubricate the drilling process. The process is designed to minimize or avoid the possibility of drilling mud discharging into the lake. An Inadvertent Return Contingency Plan is discussed in more detail in Section 2.6.4. The drilling mud (a clay-based compound such as Bentonite) would be National Sanitary Foundation approved for drinking water applications, such as water wells.

Once the export cable is connected to shore, the remainder of the cables would be installed from north of the breakwater to the first MB using a deck barge with cable installation and burial equipment mobilized on board the deck. The proposed installation technique for the cable is bury-while-lay (typically referred to as simultaneous lay burial). This technique buries the cable 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 sediment 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 inter-array and export cables are proposed to be buried approximately 1 to 1.5 meters (3.3 to 5 feet) below the lakebed; although, in some areas, they may be buried deeper. The sediments that are disturbed by either process would subsequently settle back onto the lakebed, providing a degree of back-fill. See Section 3.2.2.2 for additional details on sediment suspension. Figure 2-13 depicts the cable interface with the MB and lakebed.

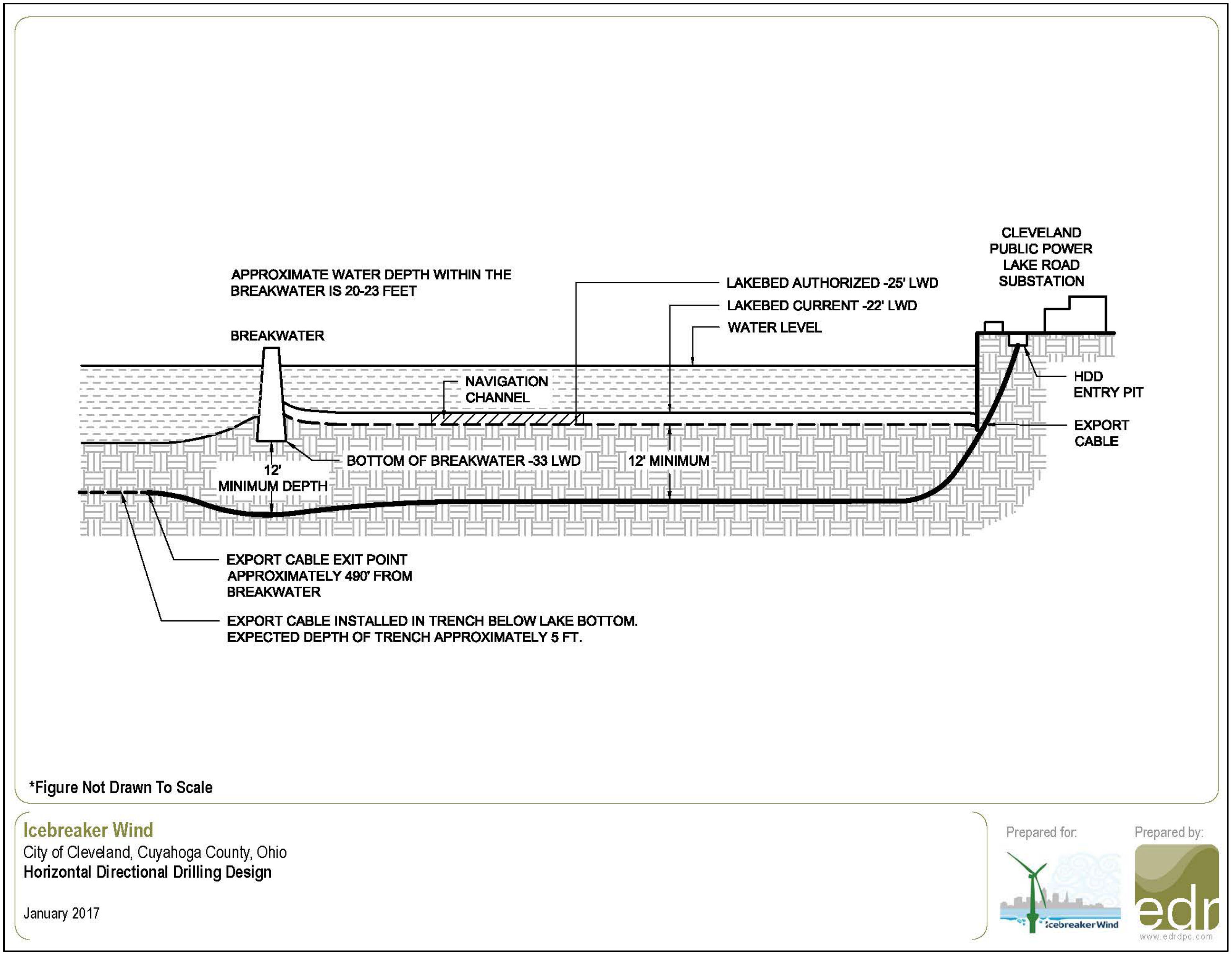


Figure 2-11. Horizontal Directional Drilling Design

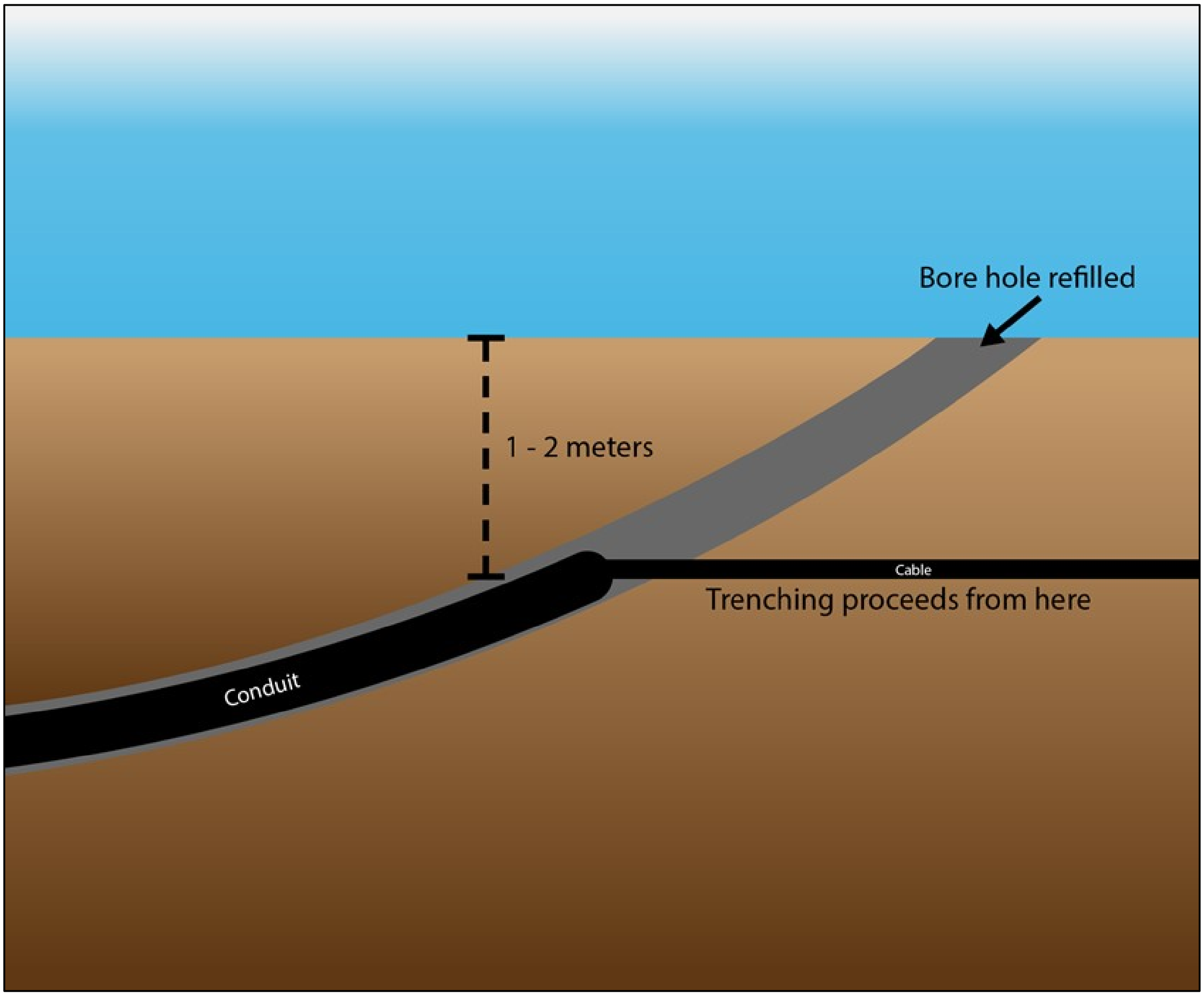


Figure 2-12. Design for Connection Between HDD and the Export Cable

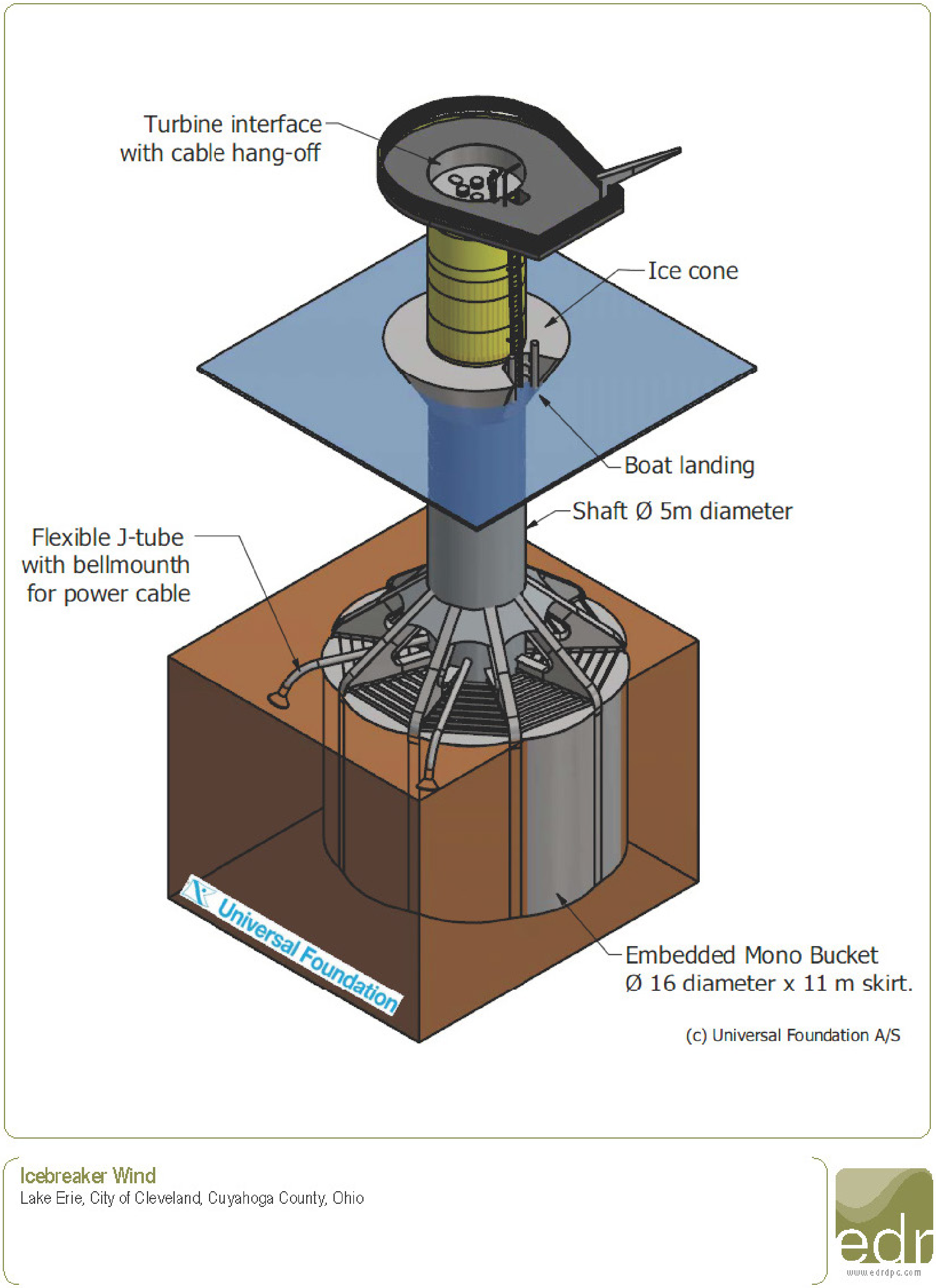


Figure 2-13. Mono Bucket and Cable Lakebed Interface Design

2.2.5 Substation and Associated Electric Transmission

The Proposed Substation would be constructed on the CPP site adjacent to the existing Lake Road Substation. The area surrounding the Lake Road 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 Proposed Substation and its bus structures, switch gear, the step-up transformer, and a 14-foot by 37-foot building for control equipment (Appendix B).

The entire Proposed Substation area would be excavated to a depth of approximately 3 feet for the installation of the Proposed Substation grounding grid. All unused excavated backfill would be removed from the site for appropriate disposal upon completion of the Proposed Project. Compacted backfill would be placed over the ground grid with a final 18-inch layer of coarse aggregate as the final Proposed Substation surface. Bus support structures, overhead line dead-end structure (self-supporting structure that allows the transition from electric lines to cable), and the control house would be placed upon drilled caisson foundations with elevated piers.

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

The final color of all equipment would be American National Standards Institute (ANSI) 70 gray. Bus support structures and dead-end H-Frame would be gray galvanized steel.

The Proposed Substation would be connected to the existing 138 kV system at the Lake Road Substation with an underground transmission line and then transitioned to an underground concrete duct bank. The transition from the duct bank to the termination structures would be through a pre-cast concrete pulling pit. The underground line would be a 3-phase, 138 kV circuit, utilizing a 1,000 thousand circular mil (kcmil) EPR- or XLPE-insulated, shielded, copper conductor. The circuit would run approximately 225 feet in a concrete encased conduit from an above grade termination structure at the Proposed Substation to an above grade termination structure at the Lake Road Substation. The termination structures would be placed upon slab foundations and all structures would be gray galvanized steel.

2.2.6 Construction Laydown Areas

LEEDCo would temporarily utilize space at the Port to stage, pre-assemble, and test the turbine components. The Port may also be used to stage and assemble the MB foundation components and completed foundations if a fabricator is selected that would require final assembly at the Port. The Port may also be used to stage the inter-array and export cables. 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 cables at the Port. The site within the Port that would be utilized by LEEDCo 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 would be limited to minor and temporary installation of security fencing, temporary office trailers, and secured storage areas. The materials would consist of conventional gray chain link fencing. Cranes and other material handling equipment such as fork lifts would 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 construction, all equipment and materials, including the material handling equipment, the chain link fencing, and the office trailers would be demobilized and returned to the suppliers.

2.2.7 Construction Sequence

Construction is proposed to begin in the spring and be completed by the fall of the same year. LEEDCo anticipates that construction activities would proceed in the following approximate sequence although some turbine/foundation and cable laying installation activities could occur concurrently:

- Install HDD conduit for export cable
- Construct Proposed 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

2.2.8 Operations and Maintenance

Upon completion of the construction activities, LEEDCo would conduct several weeks of commissioning activities that would include testing the turbines as well as the offshore and onshore transmission systems. It is anticipated that the Proposed Project would begin operations in the fall of the year of construction and continue until the end of the 25-year expected operational life of the facility.

During operations of the turbines, hydraulic motors within the rotor hub would rotate each blade according to wind conditions, which would enable the turbine to operate efficiently at varying wind speeds as well as varying rotor speeds. The wind turbines would begin generating energy at wind speeds of 3 meters per second (m/s) (6.7 miles per hour [mph]) and cut out at maximum wind speeds of 27.5 m/s (61.5 mph).

Operation of the turbines would require continuous remote (i.e., shore-based) monitoring and control, scheduled onsite maintenance, and unscheduled responses to faults or damage each of which are described below.

The management of the maintenance program and reporting requirements would be addressed by the operations team. This work would include, but would not be limited to:

- Remote monitoring and supervising the wind turbines and associated equipment 24 hours a day, 7 days a week using the wind power supervisory control and data acquisition system;
- Initiating any required corrective action;
- Managing the inventory of spare parts, including performing any maintenance of these spare parts;
- Scheduling and logistics planning of maintenance activities; and
- Performing daily communication with the facility operator.

2.2.8.1 Remote Monitoring

A control center capable of remotely monitoring and controlling the Proposed Project would be staffed 24 hours a day. The control center would be staffed by trained personnel and contain charts indicating global positioning system (GPS) position and identification numbers of all Project components, which would also be provided to the USCG. All turbines would be equipped with control mechanisms that would allow the operations center personnel to fix and maintain the position of the blades.

2.2.8.2 Scheduled Maintenance

Each turbine would undergo scheduled maintenance and inspection as well as a full annual maintenance program as prescribed by the turbine manufacturer. This work would be performed by personnel qualified by the manufacturer. Routine and preventative wind turbine maintenance activities would be scheduled at 6-month intervals with specific maintenance tasks scheduled for each interval.

As access to the turbines could only be achieved by a vessel, lake conditions would dictate when service may be performed. Scheduled maintenance would be scheduled to occur during summer months when conditions for accessing the turbines are typically suitable (waves less than 5 feet). However, access may be required during winter months when there may be ice covering the lake in the vicinity of the Proposed Project site and between the Proposed Project site and the shore. The fleet of tugs routinely operating in the Cleveland area has the capability to break ice on the Lake. One of these tugs would be utilized to clear a path for a crew transfer vessel in ice cover conditions. The USCG also provides ice-breaking services in Lake Erie to maintain commerce. If the ice cover exceeds that which the local tugs can handle, the USCG would, depending on availability, be utilized to clear a path for the crew transfer vessel.

To perform scheduled maintenance, service crews would board a crew transfer vessel based in the Cleveland area. Personnel would gain access to the turbines by the ladder or mechanical lift system incorporated into each foundation. Tools and light parts would be lifted onto the structure using a small crane system provided on the structure working deck. Annual maintenance for each turbine would be expected to require 5 to 8 days of onsite work. Turbines would be returned to normal operation at the end of each service day.

Consumables such as various greases used to keep the mechanical components operating and oil filters for gearboxes and hydraulic systems would be used for routine maintenance tasks. Surplus lubricants and grease-soaked rags would be removed and disposed of as required by applicable regulations.

It is not expected that any painting would be necessary during the life of the turbines, other than to repair damage. The original coating system on the towers is designed to last the lifetime of the structure.

Additionally, inspections of the underwater structures and lakebed would be performed annually or on an as needed basis.

2.2.8.3 Unscheduled Maintenance

The major components of modern wind turbines are designed to operate for up to 30 years[4]. However, wind turbines are large and complex electromechanical devices with rotating equipment and many components.

---

[4] While major components are designed to operate for up to 30 years, the expected operational life of the Proposed Project is 25 years.

Thus, at times, turbines would require unscheduled repair, most often for small components such as switches, fans, or sensors. Such repairs generally take the turbine out of service for a short period until the component is replaced. These repairs can usually be carried out by a single technician visiting the turbine for several hours. Events involving the replacement of a major component such as a gearbox or rotor are not routine. If they do occur, the use of large equipment, sometimes as large as that used to install the turbines, may be required. Typically, only a small percentage of turbines would need to be accessed with large equipment during their operating life.

2.2.8.4 Maintenance of Submerged Electric Collection Cables

During operations, it is possible that the depth of cover for the inter-array or export cables may change over time. In such circumstances, re-jetting or external protection such as concrete mattresses, may become necessary to maintain an appropriate level of protection for the cables. If there are faults on the cables or external damage during operations, repairs may become necessary. Depending on the location of the cable repair, the cables may either be repaired or replaced, which in either case would require removal and reburial using similar tools and methods to those used during the original installation.

2.2.8.5 Operation and Maintenance Center

LEEDCo proposes to lease space in an existing building from Great Lakes Towing (GLT), located on Division Road approximately 0.4 mile from the Cleveland outer harbor on the Old River (a portion of the Cuyahoga River), to serve as the Operations and Maintenance (O&M) Center for the Proposed Project. The entire GLT property site is approximately 6.3 acres. However, only a small portion of an existing GLT building would be leased by LEEDCo. It is anticipated that the area to be leased would not exceed 0.5 acre in size. The lease would include a small space for storage of spare parts, and a condition for LEEDCo to share space with GLT for access to water and locker room/bathroom facilities. LEEDCo does not anticipate making any modifications to the existing building (Figure 2-14).

Figure 2-14. Great Lakes Towing Building Proposed for Use as O&M Center

2.2.9 Decommissioning

LEEDCo would complete decommissioning of the Proposed Project, or individual wind turbines, within 12 months after the end of the useful life of the Proposed Project or individual wind turbines. Unless good cause is shown by LEEDCo, the Proposed Project or individual turbines would 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 Ohio Power Siting Board (OPSB) deems the Proposed Project or a turbine to be in a state of disrepair warranting decommissioning. A decommissioning plan is subject to approval from the OPSB. The final decommissioning plan would be provided to OPSB at least 30 days prior to the preconstruction conference and would include a description of the engineering techniques and equipment to be used in decommissioning, along with a detailed timetable for accomplishing each major step. A revised decommissioning plan is then required to be provided to the OPSB every 5 years from the commencement of construction to include advancements in engineering techniques, reclamation equipment, and standards.

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

After the Proposed Substation is completely de-energized, the export cable would 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 inter-array cables are cut, the MB foundations would be de-installed by reversing the suction process utilized during the installation. Pressure would be applied to the bucket and water would be pumped into the bucket. The pressure inside the bucket would lift the bucket out of the sediment. Once the bucket disengages from the sediment, the MB foundation would be lifted with the crane onto a feeder barge. The portion of the cable that remains attached to the MB would be transported with the MB.

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

2.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

2.4 Alternatives Considered by LEEDCo

DOE is proposing to authorize the expenditure of federal funding in support of the Proposed Project. During initial project planning (over a 3-year period), and in consideration of numerous siting and design factors, LEEDCo developed two detailed project alternatives.

2.4.1 Site and Design Considerations

2.4.1.1 Project Site

In selecting a project site, LEEDCo considered available wind resources, existing uses of the site, environmental conditions, conceptual turbine foundation design, and interconnection capacity.

Favorable wind resources were a primary consideration for site selection and project design. An evaluation of wind resources (from a meteorological tower installed on the Cleveland Water Intake Crib, combined with output from mesoscale models for the region) was conducted to evaluate average wind speed and used to determine turbine class.

A feasibility study was completed in 2009 for the Great Lakes Wind Energy Task Force (juwi GmbH, 2009). The feasibility study compared nine 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 Important Bird Area (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.

In 2009, the ODNR Office of Coastal Management released an updated Wind Turbine Placement Favorability Analysis (Favorability Analysis), which incorporated much of the same data including shipping lanes and navigable waterways, bird and fish habitat, commercial and sport fishery efforts, shipwrecks, restricted areas, industry, and utilities. The resulting favorability analysis map is provided as Appendix C.

LEEDCo prioritized minimization of potential environmental impacts in site selection and project design. Assessments of environmental conditions including avian and bat risk, aquatic ecology, geology, water depth, and effects of icing, lake ice, wind, and waves have been performed by Cuyahoga County, Case Western Reserve University, Germanischer Lloyd, LEEDCo, and ODNR and were considered in the site selection planning process. Other existing uses of the lake, including commercial shipping, recreational boating, sport fishing, and commercial fishing, were also considered.

2.4.1.2 Turbine Layout

A wind turbine layout optimization study, which evaluated multiple turbine layouts, was conducted by the National Renewable Energy Lab (NREL) and utilized by LEEDCo (NREL, 2010). The study was designed to evaluate energy output and performance under a variety of layouts within Lake Erie. Potential layouts studied included linear layouts of between five and nine turbines, two- or three-row layouts, and an optimized layout design.

2.4.1.3 Foundation Design

Initially, LEEDCo examined four potential offshore wind foundation types (circular cell, tripod pile, gravity base, and monopile with a friction wheel [MP/FW]) in detail. Later in the project development process, LEEDCo considered an additional foundation type, the MB suction pile. In evaluating potential foundation types, consideration was given to lakebed geology, ease and cost of installation, lake ice conditions, and metocean conditions. Further, LEEDCo evaluated existing offshore wind performance data for the potential foundations types in loose glacial till sediments common to Lake Erie.

2.4.1.4 Substation Location

Three potential interconnection locations were evaluated by LEEDCo: Cleveland Electric Illuminating Co. (CEI) Lakeshore Substation, CEI Oglebay-Norton Tap, and the CPP Lake Road Substation (CPP Substation). For each potential interconnection location, LEEDCo evaluated feasibility, cost, and anticipated environmental impacts. The substation and cable route design report is provided in Appendix D.

2.4.1.5 Cable Route

LEEDCo retained an engineering firm to develop a preliminary design for the submerged electric collection cable system, including the layout of the buried cable system, shore crossing, and installation. A variety of environmental and harbor considerations were analyzed to look for potential hazards that might threaten the long-term survivability, functionality, and reliability of the cable. Physical condition, including bathymetry, morphology, lakebed geology, and wind, wave, current, and ice conditions, was considered in the cable route design. Siting constraints, including existing utilities, navigable waterways, shipwrecks, historical artifacts, and ongoing commercial activities were also incorporated into the cable route design.

2.4.2 Project Alternatives

2.4.2.1 Project Alternative 1

Nine sites that were closer to shore were analyzed over a period of 4 years. The conceptual design for Project Alternative 1 included the construction, operation, maintenance, and decommissioning of six 3 MW Siemens wind turbines located in Lake Erie, approximately 7 to 9 miles offshore near Cleveland, Ohio. The turbines would have been spaced approximately 3,120 feet apart in a southeast to northwest linear orientation.

In Project Alternative 1, each turbine would have been supported by a monopile foundation with an aggregate filled friction wheel. The monopile foundations would have been installed using pile driving and required 1,857 cubic yards of sediment to be excavated and sidecast during construction.

The transmission cable for Project Alternative 1 would have run along a direct diagonal path from the turbines to just outside of the breakwater, where it would turn perpendicular to the shoreline and pass under the breakwater and the confined disposal facility (CDF) to the interconnection at the CPP Substation. The total length of the transmission cable would have been approximately 11.1 miles from the farthest turbine to the shoreline. The portion of the transmission cable from the shoreline to outside of the breakwater would be installed using HDD. Once outside the breakwater, the cable would have been installed using hydroplowing at a depth of approximately 3 feet to 6 feet below the lake bottom. The area of potential sediment disturbance for the cable installation would be approximately 1 meter wide.

2.4.2.2 Project Alternative 2

The conceptual design for Project Alternative 2 included the construction, operation, maintenance, and decommissioning of six 3.45 MW MHI Vestas offshore wind located in Lake Erie approximately 8 miles off the coast of the City of Cleveland. The turbine array would be arranged in a single row generally oriented southeast to northwest. Spacing between the turbines would be approximately 2,480 feet.

In Project Alternative 2, each wind turbine would be supported by a MB foundation comprised of three sections: a steel skirt that would embed in the lakebed, a lid transition section, and a shaft similar to a standard offshore wind monopile foundation. The MB foundation uses suction technology, and no lakebed preparation (i.e., dredging, leveling, or drilling) would be necessary for installation. The MB foundation installation would not require any pile driving.

In Project Alternative 2, the transmission cable would run along a diagonal direct path to the breakwater, under the breakwater and around the east side of the CDF and connect to the electric grid at the CPP Substation. In Project Alternative 2, the cable route would be approximately 12.1 miles from the project site to the shoreline. As in Project Alternative 1, the portion of the cable from the shoreline to just outside the breakwater would be installed using HDD. Once outside the breakwater, the cable would be installed using a bury-while-lay method. The transmission cable would be buried approximately 3.3 to 5 feet below the lakebed; although, in some areas, it may be buried deeper. The buried portion of the cable would result in a temporary disturbance to lakebed sediments, categorized per 40 CFR 232 as "incidental fallback."

2.4.3 Conclusion

After a careful evaluation of the siting and design considerations, LEEDCo chose to move forward with Project Alternative 2. LEEDCo determined that Project Alternative 2 was preferable based on both the proposed site and the design.

The Proposed Project site in Project Alternative 2, that is approximately 1 mile further into Lake Erie than the Project Alternative 1, was determined to be preferable by LEEDCo for reasons including the following:

- The proposed site would be outside of an aquatic species area considered "moderately sensitive" and therefore would have less potential to adversely impact aquatic species than the site proposed in Project Alternative 1 that was within the moderately sensitive aquatic species area.
- The proposed site is likely to be less used by waterfowl, raptors, and bats because it is further from shore.
- There would be a reduced visual impact because of the turbines being further from shore and therefore less visible.

- The transmission cable would be further from the Cleveland Water Intake Crib resulting in less potential for any sediments disturbed during installation to affect the water quality at the Crib.
- Boating density was observed to be lower than at the site proposed in Project Alternative 1.
- The proposed site is further from shipping lanes and from past USCG search and rescue locations.

The Proposed Project design in Project Alternative 2, that incorporated the MB foundation design, was determined to be more suitable by LEEDCo for reasons including the following:

- The spacing between the turbines is less, which would lead to a project footprint that is approximately 20 percent smaller than Project Alternative 1.
- Installation of the MB foundations would not require the dredging and fill activities or pile driving that would be required for installation of the monopile friction wheel foundation design proposed in Project Alternative 1. This would reduce the amount of sediment disturbed and noise produced because of construction.
- The MB foundation would cost less to fabricate and install than the monopile friction wheel design proposed in Project Alternative 1.

DOE is proposing to authorize the expenditure of federal funding in support of Project Alternative 2. Accordingly, DOE is evaluating Project Alternative 2 as the Proposed Project in this EA. Project Alternative 1 is not under consideration by DOE or evaluated in this EA.

2.5 Permitting

2.5.1 USACE Permitting

The USACE has regulatory and permitting authority under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. Section 10 pertains to authorization of structures or work in or affecting navigable Waters of the U.S. Section 404 regulates discharges of dredged or fill material into Waters of the U.S., including wetlands.

The decision to approve or deny Sections 10 and 404 permit requests is based on an evaluation of the probable impact, including cumulative impacts, of the proposed activity on the public interest. That decision will reflect the national concern for both protection and utilization of important resources. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. All factors which may be relevant to the proposal will be considered, including the cumulative effects thereof. A summary of how each of these public interest review factors was considered in the EA is presented in the Public Interest Review Factors section below.

The USACE requested comments from the public; federal, state, and local agencies and officials; Indian Tribes; and other interested parties in order to consider and evaluate the impacts of the Proposed Project.

The USACE public comment period was 30 days and expired on October 13, 2017[5]. The USACE notice referred the reader to the Draft EA and the Section 404 and 10 permit application submitted to the USACE for details and requested input from federal and state agencies, adjacent property owners, and the public.

In addition to Sections 10 and 404, Section 408 permission must also be granted for any alterations to, or temporary or permanent occupation or use of, USACE, federally authorized, civil works projects.

USACE received a Section 10/404 Permit application for the installation of the offshore wind turbines and electric collection line, and received a Section 408 application for alterations to, or temporary or permanent occupation or use of, USACE, federally authorized, civil work projects. The Buffalo District Corps of Engineers granted Section 408 permission to Icebreaker Windpower Incorporated on September 8, 2017.

Public Interest Review Factors (33 CFR 320.4(a)(1))

The USACE general regulatory policies for evaluating permit applications require that a decision to issue a permit be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest (33 CFR 320.4). Appropriate evaluation of the potential impacts that the proposed activity may have on the public interest requires a careful examination of all relevant factors in each case. USACE's decision to authorize a proposal and its associated conditions are determined by the outcome of this general examination. In compliance with these regulations, this EA addresses the following public interest review factors: conservation of natural resources, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, and considerations of property ownership. Each public interest review factor is listed below with a conclusion or reference to where it is evaluated in the EA.

a. Conservation of Natural Resources

The Proposed Project would not result in the conservation of additional land or the use of lands conserved for other purposes. The proposed wind turbine generators, submerged electric collection cables, and substation do not cross any conservation lands. The offshore portions of the Proposed Project do not traverse any sanctuaries or other such conservation areas. Therefore, this public interest review factor was not evaluated further in the EA.

b. Economics

The affected environment and environmental impacts related to socioeconomics are described in Section 3.13 of the EA.

c. Aesthetics

The affected environment and environmental impacts related to aesthetics are described in Section 3.11 of the EA.

[5] The USACE Public Notice comment period expired on October 13, 2017, after a standard 30-day period. However, some interested parties were inadvertently omitted from the original public notice sending. Those parties were identified and provided an additional 21 days to submit written comments. The Public Notice comment period was extended for affected parties through November 3, 2017.

d. General Environmental Concerns

1. Noise

The affected environment and environmental impacts related to noise are described in Section 3.12 of the EA.

2. **Air**

The affected environment and environmental impacts related to air are described in Section 3.6 of the EA.

e. Wetlands

The affected environment and environmental impacts related to wetlands are described in Section 3.1.5 of the EA.

f. Historic Properties

The affected environment and environmental impacts related to historic properties are described in Section 3.10 of the EA.

g. Fish and Wildlife Values

1. Benthos

The affected environment related to benthos is described in Section 3.4.1.1 of the EA. The environmental impacts related to benthos are described in Section 3.4.2.1 of the EA.

3. Fish Resources

The affected environment related to fish resources is described in Section 3.4.1.2 of the EA. The environmental impacts related to fish resources are described in Section 3.4.2.2 of the EA.

4. Terrestrial Amphibians, Reptiles, and Mammals

The affected environment and environmental impacts related to terrestrial amphibians, reptiles, and mammals are described in Section 3.1.4 of the EA.

5. Birds and Bats

The affected environment related to birds and bats is described in Section 3.4.1.3 of the EA. The environmental impacts related to birds and bats are described in Section 3.4.2.3 of the EA.

h. Flood Hazards

The affected environment and environmental impacts related to flood hazards are described in Section 3.1.7 of the EA.

i. Floodplain Values

The affected environment and environmental impacts related to floodplains are described in Section 3.1.7 of the EA.

j. Land Use

The affected environment and environmental impacts related to land use are described in Section 3.1.8 of the EA.

k. Navigation

1. Lake Navigation

The affected environment related to lake-based navigation is described in Section 3.9.1.1 of the EA. The environmental impacts related to lake-based navigation are described in Section 3.9.2.1 of the EA.

2. Aviation

The affected environment related to aviation is described in Section 3.9.1.2 of the EA. The environmental impacts related to aviation are described in Section 3.9.2.2 of the EA.

l. Shore Erosion and Accretion

The affected environment and environmental impacts related to shore erosion and accretion are described in Section 3.1.6 of the EA.

m. Recreation

The affected environment and environmental impacts related to recreation are described in Sections 3.8 and 3.9 of the EA.

n. Water Supply and Conservation

The affected environment related to water supply and conservation is described in Section 3.3.1.2 of the EA. The environmental impacts related to water supply and conservation are described in Section 3.3.2.2 of the EA.

o. Water Quality

The affected environment related to water quality is described in Section 3.3.1.1 of the EA. The environmental impacts related to water quality are described in Section 3.3.2.1 of the EA.

p. Energy Needs

The Proposed Project would consist of the construction, operations, maintenance, and eventual decommissioning of an approximate 21 MW offshore wind advanced technology demonstration project, consisting of six wind turbine generators, submerged electric collection cables, and a substation. The energy generated by the Proposed Project would deliver power to a single point of interconnection on the existing CPP electric grid, the 138 kV Lake Road Substation. Additional Proposed Project details, description, and layout are provided in Section 2.2 and Appendix B of the EA.

q. Safety

1. Waste Management

The affected environment related to waste management is described in Section 3.5.1.1 of the EA. The environmental impacts related to waste management are described in Section 3.5.2 of the EA.

2. Hazardous Materials

The affected environment related to hazardous materials is described in Section 3.5.1.2 of the EA. The environmental impacts related to hazardous materials are described in Section 3.5.2 of the EA.

3. Public Health and Safety

The affected environment related to public health is described in Section 3.5.1.3. The environmental impacts related to public health and safety are described in Section 3.5.2 of the EA.

r. Food and Fiber Production

The Proposed Project would have no effect on food and fiber production. Potential effects on commercial fishing are discussed in Section 3.13.2.5 of the EA. This public interest review factor was not evaluated further in the EA.

s. Mineral Needs

The Proposed Project would have no effect on mineral needs. Therefore, this public interest review factor was not evaluated further in the EA.

t. Considerations of Property Ownership

As stated in the USACE regulatory guidance, authorization of work or structures by a USACE permit does not convey any property rights, either in real estate or material, or any exclusive privileges (33 CFR 320.4(g)(6)). The proposed turbines would be erected on foundations placed on the Lake Erie lakebed, on leased submerged state lands off the coast of the City of Cleveland, in Cuyahoga County, Ohio. These rights were obtained through a Submerged Lands Lease with the State of Ohio. The onshore components, including a proposed overhead cable, underground concrete duct bank, underground cable, and new substation would also be located in Cleveland, Ohio. Construction would be supported by the temporary use of the Port of Cleveland to stage, pre-assemble, and test the turbine components and potentially to stage and assemble the foundation components, completed foundations, and export cable.

2.5.2 Ohio Environmental Permitting

2.5.2.1 Ohio Department of Natural Resources

The ODNR is the lead agency in administering the Ohio Coastal Management Program. A summary of the Proposed Project's consistency with the Ohio Coastal Management Program and a signed Consistency Certification Statement was included as a part of the Section 10/404 permit application. The USACE forwarded the Section 10/404 permit application to ODNR and coordinated with ODNR for its review of the coastal zone consistency. On March 9, 2018, the ODNR concurred with the Proposed Project's Consistency Certification with the following conditions[6]:

1. A modification of Lake Erie Submerged Lands Lease SUB-2356-CU entered into pursuant to Ohio Revised Code §1506.11, must be obtained from ODNR;

[6] Should DOE move forward with the Proposed Action, these conditions will be incorporated into the terms and conditions of the funding agreement and the federal funding would be contingent on LEEDCo meeting these conditions and any other conditions set forth in the terms and conditions of the funding agreement.

2. A Section 401 Water Quality Certification, or waiver thereof, pursuant to Ohio Revised Code §6111.03, must be obtained from Ohio EPA; and
3. A Certificate of Environmental Compatibility and Public Need, pursuant to Ohio Revised Code §4906.20, must be obtained from the Ohio Power Siting Board.

2.5.2.2 Ohio Environmental Protection Agency

LEEDCo submitted a Section 401 Water Quality Certification application following issuance of the USACE public notice for the Section 10 and 404 permit application. The OEPA, responsible for evaluating the application for a Section 401 Water Quality Certification, authorized the Section 401 Water Quality Certification for the Proposed Project on July 26, 2018.[7]

2.5.2.3 Ohio Power Siting Board

LEEDCo must obtain a Certificate of Environmental Compatibility and Public Need from the OPSB under state law, pursuant to Chapter 4906-4 of the Ohio Administrative Code (OAC). LEEDCo filed its permit application with the OPSB on February 1, 2017, which was assigned Case No. 16-1871-EL-BGN. Refer to the OPSB website for information on the application (https://www.opsb.ohio.gov/siting-case-breakdown/16-1871-el-bgn-icebreaker-wind-facility-lake-erie/).

2.5.3 Permits and Authorizations

Table 2-3 summarizes the various permits, licenses, and authorizations required for the Proposed Project and their status.

Table 2-3. Permit Table

Permits	Agency	Project Phase	Submitted	Approval Received
Certificate of Environmental Compatibility and Public Need	OPSB	Construction and Operation	February 1, 2017	
Section 10 of the Rivers and Harbors Act	USACE	Construction and Operation	August 25, 2017	
Section 404 of the Clean Water Act	USACE	Construction	August 25, 2017	
Coastal Zone Consistency	ODNR	Construction and Operation	August 25, 2017	March 9, 2018
401 Water Quality Certification	OEPA	Construction	October 17, 2017	July 26, 2018

[7] Should DOE move forward with the Proposed Action, conditions required by the Section 401 Water Quality Certification will be incorporated into the terms and conditions of the funding agreement and the federal funding would be contingent on LEEDCo meeting these conditions and any other conditions set forth in the terms and conditions of the funding agreement.

Table 2-3. Permit Table

Permits	Agency	Project Phase	Submitted	Approval Received
Section 408 Permit to Alter, Impact, or Encroach upon a Federal Navigation Project	USACE	Construction and Operation	February 3, 2017	September 8, 2017
FAA Determination of No Hazard	FAA	Operation	July 22, 2016	February 22, 2017
Permit for Private Aid to Navigation	USCG	Operation		

2.6 Applicant Committed Measures

LEEDCo has made commitments and project design decisions to avoid or minimize potential impacts that were identified during the development of the Proposed Project and preparation of the EA. These commitments, project design decisions, and any additional measures identified through permitting or Memoranda of Understanding (collectively "measures"), would be incorporated and binding through the DOE funding agreement. The measures below were not necessary to decrease the level of impact below significant (i.e., the impacts may have been less than significant with or without the measures), but the measures are intended to further reduce the likelihood of impacts and to ensure the Proposed Project is carried out in an environmentally responsible manner. As a result of incorporating these measures into the DOE funding agreement, the federal funding would be contingent on LEEDCo implementing these measures.

2.6.1 Aquatic Resources

LEEDCo has reached agreement with the ODNR on an aquatic and fish sampling plan that lays out testing and analyses that will be conducted before, during and post-construction. A MOU between ODNR and LEEDCo was signed June 15, 2017 and filed with the OPSB July 20, 2017 (Appendix X).

2.6.2 Birds and Bats

LEEDCo has had discussions with ODNR to develop a monitoring plan that lays out testing and analyses that will be conducted before, during, and post-construction for birds and bats. A MOU between the ODNR and LEEDCo was signed July 20, 2017 and filed with the OPSB July 20, 2017 (Appendix X).

LEEDCo has developed a Draft Bird and Bat Conservation Strategy to conduct thorough post-construction monitoring of Proposed Project impacts, and to undertake adaptive management measures, if necessary. The Draft Bird and Bat Conservation Strategy has been shared with the USFWS and ODNR for review and comment. Collecting and evaluating post-construction monitoring data would inform continued operations of the Proposed Project and implementation of adaptive management measures. Mitigation and adaptive management measures would be implemented if actual impacts exceed expectations. The Bird and Bat Conservation Strategy is typically considered draft until final pre-construction work is complete, construction starts, and post-construction plans are in place. The Bird and Bat Conservation Strategy is meant to be a living document, and it is expected that additional information and planned actions may be adjusted over time.

Bat collision impacts at turbines are most frequent on nights when wind speeds are lower, especially during the late summer when migrating and swarming bats are most active. To address this concern, LEEDCo has agreed to feather the turbine blades (i.e., adjust the pitch of the turbine blades) up to the manufacturer's cut in speed (i.e., 6.7 mph, the speed at which the turbine starts generating electricity) between July 15 to October 15.

LEEDCo has committed to follow lighting recommendations per the USFWS 2012 land-based wind energy guidance documents. Gehring et al. (2009) found that the use of red or white flashing obstruction lights strongly correlated with a decrease in avian fatalities compared to non-flashing, steady burning lights at tower systems. Gehring et al. (2009) further stated, "Removing non-flashing lights from towers is one of the most effective and economically feasible means of achieving a significant reduction in avian fatalities at existing communication towers." The Proposed Project would use flashing red lights on turbines, as stipulated by the FAA for bird safety. To minimize the potential for nocturnally migrating birds to be attracted to the turbines if lights on the platforms or bases of the turbines are illuminated and face upward, bird-safe designs, such as hooded or "smart" lighting, would be used where consistent with other pertinent safety guidance on facility lighting.

DOE has advised LEEDCo to continue to work with USFWS and ODNR to address any bird and bat issues that could arise during planning, construction, operation, or decommissioning of the Proposed Project. In addition, DOE has advised LEEDCo that they must work with USFWS to ensure that they comply with the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). Finally, and in accordance with Section F.1. of the MOU between DOE and USFWS regarding implementation of Executive Order 13186, DOE has notified and advised LEEDCo "to contact the USFWS to discuss compliance with appropriate laws protecting migratory birds, independent of DOE's funding decision." LEEDCo's coordination with USFWS regarding MBTA and BGEPA, as well compliance with ODNR requirements stemming from the MOUs would be required as conditions of the DOE funding agreement.

2.6.3 Spill Prevention, Control, and Countermeasure Plan

LEEDCo must comply with federal and state regulations for management of fluids and fuels, including maintaining and implementing a spill prevention, control, and countermeasure (SPCC) plan. The purpose of a SPCC plan is to help prevent a discharge of oil or oil products into navigable waters or adjoining shorelines (lakes, rivers, or streams), and control a spill if one occurs.

Any vessel operating as part of the Proposed Project would maintain and implement a SPCC plan and would be equipped with spill handling materials adequate to control or clean up any accidental spill.

2.6.4 Inadvertent Return Contingency Plan

An Inadvertent Return Contingency Plan has been prepared by LEEDCo to address the potential risk of an inadvertent release of drilling fluids during the HDD of the proposed export cable. The plan describes the procedures LEEDCo and the contractors would implement to avoid, minimize, and remediate potential environmental impacts that could result from an inadvertent release. The plan has been submitted as part of the USACE Section 404 permit application. The plan is included as Appendix G-2.

2.6.5 Traffic and Transportation

LEEDCo would implement the following safety measures associated with traffic and transportation.

Construction:

- Notify all applicable agencies (e.g., USCG, USACE, etc.) prior to construction that a construction vessel (or vessels) would be moored and/or traveling within navigable channels. Provide the USCG with the information necessary for the USCG to issue a Notice to Mariners.
- Follow any navigation restrictions imposed by the USCG.
- Notify appropriate authorities to include the wind turbines on navigation charts.

Operation:

Comply with FAA and USCG requirements regarding markings and lighting of turbines, including FAA L-864 aviation red-colored flashing lights (20 to 40 flashes per minute) for nighttime wind turbine obstruction lighting.

Decommissioning:

Follow all requirements of any approved Decommissioning Plan.

2.6.6 Cultural Resources

While no evidence of items of archeological or cultural significance that would be impacted by the Proposed Project have been identified within Lake Erie, LEEDCo would continue to monitor for items of archeological or cultural significance and immediately notify the appropriate agencies or tribes of discovery of any previously unknown historic or archeological remains during construction. LEEDCo entered into a letter agreement with the State Historic Preservation Office and the ODNR providing that consumer grade side scan sonar would be deployed on boats engaged in aquatics and fisheries sampling efforts.

2.6.7 Socioeconomic

LEEDCo would work with Cuyahoga County, affected municipalities, and the Ohio Department of Transportation (ODOT) to develop road use agreements, meet weight requirements, and avoid road or lane closures.

2.6.8 Water Quality

LEEDCo had discussions with Cleveland Water regarding construction of the Proposed Project and its potential impacts on water quality. LEEDCo would continue discussions with the City of Cleveland and develop a communications and monitoring plan that would inform Cleveland Water plant operators of construction schedule and provide field measurements of turbidity to optimize water treatment plant operation.

LEEDCo has agreed to implement the following measures to ensure the safety of the water quality:

- Provide Cleveland Water a minimum 3-day notice before commencing construction on the proposed export cable.
- Communicate with Cleveland Water daily during the proposed cable laying operations. Construction would be anticipated to last approximately 1 week in the area of concern.
- Avoid placement of the proposed export cable in an area of open lake placement for dredged materials.
- Monitor for turbidity during construction activities and provide turbidity sensors at the surface and at the bottom elevations for the Morgan buoy[8].

Additionally, the foundations would be installed during the summer, which would reduce the travel distance of re-suspended sediments because a thermocline (sharp change in water temperature and density) has been observed at the proposed turbine locations during summer months.

2.6.9 Air Quality

LEEDCo has committed to implementing applicable construction-related emissions reduction measures listed on the EPA Construction Emission Control Checklist to minimize diesel emissions and fugitive dust. Measures include but are not limited to the following:

- Solicit bids that require the use of vehicles (marine and terrestrial) equipped with zero-emission technology or the most advanced emission control systems available.
- Establish and enforce an anti-idling policy through the construction contracting or oversight process.
- Stabilize open storage piles and disturbed areas.
- Position the exhaust pipe so that diesel fumes are directed away from operators and nearby workers.

[8] A Cleveland Water buoy.

SECTION 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS

Section 3 describes the existing environmental resources associated with the Proposed Project based on best available data, including the wind turbines, inter-array cables, export cable, substation, O&M Center, the Port staging area, and any associated workspace for the Proposed Project. The section also analyzes the potential environmental effects of the Proposed Project and the No-Action Alternative on the environmental resources using the best available data for the assessment. Potential environmental effects are analyzed for each of the following phases of the Proposed Project: (1) construction, (2) operations and maintenance, and (3) decommissioning. The evaluation of potential effects or impacts considers the size and scope of this technology demonstration project and describes the effects or impacts in terms of their type (adverse or beneficial); duration (short- or long-term); and intensity. The threshold definitions for the impact intensities used in this analysis are as follows:

- Negligible: Impacts on the resource, although anticipated, would be difficult to observe and are not measurable.
- Minor: Impacts on the resource would be detectible upon scrutiny or would result in small but measurable changes in the resource.
- Moderate: Impacts on the resource would be easily observed and measurable but would be localized or short-term (equal to or less than 2 years).
- Major: Impacts on the resource would be easily observed and measurable, widespread, and long-term (i.e., more than 2 years).[9]

In addition to these impact thresholds under NEPA, there are effects determinations definitions that are applicable specifically for the Endangered Species Act (ESA). The ESA effects determination for federally listed species can be as follows:

- No effect: Federally listed species or critical habitat will not be affected, directly or indirectly.
- May affect but is not likely to adversely affect: All effects on federally listed species or critical habitat are beneficial, insignificant, or discountable.
- May affect and is likely to adversely affect: An adverse effect to listed species or critical habitat may occur as a direct or indirect result of the proposed action and the effect is not: discountable, insignificant, or beneficial.

3.1 Environmental Resources Evaluated and Dismissed from Detailed Analysis

Consistent with NEPA implementing regulations and guidance, DOE focused the analysis in this EA on topics with the greatest potential for environmental impacts (known as the sliding-scale approach [40 CFR 1502.2(b)]). Section 3.1 and Table 3.1-1 present DOE's evaluations of the environmental resource areas on

[9] As analyzed in the EA, a major impact would be an impact that is widespread and long term and affects not just individuals within the resource or species but may result in population-level effects to the species itself at a local or regional level.

which LEEDCo's Proposed Project is expected to have no impact or a negligible impact. These resources are described below but are not carried forward for detailed analysis.

Table 3.1-1. Resources Not Carried Forward for Detailed Analysis

Resource	Not Present	No Potential for Impact	Negligible Impact	Considerations
Currents and Waves		X		• Because of the small scale of the Proposed Project and circular shape of the turbine foundations, currents and waves would not be anticipated to be affected.
Groundwater		X		• Minor excavation for construction of the Proposed Substation would be shallow, at approximately 3 feet, which is above groundwater. • The remainder of the onshore Proposed Project elements do not require excavation and have no potential to impact groundwater.
Aquatic and Terrestrial Vegetation			X	• Insufficient sunlight necessary for plant growth at depths beyond 52 feet; turbines proposed to be in 58 to 63 feet to the lakebed. • HDD would prevent impacts to nearshore submerged aquatic vegetation. • Potentially occurring aquatic vegetation that may be affected by cable burial would be expected to return to pre-installation conditions shortly after construction. • The onshore cable route and Proposed Substation would be constructed on developed land and would not require vegetation clearing at the site.
Terrestrial Amphibians, Reptiles, and Mammals			X	• Land-based wildlife in the Proposed Project Area are all highly urbanized species and have adapted to human activities such as construction. • Species that could be present during construction are highly mobile and could actively avoid construction and decommissioning activities.
Wetlands	X			• No wetlands occur within 100 feet of the Proposed Project.
Shore Erosion and Accretion		X		• Shoreline is hardened near the proposed landfall, Lake Road Substation, Proposed Substation, HDD boring pit, as well as the Port used for the quayside staging area. • Erosion and sediment control best management practices would minimize sediment runoff impacts to Lake Erie.
Flood Plain and Flood Plain Hazards		X		• No impacts related to flood plain or flood plain hazards would be anticipated from construction, operations, maintenance, or decommissioning of the Proposed Project because onshore work and facilities would occur outside Federal Emergency Management Agency-mapped 100-year floodplain boundaries. • Proposed wind turbine area is located 8 to 10 miles offshore and would be unaffected by flooding events.
Land Use and Infrastructure			X	• Proposed Project would impact 0.34 acre of open lakebed, compared to the greater than 6 million acres of total open lakebed area in Lake Erie. • Export cable would be buried in open lakebed.

Table 3.1-1. Resources Not Carried Forward for Detailed Analysis

Resource	Not Present	No Potential for Impact	Negligible Impact	Considerations
				• Proposed Substation would have a footprint of 0.22 acre on existing industrial land, adjacent to the Lake Road Substation. • O&M Center and the Port staging area would be located on existing industrial land.
Wake Effect		X		• There are no environmental impacts from wake loss because of the optimized design and small number of turbines.
Intentional Destructive Acts			X	• Proposed Project would not transport, store, or use radioactive, explosive, or toxic materials. • Proposed Project would be a single component of a diversified power grid. • Proposed Project would not be considered to offer targets for intentional destructive acts.

3.1.1 Currents and Waves

Wave climatology of the lake is closely coupled with wind climatology. Rough waves are frequent during the autumn months, especially in the eastern half of the lake. Waves of 5 feet can be encountered approximately 30 percent of the time lake-wide (NOAA, 1987). Historical data (1981 through 2001) for a buoy located approximately 30 miles northwest of Cleveland indicated that average monthly significant wave heights ranged from 0.3 meter (approximately 1 foot) to 0.8 meter (2.6 feet), with maximum wave heights near 4 meters (13.1 feet; NOAA, 2003).

Hydrodynamic surveys were performed to determine how the Proposed Project might affect local and regional lake circulation patterns and how a potential change in currents could affect water quality and food webs. Sensors were deployed at one proposed turbine location and a reference station throughout the field season of May to October 2016 and re-deployed for the winter (October 2016 to April 2017). Monitoring to date shows small deviations between the top and bottom water velocity and direction with an average current velocity at the bottom of Lake Erie of 0.07 to 0.08 m/s and an average current velocity at the surface of 0.09 m/s. The average significant wave height and mean wave period recorded for 2016 was 0.43 meter (1.4 feet) and 2.5 seconds. The current velocities and wave data measured during the 2016 surveys correspond with previous measurements collected in the lake, and the data indicated that wind was the main driver for current in Lake Erie. Detailed results are provided in Appendix E-1.

Based on this understanding of Lake Erie currents and waves, the Proposed Project would utilize 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. Because of the small scale of the Proposed Project, and circular shape of the turbine foundations, currents, and waves are not anticipated to be affected during construction, operations, maintenance, or decommissioning**.** Therefore, this resource is not carried forward for further analysis.

3.1.2 Groundwater

The Proposed Project, including the Proposed Substation, O&M Center, and staging area, would be located on developed land in downtown Cleveland with only the substation requiring excavation. The Proposed

Substation would be built on existing filled land occupied by existing utility infrastructure. Minor excavation for construction of the Proposed Substation would be shallow, approximately 3 feet. There would be no anticipated impacts associated with groundwater because of the Proposed Project, and therefore, this resource is not carried forward for detailed analysis.

Additionally, because drinking water is obtained from Lake Erie and not from groundwater in this area, no impacts to drinking water would occur from work at the Proposed Substation. Impacts to drinking water are further evaluated in Section 3.3.2.2.

3.1.3 Aquatic and Terrestrial Vegetation

The Proposed Project turbines, located 8 to 10 miles offshore, would be in deep waters, approximately 58 to 63 feet to the lakebed. Water clarity data collected by LimnoTech in 2016 (Appendix E-1) at the proposed turbine sites indicates that solar radiation essential for plant growth is primarily nonexistent at depths beyond 52 feet. Water clarity at the proposed turbine sites is insufficient to allow growth of bottom vegetation. As such, there would be no reason to expect vegetation to grow on the lakebed near the proposed turbines or inter-array cables.

The use of HDD would prevent impacts to submerged aquatic vegetation that may be found along nearshore areas of the proposed export cable. Along the proposed export cable route from the HDD exit to the proposed turbine sites (or water depths beyond 52 feet), the direct disturbance resulting from cable burial would be approximately 15 feet wide, potentially disturbing a limited area of aquatic vegetation.

The onshore cable route and the Proposed Substation would be constructed on developed land and would not require vegetation clearing at the site. The Proposed Project O&M Center would also have no impacts on vegetation because it would make use of an existing structure (to be leased by LEEDCo).

There would be no anticipated adverse impacts to aquatic or terrestrial vegetation resulting from implementation of the Proposed Project and, therefore, this resource is not carried forward for detailed analysis.

3.1.4 Terrestrial Amphibians, Reptiles, and Mammals

The Proposed Project, including the Proposed Substation, O&M Center, and staging area, would be located on developed land in downtown Cleveland along hardened shorelines. Wildlife that may occur in the upland area would likely be locally mobile species heavily adapted to urbanized human activity and locally mobile mammals, amphibians, or reptiles. Urban area nuisance species which may continue to live in the habitat available in parks, undeveloped parcels of land and vacant lots, may include raccoons, skunks, opossums, snakes, squirrels, groundhogs, and deer (ODNR, 2017a). Terrestrial amphibians, reptiles, and mammals (except for bats, which are evaluated in Sections 3.4.2.3 and 3.4.2.5) would not be expected to be influenced by the proposed activities; therefore, this resource is not carried forward for detailed analysis.

3.1.5 Wetlands

There are no wetlands within 100 feet of the Proposed Project as shown on USFWS National Wetland Inventory/surface water maps (USFWS, 2016). Lake Erie is considered open water and the shoreline is hardened near the Lake Road Substation, Proposed Substation, HDD boring pit, and the Port, which would be used as the quayside staging area for the Proposed Project (Figure 2-2). The Cuyahoga and Old Rivers also have hardened shorelines adjacent to the O&M Center. There would be no impacts to wetlands because of the Proposed Project; therefore, this resource is not carried forward for detailed analysis.

3.1.6 Shore Erosion and Accretion

The Lake Erie shoreline is hardened near the landfall, Lake Road Substation, Proposed Substation, HDD boring pit, as well as the Port, which would be used as the quayside staging area for the Proposed Project.

No shore erosion or accretion would be anticipated during construction, operations, maintenance, or decommissioning because the proposed turbines would be 8 to 10 miles offshore in Lake Erie and activities associated with the export cable, Proposed Substation, and staging would occur where the shoreline is hardened. Because of the implementation of erosion and sediment control best management practices during work on the Proposed Substation, such as silt fences, sediment runoff impacts to Lake Erie would be minimized. Therefore, this resource is not carried forward for detailed analysis.

3.1.7 Flood Plain and Flood Plain Hazards

Surface water bodies around the Proposed Project include Lake Erie, the Cuyahoga River, and the Old River. The Cuyahoga River flows northwest, discharging into Lake Erie through a channel. The Old River is a short tributary draining into the Cuyahoga near the outlet to Lake Erie. Information on floodplains for these surface waters near the Proposed Project was obtained from the Federal Emergency Management Agency (FEMA; 2010).

The Proposed Substation would be located on CPP property adjacent to the Lake Road Substation. The waters of Lake Erie are designated as Zone AE, indicating there is a 1 percent annual chance of flooding. However, while the Proposed Substation site would be located adjacent to Lake Erie, it would be located outside the FEMA-mapped boundaries of the 100-year floodplain and associated floodways (FEMA, 2010).

The Proposed Project O&M Center would be located in an existing building on land leased from GLT, on Division Road approximately 1.6 kilometers (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, near the Proposed Substation, the FEMA-mapped 100-year floodplain does not extend beyond the banks of the river (FEMA, 2010).

No impacts related to flood plain or flood plain hazards would be anticipated because of construction, operations, maintenance, or decommissioning of the Proposed Project because onshore work and facilities would occur outside FEMA-mapped 100-year floodplain boundaries. The prospect of floods would not apply to the wind turbine component of the Proposed Project, because the turbines would 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 CD at the proposed turbine locations. This resource is not carried forward for detailed analysis.

3.1.8 Land Use and Infrastructure

The Proposed Project Area for the proposed turbine sites would be approximately 4.2 acres of open lakebed in Lake Erie. The footprint of each foundation would be less than 0.06 acre, with a total footprint from all six turbines totaling 0.34 acre. The proposed export cable would be buried in open lakebed. The Proposed Substation would have a footprint of 0.22 acre on existing industrial land, adjacent to the Lake Road Substation. The O&M Center and the Port staging area would be located on existing industrial land.

There would be no change in land use because of the Proposed Project except where the turbine foundations would be located within Lake Erie. The Proposed Project would impact 0.34 acre of open lakebed. Compared to the total area of Lake Erie (over 6 million acres), these foundations would represent an extremely small amount of the lake. The proposed export cable would not result in a change of land use, as it would be buried and covered by sediment.

The Proposed Project's land-based components would be located in downtown Cleveland adjacent to an extensive highway system and other existing infrastructure. The Proposed Substation would be connected to the existing 138 kV system at the Lake Road Substation with an underground transmission line and then transitioned to an underground concrete duct bank. The transition from the duct bank to the termination structures would be through a pre-cast concrete pulling pit. The underground circuit would run approximately 225 feet in a concrete encased conduit from an above grade termination structure in the Proposed Substation to an above grade termination structure in the Lake Road Substation. The Lake Road Substation would require minimal upgrades to existing infrastructure and would have sufficient land to construct necessary Proposed Substation equipment. The Proposed Project would have a short-term impact on infrastructure during construction and decommissioning, through use of the highways (workers traveling to and from the site), the Port (fuel station, waste disposal), and work that would occur around the Lake Road Substation. However, the Proposed Project would result in a negligible increase in vehicular traffic and would not adversely impact operations at the Port or the Lake Road Substation. Therefore, the Proposed Project would not create a long-term change in traffic patterns or existing infrastructure.

There would be no anticipated adverse impacts to land use or infrastructure from implementation of the Proposed Project; therefore, this resource is not carried forward for detailed analysis.

3.1.9 Wake Effect

Wake effect consists of the potential change in wind speed as a result of the turning of the wind turbines. A wake effect may be observed downstream of the wind turbine as a reduction in speed. There are no environmental impacts from wake effect because of the optimized design and small number of turbines; therefore, wake effect was not considered in the environmental impacts analysis for the Proposed Project.

3.1.10 Intentional Destructive Acts

Installation and operation of the Proposed Project would not involve the transportation, storage, or use of radioactive, explosive, or toxic materials. The Proposed Project would not be located near any national defense infrastructure or in the immediate vicinity of other substantial national structures. Further, the Proposed Project would be a single component of a diversified power grid. Consequently, implementation or non-routine events affecting the operation of the Proposed Project would not result in a substantial potential for disruption of electrical service. The Proposed Project would not be considered to offer any targets for intentional destructive acts.

There would be no anticipated adverse impacts associated with intentional destructive acts resulting from implementation of the Proposed Project; therefore, this scenario is not carried forward for detailed analysis.

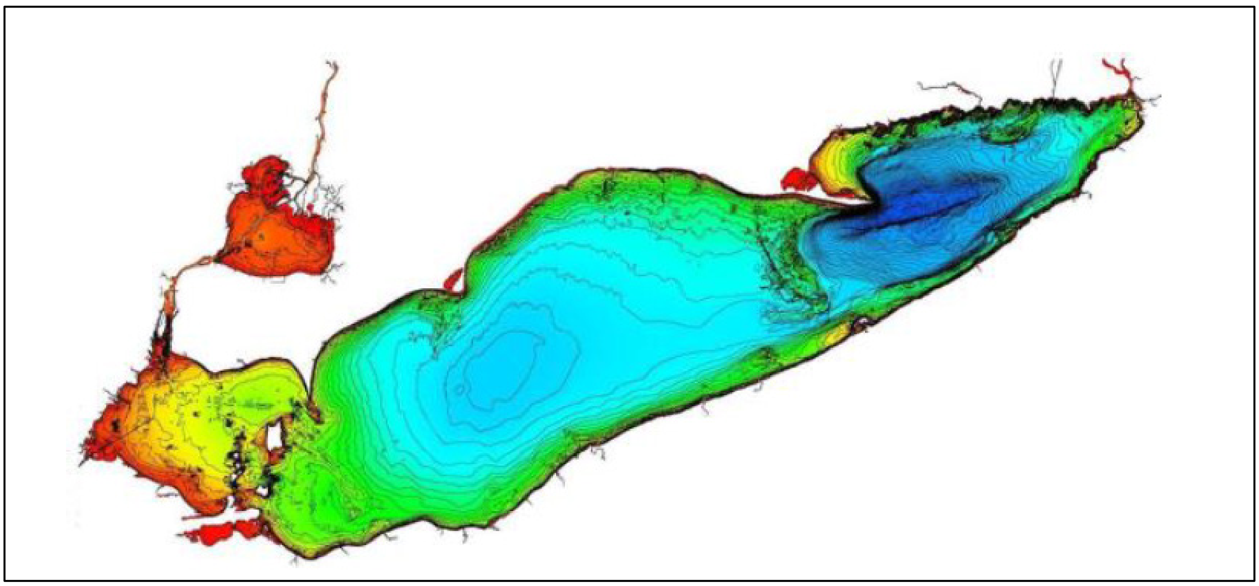
3.2 Physical Resources

3.2.1 Affected Environment

Several detailed technical surveys were conducted to determine the geological characteristics of the lakebed and the depth of water at the proposed turbine sites and along the proposed inter-array and export cable routes. The results of these surveys were used to characterize the physical features of Lake Erie in the vicinity of the Proposed Project, described in more detail below. Some of these surveys were used to establish baseline conditions of the lake and lakebed in the Proposed Project Area while others were used to properly design the turbines and their foundations. The results of these surveys were also used to look for obstructions on the lake bottom and features such as shipwrecks (see Section 3.10). The technical reports describing these surveys in more detail are attached as Appendices F-1 through F-3.

3.2.1.1 Lake Bathymetry

Lake bathymetry is the measurement of the depth of water and the topography of the lake bottom. Lake Erie is the shallowest of the Great Lakes with an average depth of 19 meters (62 feet) and a maximum depth of 64 meters (210 feet). It is the smallest of the Great Lakes by volume, although only the fourth smallest by surface area (NOAA, 2017a). Lake Erie consists of three distinct regions: the western, the central, and the eastern basins, each with significantly different bathymetric characteristics. The western basin is the shallowest with an average depth of 7 meters (21 feet) and features rocky outcrops, shoals, and islands (Lake Erie Waterkeeper, 2017). The central basin has a large flat bottom with an average depth of 20 meters (65 feet) and a maximum depth of 24 meters (80 feet) in a broad depression in the middle of the Lake (Lake Erie Waterkeeper, 2017; NOAA, 2017b). In contrast, the eastern basin contains a sharp, deep gouge with several steep slopes, an average depth of 24 meters (80 feet), and the deepest depths of the Lake off the tip of a long sandy peninsula (Lake Erie Waterkeeper, 2017). An overall view of Lake Erie is shown in Figure 3.2-1 (NOAA, 2017c).



Source: Appendix T-1

Figure 3.2-1. Bathymetric Map of Lake Erie (NOAA)

The Proposed Project would be located in the central basin. Site-specific bathymetric and side scan sonar results showed a generally uniform and smooth lake bottom at the proposed turbine locations (Appendices F-1 and F-2). Some evidence of ripples or other sedimentary features were observed along the proposed export cable route (Appendix T-1). Water depth increased linearly with increasing distance from shore. The proposed turbines and inter-array cables would be located in water depths of approximately 57 to 61 feet CD. The export cable would be located in water depths of approximately 60 feet to no shallower than 30 feet CD and buried at least 12 feet below either the break wall or the design dredge depth of the navigation channel. Figure 3.2-2 (Sheets 1 to 3) depicts the bathymetric contours of the Proposed Project Area.

3.2.1.2 Lake-Based Geology and Sediments

Bathymetric and side scan sonar results showed that the surficial lake bottom of the Proposed Project Area is comprised of soft, silty sediments (Appendices F-1 and F-2). The side scan sonar showed a generally uniform and smooth lake bottom at the proposed turbine locations (Appendix F-1). Figure 3.2-2 shows the Proposed Project, geological features of the Proposed Project Area, topographic contours, and oil and gas wells.

The proposed turbines would be located in an area of relatively uniform lakebed topography that slopes downward from southeast to northwest. Very soft to soft sediments blanket the lake bottom in the area of the proposed turbines. Underneath these surface sediments, there are a discontinuous layered sequence of glacial and post glacial sediments, underlain by a thick sequence of normally consolidated to slightly overly-consolidated clay deposits. The general sequence of sediment layers is similar beneath the proposed turbine area; however, the details within the different layers vary considerably at the different proposed turbine locations. Bedrock beneath Lake Erie may consist of shale, siltstone, sandstone, and limestone as confirmed by site-specific geological surveys (Appendix F-2).

Along the proposed HDD cable, alignment subsurface layers are composed primarily of cohesive sediments. Generally, the layers in descending order are lake-bottom mud, discontinuous sequence of layered silts, sands and clay, and normally-consolidated-to-slightly-over-consolidated clay (Appendix F-3).

Samples were collected during a site-specific geotechnical survey for analysis of physical and chemical characteristics such as grain size, total organic carbon, trace metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and organochlorine pesticides. The sediment analytical results were evaluated to determine the existing sediment quality in the vicinity of the proposed turbine sites and export cable route. Sediment results were compared to ecological sediment quality guidelines following the process outlined in OEPA's *Guidance on Evaluating Sediment Contaminant Results* (OEPA, 2010). Results indicate that existing sediment quality at the four sampled locations would pose a low potential for toxicity to aquatic receptors. For more details on the sediment evaluation, refer to the technical memorandum and Environmental Baseline Survey Technical Report in Appendix G-1.

Salt Mines

The Cargill Salt Mine extends from downtown Cleveland approximately 2.3 miles north beneath Lake Erie (juwi GmbH, 2009). The mine's roof is approximately 1,700 feet below the lakebed; it is a room and pillar mining system with unmined pillars remaining to support the overlying rock. There are long-term plans to extend the mine north and/or west beneath Lake Erie, though salt deposits would not be mined any closer to the lakebed. The salt mine is located approximately 4.7 miles from the nearest proposed turbine location and approximately 1.4 miles from the nearest edge of the export cable route envelope (Figure 3.2-3).

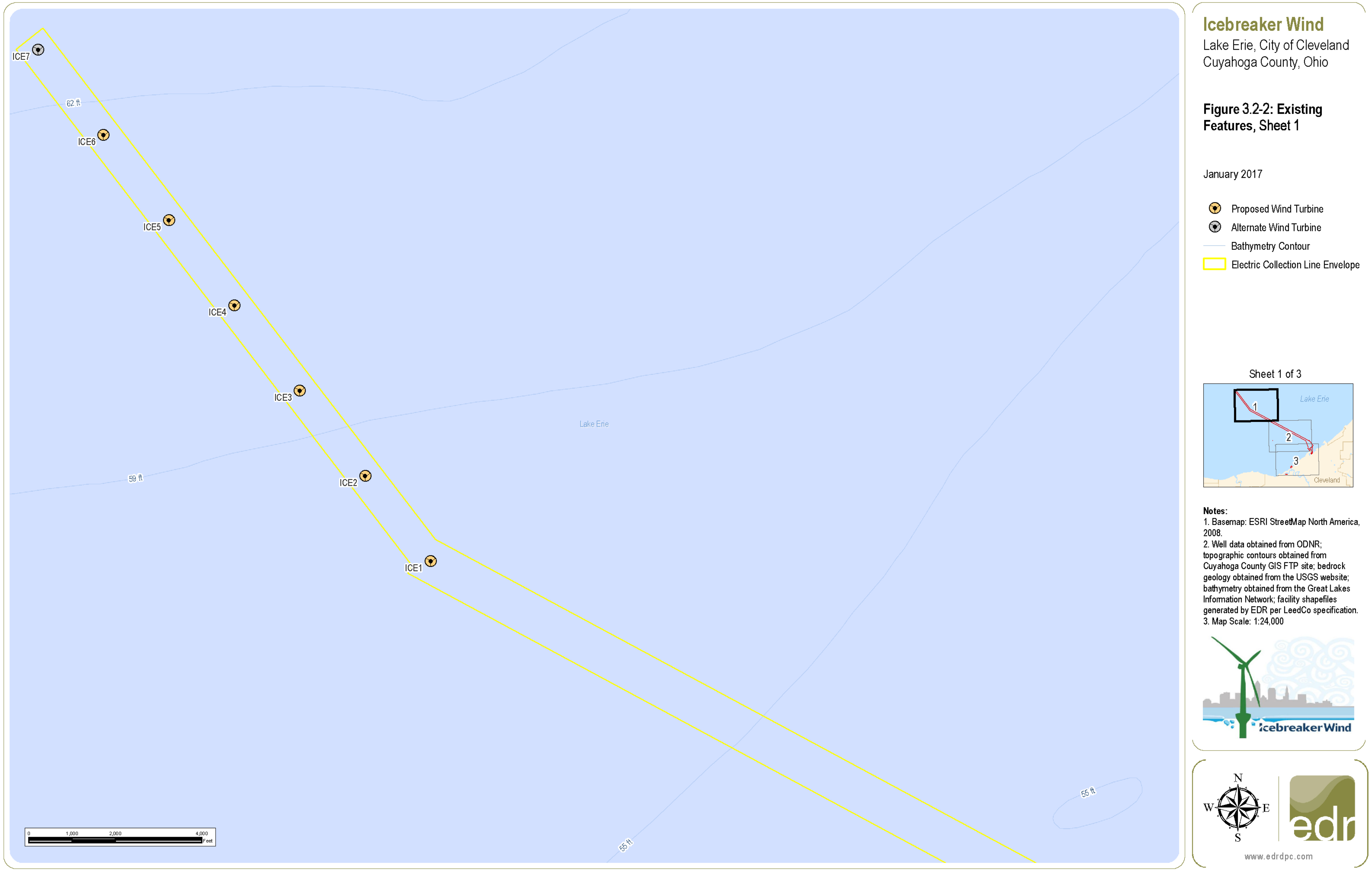


Figure 3.2-2. Existing Features, Sheet 1

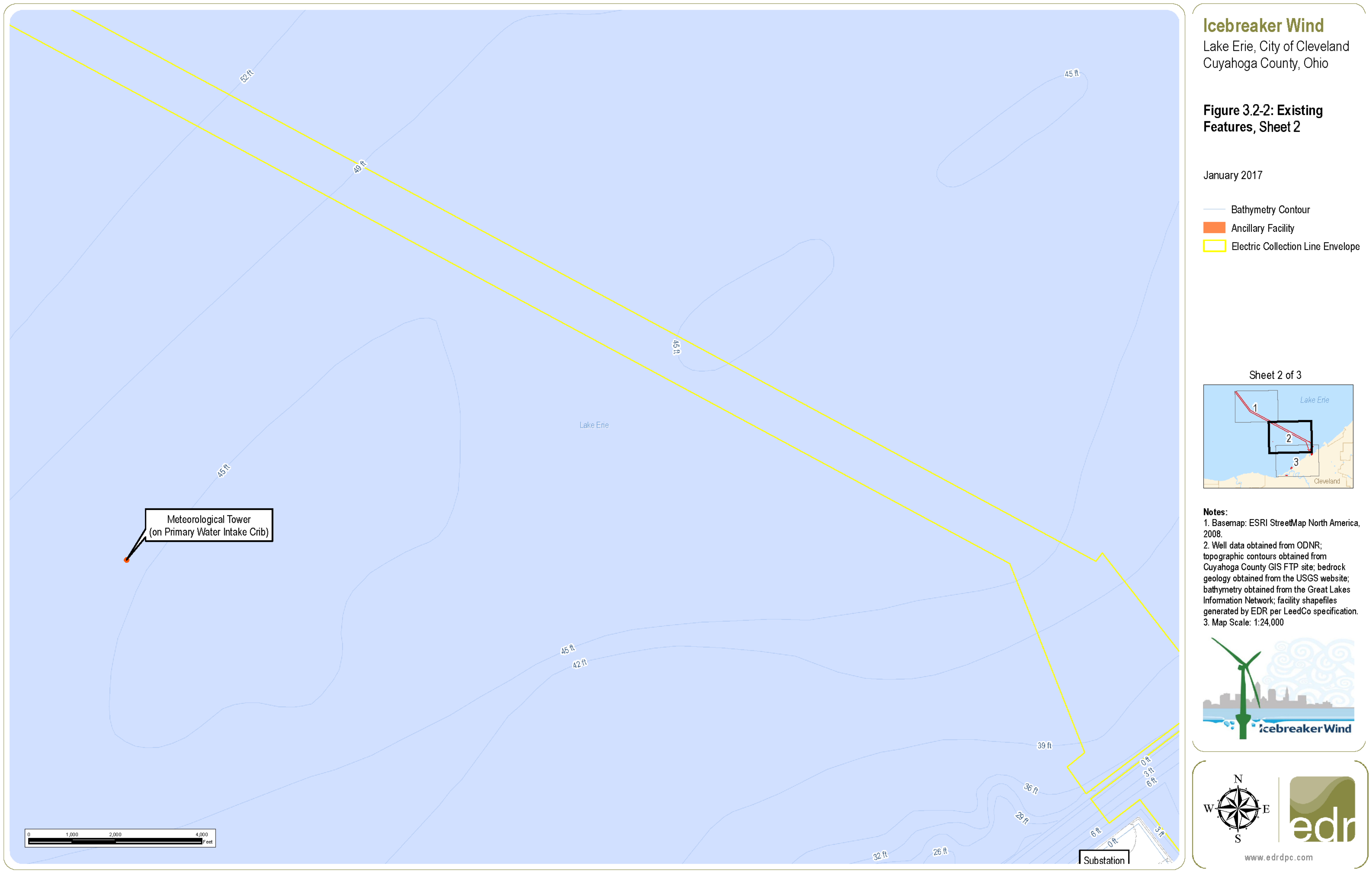


Figure 3.2-2. Existing Features, Sheet 2

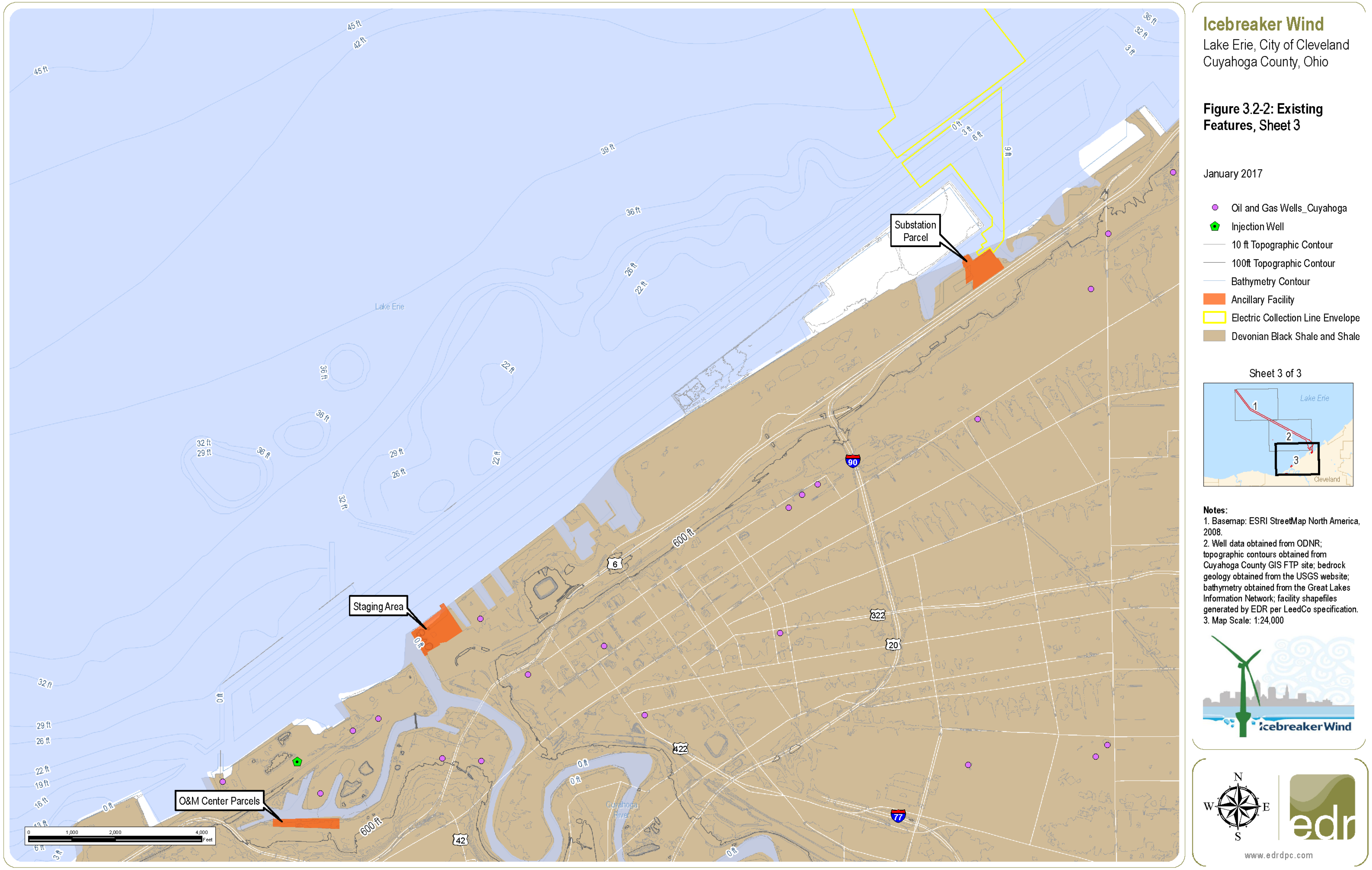


Figure 3.2-2. Existing Features, Sheet 3

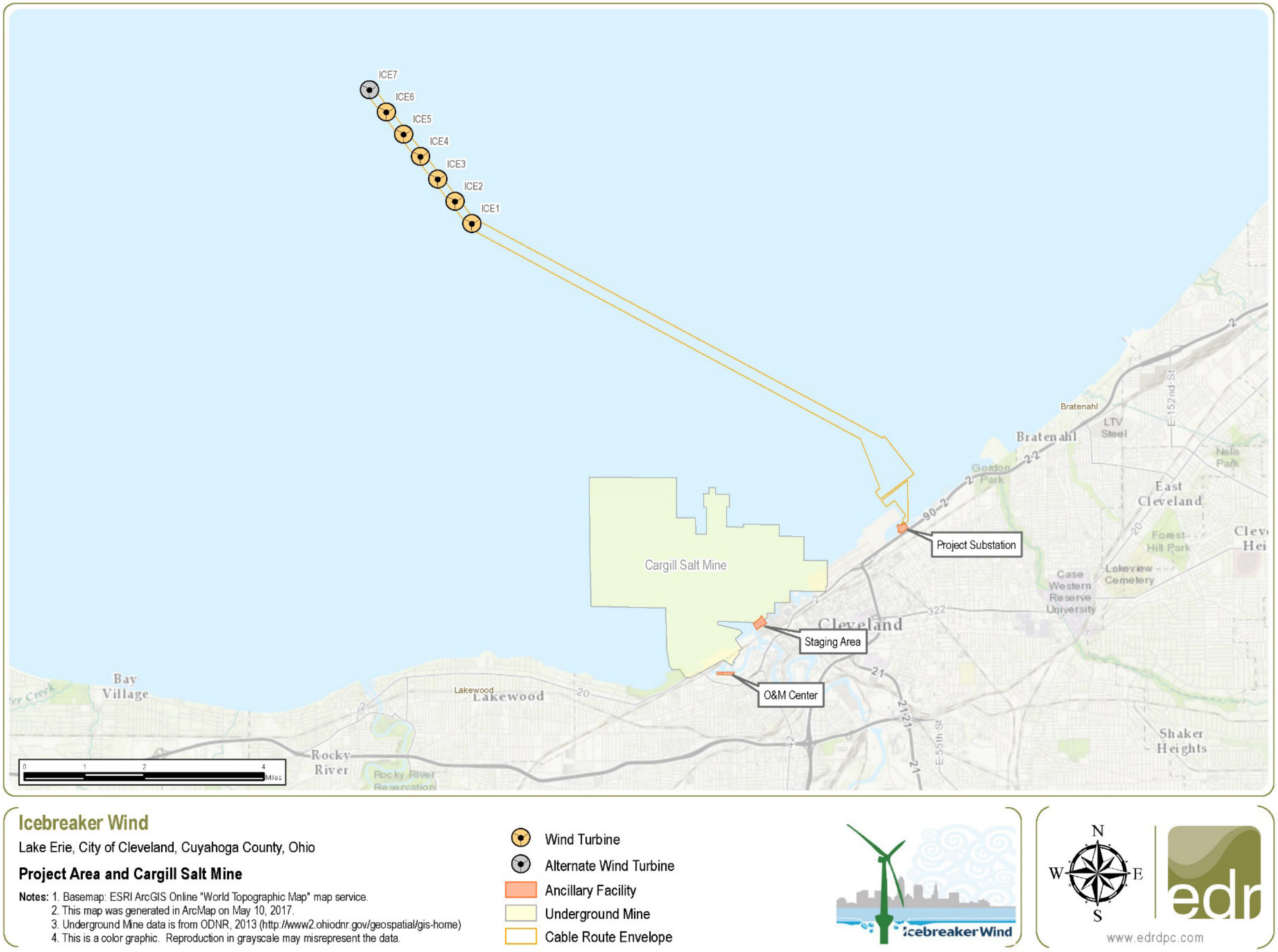


Figure 3.2-3. Location of Cargill Salt Mine in Relation to Proposed Project

Seismicity

Earthquakes of light to weak intensity have been reported near the Proposed Project Area. Most seismic activity in the area is less than magnitude 4, however, events greater than magnitude 4 have been recorded. According to the U.S. Geological Survey (USGS) (2017), earthquakes of magnitude 3 to 3.9 are described as weak (felt quite noticeably by persons indoors, especially on upper floors of buildings; standing motor cars may rock slightly; vibrations are similar to the passing of a truck). Earthquakes of magnitude 4 to 4.9 are described as light (felt indoors by many and outdoors by few during the day; at night, some people are awakened and dishes, windows, doors may be disturbed; the sensation is like a heavy truck striking a building). The average elapsed time between earthquakes is much longer in the eastern U.S. compared to the western U.S. The largest seismic event, magnitude 4.9, below the Lake Erie region occurred in Lake County, Ohio in 1986 (Ahmad and Smith, 1988). The epicenter was approximately 30 miles east of the Proposed Project Area. According to the USGS hazard map (2014), peak ground acceleration associated with a 2 percent probability of occurrence over a 50-year period is between 0.10 to 0.14 gravity (Appendix F-2). These hazard maps represent earthquake ground motion in terms of peak acceleration, defined as a percent of gravity, that have a common given probability of being exceeded in a defined number of years. These maps are employed to assess the probabilistic seismicity and provide information used to develop design provisions for building codes in the U.S. to ensure safe structures in regard to seismicity. The codes provide design standards that apply to wind towers[10].

3.2.1.3 Land-Based Topography and Elevation

Figure 3.2-2 (sheet 3) depicts the land-based geological features of the Proposed Project, topographic contours, and oil and gas wells. The land-based components of the Proposed Project would be located at or near the Lake Erie shoreline, which has a relatively flat topography and an elevation approximately 600 feet above mean sea level.

3.2.1.4 Land-Based Geology and Soils

Land components of the Proposed Project would occur on currently developed land at or near the Lake Erie shoreline within the region known as the Erie Lake Plain. The Erie Lake Plain is comprised of lacustrine deposits and glacial drift. Glacial drift consists of varying amounts of gravel, sand, silt, and clay. Bedrock underlying the unconsolidated material beneath the Proposed Project Area is Devonian Age Ohio Shale and is reported to be several hundred feet below ground surface based on a review of Glacial and Surficial Geology of Cuyahoga County, Ohio maps prepared by the Division of Geological Survey (Hull & Associates, 2016). A geotechnical and subsurface exploration was completed to inform the design of the Proposed Substation (Appendix H).

Results of the subsurface exploration at the Proposed Substation show the area's upper surface consists of a gravel base and asphalt at some locations. Fill material was encountered from ground surface to a depth of approximately 29 to 35 feet below ground surface at boring locations. The fill material consisted of non-plastic silt and sand with varying amounts of wood, gravel, brick, slag, and coal fragments, with occasional zones of lean clay. The Lake Road Substation site was formerly submerged within Lake Erie. Based on review of historical USGS topographic maps, it appears the fill was placed directly on the lacustrine deposits to create developable land.

---

[10] The Proposed Project would be required to comply with all applicable building codes.

The subsurface investigation showed that soft to medium stiff lacustrine clay was present below the fill. This clay extended to the termination depth of the borings. In general, the first 5 to 15 feet of lacustrine clay deposits directly below the fill (approximately 35 to 50 feet below ground surface), was described as a non-plastic silt or silt sand and generally was not dense. Hull & Associates (2016) indicate that this is probably the former lakebed within the harbor. Bedrock was not encountered in any of the borings because it is anticipated to be over 150 feet below ground in this region.

3.2.2 Environmental Impacts Related to Physical Resources

3.2.2.1 Lake-Bathymetry

There would be no adverse or beneficial impacts, over the short- or long-term, to lake bathymetry from construction or operational activities associated with the Proposed Project.

3.2.2.2 Lake-Based Geology and Sediments

Construction

<u>Mono Bucket Foundations</u>

The MB foundation would not require site clearing, dredging, or drilling. The MB installation process would extract and discharge approximately 4,000 cubic yards of lake water from inside the bucket. Sediments from the top 0.1 to 0.3 meter (0.3 to 0.99 foot) of the lakebed could be sucked into the pump and become entrained in the discharge water during approximately the last meter of the penetration process. Water and the vast majority of suspended sediment removed during the MB installation would be pumped from the inside of the bucket back on to the lid of the MB. The quantity of sediment that would be pumped out may vary by location and the particular composition of the sediment at each of the six turbine sites. Finer grained sediments would become more easily entrained in the discharge water when compared to coarser grained sediments. The amount of sediment that might become entrained in the discharge water and released from the exhaust port is anticipated to be up to 69.8 cubic meters (91.3 cubic yards) per MB, or an estimated total of 419 cubic meters (548 cubic yards) for the six MB foundations. The vast majority of the sediment would return to the lakebed on top of the MB lid, with a small amount possibly falling beyond the lid's diameter. Refer to Section 2.2.3.1 for detailed information on the MB installation process. The water and sediment pumped out would remain in the lake and any sediment removed and replaced would be expected to settle back to the lakebed.

The jack-up vessel used for heavy lift operations would have a temporary impact on the lakebed. The heavy lift crane vessel used for the foundation installation may or may not have jack-up legs, while the heavy lift crane vessel used for the turbine installation would likely have jack-up legs with pads that would secure its position in the lakebed. Depending on the vessel used, the maximum pad dimension anticipated is 34 feet by 18 feet (612 square feet) per leg. Assuming six pads, this results in a maximum direct area of disturbance of just under 4,000 square feet or less than 0.1 acre per turbine, or 0.6 acre for all six turbines. Movement of jack up legs could result in the suspension of lakebed sediments. Once the jack-up vessel is moved from a proposed turbine site, the location of legs would remain as a small depression that would fill in over time. The impacts would be minor, localized, and short-term in nature. If a dynamic positioning vessel is used to perform the foundation heavy lift operations, there would be no direct impact to the lakebed because dynamic positioning vessels do not require anchor placement and do not make direct contact with the bottom.

There would be no adverse or beneficial impacts, over the short- or long-term, to the salt mine or seismicity that would result from MB foundation construction activities associated with the Proposed Project.

Cable Installation

Construction activities would temporarily impact the lakebed through burial of the inter-array cables and export cable. Prior to installing the cable, if any large debris were identified within the cable route envelope, it would be removed with a grapnel hook towed behind a small work boat. The grapnel would penetrate the lake bottom to an approximate depth of 1 foot and would disturb sediments and have a minor effect on the lake bottom. The proposed inter-array cables and export cable would be installed beneath the lakebed using a cable plow or jetting tool. Along the proposed cable route, the direct disturbance resulting from cable installation would be approximately 15-feet wide. During installation of the cable, bottom sediment would become suspended within the water column; however, the impact would be minor, short-term, and localized. Lake Erie has low current velocities; therefore, bottom sediments suspended during jetting installation would be expected to settle back to the lake bottom with minimal transport of suspended sediments from the localized area. The temporary increase in suspended sediments and its impact to water quality is described in Section 3.3.2.1.

There would be no adverse or beneficial impacts, over the short- or long-term, to the salt mine or seismicity that would result from cable construction activities associated with the Proposed Project.

Operation and Maintenance

Operation and maintenance of the proposed turbines would not affect lake-based geology or sediments because any activities would occur at the lake surface and within the turbine.

The proposed inter-array and export cables do not contain any fluid. There would be no risk to the environment if they are disturbed by anchors or keels because no fluids or materials would be released. However, operation of the proposed inter-array cables and export cable may cause a minor increase in the temperature of the sediment immediately surrounding the cable. No other operational impacts would affect lake-based geology or sediments.

Maintenance repairs could require the proposed inter-array cables or export cable to be unearthed, which would affect lake bottom sediments similar to construction. These effects would occur infrequently and in smaller areas than initial construction and would therefore be negligible.

There would be no adverse or beneficial impacts, over the short- or long-term, to lake bathymetry or the salt mine that would result from operations and maintenance activities associated with the Proposed Project. Due to low levels of seismic activity and the Proposed Project being designed in accordance with codes developed based on seismicity, the seismic risk to the Proposed Project is low.

Decommissioning

The MB foundations would be de-installed by reversing the suction process utilized during the installation. Pressure would be applied to the bucket and water would be pumped into the bucket. The pressure inside the bucket would lift the bucket out of the sediment, temporarily suspending sediments in the area, resulting in minor, short-term, and localized impacts.

During decommissioning, the cables would be de-energized, thus rendered inactive, and would remain buried. The cables are heavy (> 15 lbs./ft.) and would not be expected to migrate to the surface of the lakebed. It is anticipated that they would continue to self-bury over time. Following decommissioning, there would be no risk to the environment if they are disturbed by anchors or keels because no fluids or materials would be released. In addition, the cables would pose no hazard to the vessels themselves because they would be de-energized and would not have an electric current. Therefore, the export cable and inter-array cables would have no impact on lake-based geology or sediments during decommissioning.

There would be no adverse or beneficial impacts, over the short- or long-term, to lake bathymetry, the salt mine, or seismicity that would result from decommissioning activities associated with the Proposed Project.

3.2.2.3 Land-Based Geology and Soils

There would be no adverse or beneficial impacts, over the short- or long-term, to land-based topography and elevation that would result from construction, operations, maintenance, or decommissioning activities associated with the Proposed Project.

Construction
The Proposed Substation would have a footprint of 0.22 acre within a currently developed area. The entire Proposed Substation area would be excavated to a depth of approximately 3 feet for the installation of the Proposed Substation grounding grid. All unused excavated backfill would be removed from the site for appropriate upland disposal. There would be long-term impacts at the Proposed Substation from construction of the Proposed Project; however, impacts would be minor as the site consists of previously disturbed, fill material.

Operation and Maintenance
Operation and maintenance of the Proposed Substation would have no impact to land-based geology or soils.

Decommissioning
During decommissioning, the Proposed Substation would be de-energized, as well as disconnected and isolated from the grid interconnection. There would be no impacts to land-based geology or soils from decommissioning of the Proposed Project.

3.2.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.3 Water Resources

3.3.1 Affected Environment

Surface water bodies in the Proposed Project Area include Lake Erie[11], the Cuyahoga River, and the Old River. Lake Erie is the southernmost of the five Great Lakes with surface water flowing eventually into the Atlantic Ocean through the St. Lawrence River (Michigan Sea Grant, 2017). As the shallowest and smallest of the Great Lakes by volume, water retention or replacement is 2.7 years for Lake Erie, compared to 6 to 173 years for the other Great Lakes (NOAA, 2017a). The Proposed Project would be located within the central basin region of Lake Erie, as discussed in Section 3.2.1.1. The Cuyahoga River flows northwest,

[11] The International Joint Commission (IJC) reviews applications for projects that may affect natural level and flow of water across borders within the Great Lakes. The U.S. State Department and Global Affairs Canada determined that the Proposed Project would not require approval under the Boundary Waters Treaty and therefore would not require further action with the IJC.

discharging into Lake Erie through an artificial channel. The Old River is a portion of the original Cuyahoga River channel, which drains into the Cuyahoga near the outlet to Lake Erie.

3.3.1.1 Lake Water Quality

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 (OEPA, 2014a). The report compares available data 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. The current assessment of Lake Erie is focused on attainment of standards within the coastal waters only (OEPA, 2014a).

The aquatic life use of the Lake Erie shoreline is currently considered impaired, due to nutrient and sediment loadings from tributaries, the proliferation of exotic species, algal blooms, and shoreline habitat modifications. The same nutrients that cause the aquatic life impairments are also a major contributing factor to harmful algal blooms, which are currently one of the most serious issues in Lake Erie (OEPA, 2014a). Specifically, phosphorus is recognized as the limiting nutrient in feeding algal blooms, meaning when all phosphorus is used, plant growth will cease, no matter how much nitrogen is available.

Preconstruction surveys of Lake Erie water chemistry were conducted from May to October 2016 by LimnoTech (Appendix E-1). Discrete grab sampling for water chemistry and clarity were conducted once a month from May to October 2016 at six reference locations (Ref 1-6) and three proposed turbine locations (ICE 2, 4, 6), as shown in Figure 3.3-1. Samples were collected for nitrogen, phosphorus, and chlorophyll-a analysis. A Secchi disk was used to measure water clarity, and a specialized light meter was used to determine light extinction. Temperature, dissolved oxygen (DO), conductivity, turbidity, chlorophyll-a, blue-green algae, and pH were measured at the six reference stations and all proposed turbine locations once monthly from June through October 2016. Continuous water chemistry sensors were deployed at one reference station (Ref 1) and one proposed turbine location (ICE 4) to monitor the amount of light available for photosynthesis, water temperature, and DO. In July and August, sensors were added to turbine locations ICE 1, 2, and 7 for monitoring of DO and water temperature. DO and temperature data were also retrieved from nearby buoys (45164 and 45176) to provide additional nearshore and offshore data. Figure 3.3-1 depicts the water monitoring gauging stations used in collecting preconstruction survey data.

Water chemistry parameters decreased from May to October except for phosphorus and chlorophyll-a, which began to increase in October. Average monthly water clarity was 6.5 feet in May before increasing to 24 feet in July and afterwards decreasing to 10.3 feet in October. Lake bottom DO continually dropped until water became anoxic (devoid of oxygen) in early August and did not permanently oxygenate until late-September. Weekly fluctuations in bottom lake temperature increased from offshore to nearshore as temperatures increased until the water column mixed in late-September. Surface water temperatures had little deviation from nearshore to offshore throughout the survey. Details of the preconstruction survey results are described in Appendix E-1.

Water chemistry sampling (discrete and continuous) similar to the 2016 surveys was completed by LimnoTech in 2017 (May to October). No yearly trends in water chemistry parameters were observed from May to October, unlike the 2016 results. Average monthly water clarity was 7.6 feet in May before increasing to 18.8 feet in July and afterwards decreasing to 8.3 feet in October. Bottom DO continually dropped until water became anoxic first in late-July and did not permanently oxygenate until October 1. Bottom lake temperature increased ten degrees Celsius at ICE4 and REF1 throughout the 2017 deployment with daily fluctuations due to strong wind events that mixed the water column (Appendix E-2).

3.3.1.2 Drinking Water Supply and Quality

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 (OEPA, 2003). Two intakes for the City of Cleveland Division of Water that are considered Source Water Protection Areas are located in Lake Erie in the vicinity of the Proposed Project. The intakes are approximately 4 miles offshore. Based on geographic information system (GIS) data, the export cable would be between approximately 2.9 and 3.3 km (1.8 and 2.1 miles) east of the nearest potable water intake (the Cleveland Crib). The proposed turbine sites would be approximately 6.8 km (4.2 miles) northwest of the nearest potable water intake. Figure 3.3-2 shows the location of the water intakes with respect to the Proposed Project.

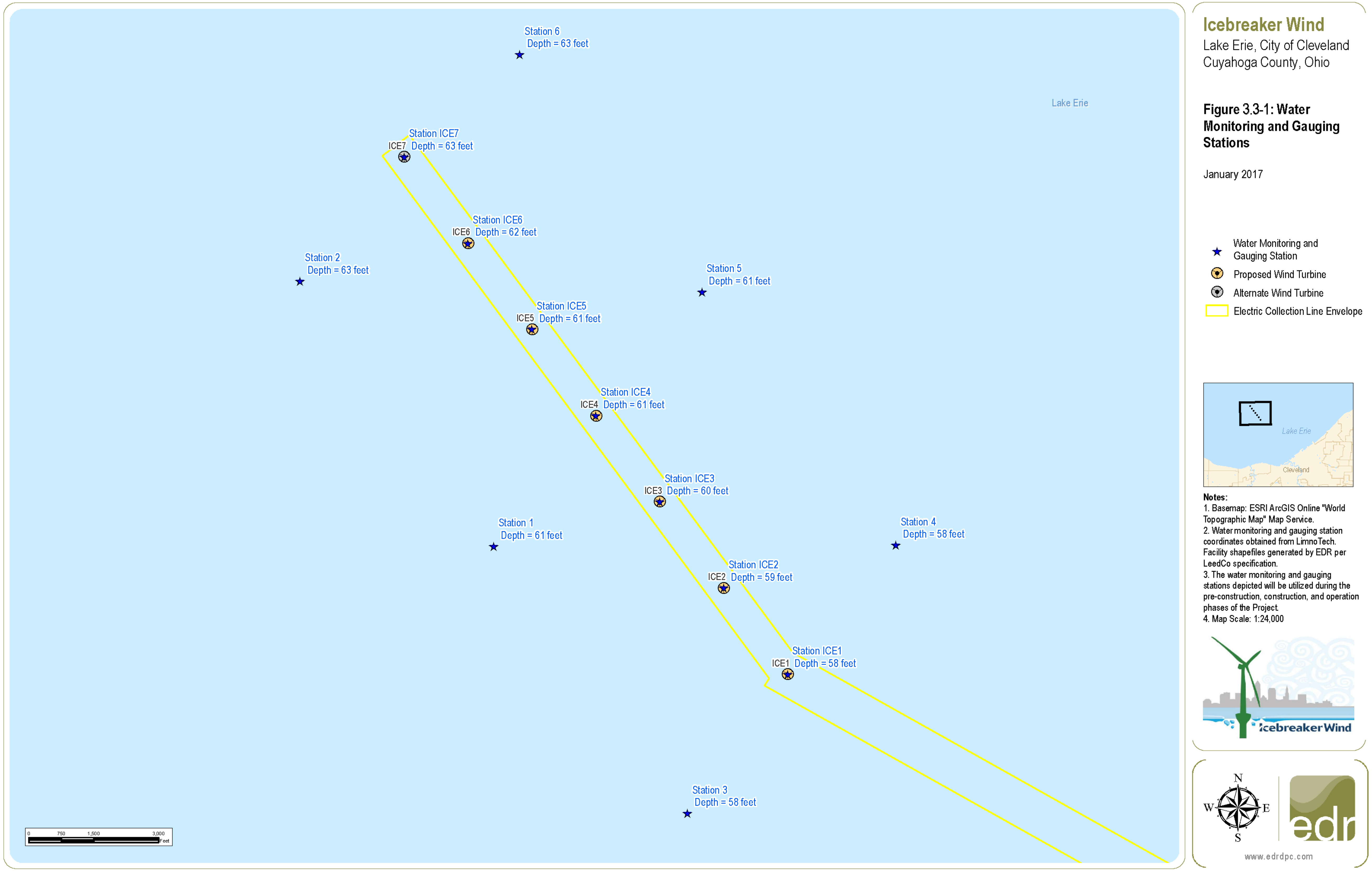


Figure 3.3-1. Water Monitoring and Gauging Stations

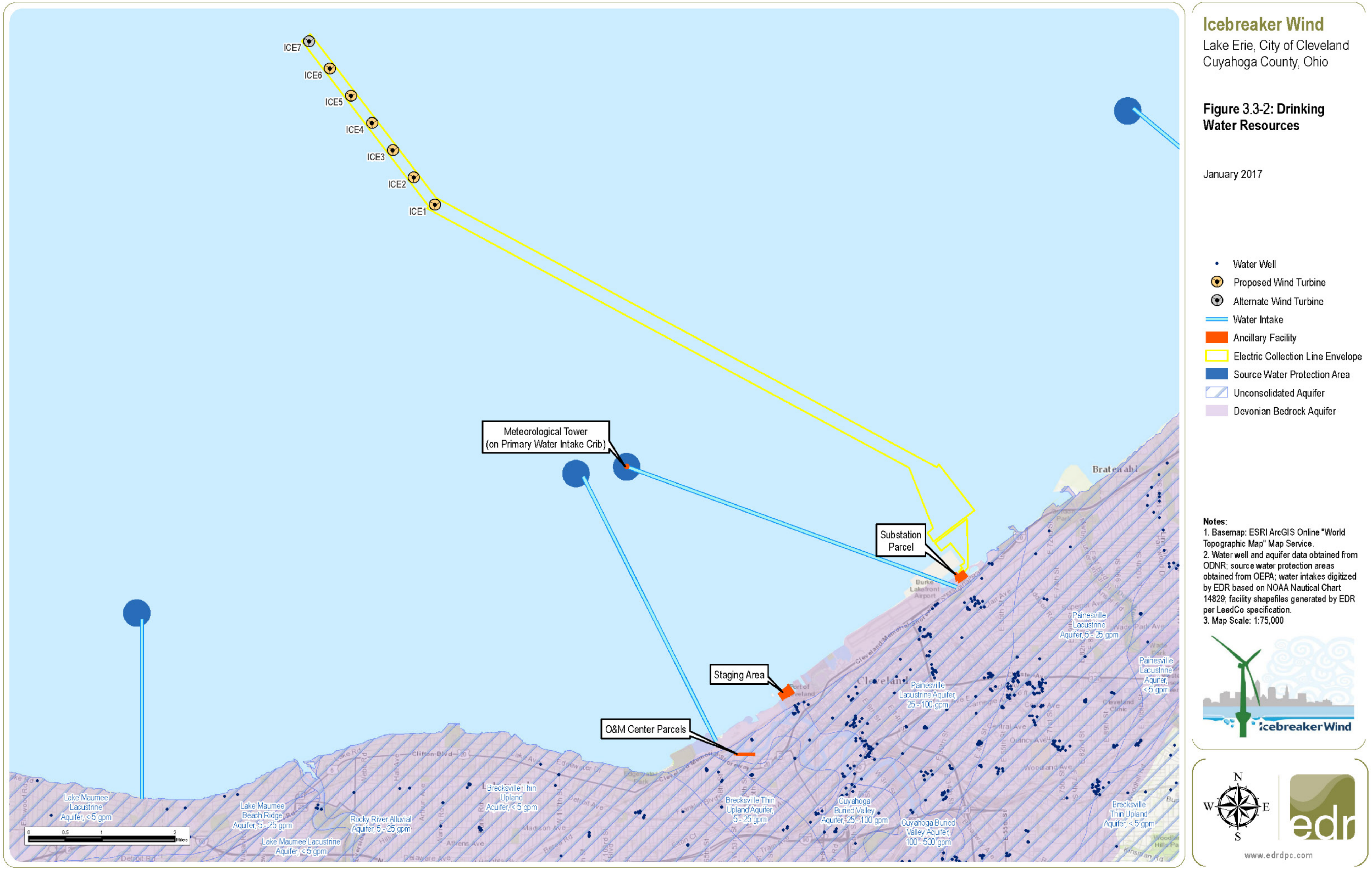


Figure 3.3-2. Drinking Water Resources

3.3.2 Environmental Impacts Related to Water Resources

3.3.2.1 Lake Water Quality

Construction

Installation of the MB turbine foundations would require no site clearing, dredging, or drilling. Sediments from the top 0.1 to 0.3 meter of the lakebed could be sucked into the pump and become entrained in the discharge water during approximately the last meter of the penetration process for the foundation installation. Water and the vast majority of suspended sediment removed during the MB installation would be pumped from the inside of the bucket back on to the lid of the MB. The vast majority of the sediment would return to the lakebed on top of the MB lid, with a small amount possibly falling beyond the lid's diameter. This process would result in minimal localized suspension of bottom sediments in the immediate vicinity of each MB foundation and would have a negligible impact on water quality. Refer to Section 3.2.2.2 for more information on sediments.

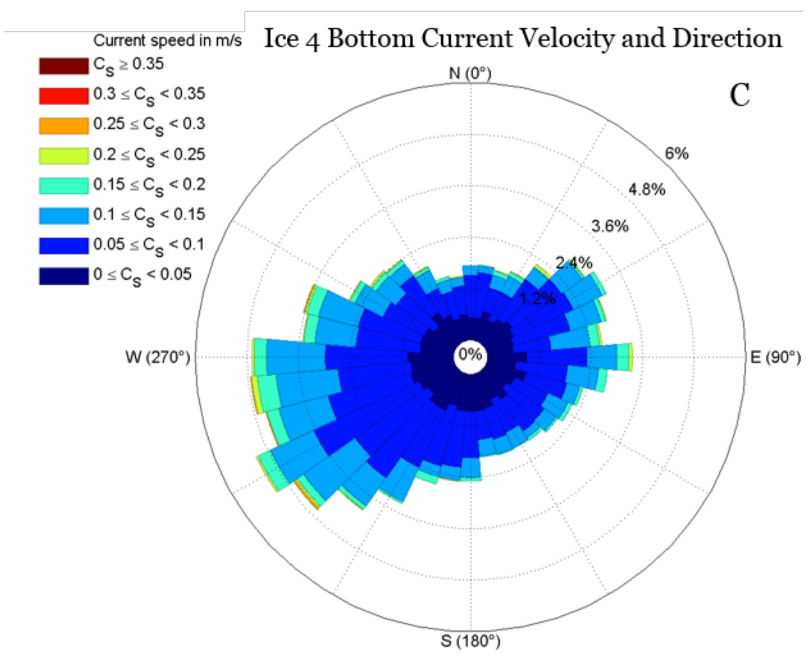
Additionally, the jack-up vessel to be used during installation of turbine components, and possibly the foundations, could result in the suspension of lakebed sediments when the jack-up legs are moved. Similarly, vessel anchoring could also cause minimal suspension of lakebed sediments. These impacts would be minor, localized, and short-term in nature and would have a negligible impact on water quality.

Installation of the submerged electric cables (inter-array and export) would result in short-term, localized sediment suspension. Sediments would be disturbed along the approximately 12-mile length of the inter-array and export cables. Data from a similar project in Lake Erie and site-specific data were analyzed to assess potential suspended sediment impacts resulting from cable installation.

The *Lake Erie Water Quality Modeling Report* prepared by HDR Engineering, Inc. (2015) for a similar project in Lake Erie, the ITC Lake Erie Connector, was reviewed to assess the potential for increases in suspended sediment from the Proposed Project. The ITC Lake Erie Connector (LEC) Project is a proposed cable route approximately 80 miles east of the Proposed Project. The LEC cable route crosses a similar nearshore to offshore bathymetric gradient and water currents and encounters a similar transition from sandy nearshore sediments to silt and clay offshore sediments as the Proposed Project. Modeling conducted for the LEC Project predicted that the highest total suspended solids (TSS) concentrations would occur around the point of cable installation and then decrease rapidly as distance from the installation area increases. At a lateral distance of 30 meters (98 feet) from the cable installation point, the maximum re-suspended TSS concentration increases were predicted to be less than 100 milligrams per liter (mg/L) above background conditions and at 100 meters (328 feet) from the cable installation point, the TSS concentration increases were predicted to be less than 3 mg/L above background conditions. TSS concentrations were predicted to drop to 100 mg/L above background TSS levels within the first hour and to less than 3 mg/L above background TSS levels within 1 to 4 hours, depending on the representative location. In the vertical direction, the model predicted that increased TSS concentrations would be limited to the bottom 5 to 11 meters (16 to 36 feet) of the water column depending on the representative location. Above these depths, the model predicted TSS concentrations of less than 3 mg/L above background conditions. Similar short-term and localized increases in TSS are expected to occur during installation of the proposed inter-array and export cables.

A variety of site-specific factors can affect the concentration and transport of suspended sediment, including the specific type of sediments and the speed and direction of water currents. Depending largely on the quantity of fine-grained sediments suspended and the properties of those sediments after suspension, sediments suspended during cable installation could remain concentrated above background levels for minutes to many hours after installation. Near the proposed turbine locations and within 2 km (1.2 miles) of the proposed turbines, surficial sediments are fine grained and typically composed of 34 to 58 percent clay, 34 to 50 percent silt, and less than 8 to 17 percent sand and gravel (Canadian Seabed Research Ltd., 2016). Along much of the proposed export cable route (i.e. from shore to 8 miles offshore), surficial sediments are sandy sediments, which, when suspended during cable installation, would settle immediately adjacent to the trench carrying the cable. Pockets of finer-grained sediments also exist along some portions of the proposed export cable route. These finer-grained sediments would remain suspended longer and travel farther than sands. Re-suspended fine-grained surficial sediments would tend to be re-suspended as flocs or masses rather than as individual particles. Consistent with this, the minimum settling rate of sediments could range from 1 meter per day (for floc settling of fine grain material) to over 100 meters per day (for coarse sand).

Ambient currents were monitored in 2016 as part of the Pre-Construction Monitoring study being conducted by LimnoTech (Appendix E-1). Lake currents from May to October 2016 were more frequently directed toward the southwest than to the northeast. Figure 3.3-3 shows a summary of current direction measurements near the bottom of the lake at the proposed turbine sites (ICE4). Typical persistent current speeds are low (about 4 centimeters per second). At this average current speed, fine grained sediments (with slow settling rates) could travel 3.5 km (2.2 miles) in 1 day if their characteristics are such that they remain suspended for this duration.



Note: Spokes represent the frequency of currents moving towards a particular direction.

Figure 3.3-3. 2016 Lake Bottom Current Velocity and Direction at ICE4

Ice scouring during winter months frequently creates large cuts and scars in the sediment bed that disturb sediment and displace aquatic life (USACE-ERDC, 2000). Wind-driven resuspension can also increase ambient turbidity levels well above background levels. The National Aeronautics and Space Administration's (NASA's) earth observatory describes an event from 2015 (Figure 3.3-4), which shows widespread increases in turbidity across Lake Erie (NASA, 2015). Natural fluctuations in turbidity have also been measured by the City of Cleveland at their water intake cribs in Lake Erie (Moegling, 2017, pers.

comm.). Figure 3.3-5 shows the daily average of turbidity measurements from two of the four water intakes (Morgan and Baldwin) located approximately 4 miles offshore during the 2016/2017 season. Frequent turbidity spikes were observed at both intake locations. Further information on water quality impacts to drinking water is described in Section 3.3.2.2.

Figure 3.3-4. NASA Satellite Image from November 25, 2015 Showing Widespread Sediment Re-suspension Across Lake Erie

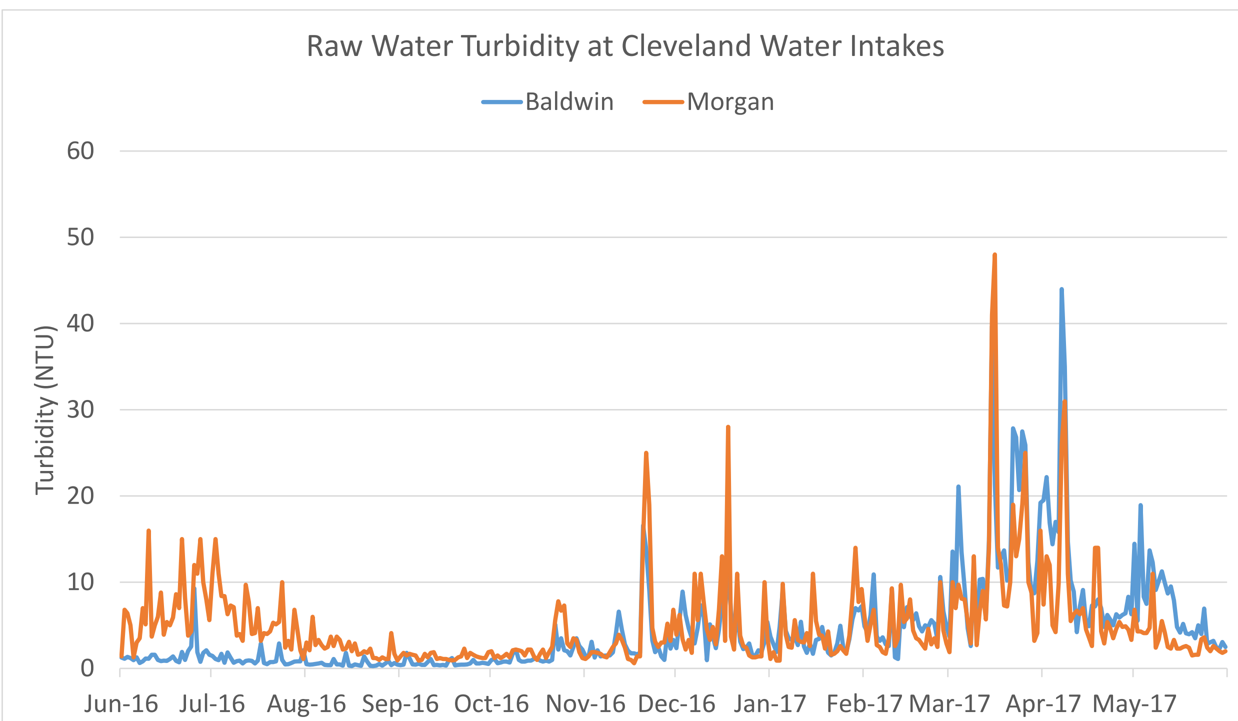


Figure 3.3-5. Turbidity Measurements at Two Cleveland Area Water Intake Cribs from June 2016 to May 2017

Significant turbidity increases in Lake Erie are also regularly caused by the passage of large tonnage lake carriers that frequent the Cleveland Harbor. Figure 3.3-6 shows the type of sediment disturbance that can take place as large ships move closer to shore along the designated shipping lanes. This image was captured on June 2, 2017 on Lake Erie by Aerial Associates of Ann Arbor during LEEDCo's recreational boat surveys that are being conducted for ODNR. In a given year, approximately 1,000 ships pass in and out of Cleveland (Port of Cleveland, 2017).

Figure 3.3-6. Aerial Image from June 2, 2017 on Lake Erie Showing Sediment Disturbance from Passing Ships

Installing the foundations during the summer would lower transport distances of re-suspended sediments because a thermocline (sharp change in water temperature and density) has been observed at the proposed turbine locations during summer months. The thermocline reduces the potential for sediments to be mixed higher in the water column and would also reduce the travel distance of re-suspended sediments. Short-term and localized increases in TSS are expected to occur during installation of the proposed inter-array and export cables similar to or less than those increases that already occur in this part of Lake Erie.

In addition to a temporary increase in turbidity and suspended sediment concentrations during the construction phase of the Proposed Project, temporary impacts to water quality from the disturbance of potentially contaminated sediment may occur. As described in Section 3.2.1.2, Lake Erie bottom sediments in areas offshore of Cleveland may contain elevated levels of contaminants, including metals, hydrocarbons, and PCBs. Limited bottom sediment samples were collected during a site-specific geotechnical survey in the vicinity of the proposed turbine sites and export cable route. Sediment results were compared to ecological sediment quality guidelines following the process outlined in OEPA's *Guidance on Evaluating Sediment Contaminant Results* (OEPA, 2010). Results from this evaluation indicate that existing sediment quality at these four locations would pose a low potential for toxicity to aquatic receptors (Appendix G-1). Mobilization of potentially contaminated sediments could have a temporary indirect impact on water quality in the immediate vicinity of Proposed Project activities, primarily related to increased turbidity/suspended sediment; however, these impacts would be short-term, localized, and minor when compared to the surrounding natural sediment and water quality conditions in the Proposed Project Area.

Multiple vessels would be used during the construction of the Proposed Project. All vessels would comply with USCG requirements for management of onboard fluids and fuels, including maintaining and implementing SPCC plans. Refer to Section 2.6, Applicant Committed Measures, regarding Proposed Project SPCC plans. The likelihood of spills would be low and impacts to water quality are unlikely.

The proposed export cable would be brought ashore under the Cleveland Harbor and the associated breakwater through a duct installed using HDD. Drilling operations would use drilling fluids to stabilize the bore hole and to lubricate the drilling process. The proposed drilling mud (a clay-based compound such as Bentonite) is National Sanitation Foundation-approved for drinking water applications such as water wells. The HDD contractor would take precautions to minimize or avoid a drilling fluid leak. An Inadvertent Return Contingency Plan has been prepared for the Proposed Project to address the potential risk of an inadvertent release of drilling fluids (refer to Appendix G-2, Inadvertent Return Contingency Plan). If drilling fluid were to be inadvertently released during HDD activities, bentonite clay could become suspended in the lake and disperse in close proximity to HDD activities, which may cause temporary, local increases in turbidity. Overall impacts to water quality from such an inadvertent release would be minor and short-term.

In summary, there would be minimal sediment disturbance and impacts to the quality of Lake Erie surface waters associated with foundation installation. Sediment dispersion from cable burial is anticipated to be localized and short term, as sediment is expected to resettle and return to background levels shortly after cable burial is complete. Water quality impacts from inadvertent spills from vessels or bentonite release from HDD activities would be minimized through use of a SPCC and Inadvertent Return Contingency Plan. Therefore, impacts to water quality from construction of the Proposed Project would be minor and short-term.

Operations and Maintenance

The operation of the Proposed Project is not anticipated to generate any sources of pollutants to Lake Erie. To make sure that no discharges of any fluids (oil, hydraulic, cooling, etc.) occur even under abnormal circumstances, the turbine would be designed for three levels of containment as described in more detail in Section 2.2.2.1. The fluids associated with operations and maintenance (oil, hydraulic, cooling, etc.) are biodegradable, capable of being decomposed or broken down by the action of living things (such as microorganisms). Most maintenance would occur inside the turbines, thereby reducing the risk of a spill, and no oils or other waste would be intentionally discharged during service events. In the extremely rare incident of failure of all three containment systems or a spill during a service event, any fluid that may leak into the environment would be biodegradable. The original coating system on the towers is designed to last the lifetime of the structure; therefore, no painting would be necessary during the life of the turbines other than to repair minor surface damage. As a result, impacts to surface water quality during operations and maintenance would be negligible.

As with vessels associated with construction, any vessels used for operations and maintenance activities (approximately one per week) would comply with USCG requirements for management of onboard fluids and fuels, including maintaining and implementing SPCC plans. Refer to Section 2.6, Applicant Committed Measures, regarding Proposed Project SPCC plans. The likelihood of spills would be low and impacts to water quality are unlikely.

The proposed inter-array and export cables do not contain any fluid. There would be no risk to the environment if they are disturbed by anchors or keels because no fluids or materials would be released. However, operation of the proposed inter-array and export cables may cause an increase in water temperature because of the heat generated as electricity moves through the cable. A thermal analysis was completed by DOE as part of the LEC Project, a proposed cable route approximately 80 miles east of the Proposed Project. The proposed 1-gigawatt cable associated with the LEC is substantially more powerful than the Proposed Project's export cable. It was estimated for the LEC Project that the temperature at the water and sediment interface on the lakebed could increase a maximum of 4.4 degrees Fahrenheit (°F) during operations with the area of greatest temperature increase approximately 9 inches from the centerline of the proposed transmission cable in the down current direction of water flow. The physical extent of this temperature increase region is limited; dropping to a 0.2°F increase at only 4 inches from the warmed region (DOE, 2016). Effects on water temperature because of the presence and operation of the proposed inter-array or export cable would be negligible.

If maintenance or an emergency repair of the inter-array or export cables is required, the effects would be limited to the immediate area of the repair site. During repair activity, the cable would be exposed, spliced with a new section, and reburied. Effects on water quality would only include local increases in turbidity and resuspension of sediments. Effects would be similar or less impactful to those of original installation.

Decommissioning

The removal of the MB foundations would be conducted by reversing the suction process utilized during the installation. Pressure would be applied to the bucket and water would be pumped into the bucket. The pressure inside the bucket would lift the bucket out of the sediment, temporarily suspending sediments in the area. Adverse impacts to water quality associated with sediment suspension resulting from the decommissioning phase of the Proposed Project would be similar to those during installation and therefore are likely to be short-term, localized, and minor.

The proposed export cable and inter-array cables would remain buried well below the surface of lake bottom sediments and therefore would have no impact on water quality from sediment suspension during decommissioning. Because the proposed export cable and inter-array cables do not contain any fluid, following decommissioning, there would be no risk to the environment if they are disturbed by anchors or keels or other sediment disturbing activity because no fluids or materials would be released.

Fuel spills or leaks from vessels and deconstruction equipment could also occur but would be unlikely because of secondary containment systems and SPCC plans. Similar to construction and maintenance, potential adverse impacts associated with fluids or spills resulting from the decommissioning phase of the Proposed Project would likely be minor and short-term.

3.3.2.2 Drinking Water Supply and Quality

Construction

The closest water intake and associated Source Water Protection Area (1,000-foot radius around the intake), shown in Figure 3.3-2, is between approximately 2.9 and 3.3 km (1.8 and 2.1 miles) from the proposed export cable and approximately 6.8 km (4.2 miles) from the closest proposed turbine. The potential for impacting water quality at the intakes depends on the prevailing lake currents during installation, precise type of sediment encountered along the proposed cable route, installation method (e.g., ship speed, trench depth/width, jet nozzle configuration), water intake design, and water plant pumping characteristics. During discussions with Cleveland Water, staff stated that they frequently deal with natural increases in suspended sediment, or turbidity, at their intakes. The Cleveland Water conventional surface water treatment plant removes turbidity continuously as part of their treatment process to clarify and disinfect water (clarification to remove particulates, filtration to remove finest of particles and some dissolved chemicals if biological filtration is occurring, and disinfection with chlorine). The range of turbidity to be removed is part of the design process and uses worst case scenarios (from historical turbidity data) to establish the design capacities (Moegling, 2017, pers. comm.). Figure 3.3-5 shows the range of turbidity measured at their two intakes closest to the export cable route. It ranges from very low (under 10 nephelometric turbidity units

[NTU]) to very high (30 to 50 NTU and higher), typically after a rain event or very choppy conditions on Lake Erie. The Cleveland Water treatment plant is large and therefore can handle most short-term variations in turbidity from within the plant. For longer term events, Cleveland Water may adjust doses within the treatment process (Moegling, 2017, pers. comm.).

In addition, the configuration of the two water intakes only begins to let water flow in at depths of 5 to 10 feet above the lakebed, further limiting potential impacts. Water current data collected by LimnoTech, shown in Figure 3.3-3, show that water currents could carry sediments in the direction of the intakes and surficial sediment data from Canadian Seabed Research Ltd. (2016) show that areas of fine-grained sediment are located along the proposed export cable route in the region near the intakes.

To avoid potential impacts to the water intakes during cable installation, LEEDCo would work with the selected cable installation contractors to monitor and mitigate the amount of suspended sediment during cable installation. This would include careful review of selected contractor's equipment and installation method, initial monitoring of cable installation to ensure minimal impact, and adjustments to installation speed or jet pressure to limit suspension. There would be no impacts to drinking water supply and quality from construction of the Proposed Project.

LEEDCo would continue discussions with the City of Cleveland and develop a communications and monitoring plan that would inform Cleveland Water plant operators of construction schedule and provide field measurements of turbidity to optimize water treatment plant operation (as would occur under regular operating conditions during storm events). Refer to Section 2.6.8, (Applicant Committed Measures) Water Quality, for additional details regarding agreements reached with Cleveland Water. These precautions and mitigation measures would further reduce the potential for any negative impacts on drinking water supply. Any temporary impacts from increased suspended sediments would be expected to mirror other naturally occurring sediment resuspension events on Lake Erie.

Water and sewage from construction vessels would be emptied and disposed of at the Port. LEEDCo would use the existing infrastructure at the Port for disposal of water and sewage from construction activities. Therefore, no impacts or contamination to water supply would result from these activities.

Operations and Maintenance

The operation of the Proposed Project is not anticipated to impact public water supplies or quality. As stated above, the proposed turbines and the export cable would be located more than 4 and 1.8 miles respectively from the closest water intake, and with the general Lake Erie flow, the Proposed Project would be located down current from the water intakes. As discussed previously and in Section 3.5, any vessels used for operations and maintenance activities (approximately one per week) would comply with USCG regulations and applicable SPCC plans.

The current building proposed for the O&M Center has existing water, effluent, and sewage lines in place for full facilities (restrooms, showers, etc.). No modifications to the existing water, effluent, and sewage lines at any of the above facilities are anticipated for the Proposed Project.

Decommissioning

Similar to construction, there would be no impacts to water supply or quality during decommissioning.

3.3.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.4 Biological Resources

3.4.1 Affected Environment

3.4.1.1 Benthos

Benthic macroinvertebrates (small aquatic animals living among stones, sediments, and aquatic plants on the bottom of lakes, rivers, and streams) are very sensitive to water quality, often reflect changing environmental conditions, and serve as an important food source for fish. Benthic samples were collected by LimnoTech in conjunction with zooplankton and phytoplankton sampling at three locations (two proposed turbine locations and one reference location) once in May 2016 and once in October 2016. All benthos collected in May 2016 fell into three main classes: Bivalvia (aquatic mollusks with a hinged shell such as mussels), Insecta (insects), and Oligochaeta (worms). Most benthos collected in October 2016 fell into the same three groups, though a few crustaceans and nematodes (roundworms) were also collected in October 2016. The densities of benthos were relatively consistent across the three sampling locations during the May 2016 and October 2016 sampling events (Appendix E-1).

Additional benthos samples were collected in May and October 2017. Consistent with the 2016 samples, the benthos collected fell into the same three main groups, Bivalves, Insecta, and Oligochaeta, with a few crustaceans, mollusks, and leeches. Their densities were relatively consistent across the three locations but densities in May were nearly double the density in October 2017. This difference was partially driven by Chironomid (an insect larvae) density (Appendix E-2). The May 2017 sampling event was likely just prior to the emergence of benthos (e.g. Chironomids) from sediment, maximizing the size and number of individuals present and captured in the sample.

The Proposed Project's offshore area consists primarily of silty clay sediments and provides few natural, permanent structures for invertebrates to attach. The featureless, silty bottom sediment likely limits taxa diversity (e.g. mussels) but the absence of intolerant species (e.g. mayflies) is mainly because of extended periods of low dissolved oxygen, typically at or below 2 to 4 mg/L. Dissolved oxygen data collected in 2016 by LimnoTech show the Proposed Project turbine locations located within the Lake Erie Dead Zone. This location may therefore offer poor habitat for macroinvertebrates. The Lake Erie Dead Zone, a large hypoxic zone is in continual flux based on changing factors (e.g., nutrient load, climate); it forms in late summer in the bottom of the central basin of Lake Erie and alters the lake ecosystem from July to October (ODNR, 2015). Invasive Dreissenid mussels (e.g. zebra and quagga mussels) were found as part of the site-specific LimnoTech study. Low summer DO prevents Dreissenid mussel populations from accumulating below the thermocline (about 40 feet deep) (Appendix E-1).

According to recent and historical data, the Lake Erie benthic community has experienced significant changes during the last half-century. The benthic community showed signs of recovery in conjunction with ecosystem restoration following the binational pollution and nutrient abatement program in the 1970s, but experienced major structural and functional changes with the introduction of Dreissenid mussels in the mid-

1980s (Burlakova et al., 2014). The zebra mussel (*Dreissena polymorpha*) and the quagga mussel (*D. bugensis*) were introduced to the Great Lakes in the ballast of shipping barges and have nearly eliminated the native mussel communities in the Great Lakes (DOE, 2016). The Dreissenid mussel invasion appears to have had a larger effect on the benthic community in the lake over the last half-century than all other environmental changes.

3.4.1.2 Fish Resources

The Lake Erie fish community has undergone substantial changes during the last century. While natural processes such as predation, competition, and seasonal hypoxia play a role in determining the fish community, human-induced stressors have played the largest role in the last half century. Historically, the lake supported a species-rich and diverse fish assemblage and has had approximately 130 species documented. However, changes in the Lake Erie fish community caused by multiple stressors including watershed deforestation, contaminants, dams, deterioration of tributary streams, and nutrient enrichment has resulted in the loss of highly valued native species and the growth of invasive species (Ryan et al., 2003).

The Proposed Project is located in Lake Erie's central basin, 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 perch and walleye, with some warm and colder water species present. 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.

The proposed turbine sites are located in the Lake Erie Dead Zone, as described in Section 3.4.1.1, where fish activity may be minimal because of hypoxic (low DO) conditions that are reached in the late summer. The ODNR fish habitat analysis indicated that the proposed turbine sites are not located near any fish spawning reefs or key habitat (Appendix I, Figure 22). Additionally, Ludsin et al. (2014) identified the spawning habitats for 24 fish species, including the most harvested commercial and 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 preferred a near-offshore presence.

In 2016, LimnoTech conducted fish surveys to identify larval and juvenile fish present near the proposed turbine sites. Larval fish were sampled once monthly in May, June, and July of 2016 at three locations (two proposed turbine locations and one reference site). No larval fish were collected in the May or July sampling events and only five larval fish (across nine trawls) were collected in the June sampling event. Overall, across all 29 trawls conducted near the proposed turbine sites in 2016, only five larval fish were collected. A single larval fish trawl was also conducted near the Cleveland Water Intake Crib in June of 2016 to compare the offshore results to a more nearshore location. This nearshore trawl collected 16 larval fish (Appendix E-1). The lack of larval fish in the Proposed Project Area is not surprising given that the proposed turbine sites are located far offshore where there are no preferred spawning habitat grounds and minimal near-shore mixing. The higher number of larval fish collected near the Cleveland Water Intake Crib and closer to shore further supports that there is likely very low larval fish abundance offshore near the proposed turbine sites.

Larval fish were also sampled in 2017. There were no larval fish collected in May, four larval fish collected in June, and three in July. Overall, across all 27 trawls near the proposed turbine sites in 2017, only seven fish were collected. This was similar to the 2016 trawling events where only five fish were collected. A sample was also collected near the Cleveland Water Intake Crib each month, which did not contain any larval fishes (Appendix E-2). This differed from the 2016 sampling where there were 16 larval fish collected nearshore in one trawl. The 2017 results support low larval fish densities at the Proposed Project site due to its distance from shore.

Juvenile fish sampling was conducted in May, August, and October 2016 at the same three locations as the larval fish sampling. 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 the 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). The August event occurred while the thermocline was located 3 to 4 meters (9.8 to 13 feet) off the bottom, resulting in severe hypoxia. However, the hypoxic event had passed in October and the October samples were similar to those collected in the May event being dominated by smelt, followed by white perch and yellow perch. Freshwater drum, walleye, goby, ghost shiner, and white bass were collected in low numbers (Appendix I). 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, 2016a). The full results of the site-specific LimnoTech fish surveys are included in Appendix E-1 and Appendix I.

The juvenile fish sampling was repeated in 2017. In total, across all nine replicate tows, 240 fish were caught in May 2017, as compared to 1,716 fish caught in May 2016. The species composition was fairly consistent across all locations and replicates. Smelt dominated most trawls, followed by white perch, yellow perch, freshwater drum, and round goby. The August event occurred when the thermocline was located roughly 1 meter off the bottom, and 37 total fish were caught, compared to only 7 fish in August 2016. The increase in fish was likely due to the location and thickness of the thermocline, in 2016 it was 3-4 meters off the bottom compared to only one meter in 2017. Smelt made up most of the trawls followed by yellow perch and white perch, with a single walleye caught at ICE2. The thermocline and associated bottom hypoxia had mostly dissipated for the October 2017 event, with a total of 1,770 fish collected. Smelt dominated all trawls, followed by white perch, and yellow perch. Freshwater drum, walleye, goby, ghost shiner and white bass were collected in select trawls in lower numbers (Appendix E-2).

LimnoTech also deployed acoustic monitors to assess whether there were any unique fish densities at the proposed turbine sites and to establish baseline conditions. Hydroacoustic monitoring was performed monthly in May through October 2016 on three transects (one transect down the center of the proposed turbine sites and two transects in nearby areas to serve as a reference). While density among the transects was 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 (Appendix E-1 and Appendix I). This trend is consistent with the lack of fish observed in the August juvenile trawls and follows the depletion in DO concentrations and the seasonal hypoxic event that occurs in the Lake Erie Dead Zone.

3.4.1.3 Birds and Bats

Migratory Birds

Migratory birds are regulated under the MBTA (16 USC 703-712) which prohibits intentionally taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the DOI[12]. The Proposed Project would be located between 8 to 10 miles

---

[12] On December 22, 2017 the DOI Office of the Solicitor issued Opinion M-37050, which finds that, consistent with the text, history, and purpose of the MBTA, the statute's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same apply only to affirmative actions that have as their purpose the taking or killing of migratory birds, their nests, or their eggs (DOI, 2017).

off the coast of Cleveland, a location that provides minimal habitat for birds. Millions of birds migrate through the Great Lakes region during spring and fall migration (Rich et al., 2004; France et al., 2012; Horton et al., 2016). The Proposed Project would be located approximately 4.5 miles from an Audubon Society-designated state IBA, the Cleveland Lakefront IBA. The area was selected as an IBA because of the large concentration of birds that congregate there during spring and fall migration. The Proposed Project would also be located within the Lake Erie Central Basin IBA, which is designated as a Global IBA. This area was selected as an IBA primarily because of the large concentration of red-breasted mergansers and other migratory water birds that use Lake Erie as a migratory stopover site. These, and other migratory birds that use the IBA are discussed in more detail in the following sections. Avian and bat species that are listed under the protection of the federal ESA are discussed further in Section 3.4.1.5.

Bald and Golden Eagles

Bald and golden eagles are protected under the BGEPA (16 USC 668), which prohibits the take of the eagles or any part, nest, or egg. The Proposed Project would be located within the range of the bald eagle (*Haliaeetus leucocephalus*). Bald eagles typically breed and winter in forested areas adjacent to large bodies of water and select large canopy roost trees that are near large waterbodies that stay open during the winter. The Proposed Project Area does not support suitable eagle nesting habitat and typically eagles are unlikely to forage 8 to 10 miles offshore; however, in the winter, eagles will seek open water, potentially covering larger distances that are ice-covered. Eagles are discussed in more detail in the following sections.

Project Area Studies

Several complimentary study techniques and reports were used to characterize and quantify a baseline of bird and bat populations in the Proposed Project Area including spatial and temporal distribution. There are challenges in gathering data on birds and bats in offshore environments. Project-specific baseline studies have been supplemented with available data from other independently performed field studies, surveys, and reviews of publicly available information.

Next-generation radar (NEXRAD) analysis examine NEXRAD weather radar data for the purpose of assessing nocturnal bird and bat migration. Analysis of NEXRAD data for ornithological research depends on separating targets that are most likely to be birds (and/or bats) from other radar targets (Gauthreaux and Belser, 1998). Assumptions must often be made during the analysis regarding wind speed and direction, and movement characteristics of radar targets. NEXRAD data is coarser than surveillance radar data. It is not possible to sample the entire altitudinal ranges of migrants moving through the night sky because of limitations of NEXRAD data. NEXRAD cannot detect targets that are close to the ground except at very close range. Analysis of NEXRAD data is useful, however, for describing variations in migrant density across time and space at the landscape scale and is therefore informative with respect to overall migrant density at the Proposed Project.

Region-wide analysis of NEXRAD was conducted to study nocturnal bird migration patterns for the entirety of spring and fall migratory periods. A central Lake Erie basin study (hereinafter Diehl et al. study) analyzed 1 year (two migratory seasons) of data from 2000. The study demonstrated that density of nocturnally migrating birds was 2.72 times higher over land than over water during the spring migration period in the central Lake Erie basin, where the turbines would be located, and 2.13 times higher over land than over the lake during the fall migration period (Diehl et al., 2003). In 2017, Western EcoSystems Technology, Inc. (WEST) completed a new analysis of nocturnal migrant bird movements over the Proposed Project Area in relation to comparison areas using NEXRAD (Appendix 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. The NEXRAD study by

WEST increased the data for the Proposed Project relative to the Diehl et al. study in three principal ways: 1) the area of study was the Proposed Project Area; 2) the new study used more recent data, from 2013 to 2016; 3) the new study analyzed 3 years (six 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 Proposed Project Area. The surveys involved weekly flights during fall (mid-October through mid-December) and spring (mid-March through mid-May) in 2009-2010 and 2010-2011 with human observers. In total, 725,785 individual bird observations were recorded, representing 51 species (Norris and Lott, 2011). Data from the surveys 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 would be sited. Figure 3.4-1 shows results of total bird observations in relation to distance from shoreline. Specific species are discussed by guild/taxon in the following sections.

Tetra Tech conducted boat-based visual observation surveys in the early morning, early evening, and night during the spring and fall 2010 migration periods to determine species composition, spatial and temporal distribution, relative abundance, and behavior of avifauna in the Proposed Project Area. Surveys were conducted along a single “saw-tooth” transect that covered an 11.1 square km area within an offshore area around the Cleveland Water Intake 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 percent of birds recorded during the spring surveys, and 58 percent of recorded birds during fall surveys (Appendix K).

A 2017-2018 aerial waterfowl and waterbird survey was conducted by WEST to characterize waterfowl and waterbird species, numbers, distribution, and use of the Proposed Project Area from fall to spring, the non-breeding season. The first survey efforts were completed from October 2017 to January 2018 with survey data identifying 11 species within the Proposed Project Area, which was consistent with the ODNR surveys (Norris and Lott, 2011) (Appendix L-2).

The USFWS Avian Radar Team conducted a study during the fall of 2017 to provide data on the use of airspace in the vicinity of Cleveland by aerial migrant birds and bats (Gosse et al, 2018). This data and ongoing surveys and studies continue to characterize potential bird and bat resources in the area and to refine pre- and post-construction monitoring for the demonstration project.

Bird use of Lake Erie is discussed as follows by guild/taxa (e.g., raptors, songbirds, water birds).

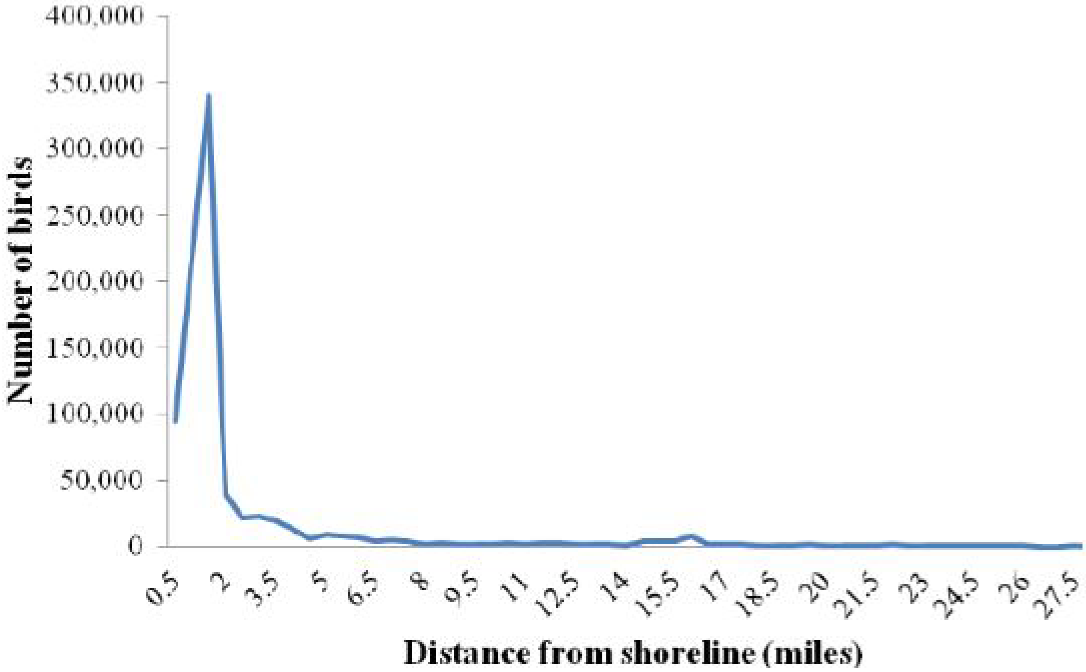
Raptors and Eagles

Large congregations of migrating birds in the spring or fall along the shoreline may attract raptors (ODNR, 2017b). No species of eagle or other raptor regularly utilizes offshore environments 8 to 10 miles from shore (Appendix L-1). An exception to note is from a mid-Atlantic offshore study which indicated extensive use of the offshore environment by peregrine falcons (*Falco peregrinus)* (Williams et al., 2015). During migration, raptors tend to concentrate along the shorelines of the Great Lakes, suggestive of a general tendency of raptors to avoid making migratory flights over large bodies of water (Appendix L-1). Nonetheless, migrating raptors are known to cross the Great Lakes in their migratory flights, particularly at "pinch points" such as north-south oriented peninsulas, but also to a lesser degree elsewhere (Appendix L-1).

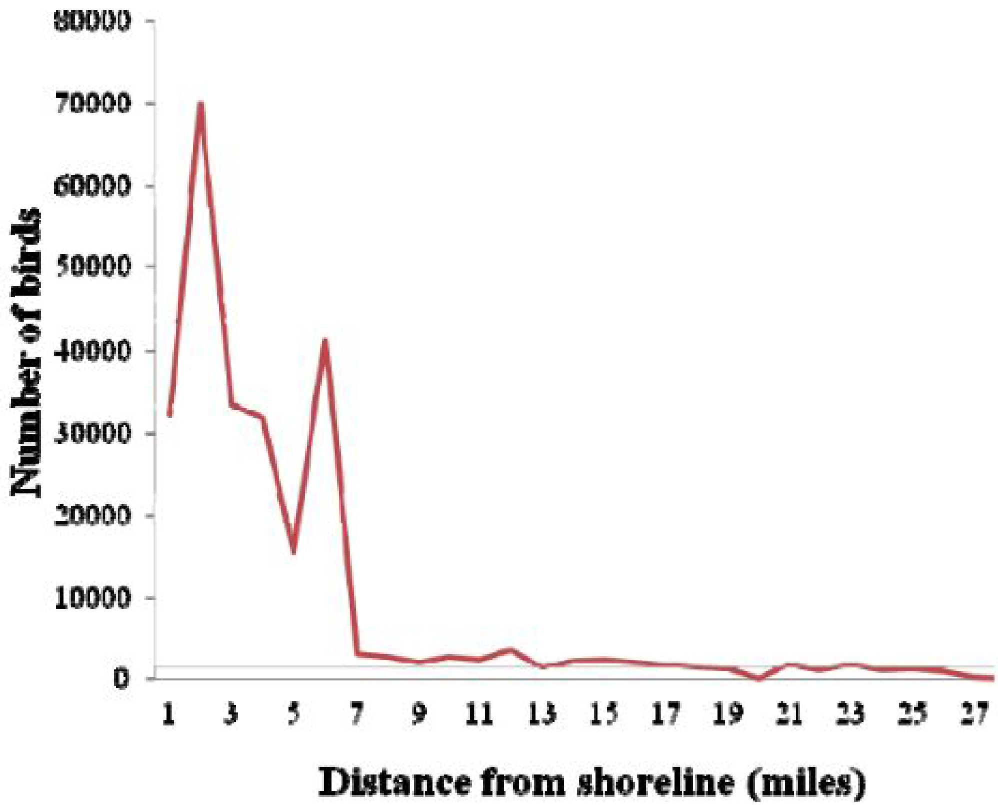
Although bald eagles and osprey (*Pandion haliaetus*) both regularly forage over water for fish, these species are typically restricted to areas within several miles of shore (Buehler, 2000; Poole et al., 2016). This general pattern was evidenced at the proposed turbine sites and vicinity by the boat-based avian baseline surveys conducted in offshore waters near the Proposed Project in May, September, and October 2010

(Appendix K) and the aerial avian surveys conducted in 2009-2011 by ODNR (Norris and Lott, 2011), neither of which resulted in observations of any raptors in the offshore environment within 10 miles of the proposed turbine sites. The presence of ice in the winter may affect available foraging areas, resulting in eagles traveling longer distances.

Songbirds
Although songbirds are generally terrestrial species that nest and forage onshore, nocturnally migrating songbirds and similar birds migrate across Lake Erie in the spring and fall. At least 95 percent of the songbird migration in the region is expected to be nocturnal. Nocturnal migrants include all the warblers, thrushes, sparrows, flycatchers, vireos, orioles, grosbeaks, buntings, tanagers, and other small birds that are similar to songbirds such as cuckoos. Among songbirds, only a very small minority of species migrate during the day, including swallows (Cornell University, 2017).



Total bird observations in relation to distance from Lake Erie shoreline from fall 2009 to spring 2010



Total bird observations in relation to distance from Lake Erie shoreline from fall 2010 to spring 2011

Source: Norris and Lott, 2011

Figure 3.4-1. Results from the ODNR Aerial Avian Survey

The Gosse et al. (2018) radar study provides data of migrant birds crossing Lake Erie. Several other recent studies employing marine radar in shoreline environments have demonstrated relatively high concentrations of nocturnal migrant birds along the shorelines of Lake Erie and Lake Ontario (Rathbun et al., 2016; Horton et al., 2016). Analyses of NEXRAD data demonstrated that the density of songbird migration over the central Lake Erie basin was less than one half of what it was over terrestrial environments within the region (Diehl et al., 2003). While large numbers of birds flew over the Great Lakes, even larger numbers remained over land during migration in both seasons. The WEST NEXRAD data analysis of migration over the Proposed Project Area showed that migration intensity was 2.5 times lower at the Proposed Project Area than over land in both spring and fall. When comparing over water sites, migration intensity was more than 7 times higher over eastern Lake Erie than over the Proposed Project Area in central Lake Erie (Appendix J). Target direction was consistent with expected seasonal migration patterns. In the fall, target directions near Cleveland were toward the southwest, and in the spring, toward the north-northeast (Appendix J).

Waterfowl and Waterbirds

Examination of species-specific and spatially-explicit patterns in the ODNR aerial survey data suggest that the only species that may occur in the vicinity of the Proposed Project Area on a somewhat consistent basis are red-breasted merganser (*Mergus serrator*), common loon (*Gavia immer*), horned grebe (*Podiceps auritus*), Bonaparte's gull (*Chroicocephalus philadelphia*), ring-billed (*Larus delawarensis*), and herring gull (*L. argentatus*). Several additional gull species (e.g., glaucous gull [*L. hyperboreus*], Iceland gull [*L. glaucoides*], great black-backed gull [*L. marinus*]) likely use the Proposed Project Area on an occasional basis (Norris and Lott, 2011). For the merganser, loon, and grebe, the estimated survey abundance of birds in the vicinity of the Proposed Project Area was roughly one bird per survey or lower. Ring-billed gull, herring gull, and Bonaparte's gull are the only bird species that used the Proposed Project Area and vicinity at estimated abundance generally greater than one bird observed per survey (abundance of up to five birds per survey) (Norris and Lott, 2011). By contrast, the ODNR survey effort documented markedly higher bird species richness and abundance closer to shore. The overlap of the ODNR transect survey and the proposed turbine area were not determined quantitatively, but visually estimated from the ODNR report figures, with the transect survey appearing to have included a path that went through or very near to the proposed turbines. The quantitative information extracted from the figures, while estimated, is informative regarding the abundance and species composition of birds that use the offshore environment in the vicinity of the Proposed Project.

Bats

Tetra Tech conducted a bat acoustic survey deploying four ultrasound detectors at land-based locations along the central Lake Erie shore and four identical detectors on the Cleveland Water Intake Crib, located roughly 3 miles offshore of Cleveland in Lake Erie, to gather data on offshore compared with onshore bat acoustic activity in the central Lake Erie basin. Ultrasound acoustic recordings were gathered at these locations during the entire spring and summer/fall migratory periods in 2010 to quantify bat use of the area. During the spring 2010 deployment (April 1 through May 31, 2010), a total of 244 detector-nights of data were gathered at the onshore locations, and a total of 232 detector-nights of offshore data were gathered at the Crib. During the summer/fall 2010 deployment (June 1 through November 10, 2010), a total of 616 detector-nights of data were gathered at the onshore locations, and a total of 482 detector-nights of offshore data were gathered at the Crib (Appendix K).

During spring 2010 monitoring periods, five bat species were detected, including: hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*, big brown bat (*Eptesicus fuscus)*, eastern red bat (*Lasiurus borealis*), and little brown bat (*Myotis lucifugus)*. 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 (*Perimyotis subflavus)*, and little brown bat (Appendix K).

Tetra Tech'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.

The eastern red bat, hoary bat, and silver-haired bat, are state-listed as species of concern (Section 3.4.1.5 discusses protected species). These bats are known to migrate long distances and are known to occur in the offshore environments of Lake Michigan (Boezaart and Edmonson, 2014) and Lake Erie (Stantec, 2016). These bats were all positively identified in the recordings from both the spring and fall 2010 monitoring periods during the Tetra Tech baseline study for the Project. In this baseline study, calls of these bats were recorded onshore nearly two times more frequently than they were offshore. The spring, summer, and fall acoustic survey indicated that the Lake Erie shoreline, and to a lesser extent the offshore Cleveland Water Intake 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. The relatively low number of call sequences recorded offshore during the baseline study suggests that the Proposed Project Area is not likely a major migratory corridor for bats.

The acoustic baseline study also demonstrated that overall bat activity level, based on total bat call rate of all species combined, was roughly 10 times greater on land than offshore during the spring and summer/fall study periods. This study may overestimate offshore bat activity at the proposed turbine sites because the offshore call rates were recorded at the Cleveland Water Intake Crib, roughly 3 miles from shore. Because there were substantially lower levels of bat activity 3 miles from shore when compared to the onshore activity, and the proposed turbines would be 8 to 10 miles offshore, even lower levels of bat activity are expected where the turbines would be located.

Bat acoustic monitoring was conducted in 2017 by WEST. Acoustic detectors were deployed at five stations (two located within the proposed turbine area approximately 9 miles offshore, one located west of the Cleveland Water intake crib approximately 3 miles offshore, and two located on the Cleveland Water intake crib) with 939 successful detector nights (a complete night of recording). The monitoring covered the spring migration season (March 21 to May 14), summer maternity season (May 15 to July 31), and the fall migration season (August 1 to November 15) (Appendix L-2). Long-distance migratory species (Eastern red bat, hoary bat, and silver-haired bats) were the three most commonly identified bat species across all stations. Bat species diversity was highest at a station located within the proposed turbine area with six species identified (eastern red, hoary, silver-haired, big brown, little brown, and tri-colored). Bat activity varied between stations, with the highest activity seen at the intake crib location, and bat activity decreasing as distance from land increased (Appendix L-2).

3.4.1.4 Insects

A Presidential Executive Memorandum was issued in 2014 to create a federal strategy for promotion of the health of honey bees and other pollinators, which includes the monarch butterfly. In December 2014, 90-day findings were published in the Federal Register for a petition requesting the USFWS to list the monarch butterfly (*Danaus plexippus plexippus*) under the ESA as a threatened species. The USFWS found that the petitioned actions may be warranted and initiated a status review to determine whether actions under the ESA are warranted. Based on the status reviews, the USFWS issued a 12-month finding in accordance with 16 USC 1533(b)(3)(B) of the ESA, stating whether listing, reclassification, or delisting, as appropriate, is warranted. The 12-month finding was not issued, and a lawsuit was filed against the USFWS. Subsequently, an agreement was reached requiring the USFWS to determine by June 2019 whether the monarch butterfly will receive federal protection under the ESA (USFWS, 2017a). Because the monarch butterfly USFWS status review is pending, the species is not discussed within Section 3.4.1.5, Protected Species, but is discussed in the following text.

Monarch Butterfly

The monarch butterfly can be found in all 88 Ohio counties but is most common in late summer during its fall migration in late August, September, and early October (ODNR, 2017c). Monarch butterflies are known to migrate through the Proposed Project Area. Research conducted by Monarch Watch (2015) and citizen scientists provide evidence that monarch butterflies cross Lake Erie during migration using the Point Pelee National Park on the North shore of Lake Erie in Ontario, Canada; South Bass Island and the Lake Erie islands; and along the shoreline of Lake Erie in Ohio for resting. Monarchs have also been reported at Wendy Park on Whiskey Island near downtown Cleveland and from observers on recreational boats within the lake. Observers have noted ranges of flying heights between 10 and 100 feet above the water, though most observers cannot see beyond a height of 300 feet above them. Monarchs are also known to ride thermals to much greater heights during migration. Glider pilots have seen monarchs at 10,000 feet, and helicopter pilots servicing oil rigs in the Gulf have seen them at 1,000 to 1,200 feet (Monarch Watch, 2015).

Monarch butterfly habitat predominantly consists of milkweeds and native flowering plants or nectar producers. Monarch waystations, small areas of milkweed and/or wild flowers, have become a common conservation practice to provide habitat during spring and summer breeding season and during the fall migration. Cleveland Metroparks (2016) has registered monarch waystations in and around the Cleveland area. There is no monarch habitat at the Proposed Substation, O&M Center, Port staging area, or where the export cable makes landfall, which would be located on developed land.

Other Insects

State-listed threatened and endangered species reported to occur within Cuyahoga County include four insects: black caddisfly (*Chimarra social*), two-spotted skipper (*Euphyes bimacula*), regal fritillary (*Speyeria idalia*), and marked noctuid (*Tricholita notate*). Habitat for these species includes high velocity water for the black caddisfly, wetlands for the two-spotted skipper, and prairies for the regal fritillary and marked noctuid. These habitats are not found within the Proposed Project Area. State-protected species are discussed further in Section 3.4.1.5.

3.4.1.5 Aquatic and Terrestrial Protected Species

Federally-Listed or Protected Species

The USFWS has identified five federally listed species that may occur in Cuyahoga County and therefore have the potential to be affected by the Proposed Project. Table 3.4-1 details these federally listed species.

There are no candidate species, proposed listed species, or proposed or designated critical habitats in this location (USFWS, 2017b).

Table 3.4-1. Federally Listed Species Occurring in Cuyahoga County

Common Name	Scientific Name	Federal Listing	Critical Habitat Present
Birds			
Kirtland's Warbler	*Setophaga kirtlandii*	Endangered	None
Piping Plover	*Charadrius melodus*	Endangered	None
Red Knot	*Calidris canutus rufa*	Threatened	None
Mammals			
Indiana Bat	*Myotis sodalis*	Endangered	None
Northern Long-eared Bat	*Myotis septentrionalis*	Threatened	None

More detailed information on the life cycle and historic abundance of these five federally listed species can be found in Appendix M-1.

Indiana Bat

Indiana bats migrate seasonally between their summer habitats and winter hibernacula, which are large, climatically stable caves and mines where the bats hibernate. Indiana bats are generally not found hibernating in artificial roosts, such as buildings. Indiana bats exhibit site fidelity to traditional summer maternity areas, returning annually to the same established home ranges and individual roost trees (Gardner et al., 1991; Callahan et al., 1997; Gumbert et al., 2002; Kurta and Murray, 2002). Reproductive females migrate to their summer habitats where they form maternity colonies of typically 20 to 100 mature individuals to give birth and raise their young (Kurta, 2004). Maternity colonies are usually selected in riparian zones, floodplains, bottomland habitats, upland communities, or wooded wetlands, although maternity roosts are occasionally found in pastures (Humphrey et al., 1977; Gardner et al., 1991; Callahan et al., 1997; Whitaker and Hamilton, 1998). The summer months are spent foraging for aquatic and terrestrial insects along streams, in riparian forests and floodplains, and in upland forests and low open areas. Indiana bats typically avoid urban habitats and prefer to forage along streams or rivers and above waterbodies, but they are also known to utilize upland forests, clearings with successional old field vegetation, the borders of croplands, wooded fencerows, and pastures (Humphrey et al., 1977; LaVal et al., 1977; Brack et al., 1983; Gardner et al. 1991; Sparks et al., 2005). A variety of deciduous tree species are used for roosting, and it is believed that the presence of exfoliating bark or crevices, a high amount of solar exposure (less than 20 percent canopy cover), and a large diameter tree are important factors in Indiana bats selecting a suitable roost site (Foster and Kurta, 1999; Kurta, 2004).

The federally and state-listed endangered Indiana bat is largely distributed throughout the central and eastern U.S. (22 states) and southeastern Canada. The USFWS defines four Recovery Units based on "evidence of population discreteness and genetic differentiation, differences in population trends, and broad-level differences in macrohabitats and land use" (USFWS, 2007). The entire state of Ohio is located within the Midwest Recovery Unit. The Indiana bat population in the Midwest Recovery Unit represents approximately 45.9 percent of the 2017 overall range-wide population. As summarized in Table 3.4-2, USFWS population estimates indicate that the overall Indiana bat population in the Midwest Recovery Unit has declined by 13.7 percent since 2009 with the proliferation of white-nose syndrome (WNS) (USFWS, 2017c).

Table 3.4-2. Indiana Bat Population Estimates for the Midwest Recovery Unit

State	2009	2011	2013	2015	2017	% Change from 2015
Indiana	213,244	225,477	226,572	185,720	180,583	-2.8%
Kentucky	57,319	70,626	62,018	64,571	58,155	-9.9%
Ohio	9,261	9,870	9,259	4,809	2,890	-39.9%
Tennessee	1,657	1,791	2,369	2,401	1,598	-33.4%
Alabama	253	261	247	90	85	-5.6%
Southwest Virginia	217	307	214	137	70	-48.9%
Michigan	20	20	20	20	20	0.0%
Total	**281,977**	**308,352**	**300,699**	**257,748**	**243,401**	**-5.6%**
Range-wide Total	**612,337**	**628,234**	**610,512**	**550,224**	**530,705**	**-3.5%**

Source: USFWS, 2017c.

The number of Indiana bats within Ohio has always been a small fraction of the range-wide population, even before WNS. Within the Midwest Recovery Unit, approximately 1.2 percent of the Indiana bats hibernated in Ohio in 2017. Since the onset of WNS, the population of Indiana bats in Ohio is declining faster than the overall Midwest Recovery Unit, declining 69 percent since 2009 compared to 14 percent across the entire unit (USFWS, 2017c).

Indiana bat hibernacula are categorized into the following four different priority groups based on population size: Priority 1 (P1, ≥10,000 Indiana bats), Priority 2 (P2, 1,000-9,999 Indiana bats), Priority 3 (P3, 50-999 Indiana bats), and Priority 4 (P4, 1-49 Indiana bats). There are seven known Indiana bat hibernacula in the state of Ohio, and of these, two still have winter populations (i.e., at least one record since 1995). The two surviving hibernacula consist of a P2 hibernaculum located in Preble County in southwest Ohio, and a P3 hibernaculum located in Lawrence County in south-central Ohio (USFWS, 2007). The two known hibernacula closest to the Proposed Project are both P4 hibernacula located in Lawrence and Beaver Counties, in Pennsylvania, more than 70 miles southeast of the Proposed Project. Most Ohio capture records of reproductive Indiana bat females and juveniles have been reported from the western part of the state (USFWS, 2009a). In Cuyahoga County, where the Proposed Project would be located, there is one known Indiana bat maternity colony and no known hibernacula (USFWS, 2007).

The relatively low level of bat acoustical activity recorded at sites greater than 3 miles from shore to date (Ahlén et al., 2009; Pelletier et al., 2013; Boezaart and Edmonson, 2014; Stantec, 2016) is consistent with the basic observation that bats are primarily terrestrial animals. Pre-construction bat acoustic surveys were conducted by Tetra Tech in 2010 to evaluate offshore bat use of Lake Erie near the Proposed Project. The acoustic survey was conducted offshore at the Cleveland Intake Crib 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 Project. Bat acoustic monitoring cannot reliably distinguish between the high frequency calls of multiple *Myotis* species, including Indiana bat, little brown bat, northern long-eared bat, and eastern small-footed bat. Therefore, the Tetra Tech study could neither confirm nor rule out the presence of Indiana bats in the vicinity of the Proposed Project. The *Myotis* species group was recorded at both onshore and offshore detectors but represented a very small percentage of the total calls recorded (2.4 percent in the spring and 2.2 percent in the fall). The acoustic data indicate that for all bat species detected, offshore activity levels were substantially less than onshore activity levels. Only 6 and 7 percent of the total number of call sequences were recorded offshore in the spring and fall, respectively (Appendix K).

The WEST 2017 bat acoustic surveys, which were conducted at the proposed turbine location (9 miles offshore), 3 miles offshore, and at the intake crib, observed bat activity decreasing as distance from land increased (Appendix L-2). An Indiana bat call was not identified as part of the survey, but the species could have been a part of the unidentified high frequency calls documented. The unidentified high frequency calls represented less than 1 percent of total bat calls qualitatively verified.

There is no undisturbed forested area typically utilized as summer habitat by Indiana bats in the vicinity of the Tetra Tech shoreline monitoring sites, and there are no known colonies of Indiana bats in Ontario (the species is almost unknown in Ontario). Therefore, it is unlikely that these bats migrate across the lake or are present around the proposed wind turbines because there is no habitat or known colonies on either side of the lake. Based on these factors, and the results of the acoustic survey, Tetra Tech (2012) concluded that Indiana bat is unlikely to occur in the vicinity of the Proposed Project, and if the Indiana bat is present, it is likely to occur in very small numbers.

Northern Long-eared Bat

There is little information available regarding spring emergence and dispersal of northern long-eared bats from hibernacula. Shortly after emergence, northern long-eared bats migrate to their summer habitat. Spring migration direction of northern long-eared bats appears to radiate outward from hibernacula during migration, with the bats migrating directly to maternity sites, rather than moving primarily north or south (Davis and Hitchcock, 1965; Fenton, 1970; Griffin, 1970; Humphrey and Cope, 1976). Northern long-eared bats have shown high site fidelity related to summer roost habitat (Sasse and Pekins, 1996; Patriquin et al., 2010; Perry, 2011). Northern long-eared bats most frequently utilize mature-growth forests during the summer maternity season (Lacki and Schwierjohann, 2001; Ford et al., 2006; Foster and Kurta, 1999). Day and night roosts are used by northern long-eared bats during spring, summer, and fall, usually within mature forest communities with decaying trees and/or live trees with cavities or exfoliating bark selected most frequently (Foster and Kurta, 1999; Owen et al., 2003; Broders and Forbes, 2004). Northern long-eared bats do not forage in intensively harvested forest stands or open agricultural areas, generally restricting movement to intact forests (Patriquin and Barclay, 2003; Henderson and Broders, 2008). They are known to forage under the forest canopy at small ponds or streams, along paths and roads, or at the forest edge (Caire et al., 1979).

Late summer swarming behavior and relatively high concentrations at some caves indicate that there is some degree of local or regional movement prior to reproduction. Mine and cave sites have been most often reported as hibernacula for northern long-eared bats (Whitaker and Winter, 1977; Stones, 1981; Griffin, 1945). Hibernating northern long-eared bats do not form large aggregations or clusters typical of some bat species. Instead, individuals or small groups seem to favor deep crevices for hibernation (Caceres and Barclay, 2000), and often go unnoticed until spring emergence.

Prior to the spread of WNS to Ohio, northern long-eared bats were typically the second to fourth most commonly caught bat in Ohio studies. Although there was evidence of northern long-eared bat reproduction in many Ohio counties across the state, the northeastern part of the state appeared to have the greatest concentration of northern long-eared bats (Brack et al., 2010). Despite this, northern long-eared bats would not be expected to breed in the area of the Proposed Project. According to the USFWS (2014a), "Trees found in highly developed urban areas (e.g., street trees, downtown areas) are extremely unlikely to be suitable NLEB [northern long-eared bat] habitat." However, it is possible that northern long-eared bats could migrate through the Proposed Project, as the species has been documented in Ontario, along the northern shores of Lake Erie (Dzal et al., 2009).

As described previously with Indiana bats, Tetra Tech biologists conducted a bat acoustic survey offshore at the Cleveland Intake Crib Proposed Project Area during the spring, summer, and fall of 2010 to quantify bat use near the Proposed Project. The *Myotis* species group was recorded at both onshore and offshore detectors but represented very small percentage of the total calls recorded (2.4 percent in the spring and 2.2 percent in the fall). The high frequency *Myotis* group accounted for 2.6 percent of all calls onshore and 2.4 percent of all calls offshore in spring, and 2.1 percent of all calls onshore and 3.5 percent of all calls offshore in fall. Because bat acoustic monitoring cannot reliably distinguish between the high frequency calls of multiple *Myotis* species, the Tetra Tech study could neither confirm nor rule out the presence of northern long-eared bats. Comprehensive comparisons (all bat taxa) of onshore against offshore bat acoustic activity from the Tetra Tech study are presented in Section 3.4.1.3 and Appendix K. For all bat species detected, the acoustic data indicate that offshore activity levels were substantially less than onshore activity levels (Appendix K). Because of this and the lack of maternity and foraging habitat in the vicinity of the Proposed Project, if the northern long-eared bat is present it would likely occur in very small numbers.

Similar to the Indiana bat, the WEST 2017 acoustic surveys did not identify a northern long-eared bat call, but the species could have been a part of the unidentified high frequency calls documented. The unidentified high frequency calls represented less than 1 percent of total bat calls qualitatively verified (Appendix L-2).

Kirtland's Warbler

The Kirtland's warbler may have the most geographically restricted distribution of any mainland bird in the continental U.S. (USFWS, 2012). Michigan's Lower Peninsula is still the primary nesting range; the known nesting range has expanded somewhat, and currently includes several much smaller areas in Michigan's Upper Peninsula, as well as Wisconsin and Ontario, Canada. Kirtland's warblers winter primarily in the Bahama Islands, with reports of solitary individuals in Mexico, the Dominican Republic, Cuba, and Bermuda (Faanes and Haney, 1989; Mayfield, 1996; USFWS, 2012). Migrating Kirtland's warblers generally enter and leave the U.S. along the coasts of North and South Carolina, arriving on the northern breeding grounds in mid-May (Mayfield, 1988).

The habitat requirements for nesting birds are both highly specific and disturbance-dependent. Optimal nesting habitat can be characterized as large jack pine (*Pinus banksiana*) stands, composed of 8- to 15-year old trees that regenerated after wildfires, with 35 to 65 percent canopy cover, and more than 3,000 stems per acre. Nests are on the ground, well concealed under arching plants near the bases of pines. Kirtland's warblers are primarily insectivorous, and forage by gleaning pine needles, leaves, and ground cover.

The Kirtland's warbler, like other North American warblers, is a nocturnal migrant. During the migratory periods of spring (roughly mid-March through mid-April) and fall (roughly mid-August through mid-October), individuals enter a state of migratory restlessness stimulated by hormonal changes, and individuals engage in migratory flights that generally extend from just after dusk until just before dawn, completing their entire migratory journey in as little as 1 to 2 weeks (Bocetti et al., 2014). It is thought that "all or nearly all" of the Kirtland's warbler population passes through Ohio during migration (ODNR, 2007a). In fact, the species was first discovered when a spring migrant was collected from a farm near Cleveland in May 1851 (USFWS, 1985). Most migrants appear to be concentrated in northwest Ohio, along the shores of Lake Erie between Toledo and Sandusky (eBird, 2016; USFWS, 2012). In a recent study using light-sensitive geolocators to reveal migration paths on 27 birds, Cooper et al. (2017) documented a pattern of "loop migration" in Kirtland's warblers, with most birds taking an easterly route, potentially entailing a southbound Lake Erie crossing during fall migration, and most birds following a more westerly route in spring, generally passing to the west of Lake Erie on their journey North. There were only five documented sightings of Kirtland's warbler in the Cleveland region between 1950 and 2004 (McCarty, 2012).

Piping Plover

The piping plover is a small migratory shorebird that nests in three separate geographic areas in the U.S.: The Great Plains, the shores of the Great Lakes, and the shores of the Atlantic coast. In the Great Lakes region, piping plovers breed and raise young on the shores of the Great Lakes, spending approximately 3 to 4 months a year on breeding grounds. Birds begin arriving on breeding grounds in late April, and most nests are initiated by mid- to late May. Piping plovers depart Great Lakes breeding areas from mid-July to early September. Migration of piping plovers is nocturnal; while migration routes are poorly understood, it has been thought that most piping plovers probably migrate non-stop from interior breeding areas to wintering grounds along the Atlantic and Gulf coasts (Haig and Plissner, 1993; USFWS, 2003).

Piping plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada (USFWS, 2003). The piping plover disappeared from southern Lake Erie's shores somewhat earlier than from the other lakes. Despite the 2001 designation of two critical habitat units in Ohio (i.e., OH-1 near Sandusky and OH-2 near Painesville [66 Federal Register {FR} 22967]), piping plovers do not currently breed in Ohio. The piping plover is now considered only a migrant species in Ohio (ODNR, 2017d). No piping plovers were found in the Proposed Project's offshore study area during boat-based visual observation surveys or avian acoustic monitoring, both conducted during the spring and fall migration periods (Appendix K). Regional scarcity of piping plovers has also been documented in The Birds of North America (Elliott-Smith and Haig, 2004) and in the eBird database (eBird, 2016).

Rufa Red Knot

The rufa red knot is a migratory shorebird with one of the longest yearly migrations of any bird. It migrates annually between its breeding grounds in the central Canadian Arctic and several wintering regions, including the Southeast United States, the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America (Baker et al., 2013). Rufa red knots are restricted to ocean coasts during winter and occur primarily along the coasts during migration. However, single birds or small flocks of rufa red knots are reported annually across the interior U.S. during spring and fall migration (eBird, 2016). These reported sightings are concentrated along the Great Lakes, but multiple reports have been made from every interior state (USFWS, 2014b). During both the northbound spring and southbound fall migrations, rufa red knots use key staging and stopover areas to rest and feed. Rufa red knot is a specialized molluscivore, eating hard-shelled mollusks, sometimes supplemented with easily accessed softer invertebrate prey, such as shrimp- and crab-like organisms, aquatic worms, and horseshoe crab eggs.

Reliable rangewide population data is not available for rufa red knot. Rufa red knots are only occasionally seen in the region during migration, and in very low numbers, as evidenced in the eBird database (2016). Small numbers of rufa red knots pass through Ohio, with more moving through in the fall than in the spring (ODNR, 2017e). In the Great Lakes region between 25 and 100 birds are recorded annually in spring and between 100 and 200 in the fall, the majority along the shores of Lakes Michigan and Erie. Most of these records are of singles, pairs, or small flocks of 3 to 10 birds. The species appears to be opportunistic and can occur almost anywhere along the Great Lakes shores or inland on mudflats of falling reservoirs in late summer and autumn or flooded fields in spring. The northern shoreline of Ohio is visited regularly during fall migration, particularly Ottawa National Wildlife Refuge (USFWS, 2014b). No rufa red knots were found in the Proposed Project's offshore study area during boat-based visual observation surveys or avian acoustic monitoring, both conducted during the spring and fall migration periods (Appendix K).

State-Listed Species

State-listed threatened and endangered species within Cuyahoga County are listed in Table 3.4-3. 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 the county.

Table 3.4-3. State-Listed Species Occurring in Cuyahoga County

Species Name	Common Name	Habitat	State Status[1]
Plants			
Calopogon tuberosus	grass-pink	wet areas	T
Carex louisianica	Louisiana sedge	forested swamps	E
Cyperus schweinitzii	Schweinitz's umbrella-sedge	sandy areas	T
Cypripedium reginae	showy lady's-slipper	wet areas	T
Elymus trachycaulus	bearded wheat grass	variety	T
Epilobium strictum	simple willow-herb	wet areas	T
Hieracium umbellatum	Canada hawkweed	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	dry, sandy areas	E
Oryzopsis asperifolia	large-leaved mountain-rice	well-drained areas	E
Plagiothecium latebricola	lurking leskea	swamps, marshy areas	T
Sisyrinchium montanum	northern blue-eyed grass	wet areas	T
Solidago puberula	dusty goldenrod	dry areas	E
Solidago squarrosa	leafy goldenrod	rocky woods, thickets	T
Viburnum alnifolium	hobblebush	moist woods	T
Insects			
Chimarra socia	a black caddisfly	High velocity water	E
Euphyes bimacula	two-spotted skipper	wetlands	SC
Speyeria idalia	regal fritillary	prairies	E
Tricholita notata	marked noctuid	prairies	E

Table 3.4-3. State-Listed Species Occurring in Cuyahoga County

Species Name	Common Name	Habitat	State Status[1]
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
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 water basin	SC
Reptiles and Amphibians			
Clemmys guttata	spotted turtle	wetlands	T
Emydoidea blandingii	Blanding's turtle	wetlands	T
Hemidactylium scutatum	four-toed salamander	wetlands	SC
Birds			
Accipiter striatus	sharp-shinned hawk	woodlands	SC
Charadius melodus	piping plover	migrant	E[2]
Setophaga kirtlandii	Kirtland's warbler	migrant	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

Table 3.4-3. State-Listed Species Occurring in Cuyahoga County

Species Name	Common Name	Habitat	State Status[1]
Mammals			
Condylura cristata	star-nosed mole	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
Myotis sodalis	Indiana bat	woodlands	E
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

Sources: ODNR, 2016b, 2016c, and 2017f,

[1] E = Endangered, T = Threatened, SC = Species of Concern.

Habitat for these state-listed species is generally not found associated with the Proposed Project, which includes developed, urban environment, and hardened shorelines of the Cuyahoga River, the Old River, and Lake Erie in the vicinity of the Proposed Substation, export cable landfall, HDD boring pit, O&M Center, and Port staging area; and Lake Erie open water. Migrating species such as birds and bats may pass through the area during spring and fall migrations and are discussed in previous sections (Section 3.4.1.3, Birds and Bats, and Section 3.4.1.5, Aquatic and Terrestrial Protected Species – Federally Listed or Protected).

A letter from the ODNR Division of Wildlife on February 1, 2017, which can be found in Appendix N, indicated they have no records of rare or endangered state-listed species in the Proposed Project Area.

3.4.2 Environmental Impacts Related to Biological Resources

3.4.2.1 Environmental Impacts Related to Benthos

Construction

Foundations and Turbines

Installation of the turbines would directly disturb approximately 0.34 acre of substrate habitat for the turbine foundations and approximately 0.6 acre of substrate habitat associated with the legs and pads used to stabilize the heavy-lift crane vessel. If a DP vessel is used to perform the foundation heavy lift operations, there would be no direct impact to the lakebed by that vessel because DP vessels do not require anchor placement and do not make direct contact with the bottom. These activities would result in the loss of infauna (small aquatic animals that burrow into soft sediment or live between sediment particles of the lakebed) and benthic invertebrates within the immediate footprint of construction disturbance. However, this footprint is small compared to the total area of Lake Erie. Following construction, benthic macroinvertebrates would be expected to recolonize the areas directly disturbed by turbine installation. Direct impacts to benthic habitat and benthic invertebrates from installation of the turbines would represent a minor adverse impact.

The MB turbine foundation installation would result in minimal indirect impacts to benthic resources from sediment resuspension. Since the MB foundation would use suction technology, no lakebed preparation would be necessary (dredging, leveling, or drilling) for installation, and disturbance to sediment would be limited to the area immediately around the bucket associated with either the water pumped out of the bucket or the water jets adjusting the verticality of the bucket. Sediment suspended during MB installation would be expected to settle back to the lakebed, resulting in a short-term, localized, and minor increase in sediment suspension. Minimal sediment resuspension would also occur from movement of the jack-up legs on the heavy-lift crane vessel and from anchoring of the feeder barge.

Inter-Array and Export Cables

During construction, an approximately 15-foot wide area would be directly disturbed for installation of the proposed export cable and inter-array cables along the 12.1-mile length (up to the HDD location). As with the MB turbine foundations, these activities would result in the loss of infauna and benthic invertebrates within the immediate area of construction disturbance. Following construction, benthic macroinvertebrates would likely recolonize the areas directly disturbed by cable installation.

Sediment disturbed from cable installation activities would be expected to settle quickly out of the water column, and benthic invertebrates from adjacent, undisturbed areas of Lake Erie would recolonize the affected area. Recolonization depends on the stability of the disturbed area, tolerance of benthic organisms to physical changes, and availability of recruits in the area. The benthic community recovery time ranges from several months to several years depending on the type of community and type of disturbance (DOE, 2013).

Installation of the inter-array cables and export cable would also result in a temporary indirect impact to benthic habitat and benthic invertebrates from sediment resuspension. These impacts would occur during inter-array cable and export cable installation and at the HDD tie-in location. These short-term, minor impacts would be expected to last only several hours and have limited spatial extent beyond the point of installation. Refer to Section 3.3.2.1 for more detailed information on impacts from suspended sediment.

Operation and Maintenance

Turbines

The presence of the proposed turbine foundations would result in the loss of approximately 0.34 acre of substrate habitat and would alter habitat in the Proposed Project Area through small-scale loss of silty-bottom areas. This loss would be temporary and of unknown duration as the habitat would be reconstituted after decommissioning and removal of the MB foundation. The bare silty-bottom sediment directly covered by the footprint of the turbine foundations may be altered along with the resident benthic organisms and those species that prey on them. Sediment would return to the lakebed on top of the MB lid, with a small amount possibly falling beyond the lid's diameter. This fallback of sediment onto the lid would reconstitute portions of the benthic habitat that would be lost because of the installation of the MB.

The turbine foundation, the shaft and potentially the MB lid, below the surface water would create small microhabitats comparable to those found in hard surface artificial reefs. An artificial reef is an object of human origin which has been deployed purposefully to the sea (or lake) bottom, which adds a vertical profile to the benthic environment, which can then be settled by fish and other invertebrates (Seaman, 2000). The artificial reefs created around each turbine would allow for attachment of sessile invertebrates, such as mussels. According to Seaman (2000), there is an expectation that over the long-term, assemblages of sessile organisms would eventually increase the biomass at the local site of an artificial reef created by a turbine foundation. Although the loss of habitat is approximately 0.34 acre of substrate, more surface area of potential reefing habitat is introduced when considering the vertical surface area provided by each turbine.

Thickness of the biological growth depends on site-specific characteristics such as illumination, alkalinity, oxygen content, flow, turbulence, and temperature; while also considering the relative position of structural components with respect to their water level and exposure, with prominent biological growth expected in the splash zone and the submerged sections. Limited biodiversity and hypoxic conditions have been documented at the proposed site; the amount of surface created by the foundation would be minimal; therefore, it would not be expected to impact aquatic life.

The artificial reef habitat could attract invasive species such as Dreissenids (e.g. zebra and quagga mussels) found during the LimnoTech survey (Appendix E-1). These mussels can cause biofouling of structures. Depending on depth, the quagga mussel may impact the Proposed Project because it can outcompete the zebra mussel in deeper and colder water habitats. Therefore, structures in deep water, particularly, may encounter increased fouling by this species. The zebra mussel is currently the primary fouling threat to most shallow hard and soft substrates in Lake Erie, but even at these depths, their impact has been tempered by the quagga mussel. Little record exists of native fouling species in Lake Erie; therefore, it is likely they would have a negligible role.

While low summer DO prevents permanent populations of Dreissenids from accumulating below the thermocline (about 40-foot depth) (Appendix E-1), these mussels could use the turbine tower above the thermocline.

Inter-Array and Export Cables

The sediment composition following construction is likely to be similar to the existing conditions along the cable route, as sediment resettles. A slight depression in the lake bottom would be present over the installed inter-array cables and export cable temporarily, but pre-installation conditions are expected to return through natural deposition to the lakebed. The only permanent disturbance of the lakebed would be the presence of the inter-array and export cables, proposed to be buried approximately 1 to 1.5 meters (3.3 to 5 feet) below the surface, although in some places the cables may be buried deeper. The impacts from alteration of the silty-bottom along the inter-array cables and export cable route would be minor and short-term as natural sediment accretion would occur again after construction is complete.

As described in Section 2.2.4, the proposed cables would be 34.5 kV alternating current cables and would be composed of a three-core copper conductor with XLPE or EPR insulation (insulation would be dependent on manufacturer). The magnetic field associated with a transmission cable can travel through sediment and water; however, studies show that the magnetic fields are similar to background levels and decrease exponentially with distance from the cable. Bureau of Ocean Energy Management (BOEM) research compared fish and invertebrate assemblages for buried and unburied pipes and cables and natural habitat and found that each community strongly overlapped, and differences between communities were indistinguishable and negligible (Love et al., 2016). LimnoTech, using available specifications for the proposed inter-array and export cables and voltage for the Proposed Project, estimated the magnetic field at 1 meter (3.3 feet) from the proposed inter-array and export cables as approximately 2 micro tesla units (μT). The level of the naturally occurring magnetic field from the earth is around 50 μT, and a comparison of electromagnetic field (EMF) studies at existing buried cable installations found the maximum magnetic field of existing buried cables at the seabed to be around 18 μT and average 7.8 μT. More details on the comparison study can be found in the LimnoTech Report (Appendix E-1). No major effects on benthic communities would be expected because of the minor increase in the magnetic field associated with the operation of the proposed inter-array and export cables and as supported by BOEM studies (Love et al., 2016).

Similarly, anticipated increases in the temperature of the sediment and water column associated with the inter-array and export cables would be expected to fall within the range of natural ambient variability and would not affect benthic communities, as concluded for the LEC Project, a proposed cable approximately 80 miles east of the Proposed Project in Lake Erie (DOE, 2016).

Following recovery of the benthos after construction, the operations and maintenance of the proposed cable would result in minor impacts to benthic resources.

Decommissioning

Impacts to benthos during decommissioning would be similar to disturbance during construction with temporary, localized sediment suspension from the removal of the turbine foundations, barge anchoring and jack-up legs from the heavy-lift crane vessel. Benthic habitat that was occupied by the surface area of the MB turbine foundations would become available again as habitat following removal of the foundations and the transmission cable would remain buried.

3.4.2.2 Fish Resources

Construction

Habitat Disturbance and Suspended Sediment

Installation of the turbines would directly disturb approximately 0.3 acre for the turbine foundations and approximately 0.6 acre associated with the legs and pads used to stabilize the heavy-lift crane vessel. Installation of the inter-array cables and export cable would directly disturb approximately 22 acres. These activities would result in the potential loss of fish habitat within the immediate area of construction disturbance. Following construction, benthic macroinvertebrates would likely recolonize the areas directly disturbed by turbine and cable installation and would once again become available as potential prey for fish species.

The MB turbine foundation installation would result in minimal indirect impacts to fish resources from sediment resuspension. As described in Section 3.4.2.1, sediment suspended during MB installation would be expected to settle back to the lakebed, resulting in a short-term, localized, and minor increase in sediment suspension. Minimal sediment resuspension would also occur from movement of the jack-up legs on the heavy-lift crane vessel and from anchoring of the feeder barge. Installation of the inter-array cables and export cable would also result in a temporary indirect impact to fish species from sediment resuspension. These short-term impacts would be expected to last only several hours and have limited spatial extent beyond the point of installation. Refer to Section 3.3.2.1 for more detailed information on impacts from suspended sediment.

Because larval fish are not anticipated to occur at the proposed turbine sites, the direct disturbance to the lakebed and minimal increase in suspended sediment would primarily affect older life stages of fish that are mobile and can temporarily avoid the area of construction and higher suspended sediment. This temporary displacement of fish and avoidance behavior during turbine and cable installation activities is anticipated to be localized and small in scale. Fish would use nearby habitat and would be expected to return to the area shortly after construction activities are complete. Effects are also expected to be minimal because the proposed turbine sites are not located near any identified fish spawning areas, larval nursery areas, or critical habitat areas (Appendix I).

Habitat disturbance impacts from proposed construction activities to fish would be short-term and minor.

Noise Disturbance
The MB foundation design eliminates the need for pile driving and significantly reduces potential construction related noise when compared to other foundation types. The MB installation produces noise at levels of 73 decibels (dB), versus pile driving, which produces noise at 191 dB. Other construction-related noise expected in the vicinity of the proposed turbine sites would consist mainly of noise related to construction vessels and onboard equipment.

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 underwater sound levels has been conducted 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-based foundations, like the proposed MB foundations, do not require pile driving and 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 fish are likely to return soon after exposure has ended (Bergstrom et al., 2014). While knowledge on how freshwater fish hear is well documented, noise-related impacts to fish in field conditions is unclear.

There would be additional boat traffic associated with construction of the proposed turbine foundations, inter-array cables, and export cable. However, noise levels during construction would be temporary and similar to noise levels experienced consistently in the region which experiences up to 1,000 passing lake freighters traveling into and out of the Port annually. The additional noise-related effects to aquatic communities, including fish species, from a temporary increase in boat traffic are expected to be similar to what these aquatic organisms experience regularly. Therefore, noise-related impacts from proposed construction activities to fish would be negligible.

There would be minimal anticipated noise effects on fish or other organisms from HDD construction operations associated with the proposed export cable installation because the noise generating equipment would be located onshore, except for the drill bit and string, which would be located approximately 12 feet below the lakebed (Xodus, 2015). Noise generated from HDD would be short-term with impacts occurring only during actual HDD activities, which would be expected to last approximately one month.

Operation and Maintenance

Habitat Disturbance and Reef Effect

The proposed turbine foundations would result in the loss of approximately 0.3 acre of existing substrate habitat (0.05 acre per turbine). Spacing between turbines is approximately 0.5 mile. Therefore, the footprint of the foundations represents an insignificant loss of habitat to fish species.

The foundations of the proposed turbines are anticipated to have impacts similar to those observed for offshore oil rigs in the Gulf of Mexico and offshore wind facilities in Europe. These structures would likely have an artificial reef effect that would increase both the diversity of fish and abundance of some fish species within the immediate vicinity of the foundations (Bergstrom et al., 2014; Wilhelmsson et al., 2006). The artificial reefs created around each turbine would allow for attachment of sessile invertebrates and would provide structure and feeding areas for fish. These new structures would provide new habitat and make different prey available to fish in this localized area.

The sediment composition following construction is likely to be similar to the existing conditions at the proposed turbine sites and along the proposed cable route, as sediment resettles. The only permanent disturbance of the lakebed habitat resulting from cable installation would be the presence of the inter-array and export cables; however, these cables would be buried approximately 1 to 1.5 meters (3.3 to 5 feet) below the surface and in some areas, may be buried deeper. Therefore, they would not interfere with fish migration or movement, and impacts to fish would be negligible.

Electric and Magnetic Fields

To determine the potential significance of EMF from the operating inter-array and export cables, a literature review of EMF related to fish was conducted (Appendix O). 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 the Proposed Project 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 proposed inter-array and export cables is low in comparison to other underwater transmission lines and should be less than background levels (Appendix O). LimnoTech reviewed a study involving lake sturgeon, which are benthic feeding and considered an 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 proposed inter-array and export cables will be well below the strength threshold for behavioral response in lake sturgeon because the cables will be buried at a depth of approximately 1 to 1.5 meters (3.3 to 5 feet) (Appendix O).

In marine environments, BOEM 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. BOEM reported that the EMF produced by energized cables diminishes to background levels about 1 meter (3.3 feet) away from the cable. BOEM concluded that given the rapidity with which the EMF produced by energized cables diminishes, and the lack of response to that EMF by fish and invertebrates, cable burial is not actually necessary for biological reasons (Love et al., 2016).

Based on the low expected EMF levels to be generated by the Proposed Project, the added diminishment of EMF from burial of the proposed inter-array and export cables, and current research regarding EMF impacts on fish behavior, no impacts to fish are anticipated from EMF generated by the Proposed Project.

Similarly, anticipated increases in the temperature of the sediment and water column associated with the inter-array and export cables would be expected to fall within the range of natural ambient variability and would not affect fish species as concluded for the LEC Project, a proposed cable approximately 80 miles east of the Proposed Project in Lake Erie (DOE, 2016).

Noise Disturbance

A review of the current knowledge of fish detection and reaction to underwater sound with special emphasis on underwater noise from offshore wind farms was conducted by Wahlberg and Westerberg (2005). The review looked at sound impacts to fish from noise generated by wind farms in terms of masking of acoustic communication, consistent triggering of alarm reactions, and temporal or permanent hearing damage. Sound measurements from 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 (3 to 7 feet). 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 an adverse impact on the maximum acoustic signaling distances by fish. However, it is not known to what degree this reduces the fitness of the fish (Wahlberg and Westerberg, 2005).

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, water depth, and bottom type may cause the detection and masking ranges calculated to vary considerably between different wind turbine sites (Wahlberg and Westerberg, 2005). 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).

Shipping causes considerably higher sound intensities than wind turbines (Wahlberg and 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 (especially from equipment such as a pile driver and jacket hammer), but only at moderate source levels during their operation (Hildebrand, 2009). A cargo vessel (173 meters [568 feet] in length, at 16 knots) will produce a source level of 192 dB re 1 micropascals (µPa) at 1 meter (3.3 feet), a small boat outboard engine (at 20 knots) will produce a source level of 160 dB re 1 µPa at 1 meter (3.3 feet), and an operating wind turbine will produce a source level of 151 dB re 1 µPa at 1 meter (3.3 feet) [13] (Hildebrand, 2009). Therefore, noise generated from the operation of the proposed turbines would be less than routine vessel sounds that occur in the Proposed Project Area and would not have an adverse impact to fish species.

There would be a slight increase in boat traffic consisting on average of one trip for a crew transfer vessel or tug boat per week over the year during maintenance activities at the proposed turbines (52 trips yearly as a conservative estimate). However, because Lake Erie experiences frequent boat traffic from commercial

[13] Hydrophones measure sound pressure, normally expressed in units of µPa. Early acousticians working with sound in air, realized that human ears perceive differences in sound on a logarithmic scale, so the convention of using a relative logarithmic scale (dB) was adopted. To be useful, the sound levels need to be referenced to some standard pressure at a standard distance. The reference level used in air (20 µPa at 1 meter) was selected to match human hearing sensitivity. A different reference level is used for underwater sound (1 µPa at 1 meter). Because of these differences in reference standards, noise levels cited in air do NOT equal underwater levels.

shipping and fishing and recreation, no significant additional underwater noise impacts would result from maintenance activities.

Based on the information above and LimnoTech's pre-construction ambient noise monitoring (see Section 3.12), noise generated from operation of the Proposed Project would result in negligible impacts to fish. Overall, long-term adverse impacts to fish species from operations and maintenance of the Proposed Project would be minor.

Decommissioning

Impacts associated with decommissioning activities would be similar to or less than construction activities, including temporary displacement and avoidance behavior during removal of the turbines. The inter-array and export cables would remain buried, therefore avoiding additional construction vessels.

3.4.2.3 Birds and Bats

Construction

Potential impacts associated with construction of the Proposed Project could include behavioral avoidance and displacement effects associated with the presence or activity of construction.

Displacement Effects

The potential for displacement effects, defined as the transformation of the Proposed Project Area from suitable habitat to less suitable habitat as a result of construction, was evaluated by examining data on the use of the Proposed Project Area and other offshore environments in the central Lake Erie basin by birds and bats for activities other than transit, in the context of technical literature on the subject. Baseline data have shown that the use of the Proposed Project Area as a habitat for anything other than migratory transit by any bird or bat species is minimal or negligible. For example, the ODNR aerial survey conducted over a large portion of Lake Erie, including the Proposed Project Area, documented the presence of only six species of water birds on a somewhat consistent basis in the vicinity of the Proposed Project Area. Three of these species were gulls (Bonaparte's gull, ring-billed, and herring gull), with averages roughly between one and five individual birds observed in the Proposed Project Area and vicinity per survey. For the other three species, (i.e., horned grebe, common loon, and red-breasted merganser), averages of roughly one individual or fewer were observed within the Proposed Project Area and vicinity per survey. At low abundance, statistically significant displacement effects would be difficult to detect and would not have any population-level impact on any species. Therefore, the displacement effects of construction to birds or bats of the Proposed Project would be negligible.

Behavioral Avoidance

Behavioral avoidance is defined as the avoidance of the Proposed Project by bird or bat species that would otherwise use the Proposed Project Area strictly for transit (other uses are covered by displacement effects). Some migrating birds and bats from a variety of taxa would be likely to migrate through the Proposed Project Area during construction. Migrating birds and bats may detect construction equipment and vessels and fly around them or avoid areas of construction. In such cases, the additional energy expenditure of this avoidance behavior is expected to be negligible (Appendix L-1). Therefore, the potential for adverse effects from avoidance behavior during construction would be negligible.

Operation and Maintenance

Potential impacts associated with operation and maintenance could include displacement effects, behavioral avoidance, or attraction effects, such as barriers to flight paths from the presence of the turbines or attraction to the turbines, and the risk of collision with wind turbines.

Displacement Effects

Similar to displacement effects for construction, the potential for displacement effects as a result of operation and maintenance, defined as the transformation from suitable habitat to less suitable habitat including use or avoidance of foraging, roosting, breeding, or wintering habitat, was evaluated by examining data on the use of the Proposed Project Area and other offshore environments in the central Lake Erie basin by birds and bats for activities other than transit, and considering the size of the Proposed Project. Baseline data have shown that the use of the Proposed Project Area as a habitat for anything other than migratory transit by any bird or bat species is minimal or negligible. Therefore, because of a low abundance of birds and bats, the displacement effects of operation and maintenance to birds or bats of the Proposed Project would be negligible.

Behavioral Avoidance/Attraction Effects

The potential for behavioral avoidance or attraction effects was evaluated by examining post-construction monitoring results of other offshore wind energy facilities, and by reviewing technical literature on this subject. As previously stated, behavioral avoidance is defined as the avoidance of the Proposed Project by bird or bat species that would otherwise use the Proposed Project Area strictly for transit. Behavioral attraction is defined as attraction to the Proposed Project by bird or bat species that would otherwise utilize the area less frequently or not at all. The analysis concluded that the proposed wind turbines have the potential to generate both behavioral avoidance and attraction effects in some groups of birds or bats.

After construction, some migrating birds and bats may detect the presence of the wind turbines and fly around them (avoidance). In such cases, the additional energy expenditure of this avoidance behavior is expected to be negligible, as has been demonstrated at offshore wind projects in Europe (Appendix L-1), and due to the small size of the Proposed Project. Therefore, the potential for adverse effects from avoidance behavior would be negligible.

Birds and bats flying in the vicinity may be attracted to the proposed wind turbines and platforms as structures to perch or roost (attraction). Attraction is not likely to occur in nocturnal (nighttime) migrant birds, because the wind turbines would utilize flashing red aviation obstruction lights, which do not attract nocturnal migrants or other birds. Nocturnally migrating birds may be attracted to the turbines if other lights are illuminated and face upward during nocturnal migrant flight periods, such as lights on the platforms or bases of the turbines. This potential effect would be minimized by using bird-safe designs, such as hooded or "smart" lighting, where consistent with other pertinent safety guidance on facility lighting. Attraction effects are more likely to occur with some diurnal (daytime) water birds such as gulls and cormorants, as has been demonstrated in Europe, and may also occur with additional taxa, including bats or migrating raptors (Skov et al., 2017). Such attraction effect, if present, may be beneficial by providing foraging sites or roosting in an area not typically used by birds or bats or may be adverse, increasing the risk of collision with the operating turbines (Appendix L-1). Due to the small size of the Proposed Project, and the use of bird-safe designs in regard to nocturnal migrants, the potential for adverse effects from attraction behavior would be minor.

Collision Effects

The potential for collision effects was evaluated by examining data on the use of the proposed turbine sites and other offshore environments in the central Lake Erie basin by birds and bats, including merely for transit, contextualized with information on taxon-specific wind-turbine collision susceptibility patterns from technical literature and publicly available post-construction monitoring reports from other wind energy facilities. Direct monitoring of offshore wind facility fatalities has rarely been attempted, and minimal data are available. Most European offshore wind facility impact studies focus on collision risk modeling. Using the information on the collision probability from European offshore wind studies, combined with known bird and bat fatality patterns from North American land-based wind energy facilities provides a basis for assessing collision risk anticipated for various bird and bat species from the Proposed Project. The risk evaluations (e.g. low, moderate, high) refer to how the range of potential fatality rates likely to be generated by the Proposed Project compare to fatality rates that have been documented at typical land-based energy facilities in the region.

The overall conclusion of the risk assessment was that total fatality levels of birds and bats are expected to be lower for the Proposed Project than for typical land-based wind energy facilities in the region. The possibility of attraction effects for some species not typically found foraging or roosting in the area could result in higher incidences of collision. Still, the proposed wind turbines are not likely to generate population-level effects for any species. These conclusions are based primarily on the small size of the Proposed Project. As seen in the following discussion, the total fatalities for the categories of birds and bats that may use the Proposed Project Area are low. While fatalities would occur, the potential impacts to bird and bat species would be considered minor and would not result in population-level effects to any species.

Raptors and Eagles

A small number of eagles and other raptors may be exposed to collision risk if they encounter the proposed wind turbines while migrating across Lake Erie. However, eagles and other raptors tend to avoid migrating over large water bodies such as Lake Erie, and no raptors were documented within 10 miles of the Proposed Project Area during a 2-year baseline survey effort (Norris and Lott, 2011) or in the boat-based baseline survey conducted specifically for the Proposed Project Area and vicinity (Appendix K). A recent study by Skov et al. (2017) presented evidence that when raptors are migrating southward across open water near the Nysted wind farm in Denmark, they exhibit a tendency to be attracted to the wind farm. If North American raptors migrating across Lake Erie behave the same way, it could increase collision risk for these birds above what it would be in the absence of such an effect. The extent of raptor migration across the central Lake Erie basin is likely to be low, hence the overall number of raptors that could be attracted to the Proposed Project Area would also be low. Due to the small size of the Proposed Project risk of collision would be low.

Foraging raptors and eagles would be unlikely to forage 8 to 10 miles offshore during the summer when plentiful food sources are available. In winter as the lake freezes, eagles will feed on fish and waterfowl along the leading edge of the ice. In 2014, a severe winter with extensive ice cover, numerous water openings were observed throughout the offshore ice sheet with open water between Cleveland and the Proposed Project Area (Appendix L-1). While extensive ice has the potential to put eagles near the proposed turbines, such extensive icing events are rare, and during such events it is unlikely that the proposed turbine sites would provide a unique ice-free environment. Therefore, collision risk for foraging eagles or raptors would be low.

Songbirds

The majority of concern regarding collision risk for songbirds and other small migratory birds is during the night, though it is not exclusively restricted to the night. Nocturnally migrating songbirds and similar birds may be exposed to collisions with the proposed turbines as they migrate across Lake Erie in the spring and fall. The results of available mortality studies conducted primarily in terrestrial environments indicate that most collisions with man-made structures take place at night during periods of inclement weather (Kerlinger, 2000). Birds that fly within the rotor swept zone of the proposed turbines during periods of low visibility would be at the greatest risk of collision. Based on land-based wind energy facilities bird fatality studies, as a group, nocturnally migrating songbirds and similar birds exhibit low general susceptibility to collisions with wind turbines. Such studies integrate all weather conditions over the time periods during which the studies are conducted. Susceptibility may be related to overall abundance of the species in the area, amount of time spent flying within rotor swept altitudes, behavioral/morphological factors (e.g. high degree of aerial maneuverability), and lack of attraction of nocturnally migrating birds to wind turbines, as long as intermittent aviation obstruction lighting is used on the nacelles (Appendix L-1).

A region-wide analysis of NEXRAD data demonstrated that the density of songbird migration over the central Lake Erie basin was less than one half of what it was over terrestrial environments within the region (Diehl et al, 2003). This conclusion was reinforced by WEST's January 2017 analysis of 3 years of more recent NEXRAD data over the Proposed Project Area and six on- and off-shore comparison sites. However, because NEXRAD data does not measure flight altitudes its usefulness in predicting risk is limited.

Several recent studies employing marine radars in shoreline environments have demonstrated relatively high densities of nocturnal migrant birds along the shorelines of Lake Erie and Lake Ontario (Rathbun et al., 2016; Horton et al., 2016).

WEST's report (Appendix L-1) compared studies conducted at operational, land-based wind energy facilities within the Great Lakes region to develop rough, quantitative predictions of the Proposed Project's collision fatality rates for nocturnal songbirds. Land-based facilities include a significant proportion of collisions by birds that are local, diurnally active residents in the facility area and not from collisions during nocturnal migratory flights. Therefore, using the total bird fatality rates for predicting nocturnal migrant songbird fatality rates at the Proposed Project may result in an overestimate, but still provides a useful prediction. Studies show fatality rates would most likely be between 2.10 and 3.35 birds per MW per year for small passerines, most of which are nocturnal migrants, which would lead to roughly 44 to 70 total bird fatalities per year for the Proposed Project. If assuming the nocturnal migrant bird passage in the vicinity of the Propose Project is less than over land, potential fatality rates for nocturnal migrants at the Proposed Project might be closer to the range of 1 to 2 birds per MW per year, or 21 to 42 total bird fatalities per year.

Based on the small size of the Proposed Project the overall collision risk for nocturnally migrating songbirds and similar birds would be low and would not result in population-level effects to any species (Appendix L-1).

Waterfowl and Water Birds

For waterfowl and other water birds, baseline aerial survey data have shown that these birds are largely restricted to the first 3 to 6 miles from shore in the central/southern Lake Erie basin, with minimal or negligible abundance of waterfowl and other water birds in the vicinity of the proposed wind turbines (Norris and Lott, 2011). A variety of studies at U.S. land-based wind energy facilities near waterfowl concentration areas have shown low wind-turbine collision susceptibility of waterfowl (Derby et al., 2009, 2010; Jain, 2005; Niemuth et al., 2013). Certain other water bird species, notably several species of gulls, may experience higher levels of exposure to potential collision risk, as they occur more regularly at the proposed wind turbine site and are known to fly more frequently within rotor swept altitudes. Such exposure may be increased further if gulls are attracted to the proposed wind turbines after construction, as has been shown for some gull species at some European offshore wind energy facilities (e.g. Krijgsveld et al., 2011). Although this exposure is likely to result in some collisions of gulls with the proposed turbines, such collisions are likely to be rare in relation to exposure, because of the high degree of aerial maneuverability and visual acuity of gulls, which confers low wind turbine collision susceptibility to gulls as a group (Cook et al., 2014). For this reason, the current European practice is to assign a very high collision avoidance probability to gull species in avian collision risk modeling studies for European offshore wind energy facilities (Cook et al., 2014).

Similar to eagles, waterfowl and water birds would have the potential to be near the proposed turbines as part of an ice-free zone during winter. However, review of ice cover data for the lake indicates that extensive icing events are rare and, when they do occur, there are generally ice-free areas distributed across the Lake, including nearer to shore than the proposed turbine sites.

As detailed in Appendix L-1, the overall risk of collision for waterfowl and waterbirds from the Proposed Project would be considered low.

<u>Bats</u>

Bat use of the airspace around the proposed turbines is expected to be largely limited to migratory transit (Appendix L-1). Although bats are primarily terrestrial animals, some species are likely to cross Lake Erie and the Proposed Project Area regularly, particularly as they are migrating. The extent to which bats may be attracted to the proposed turbines as they are migrating across the Lake, increasing collision risk, is not well-known.

The relationship between pre-construction bat acoustic activity, or "exposure" data and post-construction collision fatality at wind energy facilities is known to be complex, as bat acoustic activity is not equivalent to bat abundance (Strickland et al, 2011).

Bats that are known to migrate long distances, including the eastern red bat, hoary bat, and silver-haired bat, are the most commonly found bats in North American wind farm fatality studies, comprising 78 percent of fatalities (Arnett et al., 2008). Project-specific acoustic surveys (Appendix K) were conducted to evaluate the presence of bat species over Lake Erie and results showed six species were observed.

WEST (Appendix L-1) compiled information from 55 post-construction studies of bat fatalities at land-based wind energy facilities within the Great Lakes region, restricting the review to studies that produced estimates of total annual bat fatality rates based on robust study designs that included intensive, systematic carcass search efforts and corrections for searcher efficiency and carcass scavenging biases. Bat fatality rates in these studies ranged from <1 to slightly over 30 bat fatalities per megawatt per year. WEST concluded that the Proposed Project was likely to generate bat fatality rates that fall within this range.

Applying a comparison to make rough, quantitative predictions of the Proposed Project's collision fatality rates for bats indicate that bat fatality rates would be on the order of 1 to 4 bats per MW per year, which would lead to roughly 21 to 83 total bat fatalities per year for the Proposed Project, or as high as 20 to 30 bats per MW per year. Therefore, based, in part, on the small size of the Proposed Project, the risk of collision for bats would be low-moderate and would not be expected to have population-level impacts.

Decommissioning

Adverse impacts to bird and bat species associated with decommissioning activities would be minor and short-term, similar to construction activities.

3.4.2.4 Insects

Construction

The shoreline and land areas of the Proposed Project do not include monarch butterfly habitat; therefore, the Proposed Project would have no impacts to monarch habitat during construction. However, the Proposed Project would be located within the migration path of the monarch butterfly. Monarch butterflies must maintain a body temperature of 55°F for flight (Masters et al., 1988). Warm air over Lake Erie is present from the middle of July until the middle of October as lake waters cool much more slowly than surrounding air over land (NOAA, 2017d). Construction of the Proposed Project is proposed to begin in the spring and be completed by the fall of the same year. Fall construction activities such as vessel traffic on the lake, could affect migrating monarch butterflies if they pass near the Proposed Project Area; however, it is unlikely that construction activities would adversely impact the monarch butterfly. The number of vessels that would be used for construction of the Proposed Project would not be a significant increase over current vessels operating in the Proposed Project Area. In addition, observations from a charter boat captain in Lake Michigan reported observing migrating monarchs during an afternoon charter trip and noted that they never landed on his boat (Monarch Watch, 2015). Therefore, monarch butterflies are not likely to be disturbed by vessels or construction activities during installation of the Proposed Project resulting in negligible impacts.

The four state-listed insects that occur in Cuyahoga County are generally found in high velocity rivers and streams, wetlands, and prairie habitats, which do not occur within the Proposed Project Area. The Port, the Proposed Substation, onshore cable route, and HDD boring pit would be within developed land which does not provide habitat for these state-listed threatened and endangered species. This is the only area proposed for onshore construction activities. The ODNR Natural Heritage Program had no records for rare or endangered species in the Proposed Project Area. Therefore, impacts to state-listed insect species are not anticipated for the Proposed Project during construction.

Operation and Maintenance

The shoreline and land areas of the Proposed Project do not include monarch butterfly habitat or state-listed insect habitat; therefore, the Proposed Project would have no impacts to monarch butterfly or state-listed insect species habitat during operation.

The proposed turbine area does not include habitat for the four state-listed insect species as identified above. Therefore, impacts to the state-listed insect species are not anticipated at the proposed turbine site during operation and maintenance.

The proposed wind turbines would be located within the migration path of the monarch butterfly. Direct research on the impact of wind turbines on migrating butterflies is limited; however, other studies on butterflies offer data that suggest wind speeds and patterns associated with operating turbines likely would not cause collision issues (Grealey and Stephenson, 2007). Butterflies approaching from a downwind direction may be repelled by the wake from the turbine or become trapped in the wake of the downwind vortex created by wind turbines. Butterflies approaching a turbine from an upwind direction likely will be unaffected unless they collide with the turbine. Wind currents created by turbine blades may be great enough to sweep butterflies away from the turbine blades before physical collision can occur (Grealey and Stephenson, 2007). Because of the small scale of the Proposed Project, variability in reported flight heights of the migrating monarch butterfly, with butterflies migrating at heights of up to 10,000 feet, and the limited time in which the monarch butterfly migrates through the area, adverse impacts during operation and maintenance would be negligible.

Decommissioning

Similar to construction, the Proposed Project would have no anticipated impacts to state-listed insect species or monarch butterfly habitat during decommissioning because there is no habitat for these species within the Proposed Project Area. Vessel traffic required for decommissioning would be similar to current vessels operating in the Proposed Project Area and the presence of vessels is not anticipated to alter the monarch butterfly's flight pattern even if activities are conducted during the monarch butterfly migration period. Therefore, impacts to monarch butterflies would be negligible and no impacts are anticipated for state-listed insects during decommissioning activities.

3.4.2.5 Aquatic and Terrestrial Protected Species

State-listed species are not expected to occur in the Proposed Project Area based on a lack of habitat and the ODNR Division of Wildlife letter (2017) indicating no records of rare or endangered species in the area. Therefore, state-listed species are not evaluated further in this section except for bird and bat species that are also federally listed.

A Biological Assessment was prepared for the purpose of the ESA Section 7 consultation with USFWS (Appendix M-1). The USFWS concurs with the Biological Assessment that the Proposed Project may affect but is not likely to adversely affect the federally listed threatened and endangered species discussed in Section 3.4.1.5 (Appendix M-2). The concurrence concluded the ESA Section 7 consultation.

Construction

Potential impacts associated with construction of the Proposed Project could include loss of habitat and disturbances associated with the presence or activity of construction. As seen in the following discussion, the risks during construction for federally listed threatened and endangered species is negligible. Therefore, construction of the Proposed Project may affect but is not likely to adversely affect the federally listed threatened and endangered species.

Indiana Bat and Northern Long-Eared Bat

Habitat associated with the Proposed Project includes developed, urban environment, hardened shorelines of the Cuyahoga River, the Old River, and Lake Erie, and Lake Erie open water. Undisturbed forested habitat typically occupied by Indiana and northern long-eared bats does not occur near the Proposed Project; therefore, no Indiana bat or northern long-eared bat habitat would be lost from construction of the Proposed Project.

Baseline data have shown that the use of the Proposed Project Area as a habitat for anything other than migratory transit by any bat species is minimal or negligible. The presence or activity of construction would have negligible effect on Indiana bats or northern long-eared bats because they are unlikely to occur in the vicinity of the Proposed Project, or if present, it is likely in very small numbers.

Kirtland's Warbler

Habitat associated with the Proposed Project includes developed, urban environment, hardened shorelines, and Lake Erie open water, none of which are considered important habitat for Kirtland's warbler. Nesting habitat preferred by the Kirtland's warbler does not occur near the Proposed Project; therefore, no Kirtland's warbler habitat would be lost from construction of the Proposed Project. Migrating Kirtland's warbler could pass through the Proposed Project Area during construction; however, there have been only five documented sightings of Kirtland's warbler in the Cleveland region between 1950 and 2004. Effects from the presence or activity of construction would be negligible.

Piping Plover

The piping plover is now considered only a migrant species in Ohio (ODNR, 2017d) and no project construction activities would occur in areas that might be used by feeding or resting plovers. Therefore, no piping plover habitat would be lost from construction of the Proposed Project. Migrating piping plover could pass through the Proposed Project Area during construction; however, effects from the presence or activity of construction would be negligible.

Rufa Red Knot

The rufa red knot is only a migrant species in Ohio and no project construction activities would occur in areas that might be used by feeding or resting rufa red knots. Therefore, no rufa red knot habitat would be lost from construction of the Proposed Project. Migrating rufa red knot could pass through the Proposed Project Area during construction; however, effects from the presence or activity of construction would be negligible.

Operation and Maintenance

Potential impacts associated with operation could include disturbances, such as barriers to flight paths from the presence of the turbines, and the risk of collision with wind turbines. Potential effects associated with maintenance activities could include disturbances with the presence or activity of equipment or vessels (similar to construction).

Indiana Bat and Northern Long-Eared Bat

The Indiana bat is unlikely to occur in the Proposed Project Area because there is no undisturbed forested area typically utilized as summer habitat nearby. In addition, because there are no known colonies of Indiana bats in Ontario, it is unlikely it migrates across the lake or is present in the area of the proposed wind turbines. The Proposed Project may affect but is not likely to adversely affect Indiana bats and population-level impacts are not expected.

It is possible that northern long-eared bats could migrate through the Proposed Project Area, as the species has been documented in Ontario, along the northern shores of Lake Erie (Dobbyn, 1994; Dzal et al., 2009). However, the species is not a long-distance migratory bat species and unlikely to cross Lake Erie, and therefore, unlikely to come into contact with the proposed turbines. Bat collision impacts at turbines are most frequent on nights when wind speeds are lower, especially during the late summer when migrating and swarming bats are most active. To address this concern, LEEDCo has agreed to feather the turbine blades (i.e., adjust the pitch of the turbine blades) up to the manufacturer's cut in speed (i.e., 6.7 mph, the speed at which the turbine starts generating electricity) during these active periods. Therefore, the Proposed Project may affect but is not likely to adversely affect northern long-eared bats and population-level effects are not expected.

Kirtland's Warbler

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, 2017b). It is thought that "all or nearly all" of the Kirtland's warbler population passes through Ohio during migration (ODNR, 2007a). While no Kirtland's warblers were observed during the boat surveys or detected during the spring and fall avian acoustic monitoring, the species is known to migrate through the Cleveland area, as evidenced by five documented sightings in the Cleveland region between 1950 and 2004 (McCarty, 2012). A model previously developed by the USFWS to assess the effects of communication towers on the Kirtland's warbler was used to evaluate the potential effects of the Proposed Project. The model predicted that, over the 30-year lifespan of the Proposed Project, the take of Kirtland's warbler may be estimated at 0.002 warblers per year (one Kirtland's warbler death every 500 years) (Kerlinger and Guarnaccia, 2013). In this modeling exercise, Kerlinger and

Guarnaccia used a conservative assumption that 10% of the entire global population of Kirtland's warbler passes over the Proposed Project site twice per year. This assumption is consistent with new evidence recently produced by Cooper et al. (2017) who showed that while a substantial portion of the Kirtland's warbler population may migrate across Lake Erie during fall migration, few birds are likely to cross the Lake during spring migration.

Details of the Kirtland’s warbler migration and specific habitat used during migration are not well understood (USFWS, 2012). However, coastal areas along the Atlantic Ocean and the Great Lakes are areas of potential importance to the species during migration (USFWS, 2012). Several recent studies employing marine radars in shoreline environments have demonstrated relatively high densities of nocturnal migrant birds along the shorelines of Lake Erie and Lake Ontario (Rathbun et al., 2016; Horton et al., 2016), reinforcing the understanding that such migrants tend to concentrate along coastlines and avoid flying over large water bodies, such as Lake Erie, if possible. Marine surveillance radar studies conducted at approximately 20 sites in the eastern U.S. have indicated that in spring and fall migratory periods, there is more nocturnal songbird migration at higher altitudes than there is within the altitudes that would be swept by the Proposed Project’s turbines (Kerlinger and Guarnaccia, 2013). Although there is little data specific to Kirtland’s warbler, nocturnally migrating songbirds generally exhibit low susceptibility to collisions with wind turbines.

Therefore, the Proposed Project may affect but is not likely to adversely affect Kirtland’s warbler and population-level effects are not expected.

Piping Plover

The piping plover is now considered only a migrant species in Ohio (ODNR, 2017d). While no piping plovers were found in the offshore study area during boat-based visual observation surveys or avian acoustic monitoring, both conducted during the spring and fall migration periods (Appendix K), the possibility exists that piping plovers could migrate through the Proposed Project Area and collide with the wind turbines. There are two piping plover critical habitats in Ohio. OH-1 near Sandusky is located approximately 60 miles to the west of the Proposed Project Area and OH-2 near Painesville is located approximately 30 miles to the east of the Proposed Project Area. Both critical habitats are used as migration stopover locations and have regular observations of plovers during migration (USFWS, 2009b). In addition, documented migration stopovers also occur at Point Pelee and Long Point in Ontario, on the north side of Lake Ontario (USFWS, 2009b). While little is known about the exact migration routes of piping plovers, observations along the Great Lakes shoreline suggests plovers may use the shorelines as a migration corridor.

The risk of collision of piping plover during migration movements would be based on flight frequency through the area, height of flight, visibility conditions, and turbine avoidance behaviors (which are not known). Unfortunately, piping plover migration is poorly understood, but interior populations, such as those with breeding grounds around the Great Lakes, likely make non-stop migrations to their wintering grounds (Haig, 1992). It is not known what flight paths piping plovers use on their migration, if plovers cross Lake Erie during migration, or their average flight height. Shorebirds migrating from Nova Scotia were recorded flying at an overall mean altitude of approximately 6,500 feet (2,000 meters) (median 5,500 feet [1,700 meters]), well above the rotor swept area (Richardson, 1979). These birds are known to cross large expanses of land and water and make stop-overs at staging areas along the way. Looking at numerous studies, Richardson (1978) determined that for most bird species, the number of birds migrating peaked when winds were in the direction of the migration path. Following winds would be important for birds that migrate long distances, especially over barren landscapes (Richardson, 1990), such as Lake Erie. Piping plovers migrate both during the day and night (O’Brien et al., 2006), and may wait out inclement weather conditions prior to flight, thereby reducing collision risk.

Although there is little data about collision risk to piping plovers specifically, studies conducted to date have shown that shorebirds generally have a low risk of collision mortality. For example, post-construction bird and bat fatality monitoring studies conducted by the New Jersey Audubon Society at the Atlantic City Utilities Authority's Jersey Atlantic Wind Power Facility revealed negligible shorebird fatality rates despite this project's location adjacent to coastal habitat within one of the most concentrated shorebird migration corridors on the east coast of the U.S. (New Jersey Audubon Society, 2008a; 2008b; 2009). No piping plover fatalities have been documented at operating wind energy facilities. The same model used to predict take of the Kirtland's warbler (discussed above) was used to estimate the piping plover take because of the Proposed Project. The estimated take for piping plovers was one piping plover every 2,500 years.

Therefore, the Proposed Project may affect but is not likely to adversely affect piping plover and population-level effects are not expected.

Rufa Red Knot

The rufa red knot is a migratory bird traveling yearly from the Arctic to South America. Small numbers of rufa red knots pass through Ohio, with more moving through in the fall than in the spring (ODNR, 2017e). The species can occur almost anywhere along the Great Lakes shores or inland on mudflats of falling reservoirs in late summer and autumn or flooded fields in spring. The northern shoreline of Ohio is visited regularly during fall migration, particularly the Ottawa National Wildlife Refuge (USFWS, 2014b), approximately 66 miles west of the nearest turbine. While no red knots were found in the offshore study area during boat-based visual observation surveys or avian acoustic monitoring, both conducted during the spring and fall migration periods (Appendix K), the potential exists for the species to migrate through the Proposed Project Area.

Although there are no documented instances of red knot mortality from wind energy facilities, the Proposed Project operation could result in red knot mortality from collision with the wind turbine blades. Red knots can travel 1,500 miles or more per day, migrating both day and night (Normandeau Associates, Inc., 2011) to reach their staging and stopover locations to rest and feed. Birds on long-distance flights, such as red knots crossing the offshore environment, fly at higher altitudes than short-distant migrants (78 FR 60024), thereby reducing exposure to wind energy facilities. Although no red knot avoidance data is available, studies to date indicate that collision risk for shorebirds, in general, is low (New Jersey Audubon Society, 2008a; 2008b; 2009).

It is unlikely that the proposed wind turbines would pose a significant barrier to bird migration or local flight paths on Lake Erie. If migratory or local movement takes red knots in the vicinity of the Proposed Project, it is expected that birds would normally cross the wind turbines well above the rotor-swept area (Gordon and Nations, 2016).

Therefore, the Proposed Project may affect but is not likely to adversely affect rufa red knot and population-level effects are not expected.

Decommissioning

Impacts associated with decommissioning activities are expected to be similar to construction activities. Therefore, effects to the Indiana bat, northern long-eared bat, Kirtland's warbler, piping plover, and rufa red knot because of decommissioning would be negligible. Therefore, decommissioning of the Proposed Project may affect but is not likely to adversely affect the federally listed threatened and endangered species.

3.5 Health and Safety

3.5.1 Affected Environment

3.5.1.1 Waste Management

The OEPA, Division of Materials and Waste Management defines non-hazardous waste to include solid waste, infectious waste, and construction and demolition debris (OEPA, 2017a). No significant debris or solid waste has been identified within the Proposed Project Area.

3.5.1.2 Hazardous Materials

Hazardous materials are materials with properties that make them dangerous, or capable of having a harmful effect on human health or the environment. Hazardous wastes are defined in 40 CFR 261.3.

A search of the EPA Envirofacts lists CPP as a Conditionally Exempt Small Quantity Generator and regulated under the Resource Conservation and Recovery Act (EPA, 2017a).

3.5.1.3 Public Health and Safety

Public safety concerns associated with the Proposed Project construction include: (1) the movement of large construction vehicles, vessels, equipment, and materials; (2) slips, trips, and falls; (3) falling overhead objects; and (4) electrocution. Public health and safety requirements for the Proposed Project while working on the Proposed Project components are regulated by the U.S. Occupational Safety and Health Administration (OSHA), while health and safety requirements for activities that take place on vessels would be regulated by the USCG under its regulations at 46 CFR Part 4.

3.5.2 Environmental Impacts Related to Health and Safety

3.5.2.1 Construction

Waste Management

The amount of construction waste generated by the Proposed Project would be minimal and consist of some solid waste, primarily plastic, wood, cardboard, and metal packing/packaging materials; construction scrap; and general refuse. Construction waste would be collected from turbine sites and other Proposed Project work areas and disposed of in dumpsters located at the O&M Center. Any waste generated on installation vessels during the Proposed Project construction would be brought back to the Port for disposal. Waste would be recycled when possible, and if it is not recyclable it would be disposed of at dumpsters located at the O&M Center. A private contractor would empty the dumpsters on an as-needed basis and dispose of the refuse at a licensed solid waste disposal facility. The following is a list of the estimated solid waste that would be generated by construction activities.

- Wood (Clean) – 500 kilograms (kg) (1,102 pounds)
- Recyclable waste (soiled wood) – 600 kg (1,323 pounds)
- Recyclable waste (paper, plastic) – 200 kg (441 pounds)
- Combustible general waste – 700 kg (1,543 pounds)
- Landfill – 250 kg (551 pounds)
- Oils – 20 liters (5.3 gallons)
- Paints – 5 kg (11 pounds)

Because these waste amounts are small waste quantities managed regularly by waste companies, the potential impacts from waste generated from the Proposed Project would be negligible.

Hazardous Materials

Construction equipment and vessels used during construction of the Proposed Project would use minor amounts of hazardous materials (oil, fuels, hydraulic fluids, lubricants) necessary for proper operation. Contractors would be required to develop and implement a SPCC plan. Used oil and universal waste would be handled, managed, and disposed of in accordance with federal, state, and local regulations and compliance with these regulations would ensure that potential impacts from hazardous materials during construction would be negligible.

It is not anticipated that construction of the Proposed Project would increase the amount of hazardous wastes generated by the CPP facility. It is also not anticipated that CPP's identification as Conditionally Exempt Small Quantity Generators would affect the Proposed Project construction. Furthermore, the proposed export cable and the Proposed Substation on the CPP property will not result in excavation in any areas that may be used for waste storage.

The potential impacts from hazardous materials from the Proposed Project would be negligible.

Public Health and Safety

Health and safety issues would be most relevant to construction personnel who would be working in close proximity to construction equipment and materials and exposed to construction-related hazards daily. The risk of construction-related injury would be minimized through weekly safety meetings, regular safety training, and the use of appropriate safety equipment. The Proposed Project would employ OSHA measures to ensure worker safety during construction and operation. Construction contractors would follow safety procedures and best practices for offshore wind construction as specified by LEEDCo and outlined in its Construction Phase Health, Safety, and Environmental Plan.

The general public would also be exposed to construction-related hazards from 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. Exposure risk to the public is anticipated to be minimal, because there would be buoys marking a site exclusion zone during construction, and guard vessels to keep out errant vessels. Vessels involved in the construction phase would be properly marked, lighted, and outfitted with sound signals in accordance with navigational rules. Notices to mariners (as well as LEEDCo's project website notices) and/or radio navigational warnings would be broadcast prior to and during construction.

In accordance with OSHA Part 1926.35, the prime contractor would develop and implement a Project Emergency Action Plan for the construction phase. Additionally, LEEDCo would work with local fire departments and other emergency responders to provide training for response to emergency situations related to the Proposed Project and equipment.

Adverse impacts to health and safety from the Proposed Project would be minimized during construction through established health and safety policies and procedures, providing notice to the public, and providing training to appropriate emergency response personnel.

3.5.2.2 Operation and Maintenance

Waste Management

The operation and maintenance of the Proposed Project would 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, general refuse, and used antifreeze. The O&M Center offices would generate solid wastes comparable to a typical small business office. The O&M Center would utilize local solid waste disposal and recycling services. Facility operation would not require acquisition of waste generation, storage, treatment, transportation, and/or disposal licenses or permits. Waste management impacts during operation and maintenance of the Proposed Project would be negligible.

Hazardous Materials

Any used oil and universal waste generated from the Proposed Project during operation and maintenance would be handled, managed, and disposed of in accordance with federal, state, and local regulations.

The operation of the Proposed Project would not 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 would be designed for three levels of containment. Each primary system, i.e. gearbox, would be a sealed system with multiple sensors that monitor fluid performance and containment, with each of these inspected at regular maintenance intervals. The secondary system would be in the nacelle itself, where fluid containment reservoirs would be designed to capture any leaks from a primary system failure. If both primary and secondary containment fails, the bottom of the tower would have 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 would be inherently biodegradable. In addition, service vessels would be equipped with oil spill handling materials adequate to control or clean up any accidental spill.

As part of the O&M Plan for the operations of the turbines, a SPCC plan would be developed which would include the identification of a qualified Spill Responder. The Spill Responder would maintain the resources and availability necessary to address any spills. It is anticipated that development of the oil spill response plan would be performed through close communication with the appropriate agencies such as the USCG. Therefore, potential adverse impacts associated with hazardous materials and wastes resulting from the operations and maintenance phase of the Proposed Project would be negligible and short-term.

It is not anticipated that operation of the Proposed Project would increase the amount of hazardous wastes generated by the CPP facility. It is also not anticipated that CPP's identification as Conditionally Exempt Small Quantity Generators would impact the Proposed Project operation; therefore, impacts would be negligible.

Public Health and Safety

Turbines would be fitted with safety lighting to satisfy FAA and USCG standards. The lowest tip of the turbine blade would be 20 meters (65 feet) above the surface of Lake Erie. 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 (Appendix P). Of all the sailboats classified in the study, 99 percent of boats had a mast height below 65 feet. Additionally, a study of location of boats offshore found that only 2 percent of the boats counted in all of the surveys were within 3 miles of the proposed turbine sites (Appendices E-1 and I). The Proposed Project, working with the USCG, has prepared a preliminary Navigational Risk Assessment to ensure all navigational hazards are appropriately addressed; the Navigational Risk Assessment is discussed in Section 3.9, Traffic and Transportation.

Adverse impacts to health and safety from the Proposed Project during operation and maintenance would be minimized through established health and safety policies and procedures.

3.5.2.3 Decommissioning

Waste Management

With decommissioning, removal of the Proposed Project would be accomplished by simply reversing the installation process and would permit complete removal and recycling of steel materials. Other project materials including items such as fittings and connectors, light sources, control equipment and electronics, and waste would be recycled when possible, and if it is not recyclable, it would be disposed of appropriately at a licensed solid waste disposal facility. Impacts would be negligible.

Hazardous Materials

Construction equipment and vessels used during decommissioning of the Proposed Project would require minor amounts of hazardous materials (oil, fuels, hydraulic fluids, lubricants). Contractors would be required to develop and implement a SPCC plan. Used oil and universal waste would be handled, managed, and disposed of in accordance with federal, state, and local regulations. Impacts would be negligible.

Public Health and Safety

Similar to construction, safety trainings and weekly meeting would be completed, OSHA measures would be employed, and appropriate plans implemented for construction workers.

Adverse impacts to health and safety from the Proposed Project would be minimized during decommissioning through established health and safety policies and procedures, providing notice to the public, and providing training to appropriate emergency response personnel.

3.5.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.6 Air Quality

3.6.1 Affected Environment

Ambient Air Quality

The OEPA 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 *Ohio Air Quality 2015* Report (OEPA, 2015). Included in that report is a summary of 2015 air quality data, a discussion of toxics monitoring projects, and trend studies for selected pollutants. Pollutants monitored over 14 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.

Air emissions in the Proposed Project Area would be related primarily to vehicular travel and manufacturing. The greatest sources of manufacturing emissions in the vicinity of the Proposed Project 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 (OEPA, 2014b).

General Conformity

The Clean Air Act (CAA), as amended in 1990, requires the EPA to set National Ambient Air Quality Standards (NAAQS) (40 CFR 50) for pollutants considered harmful to public health and the environment. The EPA Office of Air Quality Planning and Standards has set NAAQS for six 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 describing how they will attain and/or maintain the NAAQS for each criterion pollutant exceeding or that has exceeded its standard in the past.

As described above, air quality monitoring occurs in Cuyahoga County. According to the OEPA (2015), a violation of NAAQS was reported for 2.5-micron particulate matter (3-year average of annual average).

The 1990 CAA amendments prohibit federal entities from taking actions in nonattainment and maintenance areas that do not conform to State Implementation Plans 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.

3.6.2 Environmental Impacts Related to Air Quality

3.6.2.1 Air Quality Impacts

In accordance with Section 111 of the CAA, the EPA established New Source Performance Standards (NSPS) to regulate emissions of air pollutants from new stationary sources. The OAC regulations do not contain any NSPS regulations for the Proposed 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, NSPS would not apply to the Proposed Project.

All new sources of air emissions in Ohio are required to obtain a Permit to Install for Title V facilities, or a Permit to Install and Operate for non-Title V facilities. Because wind turbines generate electricity without releasing pollutants into the atmosphere, the Proposed Project would not require a Permit to Install or a Permit to Install and Operate.

Administered by the EPA, the Acid Rain Program was established by the CAA Amendments of 1990 to reduce emission of sulfur dioxide 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 Project would not require an acid rain permit.

Prevention of Significant Deterioration 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 Project would not be a major source of any pollutants. Therefore, Prevention of Significant Deterioration would not apply.

Construction

The Proposed Project would be located in Lake Erie, 8 to 10 miles north of the City of Cleveland. Site clearing would not be required for construction, and any sediment disturbance during construction of turbine foundations, towers, and electrical cable would be submerged at the lakebed. Therefore, fugitive dust control would not be an issue for the Proposed Project. The proposed substation would be located at an already-developed parcel in use as electric system infrastructure and no clearing activities would be anticipated.

Air contaminants would be emitted from the vessels used to transport project components and work crews to the project location out in Lake Erie. These emissions would be limited to the products of combustion from diesel and gasoline engines, including: carbon dioxide, particulate matter, volatile organic compounds, and NO_X. Table 3.6-1 shows the estimated air pollutant emissions for the project construction activities. The engines would be both those used for vessel propulsion and those needed to power cranes and other onboard construction equipment. During construction, these pollutants would be emitted during the transit to and from the Port as well as while construction vessels were on station erecting the proposed foundations and wind turbines as well as during the laying off the proposed electrical export cable. These emissions from the Proposed Project would be very similar in nature to those regularly occurring on Lake Erie from commercial shipping and commercial and recreational fishing activities.

Table 3.6-1. Construction Emissions Estimates by Vessel Type

Vessel/ Vehicle Type		Large lift crane barge (propulsion)	Large lift crane barge (lift crane)	Tow tug	Crew boat	Inspection boat	Heavy lift vessel	Generators	Totals
Emissions Total (tons per year)	CO_2	381	276	2,499	881	881	1,256	384	6,557
	CO	<1	1	9	3	3	4	1	23
	NO_2	9	2	37	12	12	19	4	95
	SO_2	<1	<1	<1	<1	<1	<1	<1	<1
	VOC	<1	<1	<1	<1	<1	<1	<1	2
	PM	<1	<1	1	<1	<1	<1	<1	3

Operation and Maintenance

The nature of emissions of air contaminants during operation and maintenance would be the same as those emitted during construction but are anticipated to be substantially less in quantity annually because most of the effort for maintenance would be expected to be from smaller vessels than those used during initial construction.

Decommissioning

Emissions of air contaminants during decommissioning would be the same or less than those emitted during construction, both in the nature and quantity of the contaminants as those that would be emitted during initial construction.

3.6.2.2 Conformity Analysis

General Conformity ensures that the actions taken by federal agencies, like DOE, do not interfere with a state's plans to attain and maintain national standards for air quality. The Proposed Project would be located within a designated nonattainment area. DOE conducted an applicability analysis to evaluate whether construction and operation of the Proposed Project would negatively affect state efforts to comply with NAAQS. Estimated onshore emissions of carbon monoxide, particulate matter, volatile organic compounds, and NO_X were estimated to be less than the EPA de minimis threshold values as shown in Table 3.6-2 (EPA, 2017b). Therefore, a conformity determination would not be necessary for the pollutants that would be emitted during the construction, operation, and decommissioning of the Proposed Project. The potential impacts to air quality from the Proposed Project would be negligible.

Table 3.6-2. Comparison of Annual Emissions of Criteria Pollutants with USEPA de minimis Thresholds for General Conformity

	USEPA de minimis threshold (Tons/Year)	Project Icebreaker Construction Emissions (Tons/Year)
Criteria Pollutants		
Nitrogen Oxides (NOx)	100	95
Volatile Organic Compounds (VOCs)	50	2
Sulfur Dioxide (SO_2)	100	<1
Carbon Monoxide (CO)	100	23
Primary PM, Filterable and Condensable Portions (All Less than 1 Micron) (PE)	100	3

Source: EPA, 2017b

3.6.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.7 Climate Change

3.7.1 Affected Environment

Global climate change is a transformation in average weather, which can be measured by changes in temperature, wind patterns, and precipitation. Human activities since the Industrial Revolution have increased the abundance of greenhouse gases resulting in rising average global temperatures (NOAA, 2017e). Greenhouse gases (GHGs) trap heat in the atmosphere and regulate the Earth's temperature. They include water vapor, carbon dioxide, methane, nitrous oxide, ground-level ozone, and fluorinated gases such as chlorofluorocarbons and hydrochlorofluorocarbons.

3.7.2 Environmental Impacts Related to Climate Change

3.7.2.1 Effects of Project on Climate Change

Anticipated GHG emissions from the construction and operation of the Proposed Project were evaluated. Table 3.6-1 provides the Proposed Project emissions.

Construction

Emissions of GHG from Proposed Project construction will be minimal and short-term. As shown in Table 3.6-2, GHG emissions from construction of the Proposed Project would be far less than 1 percent of the annual GHG emissions in Cuyahoga County, Ohio. Any potential air quality impacts related to GHG emissions from construction activities would be negligible.

Operation and Maintenance

There would be minimal emissions of GHG from the Proposed Project operation and maintenance activities. The potential GHG emissions during operation and maintenance would be offset by the reductions in GHG emissions that would result from the generation of emissions-free electricity by the Proposed Project. Any potential air quality impacts from operation and maintenance activities would be negligible.

Decommissioning

The estimated emissions of GHG from decommissioning is expected to be the same as those resulting from construction activities and would be minimal and short-term. Any potential air quality impacts from decommissioning activities would be negligible.

3.7.2.2 Effects of Climate Change on Project

Construction

It is anticipated that the Proposed Project would be constructed no sooner than 2020 when the necessary permits and approvals are obtained. Climate change phenomena such as water level changes in Lake Erie would not be expected to occur at levels that would cause difficulties in constructing the Proposed Project.

Operation and Maintenance

According to the NOAA Great Lakes Environmental Research Laboratory, forecasts for future, long-term Great Lakes water levels are uncertain. Based on recent studies, there is little evidence that future water level variability will greatly exceed the historical range (NOAA, 2017f).

There is a large variation of ice cover at Lake Erie, ranging from less than 25 percent cover of the lake surface in a mild year to 100 percent cover during severe winters (Daly, 2016). Ice cover in Lake Erie has the potential to produce two different types of loading on the proposed 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. Characterization of Lake Erie ice was investigated using multiple approaches, and is discussed in more detail in Appendix Q. The results provided an extensive data set for sheet ice thickness, frequency of ridges and keels, the maximum possible thickness of consolidated ice, and estimated dynamic ice forces and their significance in the fatigue limit design of the turbine foundations. The Proposed Project foundation design incorporated the available data. LEEDCo performed ice load modeling and analysis to confirm that the foundation design would meet design requirements for offshore wind turbines and be able to withstand Lake Erie ice loadings.

Should changes occur to Lake Erie water levels, ice formation or dynamic ice forces from climate change, the Proposed Project may potentially be affected. As discussed above, the Proposed Project would be designed to withstand the expected ice loading conditions and so impacts to the Proposed Project from climate change would be negligible.

Decommissioning

As time goes on, climate change processes may result in changes to lake levels and ice formation. If such changes occur during the service life of the Proposed Project, it may make decommissioning activities more complex. However, such impacts would be expected to be minor.

3.7.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.8 Lake Use

3.8.1 Affected Environment

The Cleveland Harbor consists of an outer harbor formed by breakwaters and an inner harbor made up of the Cuyahoga River and the Old River. The harbor is approximately 1,600 to 2,400 feet wide and approximately 1,300 acres (USACE, 2009). The main entrance to the Harbor is a dredged navigational channel opposite the mouth of the Cuyahoga River. Additional entrances include a navigational channel at the east end and one at the west end for small crafts. The Cleveland Harbor is a USACE navigation civil works project in which the USACE provides safe, reliable, efficient, and environmentally sustainable waterborne transportation for movement of commerce, national security needs, and recreation. More details and dimensions for the Cleveland Harbor are provided in the Navigational Risk Assessment in Appendix R.

There are extensive waterfront facilities in the Cleveland outer harbor and along the banks of the Cuyahoga River and Old River. Facilities in the Cleveland Harbor are listed in U.S. Coast Pilot (NOAA, 2016a). During the closed navigation season, many of the piers, wharves, and docks are available for winter mooring of vessels. The harbormaster, who has control of the waters for the anchorages, generally orders vessels to anchor outside the harbor.

The Cleveland-Cuyahoga County Port Authority operates the Port of Cleveland in the Cleveland Harbor. The Port has cargo terminals with 12 docks to the east and west of the Cuyahoga River along the Lake Erie shoreline. Major commodities handled at the port include iron, steel, and aluminum products, limestone, iron ore, sand, stone, salt, and other minerals, petroleum products and other liquid bulk cargo, and general and containerized cargo in the foreign trade (NOAA, 2016b). The Port of Cleveland also includes the Cleveland Bulk Terminal, which is approximately 44 acres in size and located west of the river. The Cleveland Bulk Terminal primarily handles iron ore and limestone.

The waterways in the Proposed Project Area experience both commercial and recreational vessel traffic, both of which increase in numbers during the peak spring and summer boating season. Commercial vessels in the Great Lakes typically include bulk freighters, self-unloaders, integrated tug barges, chemical carriers, cement carriers, tugs, and barges (Haberly and Stalikas, 2013). The Cleveland Bulk Terminal is the main Port facility located to the west of the Cuyahoga River.

The ODNR manages sport and commercial fisheries in 2.24 million acres of Lake Erie. Ohio commercial fisheries harvested 4.6 million pounds of fish in 2015 with a dockside value of $4.9 million (ODNR, 2016a). Harvest included burbot, freshwater drum, gizzard shad, lake whitefish, buffalo, bullhead, common carp, channel catfish, goldfish, quillback, suckers, white bass, white perch, and yellow perch. Yellow perch, freshwater drum, and white bass were the three primary fish harvested accounting for 28, 20, and 17 percent of the total commercial harvest, respectively (ODNR, 2016a). The proposed location of the turbines would be in ODNR management units that comprised less than 3 percent of total commercial fishery nets pulled in Lake Erie from 2011 to 2015 (Appendix R, Figure 9). The more heavily fished areas are to the west of the proposed turbine sites.

The ODNR prepared a sport fishery effort map during the creation of their Offshore Wind Turbine Placement Favorability Analysis. In the sport fishery effort map, the 10-minute quadrangle that included the proposed turbine locations was determined to receive 106,000 to 700,000 average hours targeting walleye and yellow perch from 2000 to 2006. This represented the greatest concentration of sport fishery effort mapped by the analysis. However, in 2016, LimnoTech conducted aerial surveys of the 5-minute quadrangles in the Cleveland area to count boats on 12 different days between May and October. Across all dates, only 2 percent of the boats counted were in the vicinity of the proposed turbines (Appendices E-1, I, and P). These data indicate that recreational boating (including recreational fishing) occurs closer to shore than suggested by the ODNR-developed sport fishery effort maps. The ODNR sport fishery effort maps are based on data from 10-minute survey grids, which are likely too coarse to evaluate expected fishing effort in the immediate vicinity of the proposed turbines (Appendix I).

There are no transportation passenger ferry routes that operate out of the Cleveland Harbor or navigate around the Proposed Project Area (ODNR, 2007b); however, there are numerous commercial passenger cruises (Donahue, 2016) and charter boats that can be rented for various activities including fishing and diving.

Cleveland Harbor hosts many recreational vessels including yachts, sailboats, power boats, and fishing boats. Recreational craft usage in the inner harbor typically peaks in June, July, and August and tends to be higher on the weekends and when weather conditions are favorable. Marinas in the inner harbor provide access to the Cuyahoga River and Lake Erie for over 800 recreational craft (USACE, 2009). Additional details on the Cleveland Harbor marinas are described in the Navigational Risk Assessment in Appendix R.

Several lake-based events take place in the Lake Erie waters off the coast of Cleveland, including sailing boat races, sailing regattas, festivals, boat shows, boat exhibitions, and fireworks displays. Most of the sailing regattas in the Proposed Project Area are hosted by the Cleveland Sailing Association with buoys for race courses marked (Appendix R, Figure 8). These buoys are not located within the proposed export cable route or the proposed wind turbine sites.

LimnoTech conducted an aerial survey to monitor use of the Proposed Project Area by recreational boaters (Appendices E-1, I, and P) and a recreational boat slip study in 2016 to count and classify power and sail boats in recreational harbors, marinas and yacht clubs in Lorain, Cuyahoga, and Lake Counties (Appendix I). Data from the aerial surveys show that boating activity and recreational fishing occurs closer to shore and well away from the proposed turbine sites. Across all dates, only 2 percent of the boats counted were found within the ODNR 5-minute block covering the proposed wind turbine sites (Appendix E-1, Figure 30). Aerial imagery from August 3, 2016 was used to inventory a total of 6,057 boat slips across 16 marinas. Of the sailboats classified through the recreational boat slip study, 99 percent had a maximum mast height below 65 feet, which is less than the proposed clearance between the lowest point of the turbine blade to the water of 20 meters (65.6 feet).

More details and historical data for vessel activity are provided in Section 3.9, Traffic and Transportation, and in the Navigational Risk Assessment in Appendix R.

3.8.2 Environmental Impacts Related to Lake Use

Construction

Typical vessels that would be used in the installation of the Proposed Project include tugs, barges, jack-up rigs, supply and crew transport vessels, and cable-laying vessels. Vessels would be operating continually between the Port, proposed turbine locations, and Proposed Substation. Vessels would be properly marked, lighted, and outfitted with sound signals in accordance with applicable navigational rules. During construction, a 500-meter (1,640-foot) safety avoidance zone would be requested around the installation vessels and a 100-meter (328-foot) safety avoidance zone around each proposed wind turbine and the Proposed Substation. During installation of the export cable, a 500-meter (1,640-foot) safety avoidance zone would be requested around the cable-lay vessel. In addition, security would be maintained by 24-hour presence of the site safety craft. Vessels would 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.

Approximately 10 vessels would be used for construction of the Proposed Project. This would be a minor increase over current vessels operating in the Proposed Project Area; however, any increase in vessels would potentially increase risks of collision or other interactions. Coordination between the USCG, harbormaster, and construction vessels would minimize risks.

The Proposed Project would have a short-term, minor adverse effect on lake use associated with temporary displacement of commercial and recreational boating, fishing, and tourism activities during construction. However, proposed construction activities would occupy only a small portion of available lake area used for fishing and boating and there would be adjacent areas unaffected by construction where these activities could still take place during construction. In addition, most of the recreational and commercial vessel activity occurs outside of the proposed turbine sites. Most construction impacts would occur in the areas closer to shore when vessels are transiting to the proposed turbine sites or during installation of the export cable.

Operation and Maintenance

Vessels most likely to access the proposed turbine sites are commercial fishing, recreational fishing, commercial charter, and recreational passenger vessels. Operation of the Proposed Project would introduce a potential obstacle to traditional navigation routes and to vessels in the area because of the presence of the six proposed turbines. However, the turbines would be spaced 0.5 mile apart which would allow vessels to access the area both through and around each proposed turbine while also maintaining safe distance from other vessels and commercial shipping lanes. The proposed turbines would be marked and lighted in accordance with navigational rules which provide added safety measures. In addition, no vessel exclusions within the proposed turbine sites are anticipated during operation; therefore, vessels are expected to be able to operate without restrictions in this area. In addition, the inter-array and export cables would be buried to an approximate depth of 1 to 1.5 meters (3.3 to 5 feet) beneath the lakebed and would not interfere with vessel anchoring or commercial fishing gear.

According to vessel traffic data obtained from the Automatic Identification System (AIS) collected by the USCG, cargo, tug and towing, passenger and pleasure craft, and sailing vessels are all documented in the general vicinity of the Proposed Project Area but are found only in low densities around the proposed turbine sites (Marine Cadastre, 2016). Therefore, operational impacts to commercial and recreational vessels in the lake are further reduced given the low densities of vessels documented around the proposed turbine sites.

There is the potential that recreational fishermen in the region may seek to fish near the proposed turbines because they will serve as new structures on the lakebed that will likely attract certain recreational species such as smallmouth bass. This new potential lake use would be an operational benefit of the Proposed Project to recreational fishers.

The proposed turbine sites, inter-array cables, and export cable were sited outside of transportation ferry routes that operate out of the Cleveland Harbor and outside of the race courses set by the Cleveland Sailing Association for sailing regattas. Therefore, the Proposed Project would not have an impact on commercial ferry traffic or recreational sailing events during operation.

Overall, impacts from operation of the Proposed Project on lake use would be minor.

Decommissioning

Decommissioning of the Proposed Project may result in a temporary increase in the number of vessels operating in the area; however, similar to the impacts described for the construction phase, these impacts to lake use would be short-term and minor. Upon completion of decommissioning activities, the Proposed Project Area is expected to return to pre-construction conditions and the inter-array cables and export cables would be rendered inactive and remain buried.

3.8.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.9 Traffic and Transportation

3.9.1 Affected Environment

3.9.1.1 Lake Transportation

Commercial and recreational vessel traffic occurs in the vicinity of the Proposed Project, both of which increase in numbers during the peak spring and summer boating season. As described in Section 3.8, commercial vessels in the Great Lakes typically include bulk freighters, self-unloaders, integrated tug barges, chemical carriers, cement carriers, tugs, and barges (Haberly and Stalikas, 2013). The Cleveland Bulk Terminal is the main Port facility located to the west of the Cuyahoga River and accommodates around 150 vessel movements per year from self-unloading vessels delivering bulk commodities. The inner harbor accommodates around 700 commercial vessels per year and experiences around 1,400 vessel transits per season with an average of approximately four transits per day during March through December. More details and historical data for vessel calls are provided in the Navigational Risk Assessment in Appendix R.

Deep-draft vessels normally anchor approximately 2 miles southwest or 3 miles east of Cleveland Waterworks Intake Crib Light. Additionally, vessels are prohibited from anchoring within 2,000 feet west of the main entrance channel (NOAA, 2016a). Within the harbor, general anchorages are located in the northwest part of the west basin and south of the dredged channel in the east part of the east basin.

There are no transportation passenger ferry routes that operate out of the Cleveland Harbor or navigate around the Proposed Project Area (ODNR, 2007b). However, there are numerous commercial passenger cruises (Donahue, 2016) and charter boats can be rented for various activities including fishing and diving.

There are three known shipping channels within the Proposed Project Area, two of which cross over the proposed underwater export cable. Vessel traffic data, or AIS data, collected by the USCG, is available for the Great Lakes Region. While AIS is not a precise indicator of the entire range of vessel traffic that may traverse the area, it does provide a relative indicator of where vessel traffic is heaviest. Vessel density from 2013, including data for cargo vessels, tug and towing vessels, passenger vessels, pleasure craft, and sailing vessels, are available for the Proposed Project Area from the Marine Cadastre marine information system website. As described and depicted in Figures 9 through 12 of the Navigational Risk Assessment (Appendix R), these data indicate that cargo, tug and towing, and commercial pleasure craft and sailing vessel traffic is generally concentrated within the inner and outer Cleveland Harbors, and within the 2 miles leading to the main harbor entrance. As distance from port increases, the traffic density decreases, as vessel traffic spreads out over the shipping channels. Any reported vessel travel in the vicinity of the proposed turbines are shown to occur at low densities. Passenger vessel density was reported as low throughout the Proposed Project Area and, while passenger traffic would likely cross the proposed export cable route, based on the historical vessel traffic data, it would not intersect with the proposed turbine sites. While cargo, tug and towing, passenger, pleasure craft and sailing vessels occur at times in the vicinity of the Proposed Project Area, they are only present in low densities around the proposed turbine sites.

As described in Section 3.8, recreational craft usage in the inner harbor typically peaks in June, July, and August and tends to be higher on the weekends and when weather conditions are favorable. Marinas in the inner harbor provide access to the Cuyahoga River and Lake Erie for over 800 recreational craft (USACE, 2009). Sailing regattas occur in the Lake Erie waters off Cleveland; however, race courses for these regattas occur outside the proposed export cable route and proposed turbine sites (Appendix R). Results from aerial surveys conducted by LimnoTech show that boating activity and recreational fishing effort occur closer to shore and well away from the proposed turbine sites (across all dates only 2 percent of the boats counted were found within the ODNR 5-minute block covering the proposed turbine sites (Appendix E-1, Figure 30). An aerial imagery inventory of recreational boat slips, also conducted by LimnoTech, showed that of the sailboats classified through the study, 99 percent had a minimum mast height below 65 feet, which is less than the proposed clearance between the lowest point of the turbine blade to the water of 20 meters (65.6 feet) (Appendix R).

The Cleveland USCG station is located on the south end of the Outer Harbor. The USCG provides search and rescue and pollution incident responses in the Proposed Project Area. USCG vessels would be expected to be present in the Proposed Project Area, as well as potentially research vessels used by NOAA and EPA.

Ice conditions and winter storms restrict navigation for vessels on Lake Erie. Typical ice formation in Lake Erie begins in the western basin in late December and spreads east across the lake with peak ice coverage in February (NOAA, 1987). Shipping restrictions can occur in the St. Lawrence Seaway from the middle of December to the beginning of April. Shipping among the Great Lakes and within Lake Erie can usually continue until January (or even longer) with assistance from USCG icebreakers so that a path is maintained along main vessel routes.

3.9.1.2 Terrestrial Transportation

The Proposed Project's components on land would be located in downtown Cleveland adjacent to numerous interstate, U.S., and state highways, as well as county and local roadway networks, in addition to freight rail lines and small airports.

Highways and Local Roadways

The main transportation route to the Proposed Project Area is Interstate 90 (I-90) (Cleveland Memorial Shoreway/Innerbelt), which runs adjacent to the Proposed Substation site. U.S. Route 20/State Route 2, the western branch designated the Cleveland Memorial Shoreway, runs adjacent to the Port, the location of the proposed O&M Center and main port to the turbines. I-77 and I-71 converge downtown from the south and southwest, respectively. U.S. Routes 480 and 271 provide bypass routes that avoid the congestion near downtown Cleveland. These and other primary routes facilitate transportation between the Proposed Project Area and the surrounding metropolitan areas.

Rail

Freight rail lines connect several of the municipalities throughout the Proposed Project Area, nearly all converging near the site of the proposed 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. Area municipalities connected to freight rail lines include the Cities of Cleveland and East Cleveland and the Villages of Bratenahl and Cuyahoga Heights.

Aviation

No airports or landing strips are located within 5 miles of the proposed turbine sites. The Proposed Substation is in proximity to the Cleveland Hopkins International Airport and the Cleveland Burke Lakefront Airport, the closest airport facilities to the Proposed Substation. Helipads and landing strips are also present within 5 miles of the Proposed Substation.

3.9.2 Environmental Impacts Related to Traffic and Transportation

3.9.2.1 Lake Transportation

Construction

Construction vessels would operate in accordance with USCG Navigational Rules and state navigation regulations that would help minimize lake traffic risks associated with the Proposed Project. Vessels involved in the construction of the Proposed Project would be properly marked, lighted, and outfitted with sound signals in accordance with applicable navigational rules. These regulations are detailed in the Navigational Risk Assessment (Appendix R).

Typical vessels that would be used in the installation of the Proposed Project include tugs, barges, jack-up rigs, supply and crew transport vessels, and cable-laying vessels. Vessels would be operating continually between the Port, proposed turbine locations, and Proposed Substation although construction activities would be restricted during adverse weather conditions. Table 3.9-1 lists weather constraints for different construction activities that would mitigate unnecessary risks to personnel, vessels, and the environment.

Table 3.9-1. Weather Limitations for Offshore Installation Activities

Operation	Vessel	Wind Limit (m/s)	Wave Limit (m)
Foundation transportation	Feeder barge	10	1.5 - 2
Turbine component transportation	Feeder barge	10	2
Transit to site	Feeder barge	10	1.5 – 2
Nacelle and tower sections installation (lift)	Jack-up vessel	10	1
Rotor installation	Jack-up vessel	8	1
Cable installation	Cable lay barge	10	1
Transport of personnel	Crew transport vessel	10	1.5 – 2
Transfer of personnel to turbine platform during cable installation and commissioning	Crew transport vessel	10	1.5

Source: Appendix R, Navigational Risk Assessment

During construction, safety avoidance zones would be requested as described in Section 3.8. In addition, security would be maintained by 24-hour presence of the site safety craft. Vessels would 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. These temporary construction exclusion areas have the potential to cause minor disturbance to vessel traffic. However, these exclusion areas would be a maximum of 500 meters (1,640 feet) in size and vessel traffic would be restored to normal upon completion of each component installation.

NOAA's Automated Wreck and Obstruction Information System (AWOIS) and Electronic Navigation Charts were consulted to identify submerged wrecks and obstructions in the Proposed Project Area (Appendix R, Figure 7). The obstructions closest to the Proposed Project (AWOIS 14295 and 14293) are both submerged pilings at a depth of at least 19 feet and are outside of the construction envelope for the proposed export cable determined from the results of the geotechnical surveys (NOAA, 2016c). The distance and depth of the obstructions are anticipated to be sufficient to ensure safe installation of the proposed cable line and construction personnel would be notified of the presence of these obstructions.

The number of vessels that would be used for construction of the Proposed Project would not be a significant increase over current vessels operating in the Proposed Project Area; however, any increase in vessels would potentially increase risks of collision or other interactions. The USCG would be notified of the construction schedule, location, type and number of vessels, and any Private Aids to Navigation (ATON) around the construction area, if needed. Preliminary Notices to Mariners and/or Radio Navigational Warnings would be broadcast prior to and during construction (U.S. Department of Homeland Security and USCG, 2005), and timely notices of project activities would be posted on the Proposed Project's website. Coordination between the USCG, harbormaster, and construction vessels would minimize risks.

The Proposed Project would have a short-term, minor adverse effect on lake traffic and transportation during construction.

Operation and Maintenance

Potential Impacts from Project Vessels

Once the Proposed Project is operational, project vessel traffic would be limited to maintenance vessels. The maintenance vessels and vessel operators would be held to the same standard as construction vessels. Vessels would be properly marked, lighted, and outfitted with sound signals in accordance with applicable navigational rules. The number and frequency of vessels used for maintenance of the Proposed Project would not be a significant increase over normal vessel traffic in the Proposed Project Area. The Proposed Project control center would remotely monitor and control the Proposed Project Area 24 hours a day and would collaborate with the USCG. Impacts to navigational safety from vessels used in operation and maintenance of the Proposed Project would be negligible.

Potential Obstructed Views from Proposed Turbines

The proposed design and spacing of the turbines would result in potentially obstructed views of the coastline, ATONs, and between vessels. However, the small number and the linear array of turbines would minimize potential obstruction in sightlines to the coastline and between vessels. In addition, there would be 756 meters (2,480 feet) of separation between each proposed turbine, which would result in large areas with some unobstructed lines of sight between each proposed turbine. The proposed turbines have the potential to block ATONs along the coastline from only very specific locations and not all ATONs along the coastline would be blocked by the turbines at once. Any vessels that experience blocked views of the coastline or ATONs would be at least 8 miles off the coast and would gain visibility as the vessel passes through the area. In addition, the navigational lights and fog horns that would be mounted on the turbine platforms would serve as ATONs.

Potential Vessel Avoidance of Proposed Turbines

Large commercial vessels, which typically use the shipping lanes, would not be affected by the Proposed Project because the only part of the Proposed Project that intersects shipping lanes would be the buried export cable. Because the export cable would be buried, it is not anticipated to cause disturbance to shipping commerce. However, recreational vessels (recreational fishing and passenger vessels) and smaller commercial vessels (commercial charter and commercial fishing) could access the proposed turbine sites. There would be adequate space around the proposed turbines for vessels to avoid the turbines while also maintaining a safe distance from other vessels and commercial shipping lanes. The Proposed Project would not result in any channel restrictions caused by the presence of the proposed turbines and the design and spacing are not expected to limit vessel use of the surrounding area. Therefore, there would be no effects from potential vessel avoidance of turbines.

Potential Vessel Collision with Proposed Turbines

The presence of the turbines would create a risk of potential vessel collision, as would be the case with the installation of any new structure. As described above, large commercial vessels using shipping lanes would not be affected by the proposed turbines, because they are not anticipated to pass through the proposed turbine sites. However, recreational and smaller commercial vessels could potentially be in the vicinity of the proposed turbines. In fact, recreational vessels may be attracted to the proposed turbines out of curiosity or to fish for species that may congregate around the proposed turbine foundations. A risk assessment for the Horns Rev II wind farm off the coast of Denmark concluded that the likelihood of ship-to-ship collision is "significantly higher" than the probability of a vessel colliding with a wind turbine. Additionally, at that same wind farm, approximately 48,000 boats pass through a shipping lane 8 km (5 miles) from the wind farm, and it was found to cause only minimal hindrance to commercial traffic (NREL, 2010).

There would be adequate space around the proposed turbines for smaller vessels to avoid the turbines, while also maintaining a safe distance from shipping lanes and other vessels. Electronic equipment, including GPS units, are widely available and commonly used by commercial and recreational boaters, and would serve to minimize the potential for a collision with the turbines. In addition, proposed turbines would be marked and lighted in accordance with navigational rules. During adverse weather including storm events, fog, or high winds, the potential for vessel collision with the turbines is increased. The notices to mariners, updates to NOAA navigational charts, and proposed turbine lighting, fog horns, and marking would help to minimize the potential risk of collisions under adverse weather conditions. Currents and velocities are low at the proposed turbine sites and would not aggravate the potential for a vessel collision with the turbines. In the case of vessel engine failure, a vessel could drift into a turbine, but because currents and water velocities are low near the proposed turbines, any collision from drifting is not anticipated to be significant. If a collision between a vessel and a turbine does occur, the structural integrity of the turbine would be investigated and verified, and a report would be filed in accordance with the Marine Casualty Regulations in 46 CFR 4. The anticipated impacts of vessel collision with turbines from the Proposed Project would be negligible.

Potential Impacts on Electronic Navigation and Communication Systems

Very high frequency (VHF) radio is the most frequently used radio and has designated channels for commercial ships to confirm passage and communicate actions, mayday distress calls, storm warnings, and boat-to-boat communication. VHF radios are required on vessels greater than 20 meters (65.6 feet) and, while not required, are common on smaller vessels as well. Studies on the Horns Rev wind turbines in Denmark and the North Hoyle wind turbines in the United Kingdom concluded that there were no significant effects on VHF communication in the vicinity of the wind turbines (Appendix R). Those wind turbine projects ranged from 30 to 80 turbines, compared to six turbines for the Proposed Project. It is anticipated that there would be a similar lack of effects on communication systems from the Proposed Project.

Radar technology remains one of the many tools used by vessel operators and is one of the more important instruments, particularly when visibility is reduced, in aiding a vessel operator to navigate safely and avoid collision (USCG, 2009). A study modeling the effect of offshore wind farms on marine radars typically installed on boats and shipping vessels found that wind farm signal scattering could produce a confusing navigational picture if a boat is inside a wind farm, but there would be minimal interference to tracking of vessels outside the wind farm (Ling, et al., 2013). For the Proposed Project, with only a single line of turbines, the effects on navigational radar on vessels from the proposed turbines would be minimal.

GPS technology includes 24 satellites that triangulate a user's position based on line of sight transmitted by multiple satellites (NOAA, 2017g). While objects, such as buildings or mountains, can block a satellite's line of sight, it is possible to receive only slightly degraded positions with only three satellites having line of sight (NOAA, 2017g). The proposed turbines would not obscure all satellites at the same time, given the proposed small diameter of the turbines, large distance between turbines, and single line array. Therefore, the Proposed Project's effect on GPS signal reception and accuracy would be minimal.

The wind turbines are not anticipated to generate any EMFs; however, potential EMFs could be generated by the inter-array cable and export cables. The estimated magnetic field from the inter-array and export cables would be much less than the earth's naturally occurring background levels, and because these cables would be shielded and jacketed with an insulator, electric field impacts would not pose an issue to communications (Appendix O). Any effects from EMF fields would be negligible.

Potential Ice Hazard

Because of the cold winters in Cleveland, and typical freezing conditions of Lake Erie, ice accumulations on and around the proposed turbines would be expected in some years. However, the presence of the proposed turbines would not be expected to exacerbate icing. Ice formation around the proposed turbine foundations would constrain access to the proposed turbines for operations and maintenance during winter months and may require a vessel with ice breaking capability. Research and modeling discussed in Section 3.7.2.2 were conducted to determine potential loadings and fatigue of the proposed turbines from ice cover in Lake Erie. These studies indicated that the proposed turbine foundation design is conservative and would be capable of withstanding forces from ice floes, ridges, and keels.

Blade icing and subsequent ice shedding or ice throw would be a potential hazard to vessels operating in the vicinity of the proposed turbines. There have been no reported injuries caused by ice being thrown from an operating wind turbine (Garrad Hassan Canada, Inc., 2007; Baring-Gould et al., 2012). Many factors affect the distance traveled by ice thrown from a blade, including position of the blade when the ice breaks off, the location of the ice on the blade, the rotational speed of the blade, the shape of the ice, and the prevailing wind speed. The potential for icing would be greatest in the winter months when recreational and commercial boating is limited. Marinas in the area close between October and November and do not reopen until April or May, so recreational boats on the water would be essentially non-existent when conditions are favorable for ice formation. Commercial boating is also limited when ice cover is present and the few commercial vessels on the lake during icing conditions would stay within the shipping lanes (over 2 miles from the proposed turbine sites). Therefore, the anticipated ice hazard effect to commercial and recreational vessels associated with the Proposed Project would be negligible.

Potential Impacts on USCG Search and Rescue

Based on the AIS vessel density data from 2013, while commercial and recreational vessels have been documented in the vicinity of the Proposed Project Area, they are found only in low densities around the proposed turbine sites (Appendix R). Because of the small number of turbines, the linear array, and the large distance between each turbine, the Proposed Project would not significantly affect USCG search and rescue operations. USCG marine assets would be able to operate in and around the proposed turbines with minimal impact. Additionally, the turbine platforms would serve as a refuge for stranded boaters in the vicinity.

Decommissioning

Decommissioning of the Proposed Project may result in an increase in the number of vessels operating in the area; however, similar to the effects described for the construction phase, they would be short-term, minor, adverse effects on lake traffic and transportation.

3.9.2.2 Terrestrial Transportation

The terrestrial components of the Proposed Project would be located in downtown Cleveland adjacent to numerous roadway networks, freight rail lines, and small airports. Construction and decommissioning activities, and, to a lesser extent, maintenance activities, would use the existing infrastructure networks, potentially increasing traffic, while operation of the Proposed Project would potentially affect use of the airports.

The Proposed Project intends to use locations and existing structures that currently have permanent road access; therefore, no access road construction would be required.

Construction materials that would not arrive by rail or barge would be carried on trailers. LEEDCo, working with Cuyahoga County and affected municipalities, would develop a road use agreement that would address Proposed Project activity both during construction and decommissioning. The Proposed Project would need wide load, but no oversized/heavy load, permits for the substation transformer, control house, and crawler cranes. Any trucks needed to deliver components would meet weight requirements as posed by the Ohio Department of Transportation (ODOT). There would be no temporary or permanent road closures, lane closures, road access restrictions, or traffic control necessary for construction and operation of the Proposed Project.

Construction traffic bound for the Proposed Substation would likely use I-90 Exit 175 as the primary route, while traffic bound for the proposed O&M Center would most likely use the West 45th Street exits from U.S. Route 20/State Route 2. The Proposed Project would not be expected to cause any substantial disruption to major transportation corridors serving the Proposed Project Area, because most transportation of turbine components and equipment would occur by barge.

Depending on the selected manufacturer, the rail system would potentially be used for the transportation of turbine components and equipment other than the foundation, but no modifications to the system would be anticipated. Depending on the selected foundation fabricator, the foundations would arrive completely by barge, and never be off-loaded, or would arrive in pieces by barge and/or truck with final assembly at the Port. Similarly, depending on the selected cable supplier/installer, the cable would arrive completely by barge, and never be off-loaded, or it would arrive by rail and be off-loaded and staged at the Port. There would be no site preparation or reclamation for crane paths because the cranes would be transported to port by trucks on existing roads and assembled at the Port.

Airports, helipads, and landing strips within 5 miles of the Proposed Project Substation would be notified of the proposed construction. The Proposed Substation would be constructed alongside the Lake Road Substation, would not be any taller than existing substation facilities, and would therefore have no greater effect on these aviation facilities than currently exists. LEEDCo would work with ODOT Office of Aviation to ensure there would be no aviation effects as a result of the Proposed Project.

Wind turbines have the potential to create clutter interference and possibly significant Doppler interference with sensitive radars fielded by the FAA, Department of Defense, NOAA, and other agencies. Written notification of the Proposed Project was provided on August 11, 2016 to the National Telecommunications and Information Administration (NTIA) of the U.S. Department of Commerce (DOC), which then provides plans for the Proposed Project to the federal agencies represented in the Interdepartment Radio Advisory Committee (IRAC), including the Department of Defense, the Department of Education, the Department of Justice, and the FAA. The NTIA then identifies any potential Project-related concerns detected by the IRAC during the review period. A NTIA response received on October 13, 2016 identified a DOC concern regarding the Proposed Project impacting its radar systems and the potential degradation of the detection of lake effect snow. Further consultation by LEEDCo with DOC determined there would be minimal impacts to the radar. There were no concerns from any other IRAC agencies.

The FAA conducted aeronautical studies of the proposed turbine layout under the provisions of 49 USC 44718, applicable 14 CFR 77, and Ohio Revised Code (ORC) Section 4561.32. The FAA can issue two types of determinations, one that identifies a hazard and another that identifies no hazard. 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. Form 7460-1 was submitted for the Proposed Project, with a determination of no hazard to air navigation from the FAA if the structure is marked and/or lighted in accordance with FAA Advisory circular 70/7460-1 L Change 1, *Obstruction Marking and Lighting*. Construction and operation of the Proposed Project would be designed according to FAA standards and would not result in any adverse effects to the regional air transportation network.

3.9.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.10 Cultural Resources

The cultural resource review for the Proposed Project included archaeological resources and historic-architectural resources. Archaeological resources have the potential to be directly impacted by ground-disturbing activities; indirect impacts to archaeological resources are not typically considered. Historic-architectural resources have the potential to be directly impacted through demolition or physical alteration, or indirectly through a change in the property's visual setting.

The Area of Potential Effect (APE) for direct effects includes all areas within the limits of disturbance for construction activities associated with the Proposed Project. For the lake-based area, this includes the proposed turbine sites and associated construction workspaces and the corridor of potential disturbance for the submerged transmission lines, while land-based areas include the Proposed Substation, corridor of potential disturbance for landfall of the submerged transmission line, laydown and staging areas, access roads, and operations and maintenance facilities.

The APE for indirect effects includes those areas where the Proposed Project would be visible and where there is a potential for an adverse visual impact. For properties listed under the National Historic Preservation Act of 1966 (NHPA), this would mean a change in a historic property's visual setting, which would diminish the integrity of the properties significant historic features. Aesthetics and visual resources are discussed in detail in Section 3.11.

3.10.1.1 Lake-Based Cultural Resources

An evaluation was completed of the Proposed Project's effect on submerged archaeological resources including an archaeological sensitivity evaluation of the Proposed Project's APE for direct effects for both Native American and historic-period archaeological resources by Gray & Pape (Appendix S). A geophysical survey of the proposed wind turbine sites was conducted by Alpine Ocean Seismic Survey, Inc. (Appendix F-1). VanZandt Engineering completed a geophysical survey review of the export cable route and evaluated the results according to Section 106 of the NHPA requirements (Appendices T-1 and T-2).

The Gray & Pape report includes an analysis of the potential for Native American archaeological sites to be identified within the APE for direct effects. The report considers the paleo-environmental setting of the Proposed Project Area, including the rise of lake levels and other landscape changes during the post-glacial period, the history and geomorphology of sedimentation and the movement of lake bottom deposits within the lake itself, as well as the distribution across the landscape of known Native American archaeological sites from various time periods. Based on this data, portions of the APE for direct effects were potentially habitable from about 12,000 years before present (BP) until between 5,400 and 4,750 BP (Appendix S). However, the report concludes that locating such archaeological sites, if present, would be difficult or impossible because natural lake sedimentation has covered such sites. The Gray & Pape report is provided as Appendix S for additional detail.

Submerged historic-period archaeological resources are typically shipwrecks. The NOAA Automated Wreck and Obstruction Information System (AWOIS) maintains a record of vessel losses and obstructions to shipping. The NOAA AWOIS lists 13 wrecks and obstructions in the Cleveland area (Appendix S), two of which lay in Lake Erie beyond the outer breakwater of Cleveland harbor near the substation landfall for the proposed export cable, but outside of the cable route envelope.

VanZandt also consulted the OHPO online mapping system to locate any inventoried cultural resources identified within the APE for direct effects. This included a review of the Ohio Archaeological Inventory (OAI), Ohio Historic Inventory (OHI), National Register of Historic Places (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, or NRHP are present within the lake-based APE for direct effects. There are four shipwrecks are located within 3.5 nautical miles of the APE for direct effects. However, no shipwrecks are present within the APE for direct effects (Appendices T-1 and T-2).

Data from a 2016 geophysical survey of the proposed cable route envelope was evaluated by VanZandt to determine whether the geophysical survey identified potential archaeological resources within the APE for direct effects (Appendices T-1 and T-2). The areas evaluated included areas around the proposed turbine locations, the export cable, and the inner Cleveland Harbor. 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 APE for direct effects.

3.10.1.2 Land-Based Cultural Resources

No archaeological resources were identified associated within the APE for direct effects for the land-based project components. No historic-architectural resources were identified within the APE for direct effects, The APE for indirect effects is discussed in Section 3.11, Aesthetic and Visual Resources.

3.10.2 Environmental Impacts Related to Cultural Resources

3.10.2.1 Lake-Based Cultural Resources

With respect to submerged archaeological resources, the studies conducted for the Proposed Project did not identify any potentially significant archaeological sites within the APE for direct effects (Appendices T-1, T-2, and U).

The Proposed Project (including construction, operation, maintenance, and decommissioning activities) would have no impact on lake-based cultural resources. On June 20, 2018 the OHPO concurred with this conclusion.

3.10.2.2 Land-Based Cultural Resources

The Proposed Project would not require or result in the demolition or physical alteration of any buildings or other potential historic-architectural resources or properties; therefore, the Proposed Project would have no direct impact on land-based cultural resources. The Proposed Project's indirect effect on a given historic-architectural resource or property is discussed in detail in Section 3.11.

3.10.2.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.11 Aesthetics and Visual Resources

3.11.1 Affected Environment

Aesthetic and visual resources include the viewsheds and scenic view opportunities within the Proposed Project Area. Historic-architectural resources or properties have the potential to be indirectly affected through a change in the property's visual setting.

3.11.1.1 Visual Study Area

As discussed in Section 3.10, Cultural Resources, the Proposed Project's APE for indirect effects includes those areas where the Proposed Project (including wind turbines) would be visible and where there is a potential for a significant visual effect. For properties listed under the NHPA, this would mean a change in a historic property's visual setting, which would diminish the integrity of the properties' significant historic features.

Chapter 4906-4-08(D)(4) of the OAC, Certificate Applications for Electric Generation Facilities, indicates that visual impacts to recreational, scenic, and historic resources from a proposed facility should be evaluated within at least a 5-mile radius (OPSB, 2015), and any resources valued specifically for their scenic quality should be evaluated within a 10-mile radius. Because of the Proposed Project's location (approximately 8 miles from shore) and visibility from shoreline across open water, the Visual Impact Assessment (VIA) evaluated a 10-mile radius study area. Therefore, based on the recommendations in Chapter 4906-4-08(D)(4) of the OAC, the APE for indirect effects for the Proposed Project includes those areas within 10 miles of the proposed turbines with potential visibility of the Proposed Project. This represents the area where introduction of the turbines into the visual setting of a given historic property has the potential to result in an adverse impact on the setting of the property.

A records review completed by Gray & Pape (Appendix S) documented all previously identified OHI and OAI properties within 0.5 mile of the Lake Erie Shoreline along an area parallel to the shoreline for 29.6 miles. The review was expanded to include all NRHP properties and districts as well as National Historic Landmarks (NHLs) within 1 mile of the Lake Erie shoreline. This area was purposefully larger than the APE to ensure that any adjacent properties are also identified. The review identified:

- 39 sites individually listed in the NRHP, including one NHL (the United States Ship [USS] Cod submarine)
- 7 NRHP-listed historic districts
- 478 OHI properties
- 14 archaeological resources recorded in the OAI

Of the properties identified by Gray & Pape, those located within areas with potential visibility of the Proposed Project include 23 properties or districts listed in the NRHP (including the USS Cod submarine NHL) and 186 properties included in the OHI. A majority of these properties would have limited or restricted visibility to the Proposed Project. Four properties listed in the NRHP (the USS Cod, the East and West Pierhead Lighthouses, the Universal Terminal Company Dock and Warehouse, and the Cleveland Harbor Station) are lakefront properties that would have views of the Proposed Project.

There are no state parks, state forests, national wildlife refuges, National Park Service (NPS) 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 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. Additional information about these areas can be found in Appendix U.

3.11.2 Environmental Impacts Related to Aesthetics and Visual Resources

The Proposed Project's potential effect on a given historic property would be a change (resulting from the introduction of wind turbines) in the property's visual setting. As it pertains to historic properties, *setting* is defined as "the physical environment of a historic property" and is one of seven aspects of a property's *integrity*, which refers to the "ability of a property to convey its significance" (NPS, 1990). The other aspects of integrity include location, design, materials, workmanship, feeling, and association (NPS, 1990). The potential effect resulting from the introduction of wind turbines into the visual setting for any historic or architecturally significant property is dependent on several factors including distance, visual dominance, orientation of views, viewer context and activity, and the types and density of modern features in the existing view (Appendix V-1). For an effect to be adverse, it must be an effect to a property that would diminishes the integrity of that property's significant historic features.

3.11.2.1 Construction

During construction of the Proposed Project, adverse impacts to aesthetics and visual resources would be short term and moderate. The presence of construction vessels and equipment during installation of the wind turbines and submerged electric collection cable would affect viewers from the shoreline and boaters in the vicinity of the Proposed Project. The presence of construction equipment at the Proposed Substation would affect viewers in a developed, industrial area, while the presence of construction equipment at the staging area would be typically for the Port location.

3.11.2.2 Operations and Maintenance

The proposed export cable would be submerged and therefore would have no permanent visual effects during operations. However, if maintenance or repair were needed, then adverse impacts to aesthetics and visual resources during operations would be short-term and moderate, similar to construction.

The proposed wind turbines and substation would be new, permanent visible structures. The Proposed Substation would be located in a developed, industrial area. Therefore, while adverse impacts to aesthetics and visual resources from operations of the Proposed Substation would be long-term, they would be minor.

A VIA completed by Environmental Design & Research (EDR) for the Proposed Project evaluated a study area that encompassed a 10-mile radius from the proposed wind turbines (Appendix U). The VIA included a viewshed analysis and field verification with visual simulations for the Proposed Project. The results of this analysis are summarized as follows.

Visual Impact Assessment

As described in more detail in Appendix V-1, 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 the lake surface) and the other to illustrate potential nighttime visibility of FAA warning lights (based on an assumed warning light height of 282 feet above the lake surface and the conservative assumption that all turbines could be equipped with FAA warning lights). The viewshed analyses utilized Ohio Statewide Imagery Program's 2006 Light Detection and Ranging (LiDAR) data for Cuyahoga County, which allowed for a second-level analysis that factors the screening effects of vegetation and structures, in addition to topography, into the analysis. 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 6 feet or more, except in locations of known bridges. 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 proposed turbines. However, where high rise buildings occur in areas indicated as being screened from views of the proposed turbines, views may be available from upper stories that currently have views of Lake Erie (Appendix V-1).

Because it accounts for the screening provided by structures and trees, this second-level analysis is a more accurate representation of potential turbine visibility. However, being within the viewshed does not necessarily equate to actual turbine visibility because characteristics of the proposed turbines that influence visibility (color, narrow profile, distance from viewer, etc.) are not taken into consideration in the viewshed analyses (Appendix V-1).

Field Verification – Visual Simulations

Field review by EDR confirmed that visibility of the proposed turbines would be largely restricted to the waterfront and open water portions of the visual study area, as suggested by the viewshed analysis. EDR completed 26 visual simulations, found in Appendix U.

In residential areas in Westlake, Bay Village, and Cleveland, visibility of the proposed turbines would be fully or substantially screened from inland areas by densely situated homes and vegetation along the shoreline. In most cases, visibility does not extend beyond shoreline residences, except in circumstances where an undeveloped cul-de-sac or public right-of-way exists, making water views possible from public vantage points. These shoreline residences would all likely have some level of turbine visibility because they have been purposely situated to take advantage of lake views. Multiple parks and developed open spaces along the lake shore also capitalize on open water views and therefore would have views toward the proposed turbines, but again, vegetation and structures at these sites limit unobscured offshore 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 would generally have open views of the proposed turbines. Areas inland of the shoreline offered limited open water views from interceding features (buildings, industrial facilities, and vegetation) along the shoreline. However, elevated portions of I-90 and parks such as the City Mall would have intermittent framed views of the turbines. Additionally, many of the inland high-rise structures would have visibility of the turbines 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 proposed turbines from the upper floors would be available. The field review confirmed a general lack of visibility from street level views within the inland portion of downtown Cleveland (Appendix V-1).

Conclusions of Visual Impact Assessment

Photo simulations prepared as part of the VIA provide representative views of the Proposed Project from various distances and directions within the visual study area. Visual effects analyses based on this second-level DSM-based viewshed by a licensed EDR landscape architect indicates that the proposed turbine's overall contrast with the visual/aesthetic character of the area would range from insignificant to appreciable. Insignificant to moderate contrast was noted for viewpoints that included existing developed shoreline and offshore features. Moderate to appreciable contrast was noted where existing developed features were lacking in views of Lake Erie and at viewpoints in shoreline park and residential settings where the expansive open view of the lake is an important part of the viewer experience. More details on the conclusions drawn from the VIA and the photo simulations can be found in Appendix U. In summary, adverse impacts to aesthetics and visual resources from operations of the wind turbines would be long-term and minor.

Special Consideration of Landmarks of Cultural Significance

The potential visibility of the proposed wind turbines from the identified historic resources (NRHP-listed and eligible resources, designated Cleveland Landmarks and OHI resources) are summarized in tables within Appendix V-1.

The majority of cultural resources that fall within the proposed wind turbines viewshed would have limited views from screening provided by intervening topography, vegetation, and/or structures. The proposed turbines are located greater than 7 miles from all cultural resources, where they would appear as background features in the view and the effects of distance would significantly attenuate the turbine's apparent size. The degree of visibility and contrast with the existing landscape would be substantially reduced under cloudy and partly cloudy conditions that occur on 82 percent of the days during a typical year in Cleveland (Appendix V-1).

As an example, Viewpoint 17 (Figure 3.11-4), which would be located approximately 8.5 miles from the nearest turbine, would be the view from Cleveland Mall, which is an NRHP-listed site, a Designated Cleveland Landmark, and an OHI site. The VIA classifies this viewpoint as an "Elevated City View," which is defined as an elevated vantage point within the City of Cleveland that allows for open views of Lake Erie over the top of foreground development. Elevated city views include a variety of buildings and fabricated structures that define the landscape context as an urban setting. The presence of the lake in these views enhances scenic quality and adds interest. 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. As illustrated in the simulated view from Viewpoint 17, under clear sky conditions and strong sunshine, the proposed turbines would be clearly visible on the horizon line. However, in this view, with an abundance of built features in the foreground (including a wind turbine) the Proposed Project would 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. Regardless of weather conditions, Proposed Project-related impacts on scenic quality and viewer activity from this vantage point would likely be minimal (Appendix V-1).

In summary, the Proposed Project's overall effect on the visual setting associated with historic properties and landmarks of cultural significance that have a limited view of the Proposed Project would be a long-term, but relatively minor, impact.

Special Consideration of Lakefront NRHP-Listed Properties

Four NRHP-listed properties were identified that are lakefront properties: the USS Cod, the Cleveland Harbor Station, the East and West Pierhead Lighthouses, and the Universal Terminal Company Dock and Warehouse.

These four listed properties would have direct views of the Proposed Project. EDR conducted analysis to determine whether the Proposed Project would affect the characteristics of the historic properties that qualify it for inclusion in or eligibility for the NRHP. When evaluating adverse effects to listed properties, the standard applied is whether the Proposed Project would diminish the integrity of the property's significant historic features. In doing so, visual setting may or may not be an important factor contributing to a given property's historic significance. For instance, some properties are typically determined NRHP-eligible because of their architectural design or association with a specific architect, builder, or style, and because they retain their overall integrity of design and materials. Thus, while the setting provides context for these properties, it is not the only consideration in determinations of impact or significance. To determine whether the Proposed Project would diminish the integrity of the property's significant historic features, a review was conducted by EDR that included each property's historic use, current use, significance, and justification for listing on the NRHP or elevating to NHL status (Appendix U).

DOE consulted with potential stakeholders regarding these four properties. Specifically, DOE reached out to the owners of each listed property as well as the Cleveland Foundation, which had provided funding for a restoration study of one of the properties. DOE sought input from stakeholders regarding whether they thought the Proposed Project would diminish the integrity of the property's significant historic features, and whether mitigating measures would be appropriate. DOE also consulted with the NPS in accordance with Section 800.10(c) of the regulations, "Protection of Historic Properties" (36 CFR 800), regarding the USS Cod.

The USS Cod is a World War II-era submarine permanently docked at Cleveland. The historic significance of the submarine is derived from its service and actions that occurred in the Pacific Ocean. The NRHP nomination form does not mention visual setting or views. The EDR evaluation determined that the Proposed Project would not diminish the integrity of the property's significant historic features. The nonprofit organization that owns the USS Cod stated that, in its opinion, the Proposed Project would not diminish the integrity of the property's significant historic features. The NPS determined that the Proposed Project would not diminish the integrity of the property's significant historic features. The OHPO also concurred with this conclusion. Thus, while the Proposed Project would be visible from the USS Cod, it is not anticipated that the visibility of the turbines would diminish the integrity of the property's significant historic features. Viewpoint 7 represents a simulation view from the USS Cod submarine, which would be located approximately 8.4 miles from the nearest turbine (Figure 3.11-1).

The USCG Cleveland Harbor Station is an example of an Art Modern-style maritime facility. The station was built in 1940. The station's significance is based on its architectural design and associations with the buildings intended functions. The visual setting of the building is the Port of Cleveland, and active commercial harbor. The USCG vacated the building in 1976. The building is currently owned by the City of Cleveland and has received financial assistance from the Cleveland Foundation, but currently is not in use. The EDR evaluation determined that the Proposed Project would not diminish the integrity of the property's significant historic features. The City of Cleveland did not offer a formal response to DOE's request for input. The Cleveland Foundation stated that in its opinion the Proposed Project would not diminish the integrity of the property’s significant historic features. Thus, DOE determined that the Proposed Project would not diminish the integrity of the property’s significant historic features. The OHPO did not concur with this conclusion. Viewpoint 52 represents a simulation from the USCG Cleveland Harbor Station (Figure 3.11-2).

The East and West Pierhead Lighthouses stand at either side of the entrance to the Cuyahoga River. The East Lighthouse is owned by a private party while the West Lighthouse is owned by the USCG. The emphasis throughout the NRHP listing document is on form, material, design, workmanship, and function of the lighthouses. However, as with any lighthouse, location and association with maritime activities are implicit. The visual setting for the lighthouses includes an active commercial harbor. The EDR evaluation determined that the Proposed Project would not diminish the integrity of the property’s significant historic features. The owner of the East Lighthouse failed to respond to DOE requests for consultation. The owner of the West lighthouse (the USCG) stated that that the Proposed Project would not diminish the integrity of the property’s significant historic features. Thus, DOE determined that the Proposed Project would not diminish the integrity of the property’s significant historic features. The OHPO did not concur with this conclusion. Viewpoint 52 represents a simulation from the USCG Cleveland Harbor Station and includes the East and West Pierhead Lighthouses (Figure 3.11-2).

The Universal Terminal Company Dock and Warehouse is a four-story reinforced concrete dock and warehouse built in 1929 as a terminal for automobile shipments that originated in Detroit, Michigan. In 2002, the building was converted into a 138-unit apartment complex. The criterion for inclusion on the NRHP is based on the property’s association with events that have made a significant contribution to the broad patterns of our history. The listing form identifies the building’s role as the only marine terminal in Cleveland designed exclusively for unloading and warehousing automobiles. Visual quality of the setting is not mentioned. The EDR evaluation determined that the Proposed Project would not diminish the integrity of the property’s significant historic features. The owner of the property stated that in its opinion the Proposed Project would not diminish the integrity of the property’s significant historic features. Thus, DOE determined that the Proposed Project would not diminish the integrity of the property’s significant historic features. The OHPO did not concur with this conclusion. A visualization is not available from this property; however, the property is located approximately 2 miles east of the USS Cod, thus the view would be similar to, but farther away from the Proposed Project, of that simulation (Viewpoint 7, Figure 3.11-1).

Because the OHPO did not concur with all of DOE’s findings that the historic properties would not be affected, DOE requested that the Advisory Council on Historic Preservation (ACHP) review the disagreement with the finding, pursuant to 36 CFR 800.5(c)(2)(i). On March 23, 2018, ACHP found that “DOE appears to have made a reasonable and good faith effort to comply with the requirements of Section 106” (Appendix V-2). As such, DOE determined, pursuant to 36 CFR 800.5(b), that the Proposed Project would have no adverse effect on historic properties and would not diminish the integrity of the properties’ significant historic features.

Figure 3.11-1. Visual Simulation from Viewpoint 7: USS Cod

Figure 3.11-2. Visual Simulation from Viewpoint 52: U.S. Coast Guard Cleveland Harbor Station

Figure 3.11-3. Visual Simulation from Viewpoint 19: Bicentennial Park.

Figure 3.11-4. Visual Simulation from Viewpoint 17: Cleveland Mall.

Decommissioning

Decommissioning of the Proposed Project would have similar short-term, moderate adverse impacts as construction associated with vessels and equipment.

3.11.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.12 Noise

3.12.1 Affected Environment

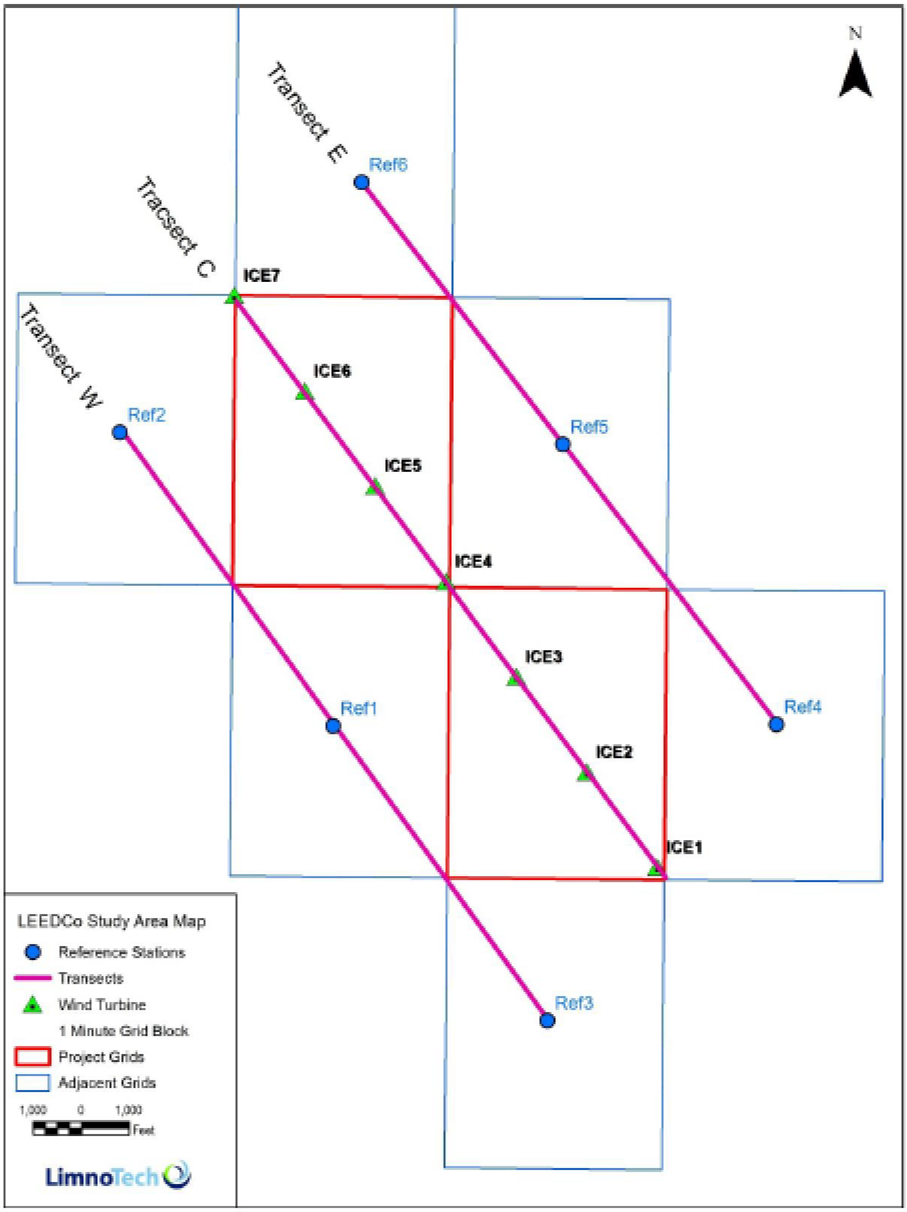
3.12.1.1 Above Water Sound

The offshore components of the Proposed Project would be located approximately 8 to 10 miles offshore of Cleveland. Existing noise in this area consists primarily of boat traffic from lake freighters, commercial shipping, commercial and recreational fishing, and recreational boaters.

The Proposed Substation, O&M Center, and the Port would be located within heavy industrial areas that are regularly exposed to industrial noise and elevated ambient sound levels. The Proposed Substation parcel would be located adjacent to I-90. The I-90 corridor near the Proposed Substation parcel has four lanes for westbound traffic and five lanes for eastbound traffic with two-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 decibels (A-weighted scale; dBA) at a distance of 50 feet while heavy traffic sound levels are typically 85 dBA, and light traffic levels are approximately 53 dBA (DOI, 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 (DOI, 2008). As the Proposed Substation parcel would be located immediately adjacent to two-lane roads and less than 100 feet from I-90, the area would be constantly exposed to elevated noise levels under existing conditions.

3.12.1.2 Underwater Sound

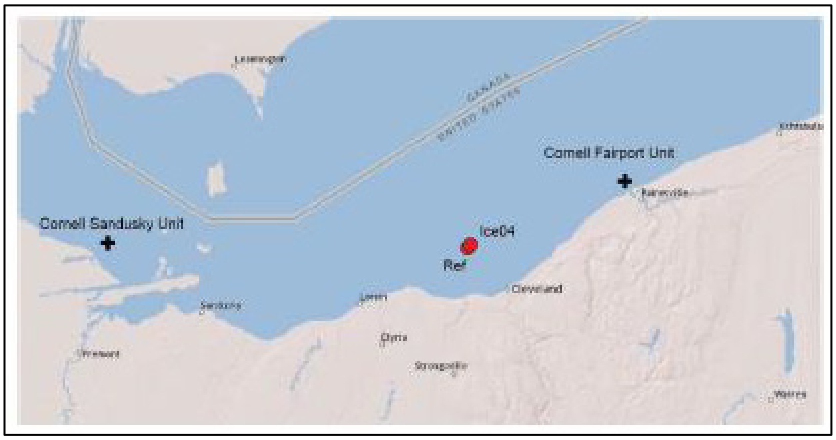
LimnoTech and Cornell Bioacoustics, in coordination with the ODNR, conducted site-specific assessments of underwater ambient noise levels. LimnoTech monitored underwater background noise continuously from May through October 2016. Two underwater sound recorders were deployed using Ocean Instruments Smart Hydrophone Soundtraps. One Soundtrap was installed at proposed turbine location 4 (ICE4) and the other was installed at a reference station, 1 mile west of the proposed turbine location (REF1), both 2 meters (6.5 feet) above the lake bottom. Figure 3.12-1 provides a layout of the Proposed Project and sampling stations. The Soundtraps recorded 30 minutes every hour at 72 kilohertz (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 that would occur during and post-construction.



Source: LimnoTech, 2016 Aquatic Sampling Report, Appendix E-1

Figure 3.12-1. Map of Proposed Project Area with LimnoTech Sampling Stations and Transects

LimnoTech's 2016 Aquatic Sampling Report with details of the preconstruction noise monitoring is provided in Appendix E-1. Using the preconstruction data, LimnoTech developed long-term spectral averages to show 24-hour or seasonal patterns in biological, human-influenced, and environmental acoustic activity that often cannot be seen at finer time scales. Relatively high levels of transient noise were observed throughout the study period, likely associated with passing ships or sporadic biological activity. ICE4 exhibited higher overall sound levels compared to REF1. Background noise was detected and varied in intensity and duration across the entire survey. Review of the long-term spectral averages over the entire survey period show considerable diversity between REF1 and ICE4 in their respective acoustic environments. A comparison was made to Cornell University deployed hydrophones located both east and west of the proposed turbine locations near Fairport and Sandusky, Ohio (Figure 3.12-2.) The Fairport survey was located in ODNR's Walleye/Perch Habitat and the Sandusky survey in a Walleye Larval and Juvenile Production area. Cornell recorded seasonal chorusing events of freshwater drum (*Aplodinotus grunniens*) in June at both locations which were not seen in REF1 or ICE4 data. REF1 and ICE4 are located in the Lake Erie Dead Zone, indicated by LimnoTech's DO data collection, and less than 1 mile from a Walleye/Perch Habitat.



Source: LimnoTech 2016 Aquatic Sampling Report, Appendix E-1

Figure 3.12-2. Recording Locations of 2016 ICE04 and REF1 Locations (red circles), Relative to Previous Cornell Acoustic Recordings in 2014 (black crosses).

3.12.2 Environmental Impacts Related to Noise

3.12.2.1 Above Water Sound

Construction

Offshore Construction
Construction of turbines would 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 would be installed underwater, requiring construction vessels offshore outside the Cleveland Harbor breakwater where the HDD exits to the turbine site, and, as such, there would be no noise impacts to the nearest onshore property.

People who could be exposed to noise during construction include recreational boaters on Lake Erie or individuals on public-use areas along the shoreline. Construction-based noise impacts to both boaters and individuals on the shoreline would be short-term and minor. In addition, boaters could choose to avoid the area during periods of elevated construction noise.

Nearshore and Onshore Construction
Construction of the Proposed Substation would occur at the Lake Road Substation site, an industrialized area. The equipment to be used for the construction of the Proposed Substation would be varied. Some of the louder pieces of equipment are shown in Table 3.12-1, along with the approximate maximum sound pressure levels at 50 feet (Resource Systems Group, 2013). However, the Lake Road Substation and adjacent parcels are located within a heavily urbanized and industrial area that is regularly exposed to elevated ambient sound levels. The area also experiences high levels of ambient traffic noise from nearby I-90 and existing heavy traffic areas are adjacent to the onshore areas. No residents are located near the proposed onshore or nearshore activities. The nearest property owner is the City of Cleveland, whose Lake

Road Substation will serve as the interconnection point for this project. Therefore, construction noise is expected to be negligible at the nearest residential property boundary.

Table 3.12-1. 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

Elevated construction noise would be expected during the HDD construction of the proposed export cable conduit. Potential sources of sound resulting from the HDD are included in Table 3.12-2 (Stantec, 2012). However, the HDD construction of the proposed export cable conduit would also occur on the Lake Road Substation site that is regularly exposed to elevated ambient noise and construction noise is expected to be negligible at the nearest residential property boundary.

Table 3.12-2. Sound Levels from HDD

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

The Port would be used for staging during construction of the Proposed Project. The Port includes 80 acres of owned and leased property including 10 berths, 11 docks, and 3 warehouses located east of the Cuyahoga River that handle general cargo operations, as well as the 44-acre Cleveland Bulk Terminal, which is located west of the river and primarily handles iron ore and limestone. Construction noise from use of the staging area would likely mix with typical ambient noise at the Port.

Based on this information, noise-related impacts from construction would be short-term and minor.

Operation and Maintenance

Offshore Operation and Maintenance

There would be no operational noise impacts from the proposed wind turbines at the nearest land property boundary because the turbines would be sited 8 to 10 miles offshore and operational noise would not be detectable above ambient noise levels at approximately 1 mile from each of the proposed turbines.

On Lake Erie, boaters could hear the turbines as they approach the proposed turbine sites. Above water noise from operating turbines is approximately 50 dB at a distance of 100 meters (328 feet) from the turbine, dropping to approximately 38 dB at 500 meters (0.3 mile) away, and not detectable above ambient noise levels 1 mile away. As a comparison, a mid-size window air conditioner can reach 50 dB of noise, and a refrigerator about 40 dB. In most places, ambient or background noise levels range from 40 to 45 dB, or 30 dB in most rural areas (General Electric, 2014). At ambient noise levels, noise from the turbines over the water would not cause interference with sound signals from vessels or ATONs near the proposed turbine sites nor pose health concerns to passing vessel crews. In addition, because the proposed wind turbines would be located at least 7 miles from land, there would be minimal, short-term affects to the majority of boaters that tend to stay closer to shore (Appendix E-1).

Nearshore and Onshore Operation and Maintenance

Some noise would be generated by the Proposed 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, an area designated to limit the noise level from long-term or continuous noise producing sources because of its use by humans or other sensitive species, to the Proposed Substation would be Kirtland Park, located approximately 900 feet to the southwest of the Proposed Substation. I-90 passes between the Proposed Substation and the park, and as such, noise impacts to Kirtland Park from the Proposed Substation would be negligible.

There would be minimal road traffic associated with operation of the Proposed Substation. The onshore areas, including the Proposed 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 would be adjacent to the onshore areas (e.g., I-90), which contribute to the current elevated noise levels.

Because of the highly urbanized and industrialized areas around the Proposed Substation and the Port, the expected high ambient noise levels, and the lack of noise sensitive areas nearby, operation and maintenance activities at the Proposed Substation and the Port would not result in adverse noise impacts.

Decommissioning

Noise-related impacts from decommissioning of the Proposed Project would be short-term and minor with similar activities as construction. The export cable would be abandoned in-place and therefore would not result in noise-related impacts.

3.12.2.2 Underwater Sound

Construction

Sound propagation underwater differs from that of sound in the air because of differences in the density and impedance of the medium (Ingemansson Technology, 2003). To date, most of the research surrounding underwater sound levels has been done to investigate pile driving. However, gravity foundations like the proposed MB foundations do not require pile driving and result in considerably lower noise levels. As described in Section 3.4.2.2, 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).

There would be additional boat traffic associated with construction of the proposed turbine foundations, inter-array cable, and export cable. However, noise levels during construction would be temporary and similar to noise levels experienced consistently in the region by lake freighters traveling into and out of the Port annually. Therefore, the additional noise-related effects to aquatic communities from a temporary increase in boat traffic would be negligible.

There would be no anticipated noise effects on fish or other organisms from HDD construction operations associated with the proposed export cable installation because the noise generating equipment would be located onshore, except for the drill bit and string, which would be located approximately 12 feet below the lakebed (Xodus, 2015). Noise generated from HDD would be short-term with impacts occurring only during actual HDD activities, which would be expected to last approximately one month.

Operation and Maintenance

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 Technology, 2003). Underwater sound from operating turbines would also be influenced by the turbine’s coupling with the bottom. Gravity foundations, such as the proposed MB foundations, are expected to emit sound within a lower interval of frequency than monopile foundations (Hammar et al., 2014).

Section 3.4.2.2 summarizes a review of the current knowledge of fish detection and reaction to underwater sound conducted by Wahlberg and Westerberg (2005). There was no evidence that wind turbine noise causes temporary hearing loss in fish even at a distance of a few meters. Wahlberg and Westerberg (2005) reported that 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 and that wind turbine noise may have an impact on the maximum acoustic signaling distances by fish. However, the authors state that it is not known to what degree this reduces the fitness of the fish (Wahlberg and Westerberg, 2005).

Wind turbine type has a large effect on the sound intensities generated during operation, and, therefore, on the range at which fish may be affected. The Proposed Project turbine would be considered average for the industry in terms of underwater acoustic noise. Additional factors, especially the number of wind turbines, water depth, and bottom type may cause the detection and masking ranges calculated to vary considerably between different wind turbine sites (Wahlberg and Westerberg, 2005). Ambient noise levels may increase during periods of calm seas and low shipping traffic. Another contributor to the ambient noise would be from sea-state (general condition of a large body of water, i.e., wind waves and swell), which would be expected to increase as the turbines rotational speed increases with wind speed. Overall, it is most likely that noise impacts to fish are limited to high wind speeds at short distances from the turbine foundation (Bergstrom et al., 2014).

Shipping causes considerably higher sound intensities than operating wind turbines (Wahlberg and Westerberg, 2005). Commercial ships are a dominant source of radiated underwater noise at frequencies less than 200 Hz, which is within the hearing range of many fish (Hildebrand, 2009; Slabbekoorn et al., 2010). Offshore wind farms create low-frequency noise at moderate source levels during their operation (Hildebrand, 2009). An operating wind turbine will produce a source level of 151 dB re 1 µPa at 1 meter (3.3 feet) compared to a cargo vessel (173 meters in length, at 16 knots) and a small boat outboard engine (at 20 knots), which will produce source levels of 192 dB re 1 μPa and 160 dB re 1 μPa at 1 meter (3.3 feet), respectively (Hildebrand, 2009). Therefore, underwater sound generated from the operation of the proposed turbines would be less than routine vessel sounds that occur in the Proposed Project Area and would not have an adverse impact to aquatic species.

There would be increased boat traffic from maintenance activities at the proposed turbines. However, because Lake Erie experiences frequent boat traffic from commercial shipping and fishing and recreation, no significant additional underwater noise impacts would result from maintenance activities.

Based on the information above and LimnoTech's pre-construction monitoring of ambient underwater sound levels, operation of the Proposed Project would result in long-term minor impacts to aquatic animals from underwater noise.

Decommissioning

Noise levels during decommissioning of the Proposed Project would be temporary and similar to noise levels experienced during construction; therefore, the additional effects to people or aquatic communities would be negligible.

3.12.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.13 Economics and Socioeconomics

Information provided in this section was obtained primarily from the *Socioeconomic Report,* prepared by EDR (Appendix W). Unless noted otherwise, the study area for the report includes the following seven municipalities in Cuyahoga County which are found wholly or partially within a 5-mile radius of the Proposed Substation (the Study Area[14]):

- City of Cleveland
- City of Cleveland Heights
- City of East Cleveland
- City of Shaker Heights
- Village of Bratenahl
- Village of Cuyahoga Heights
- Village of Newburgh Heights

Figure 3.13-1 depicts the study area.

[14] The 5-mile study radius is based on OPSB regulations.

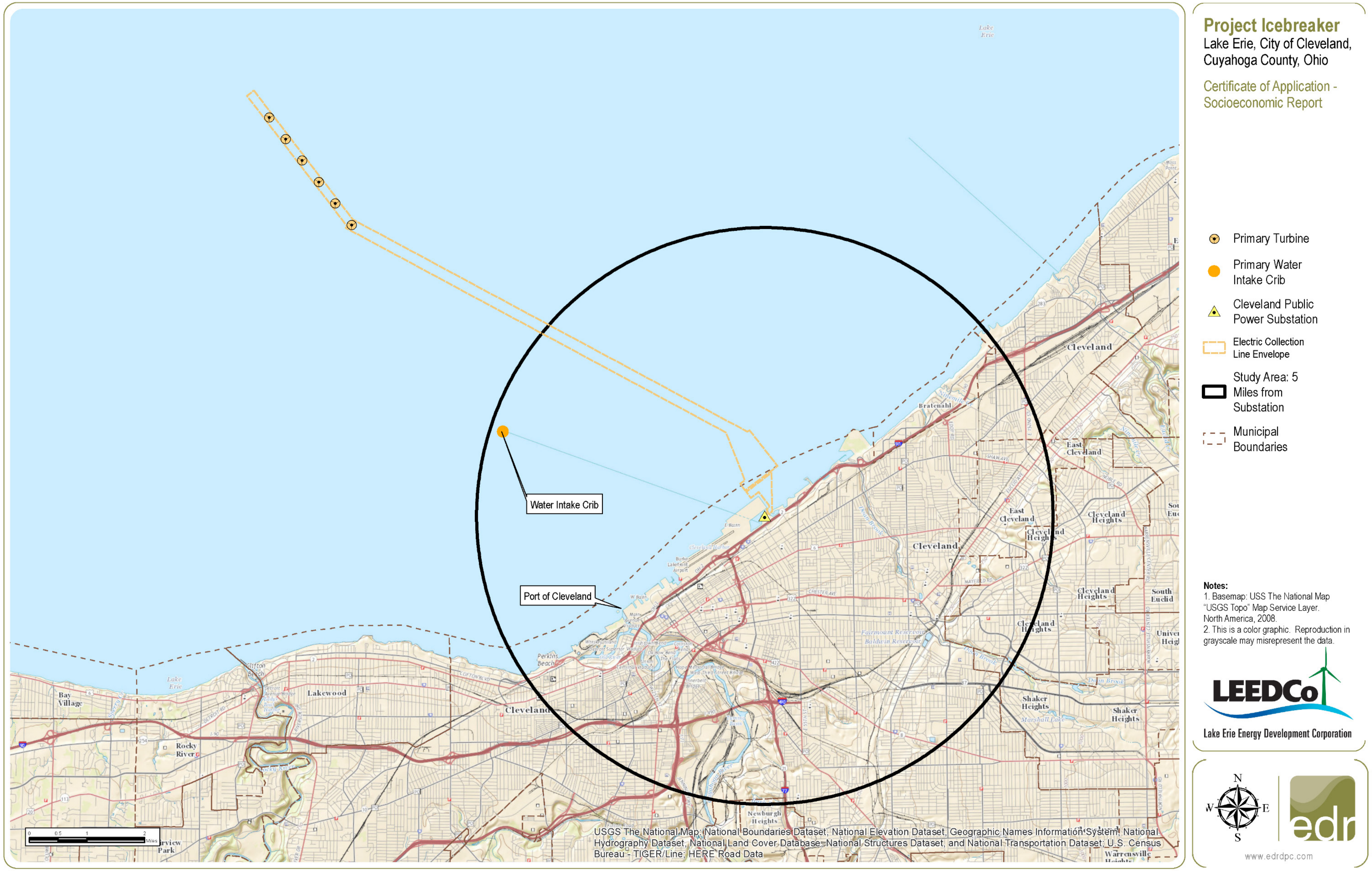


Figure 3.13-1. Proposed Project Study Area

3.13.1 Affected Environment

3.13.1.1 Population

As shown in Table 3.13-1, the total population of Cuyahoga County was 1,280,122 in 2010, marking a decrease of 9 percent 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, at a rate of -8.2 percent.

Table 3.13-1. 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, 2017a

Populations in the villages and cities within the Study Area mostly decreased between 2000 and 2010. Of the seven municipalities, only the Village of Bratenahl experienced a population increase (+2 percent) 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 3.13-2).

Table 3.13-2. Population Projections

Jurisdiction within 5-Miles Radius of Proposed Substation	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%**

Sources: U.S. Census Bureau, 2017a; Ohio Development Services Agency, 2017
Notes:
Totals calculated by formula, may reflect rounding errors.
Municipality projections based on their respective 2000-2010 growth rates.

Over the next decade, the population within the Study Area is projected to decrease by 27 percent between 2020 and 2030, from 439,047 to 370,169. Meanwhile, county population projections are only expected to decline 8 percent between the same time span, from 1,209,550 in 2020 to 1,179,030 in 2030 (Table 3.13-2).

3.13.1.2 Employment

Table 3.13-3 details the local labor force and unemployment rate within Cuyahoga County and the State of Ohio. The total annual unemployment rate for Cuyahoga County has been relatively consistent with that of the state over the past two years, and average annual unemployment rates have decreased both county- and state-wide from 2013 to 2015.

Table 3.13-3. Local Labor Force and Unemployment

Place	Labor Force	Employed	Unemployed	Unemployment Rate	Unemployment Rate, 2014 (annual)	Unemployment Rate, 2013 (annual)
Cuyahoga County	610,000	579,500	30,500	5.0	6.2	7.0
State total	5,700,000	5,423,000	277,000	4.9	6.2	7.5

Note: Not Seasonally Adjusted; Source: U.S. Department of Labor, Bureau of Labor Statistics, 2015.

Table 3.13-4 details employment by sector in Cuyahoga County for 2014, the latest available data at the time of the report.

Table 3.13-4. Employment and Payroll by NAICS Sector in Cuyahoga County

NAICS code description	Paid Employees for Pay Period Including March 12, 2014	First-quarter Payroll ($1,000)	Annual Payroll ($1,000)	Total Establishments
Total for all sectors	664,773	8,386,436	33,123,486	33,016
Agriculture, Forestry, Fishing, and Hunting	7	53	284	4
Mining, quarrying, and oil and gas extraction	C	D	D	13
Utilities	G	D	D	37
Construction	18,865	245,150	1,217,312	1,977
Manufacturing	69,685	1,109,037	4,338,234	1,811
Wholesale trade	39,107	597,972	2,405,537	2,323
Retail trade	62,232	365,641	1,534,962	4,262
Transportation and warehousing	17,422	209,500	839,754	793
Information	13,931	232,766	889,751	533
Finance and insurance	45,335	1,082,683	3,671,479	2,622
Real estate and rental and leasing	15,330	222,299	804,169	1,544
Professional, scientific, and technical services	40,735	684,135	2,912,475	4,014
Management of companies and enterprises	30,098	851,856	2,697,960	329

Table 3.13-4. Employment and Payroll by NAICS Sector in Cuyahoga County

NAICS code description	Paid Employees for Pay Period Including March 12, 2014	First-quarter Payroll ($1,000)	Annual Payroll ($1,000)	Total Establishments
Administrative and support and waste management and remediation services	43,286	321,610	1,389,774	1,870
Educational services	30,595	196,006	814,393	510
Health care and social assistance	141,315	1,671,570	6,962,513	3,601
Arts, entertainment, and recreation	10,375	130,713	729,613	423
Accommodation and food services	56,795	217,643	928,508	3,034
Other services (except public administration)	27,681	198,250	822,274	3,273
Industries not classified	58	374	1,662	43

c = 100-249 employees
g = 1,000-2,499 employees

D = Withheld to avoid disclosing data for individual companies; data are included in higher level totals.

Source: U.S. Census Bureau, 2016

The regional economy surrounding the Study 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.

3.13.1.3 Housing

As with all sectors of the economy, the housing market throughout the region surrounding the Study Area 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 percent higher), while the 8.5 percent rental vacancy rate in Cuyahoga County is substantially higher than the statewide average of 7.2 percent.

In Cuyahoga County, the median monthly gross rent is $736, which is above the statewide average of $729/month, and a higher proportion of renters (44.1 percent) whose rent accounts for more than 35 percent of their household income than statewide (41.1 percent). In addition, Cuyahoga County's median housing value of $123,300 is below the statewide average of $129,600. For more detailed housing information for each of the municipalities within the Study Area, refer to Table 5 of Appendix W.

3.13.1.4 Local Tax Revenue

Property tax receipts, based on assessed value, for Cuyahoga County have remained relatively steady since Fiscal Year 2012 with general fund property tax receipts of $14.8 million in Fiscal Year 2012, $13.9 million in Fiscal Year 2013, $14.0 million in 2014 and $14.1 million in 2015 (County of Cuyahoga, 2016).

3.13.1.5 Commercial and Recreational Fisheries

Lake Erie provides a valuable commercial and sport fishery. According to the Great Lakes Wind Energy Center Feasibility Study, in 2006, over 1.25 million recreational fishing licenses were sold in Ohio with close to one-third of the licenses sold in counties that border the lakeshore. Over $1 billion in recreational fisheries retail sales were recorded in Ohio in 2006 with close to half from fishing in Lake Erie. The 2006 USFWS survey shows that recreational fishing throughout the Great Lakes is most popular on Lake Erie. As reported, 37 percent of all Great Lakes anglers focused their efforts on Lake Erie. Although Lake Erie is the smallest of the Great Lakes, it boasts the greatest commercial harvest. Annually, there are more fish harvested from Lake Erie than all the other Great Lakes combined. Harvests from Lake Erie make up 61 percent of the total Great Lakes commercial fishery. With most of the catch coming from Canadian waters, Lake Erie commercial fishermen harvested close to 30.2 million pounds of fish in 2008. Yellow perch and walleye are the most lucrative species, as Canadian commercial operators received $6.1 million for their catch of yellow perch (4.8 million pounds) and $7.8 million for their catch of walleye (4.8 million pounds). (Michigan Sea Grant, 2017).

Ohio commercial fisheries harvested 4.6 million pounds of fish in 2015 with a dockside value of $4.9 million. Yellow perch, freshwater drum, and white bass were the three primary fish harvested accounting for 28, 20, and 17 percent of the total commercial harvest, respectively (ODNR, 2016a).

Throughout the Great Lakes, charter fishing has been a major economic contributor. From 1990 to 2009, more than 37,000 charter trips were reported to have left from Lake Erie ports, contributing an economic impact of more than $47.5 million to coastal communities (Michigan Sea Grant, 2017).

3.13.2 Environmental Impacts Related to Economics and Socioeconomics

In the evaluation of economic impacts within the *Socioeconomic Report*, EDR used the Job and Economic Development Impact (JEDI) model (version OSW08.19.16), specifically designed to assess economic impacts of wind-powered electric generation facilities and created by the NREL. This model allows impacts to be estimated for both the construction and operation phases of the Proposed Project at a state-wide level. The JEDI model requires project-specific data input (such as year of construction, size of project, turbine size, and location), and then calculates the economic impacts using state-specific multipliers. For more details on the methodology refer to Appendix W.

3.13.2.1 Population

Construction

Construction of the Proposed Project is anticipated to take approximately 6 months to complete; therefore, impacts to population would be short-term and minor.

Operations and Maintenance

As described below, under employment impacts, based on JEDI model calculations, the operations and maintenance of the Proposed Project is estimated to generate nine full-time equivalent jobs. This is a small addition of potential new residents compared to the overall population in this region. Therefore, the Proposed Project would not generate impacts to population growth within the area.

Decommissioning

Similar to construction, decommissioning of the Proposed Project would be short-term and minor.

3.13.2.2 Employment

Construction

Based upon JEDI model computations, it is anticipated that construction of the Proposed Project would directly generate employment of an estimated 159 onsite construction and development personnel. Local employment would primarily benefit those in the construction trades, including equipment operators, barge drivers, laborers, and electricians. Proposed Project construction would 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 would come from outside the area and would remain only for the duration of construction. The JEDI model also estimates that the Proposed Project could generate an estimated 187 jobs over the course of construction for supply chain industries and Proposed Project 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 2019 to 2021 construction start and wage rates consistent with statewide averages.

Operations and Maintenance

Based upon JEDI model computations, the operation and maintenance of the Proposed Project is estimated to generate nine full-time equivalent jobs with estimated annual earnings of approximately \$0.6 million. The Proposed Project would also generate an estimated 11 jobs with annual earnings of around \$0.7 million over the course of operations and maintenance for supply chain industries. In addition, it is estimated that eight jobs with associated annual earnings of \$0.4 million could be induced through the increased household spending associated with operation of the Proposed Project.

Decommissioning

The decommissioning of the Proposed Project would generate employment similar to construction.

3.13.2.3 Housing

Construction

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 Proposed Project would have an impact on the regional housing market. The high availability of vacant rental housing also indicates that the Proposed Project should not have a destabilizing effect on current renters.

Operations and Maintenance

Because of the small number of full-time equivalent jobs associated with the operation and maintenance of the Proposed Project, long-term effects on housing would be negligible.

Decommissioning

Available housing and population at the time of decommissioning is unknown; however, given current trends, it is not expected that decommissioning would have an impact on the housing market, or have a destabilizing effect on renters.

3.13.2.4 Local Tax Revenue

Construction

Local tax revenue streams are diverse, ranging from sales taxes to income taxes and beyond. The JEDI model does not account for these tax revenues and there are too many variables and associated uncertainty to accurately assess a local tax impact during the construction period. However, any local tax revenue generated during construction of the Proposed Project would be short-term and minor associated with construction (building materials, wages, and other goods and services including food and lodging).

Operations and Maintenance

LEEDCo anticipates that it would pay real and personal property taxes between the minimum and maximum rate set under ORC Section 5727.75, between $6,000 to $9,000 per MW of nameplate capacity per year during the life of the Proposed Project. Assuming an aggregate nameplate capacity of 21 MW, the increase in local tax revenues would be between $124,200 and $186,300 annually for the Proposed Project. Additionally, the Proposed Project would make few, if any, demands on local government services. Therefore, payments made to local taxing jurisdictions would be net positive gains and represent an economic benefit to the local tax base, including local school districts and other taxing districts that service the area where the Proposed Project is to be located, specifically the City of Cleveland and the Cleveland Municipal School District.

Decommissioning

Similar to construction, impacts to local tax revenue during decommissioning would be short-term and minor.

3.13.2.5 Commercial and Recreational Fisheries

Construction

Short-term impacts to commercial and recreational fisheries during construction would include the potential for temporary displacement of fish and the temporary impacts to fishing vessels from the presence of construction equipment on the lake. Because of the limited timeframe associated with construction and the small scale of the Proposed Project, any economic impacts to commercial and recreational fisheries would be negligible.

Additional information on commercial and recreational fisheries vessel movement can be found in Section 3.8, Lake Use.

Operations and Maintenance

The operations and maintenance of the Proposed Project would not restrict commercial or recreational fishing activity. It is possible that the proposed turbines would develop into areas of reef habitat that aquatic organisms would be likely to settle in and around as has been observed within the Gulf of Mexico and on the Pacific Coast around fixed oil rigs. The growth of invertebrates and algae on the foundations would likely lead to increased densities of certain species of fish which could have a positive economic benefit to the commercial and recreational fishing industry. Other aspects of Proposed Project operation and maintenance would have negligible to no economic effects on commercial and recreational fisheries.

Decommissioning

Similar to construction, because of the limited timeframe associated with decommissioning and the small scale of the Proposed Project, any economic impacts to commercial and recreational fisheries during decommissioning would be negligible.

3.13.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.14 Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629), directs that each federal agency, to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the report on the National Performance Review, shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands. Minority populations are those identified in census data as Native American or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; Hispanic; some other race; or two or more races (CEQ, 1997). Low-income populations are those identified as living at or below the U.S. poverty level.

3.14.1 Affected Environment

The onshore components of the Proposed Project, including an underground transmission line, Proposed Substation, and O&M Center would be located in the City of Cleveland. Additionally, construction would be supported by the temporary use of the Port for staging. Cuyahoga County, with a population of 1,280,122, has a minority population of 38.6 percent while the City of Cleveland, with a population of 396,815, has a minority population of 66.6 percent. Table 3.14-1 details the minority population of the county and city.

Table 3.14-1. Cuyahoga County and City of Cleveland Population Hispanic or Latino and Race

Subject	Number	Percent	Number	Percent
	Cuyahoga County		City of Cleveland	
Total population	**1,280,122**	**100.0**	**396,815**	**100.0**
Hispanic or Latino	61,270	4.8	39,534	10.0
White alone	28,126	2.2	15,219	3.8
Black or African American alone	5,230	0.4	3,464	0.9
American Indian and Alaska Native alone	560	0.0	343	0.1
Asian alone	268	0.0	114	0.0
Native Hawaiian and Other Pacific Islander alone	68	0.0	50	0.0
Some Other Race alone	21,497	1.7	16,903	4.3
Two or More Races	5,521	0.4	3,441	0.9
Not Hispanic or Latino	1,218,852	95.2	357,281	90.0

Table 3.14-1. Cuyahoga County and City of Cleveland Population Hispanic or Latino and Race

Subject	Number	Percent	Number	Percent
	Cuyahoga County		City of Cleveland	
White alone	785,977	61.4	132,710	33.4
Black or African American alone	374,968	29.3	208,208	52.5
American Indian and Alaska Native alone	2,018	0.2	997	0.3
Asian alone	32,615	2.5	7,213	1.8
Native Hawaiian and Other Pacific Islander alone	217	0.0	70	0.0
Some Other Race alone	1,842	0.1	599	0.2
Two or More Races	21,215	1.7	7,484	1.9

Source: U.S. Census Bureau, 2017a

The median income of Cuyahoga County and the City of Cleveland is $44,190 and $26,150, respectively. For Cuyahoga County, the percentage of families and people whose income in the past 12 months was below the poverty level is 14.5 and 18.7, respectively, while for the City of Cleveland, the percentage of families and people whose income in the past 12 months was below the poverty level is 31.4 and 36.2, respectively (U.S. Census Bureau, 2017b).

3.14.2 Environmental Impacts Related to Environmental Justice

Construction

No adverse impacts to minority or low-income populations are anticipated during construction because work would occur offshore in an unpopulated area and within existing facilities for the onshore portions. Additionally, an economic benefit to the local economy from the Proposed Project would be anticipated from the short-term hiring of construction workers.

Operations and Maintenance

The Proposed Project would have minor impacts to aesthetics and visual resources from operations of the wind turbines (refer to Section 3.11, Aesthetics and Visual Resources); however, it would not be expected to adversely impact property values. Wind turbines generate electricity without releasing pollutants into the atmosphere; therefore, the Proposed Project would not contribute to air pollution in the city, and no impacts to water quality or water supply would be expected. Overall, no adverse impacts to minority or low-income populations would occur during operations and maintenance.

Decommissioning

Similar to construction, no adverse impacts would occur and an economic benefit through short-term construction hiring would be anticipated from decommissioning of the Proposed Project.

3.14.3 No-Action Alternative

Under the No-Action Alternative, DOE would not authorize the expenditure of federal funds by LEEDCo in support of the Proposed Project. For purposes of this analysis, DOE assumes the Proposed Project would not proceed if DOE does not authorize the expenditure of federal funds. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

3.15 Summary of Adverse Impacts

A summary of adverse impacts by resource area is provided in Table 3.15-1. The table details the severity and duration of impacts for each resource area analyzed within this EA. The No-Action Alternative would result in no impacts to resources; therefore, the table summarizes the impacts from the Proposed Action only. The level of expected impact is based both on the resources occurring in the Proposed Project Area along with the consideration that the Proposed Project is an advanced technology demonstration project of limited size, consisting of six wind turbine generators and ancillary equipment required for electric grid interconnection. By its design, the limited size and scope of a technology demonstration project allows for the collection of environmental and technical information to inform future decision making. The Proposed Action would not result in major impacts to any resource, and there would not be population-level impacts to any biological resource.

Table 3.15-1. Summary of Adverse Impacts

Resource Area	Level of Expected Impact
Physical Resources	
Lake-Based Geology and Sediments	No Impact
Land-Based Geology and Soils	No Impact
Water Resources	
Lake Water Quality	Minor, Short-term Impact
Drinking Water Supply and Quality	No impacts
Biological Resources	
Benthos	Moderate, Short-term Impact
Fish Resources	Minor, Short-term Impact
Insects (Butterflies)	Negligible, Short-term Impact
Birds and Bats	Minor, Short-term and Long-term Impacts
Aquatic and Terrestrial Protected Species	Negligible, Short-term Impact
Health and Safety	
Waste Management	Negligible Impact
Hazardous Materials	Negligible Impact
Public Health and Safety	Minor, Short-term Impact

Table 3.15-1. Summary of Adverse Impacts

Resource Area	Level of Expected Impact
Air Quality	Minor, Short-term Impact
Climate Change	Negligible Impact
Lake Use	Minor, Short-term Impact
Traffic and Transportation	Minor, Short-term Impact
Cultural Resources	Minor, Long-term Impact
Aesthetic and Visual Resources	Minor, Long-term Impact
Noise	Minor, Short-term Impact
Economics and Socioeconomics	Negligible
Environmental Justice	No impact

3.16 Irreversible and Irretrievable Commitments of Resources

An irreversible commitment of resources is defined as the loss of future options. The term applies primarily to the effects of use of nonrenewable resources such as minerals or cultural resources. It could also apply to the loss of an experience as an indirect effect of a permanent change in the nature or character of the land. An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of production foregone is irretrievable, but the action is not irreversible. If the use changes, it is possible to resume production (DOE, 2011). Irreversible commitments of resources would be those consumed during construction, operations, maintenance, and decommissioning of the Proposed Project. These resources would include fossil fuels and construction materials, which would be committed for the life of the Proposed Project (DOE, 2011). Non-renewable fossil fuels would be lost using gasoline and diesel-powered construction equipment during all phases of the Proposed Project. The Proposed Project is not expected to create any long-term or permanent losses of unique or irreplaceable areas. Any impacts resulting from the construction and operation of the Proposed Project are temporary and have been minimized to the extent practicable with MB foundations for the turbines and a combination of jet-plowing and HDD for the proposed export cable. Removal of the turbines would restore the Proposed Project Area for alternative uses, including all current uses. No loss of future lake use options would occur.

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

Short-term use of the environment, as the term is used in this document, is that used during the life of the Proposed Project, whereas long-term productivity refers to the period after the Proposed Project has been decommissioned and the equipment removed. The short-term use of the proposed turbine sites, export cable, and substation for the Proposed Project would not affect the long-term productivity of the overall Proposed Project Area. When operation of the Proposed Project would be no longer practicable, it would be decommissioned, removed, and the areas used for the Proposed Project could be reclaimed for pre-project uses.

SECTION 4 CUMULATIVE IMPACTS

Cumulative impacts to environmental resources result from the addition of incremental impacts from a proposed action to other past, present, and reasonably foreseeable future actions regardless of what agency, industry, or person undertakes the other actions (CEQ regulations 40 CFR Part 1508.7). In accordance with the NEPA, a discussion of potential cumulative impacts resulting from projects proposed, under construction, recently completed, or reasonably anticipated to be implemented is required. The Proposed Project would have the potential to result in long-term minor impacts to biological resources (fish species, birds, and bats), public health and safety (navigational risk), and aesthetics and visual resources including historic resources based on the operation and maintenance of the proposed wind turbines. All other long-term adverse impacts resulting from implementation of the Proposed Project would be negligible. Further, implementation of the Proposed Project would result in no major short-term adverse impacts.

Cumulative impacts were considered by first identifying other actions (proposed, under construction, recently completed, or reasonably foreseeable), and then by analyzing those actions together with the Proposed Action.

4.1 Cumulative Projects

To develop a list of proposed, under construction, recently completed, or reasonably anticipated to be implemented projects for the cumulative impacts analysis, cooperating agencies were consulted (USACE and USCG) and publicly available resources were reviewed (ODOT, 2017; OEPA, 2017b; City of Cleveland, 2017). No wind energy projects beyond this Proposed Project were identified within the onshore, nearshore, or offshore environment.

DOE acknowledges that to LEEDCo and other wind energy supporters, a goal of this demonstration project is to support future wind development in Lake Erie or the Great Lakes. However, a goal does not establish a reasonably foreseeable future project. At the current time, there are no specific plans for any future projects; there are no proposals for any specific number or type of turbines, and no potential locations identified which could be analyzed. As such, DOE considers the goal of LEEDCo and other wind energy supporters to further develop offshore wind in this region speculative.

The objectives of the National Offshore Wind Strategy are:

- Reducing the costs and technical risks associated with domestic offshore wind development;
- Supporting stewardship of U.S. waters by providing regulatory certainty and understanding and mitigating environmental risks of offshore wind development; and
- Increasing understanding of the benefits and costs of offshore wind energy.

It is not an objective of the Strategy to develop offshore wind specifically within Lake Erie or the Great Lakes region. Instead, the objectives apply to all potential domestic offshore wind locations, including the 95,741 miles of U.S. coastline, and an estimated 125,000 lakes in the lower 48 states and 3 million in Alaska. At this time, DOE has no proposals or plans to support the specific construction of any offshore wind projects in Lake Erie beyond this proposal.

Because there are no proposals for future wind projects in Lake Erie, no proposed locations or turbine numbers or types to be analyzed, DOE has determined that there are no wind energy projects beyond this

Proposed Project within the onshore, nearshore, or offshore environment of Lake Erie or the other Great Lakes

4.1.1 Onshore and Nearshore Projects

The City of Cleveland continually undertakes construction, reconstruction, and renovation of City-owned facilities, buildings, roads, bridges, and infrastructure. New or renovated private buildings, and institutional development, renovation, and expansion are common within the city.

Projects to install, maintain, and repair dock facilities, breakwalls, or piles, and associated dredging activities have been previously permitted by yacht and sail clubs, the Port, or other waterfront industries in proximity to the Proposed Substation (within 2 miles) (Krawczyk, 2017, pers. comm.). These types of activities would also be reasonably anticipated in the future.

The ODOT, as part of the Cleveland Urban Core projects, is currently working on and plans continued work on projects in proximity to the Proposed Project substation (within 2 miles).

- Cleveland Innerbelt Modernization Plan focuses on improving safety, reducing congestion and traffic delays, and modernizing interstate travel along I-71, I-77, and I-90 through downtown Cleveland. The projects will rehabilitate and reconstruct about 5 miles of interstate roadways including construction of two new bridges to carry I-90 traffic and address operational, design, safety, and access shortcomings.
- Lakefront West Project is working to connect Cleveland's west side neighborhoods with the lakefront by creating multi-modal connections along the West Shoreway between West Boulevard and the Main Avenue Bridge. It will increase access to Lake Erie along a 2-mile stretch; improve green space, biking, and pedestrian facilities; increase development potential; and simplify connections along the now limited-access freeway.

4.1.2 Offshore Projects

There are no known or reasonably foreseeable offshore wind projects in Lake Erie.

Activities and offshore projects likely to occur offshore in Lake Erie during the life of the Proposed Project and in the area of the proposed wind turbines include commercial shipping, commercial and recreational boating and fishing, and dredging of shipping lanes.

As mentioned previously in the EA, the LEC Project is located approximately 80 miles east of the Proposed Project and consists of an approximately 35-mile submerged cable route within Lake Erie. Because of the distance and its limited action of a buried cable within Lake Erie, there would be no geographic or temporal overlap of impacts to resources with the Proposed Project.

4.2 Cumulative Impacts

The Proposed Project’s onshore facilities (Substation, O&M Center, and Port staging area) would be located in existing, developed areas, and nearshore facilities would be limited to a submerged cable. The Proposed Project would have negligible long-term adverse impacts and no major short-term adverse impacts to resources onshore and nearshore; therefore, onshore and nearshore cumulative impacts were not further analyzed.

The cumulative impacts analysis of the Proposed Project combined with ongoing offshore activities likely to occur in the vicinity of the Proposed Project (commercial shipping, commercial and recreational boating and fishing, and dredging of shipping lanes) was conducted at geographic ranges in accordance with the resources and potential for impacts. This analysis included the resources with anticipated long-term minor impacts resulting from the proposed wind turbines together with activities likely to occur offshore in Lake Erie.

4.2.1 Biological Resources – Fish

Overall, long-term adverse impacts to fish species from operations and maintenance of the proposed wind turbines would be minor. These long-term minor impacts include loss of approximately 0.3 acre of existing substrate habitat from the proposed turbine foundations and potential noise impacts to fish limited to high wind speeds at short distances from the turbine foundation. Cumulative impacts would also be expected to be minor as identified offshore activities in Lake Erie currently do not and are not anticipated to significantly impact fish.

4.2.2 Biological Resources – Birds and Bats

Long-term, minor adverse impacts to birds and bats would result from potential behavioral avoidance or attraction to the wind turbines and potential collision with the wind turbines. As no other offshore projects were identified and offshore activities from the Proposed Project would have negligible impacts to birds and bats, cumulative impacts to birds and bats would be expected to be negligible.

4.2.3 Public Health and Safety

Adverse impacts to health and safety from the proposed wind turbines would be long-term and minor during operation and maintenance. A Navigational Risk Assessment for the Proposed Project has been prepared in coordination with the USCG to ensure potential navigational hazards are appropriately addressed. Identified and potential future offshore activities currently coordinate or would be required to coordinate with the USCG to minimize navigational hazards; therefore, cumulative impacts to public health and safety would be minor.

4.2.4 Aesthetics and Visual Resources

The proposed wind turbines would be new, permanent visible structures. The small number of turbines, their distance from shore, and the relatively small area of the horizon occupied by the turbines all help to minimize the visual effect on the setting associated with historic resources located on the shoreline of Lake Erie. Activities which are likely to occur within Lake Erie currently do not and would not be anticipated to contribute adverse impacts to aesthetics and visual resources; therefore, cumulative impacts would be minor.

SECTION 5 REFERENCES

Ahlén, I., H.J. Baagøe, and L. Bach. 2009. *Behavior of Scandinavian Bats During Migration and Foraging at Sea.* Journal of Mammalogy 90(6): 1318–1323.

Ahmad, Moid U. and Jeffery A. Smith. 1988. Earthquakes, Injection Wells, and the Perry Nuclear Power Plant, Cleveland, Ohio. Geology. Doi: 10.1130/0091-7613(1988).

Arnett, E.B., K. Brown, W.P. Erickson, J. Fiedler, T.H. Henry, G.D. Johnson, J. Kerns, R.R. Koford, C.P. Nicholson, T. O'Connell, M. Piorkowski, and R. Tankersley, Jr. 2008. *Patterns of Fatality of Bats at Wind Energy Facilities in North America*. Journal of Wildlife Management 72: 61-78.

Baker, A., P. Gonzalez, R.I.G. Morrison, and B.A. Harrington. 2013. *Red Knot (Calidris canutus)*. In P.G. Rodewald (ed.): The Birds of North America. Cornell Lab of Ornithology, Ithaca, New York.

Baring-Gould, I., R. Cattin, M. Durstewitz, M. Hulkkonen, A. Krenn, T. Laakso, A. Lacroix, E. Peltola, G. Ronsten, L. Tallhaug, and T. Wallenius. 2012. *Wind Energy Projects in Cold Climates*. Expert Group Study on Recommended Practices, Submitted to the Executive Committee of the International Energy Programme for Research, Development, and Deployment on Wind Energy Conversion Systems. May 22, 2012.

Bergstrom, L., L. Kautsky, T. Malm, R. Rosenberg, M. Wahlberg, N. A. Capetillo, and D. Wilhelmsson. 2014. Effects of offshore wind farms on marine wildlife-a generalized impact assessment. Environmental Research Letters 9.

Bishop, I.D. 2002. "Determination of Thresholds of Visual Impact: The Case of Wind Turbines." *Environmental and Planning B: Planning and Design* (29) 707-718.

Bocetti, C.I., D.M. Donner, and H.F. Mayfield. 2014. *Kirtland's Warbler (Setophaga kirtlandii)*. In P.G. Rodewald (ed.): The Birds of North America. Cornell Lab of Ornithology, Ithaca, New York.

Boezaart, T.A. and J. Edmonson. 2014. *Lake Michigan Offshore Wind Feasibility Assessment, Final Technical Report.* Grand Valley State University. Funded by USDOE Award # DE-EE0000294. Grand Valley State University, Muskegon, Michigan.

Brack, V. Jr., A.M. Wilkinson, and R.E. Mumford. 1983. *Hibernacula of the Endangered Indiana Bat in Indiana*. Indiana Academy of Science 93: 463–468.

Brack, V., D. Sparks, J.O. Whitaker, Jr., B. Walters, and A. Boyers. 2010. *Bats of Ohio*. Produced by Indiana State University Center for North American Bat Research and Conservation, Publication Number 3. Indiana State University Press, Terre Haute, Indiana.

Broders, H.G., and G.J. Forbes. 2004. *Interspecific and Intersexual Variation in Roost-Site Selection of Northern Long-Eared and Little Brown Bats in the Greater Fundy National Park Ecosystem.* Journal of Wildlife Management 68(3): 602-610.

Buehler, D.A. 2000. *Bald Eagle (Haliaeetus leucocephalus)*. In P.G. Rodewald (ed.): The Birds of North America. Cornell Lab of Ornithology, Ithaca, New York.

Burlakova, L.E., A.Y. Karatayev, C. Pennuto and C. Mayer. 2014. *Changes in Lake Erie Benthos over the last 50 years: Historical Perspectives, Current Status, and Main Drivers.* http://www.utoledo.edu/nsm/lec/research/be/docs/burakova%20et%20al%202013.pdf. Accessed February 2017.

Caceres, M.C. and R.M.R. Barclay. 2000. *Myotis septentrionalis*. Mammalian Species 634: 1-4. American Society of Mammologists.

Caire, W., R.K. LaVal, M.L. LaVal, and R. Clawson. 1979. *Notes on the Ecology of Myotis keenii (Chiroptera, Vespertilionidae) in Eastern Missouri.* The American Midland Naturalist 102(2): 404-407.

Callahan, E.V., R.D. Drobney, and R.L. Clawson. 1997. *Selection of Summer Roosting Sites by Indiana bats (Myotis sodalis) in Missouri*. Journal of Mammalogy 78: 818–825.

Canadian Seabed Research Ltd. 2016. *2016 Icebreaker Offshore Wind Demonstration Project 2016 Marine Geophysical Survey Results, Cleveland, Ohio*. CSR Project Number: 1604, Canadian Seabed Research Ltd. and TDI Brooks, Submission Date: November 25, 2016.

Cleveland, City of. 2017. *Five Year Capital Improvement Program*. February 2017. http://www.city.cleveland.oh.us/sites/default/files/forms_publications/2017CapitalImprovementProgram.pdf. Accessed May 2017.

Cleveland Metroparks. 2016. *Monarch Waystations*. https://www.clevelandmetroparks.com/Main/Monarch-Waystations-Stepping-Stones-for-an-Amazing.aspx Accessed September 2016.

Cook, A.S.C.P., E.M. Humphreys, E.A. Masden, and N.H.K. Burton. 2014. The Avoidance Rates of Collisions Between Birds and Offshore Turbines. Scottish Marine and Freshwater Science, Volume 5, #16. Published by Marine Scotland Science.

Cooper, N. W., M. T. Hallworth, and P. P. Marra. 2017. Light-level geolocation reveals wintering distribution, migration routes, and primary stopover locations of an endangered long-distance migratory songbird. Journal of Avian Biology 48:209-219.

Cornell University. 2017. Birds of North America. The Cornell Lab of Ornithology. https://birdsna.org/Species-Account/bna/home. Accessed June 27, 2017.

Council on Environmental Quality (CEQ). 1997. Environmental Justice, Guidance Under the National Environmental Policy Act, Council on Environmental, Executive Office of the President, Old Executive Office Building, Room 360 Washington, D.C. Available at https://ceq.doe.gov/guidance/guidance.html.

County of Cuyahoga. 2016. Annual Information Statement in Connection with Obligations of the County. http://fiscalofficer.cuyahogacounty.us/en-US/obm-stats-reports.aspx. Accessed July 2017.

Daly, Steven F. 2016. *Characterization of the Lake Erie Ice Cover*. U.S. Army Corps of Engineers. Engineer Research and Development Center.

Davis, W.H., and H.B. Hitchcock. 1965. *Biology and Migration of the Bat, Myotis lucifugus, in New England*. Journal of Mammalogy 46(2): 296-313.

Derby, C., K. Bay, and J. Ritzert. 2009. Bird Use Monitoring, Grand Ridge Wind Resource Area, La Salle County, Illinois. Year One Final Report, March 2008 – February 2009. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 29, 2009.

Derby, C., J. Ritzert, and K. Bay. 2010. Bird and Bat Fatality Study, Grand Ridge Wind Resource Area, LaSalle County, Illinois. January 2009 – January 2010. Prepared for Grand Ridge Energy LLC, Chicago, Illinois. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismark, North Dakota. July 13, 2010. Revised January 2011.

Diehl, R.H., R.P. Larkin, and J.E. Black. 2003. Radar Observations of Bird Migration Over the Great Lakes. Auk 120: 278-290.

Dobbyn, J.S. 1994. *Atlas of the Mammals of Ontario*. Federation of Ohio Naturalists, Don Mills, Ontario. 120 pp.

Donahue, Raechel. 2016. "Dinner Cruises in Cleveland, Ohio." *USA Today, StudioD.* http://traveltips.usatoday.com/dinner-cruises-cleveland-ohio-17645.html. Accessed September 2016.

Dzal, Y., L.A. Hooton, E.L. Clare, and M.B. Fenton. 2009. *Bat Activity and Genetic Diversity at Long Point, Ontario, an Important Bird Stopover Site*. Acta Chiropterologica 11: 307-315.

eBird. 2016. eBird: Birding in the 21st Century. Cornell Lab of Ornithology, Ithaca, New York. http://ebird.org/content/ebird/. Accessed October 2016

Elliott-Smith, E. and S. M. Haig. 2004. Piping Plover (*Charadrius melodus*). No. 002 in The Birds of North America Online (A. Poole, Ed.). Cornell Lab of Ornithology, Ithaca, New York. http://bna.birds.cornell.edu/bna/species/002. Accessed June 27, 2017.

Enviros Consulting, Ltd. 2005. *Guidance on the Assessment of the Impact of Offshore Wind Farms: Seascape and Visual Impact Report*. Prepared for the UK Department of Trade and Industry.

Eyre, N.J. 1995. European Commission, DGXII, Science, Research and Development, JOULE, Externalities of Energy, "Extern E" Project. Volume 6. Wind and Hydro, Part I, Wind, pp1-121, Report No. EUR 16525.

Faanes, C.A. and J.C. Haney. 1989. *First Record of Kirtland's Warbler from the Dominican Republic and Additional Bird Observations*. Caribbean Journal of Science 25(1-2): 30-35.

Federal Emergency Management Agency (FEMA). 2010. *Flood Insurance Rate Map, Cuyahoga County, OH*. Flood Map Numbers 39035C0068E, 39035C0176E, and 390350177E. Effective date December 3, 2016. Downloaded August 2016 from FEMA Flood Map Service Center. http://msc.fema.gov/portal. Accessed May 10, 2017.

Fenton, M.B. 1970. *Population Studies of Myotis lucifugus (Chiroptera: Vespertilionidae) in Ontario*. Life Sciences Contributions, Royal Ontario Museum 77: 1-34.

Ford, W.M., S.F. Owen, J.W. Edwards, and J.L. Rodrigue. 2006. *Robinia pseudoacacia (Black Locust) as Day-Roosts of Male Myotis septentrionalis (Northern Bats) on the Fernow Experimental Forest, West Virginia*. Northeastern Naturalist 13: 15–24.

Foster, R.W. and A. Kurta. 1999. *Roosting Ecology of the Northern Bat (Myotis septentonalis) and Comparisons with the Endangered Indiana bat (Myotis sodalis).* Journal of Mammalogy 80: 659-672.

France, K.E., M. Burger, T.G. Howard, M.D. Schlesinger, K.A. Perkins, M. MacNeil, D. Klein, and D.N. Ewert. 2012. *Final Report for Lake Ontario Migratory Bird Stopover Project.* Prepared by The Nature Conservancy for the New York State Department of Environmental Conservation, in fulfillment of a grant from the New York Great lakes Protection Fund (C30907).

Gardner, J.E., J.D. Garner, and J.E. Hoffman. 1991. *Summary of Myotis sodalis Summer Habitat Studies in Illinois: with Recommendations for Impact Assessment.* Special Report. Illinois Natural History Survey. Illinois Department of Conservation. Champaign, Illinois. 28 pp.

Garrad Hassan Canada, Inc. 2007. *Recommendations for Risk Assessments of Ice Throw and Blade Failure in Ontario.* Prepared for the Canadian Wind Energy Association. Document No. 38079/OR/01. May 31, 2007.

Gauthreaux, S.A. and C.G. Belser. 1998. Displays of bird movements on the WSR-88D: patterns and quantification. Weather and Forecasting 13:453-464.

Gehring, J., P. Kerlinger, and A.M. Manville II. 2009. *Communication Towers, Lights, and Birds: Successful Methods of Reducing the Frequency of Avian Collisions*. Ecological Applications 19: 505-514.

General Electric. 2014. *How Loud is a Wind Turbine.* GE Reports. August 2, 2014. http://www.gereports.com/how-loud-is-a-wind-turbine/. Accessed October 2016.

Gordon, C.E. and C. Nations. 2016. *Collision Risk Model for "Rufa" Red Knots (Calidris canutus rufa) Interacting with a Proposed Offshore Wind Energy Facility in Nantucket Sound, Massachusetts.* Prepared by Western EcoSystems Technology, Inc (WEST) for the US Department of the Interior, Bureau of Ocean Energy Management, Sterling, Virginia. OCS Study BOEM 2016-045.

Gosse, J.C., K.W. Heist, N.A. Rathbun, and M.T. Wells. 2018. Draft Great Lakes Radar Technical Report Lake Erie, Fall 2017. U.S. Department of Interior, Fish and Wildlife Service.

Grealey, Jessica and David Stephenson. 2007. "Effects of Wind Turbine Operation on Butterflies." *North America Windpower*, Vol. 4, No. 1, February 2007.

Griffin, D. R. 1945. *Travels of Banded Cave Bats*. Journal of Mammalogy 26(1): 15-23

Griffin, D.R. 1970. *Migration and Homing of Bats*, pp. 233-264 in Wimsatt, W.A. (ed.): Biology of Bats, Academic Press, New York.

Gumbert, M.W., J.M. O'Keefe, and J.R. MacGregor. 2002. *Roost Fidelity in Kentucky*, pp. 143–152 in Kurta, A., and Kennedy, J., (eds.): The Indiana Bat: Biology and Management of an Endangered Species, Bat Conservation International, Austin, Texas.

Haberly, Roger E. and Stephen M. Stalikas. 2013. *Inland Navigation Economics Webinar Series Great Lakes Vessel Operating Costs.* U.S. Army Corps of Engineers. April 17, 2013. https://planning.erdc.dren.mil/toolbox/webinars/13april17-GreatLakes.pdf. Accessed September 2016.

Haig, S.M. 1992. *Piping Plover*. In A. Poole, P Stettenheim, and F Gill, eds: The Birds of North America, No. 2. The Academy of Natural Sciences and The American Ornithologists' Union. 17 pp.

Haig, S.M. and J.H. Plissner. 1993. *Distribution and Abundance of Piping Plovers: Results and Implications of the 1991 International Census*. The Condor 95: 146-156.

Hammar, L., Wikstrom, A. and Molander, S. 2014. "Assessing Ecological Risks of Offshore Wind Power on Kattegat Cod Renew." *Energy* 66: 414–424.

HDR Engineering, Inc. 2015. Lake Erie Water Quality Modeling Report. Prepared by HDR Engineering, Inc. May 2015.

Henderson, L.E. and H.G. Broders. 2008. *Movements and Resource Selection of the Northern Long-eared Myotis (Myotis septentrionalis) in a Forest-Agriculture Landscape*. Journal of Mammalogy, 89(4): 952-963.

Hildebrand, John A. 2009. Anthropogenic and Natural Sources of Ambient Noise in the Ocean. *Marine Ecology Progress Series:* Vol. 395: 5-20.

Horton, R.L., N.A. Rathbun, T.S. Bowden, D.C. Nolfi, E.C. Olson, D.J. Larson, and J.C. Gosse. 2016. Great Lakes Avian Radar Technical Report Lake Erie Shoreline: Erie County, Ohio and Erie County, Pennsylvania, Spring 2012. US Department of Interior, Fish and Wildlife Service, Biological Technical Publication FWS/BTP-R3012-2016.

Hull & Associates. 2016. Glacial and Surficial Geology of Cuyahoga County, Ohio maps prepared by the Division of Geological Survey.

Humphrey, S. R., and J. B. Cope. 1976. Population ecology of the little brown bat, Myotis lucifugus, in Indiana and north-central Kentucky. Special Publication No. 4, The American Society of Mammologists 81 pp.

Humphrey, S.R., A.R. Richter, and J.B. Cope. 1977. *Summer Habitat and Ecology of the Endangered Indiana Bat, Myotis sodalis.* Journal of Mammalogy 58: 334-346.

Ingemansson Technology AB. 2003. *Utgrunden Offshore Wind Farm Measurements of Underwater Noise*. June 17, 2003. https://tethys.pnnl.gov/sites/default/files/publications/Utgrunden_Underwater_Noise_2003.pdf. Accessed July 2017.

Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. M.S. Thesis. Iowa State University, Ames, Iowa.

juwi GmbH. 2009. Lake Erie Wind Resource Assessment: Results from the Cleveland Water Intake Crib. JW Great Lakes Wind LLC and juwi GmbH. OPSB document records, Case Number 16-1871-EL-BGN, Exhibit G, filed 2/01/17, <http://dis.puc.state.oh.us/DocumentRecord.aspx?DocID=bbf85e95-acd4-4fb5-9476-40dbb7c4debd>

Kerlinger, P. 2000. *Avian Mortality at Communication Towers: A Review of Recent Literature, Research, and Methodology*. Prepared for United States Fish and Wildlife Service, Office of Migratory Bird Management by Curry & Kerlinger, LLC. March 2000.

Kerlinger, P. and J. Guarnaccia. 2013. *Final Avian Risk Assessment, Project Icebreaker in Lake Erie, Cuyahoga County, Ohio.* Prepared for Lake Erie Energy Development Corporation (LEEDCo) by Curry & Kerlinger, LLC. October 2013.

Krawczyk, Joseph W., Biologist, U.S. Army Corps of Engineers. 2017. Personal communication (email) with Chris Rein, CH2M HILL Engineers, Inc. May 24.

Krijgsveld, K. L., R. C. Fijn, M. Japink, P. W. van Horssen, C. Heunks, M. P. Collier, M. J. M. Poot, D. Beuker, and S. Dirksen. 2011. Effects Studies, Offshore Wind Farm Egmond aan Zee: Final Report on Fluxes, Flight Altitudes and Behaviour of Flying Birds. Produced by Bureau Waardenburg for NoordzeeWind.

Kurta, A. 2004. *Roosting Ecology and Behavior of Indiana bats (Myotis sodalis) in Summer*, pp. 29-42 in Vories, K.C., and Harrington, A. (eds): Proceeding of the Indiana Bat & Coal Mining: a Technical Interactive Forum held November 16-18, 2004 at the Holiday Inn Hurstbourne, Louisville, Kentucky, U.S. Department of Interior, Office of Surface Mining, Alton, Illinois and Coal Research Center, Southern Illinois University, Carbondale, Illinois.

Kurta, A.D. and S.W. Murray. 2002. *Philopatry and Migration of Banded Indiana bats (Myotis sodalis) and Effects of Radio Transmitters.* Journal of Mammalogy 83 (2): 585–589.

Lacki, M.J. and J.H. Schwierjohann. 2001. *Day-roost Characteristics of Northern Bats in Mixed Mesophytic Forest.* Journal of Wildlife Management 65(3): 482-488.

Lake Erie Waterkeeper. 2017. Facts, Lake Erie Description by ODNR.
http://www.lakeeriewaterkeeper.org/lake-erie/facts/. Accessed July 2017.

LaVal, R.K., R.L. Clawson, M.L. Laval, and W. Caire. 1977. *Foraging Behavior and Nocturnal Activity Patterns of Missouri Bats, with Emphasis on the Endangered Species Myotis grisescens and Myotis sodalis*. Journal of Mammalogy 58: 592–599.

Ling, H., Mark F. Hamilton, Rajan Bhalla, Walter E. Brown, Todd A. Hay, Nicholas J. Whitelonis, Shang-Te Yang, Aale R. Naqvi. 2013. Final Report DE-EE0005380 Assessment of Offshore Wind Farm Effects on Sea Surface, Subsurface and Airborne Electronic Systems. The University of Texas at Austin, Prepared for U.S. Department of Energy (DOE). September 2013.

Love, M. S., M. M. Nishimoto, S. Clark, and A. S. Bull. 2016. Renewable Energy in situ Power Cable Observation. U.S. Department of the Interior, Bureau of Ocean Energy Management, Pacific OCS Region, Camarillo, CA. OCS Study 2016-008. 86 pp.

Ludsin, S.A. and Hook, T.O. 2013. Interactive effects of nutrient inputs and climate change on Lake Erie fish community. Report to International Joint Commission, 24p.

Ludsin, S.A., DeVanna, K.M. and Smith, R.E. 2014. Physical–biological coupling and the challenge of understanding fish recruitment in freshwater lakes. Canadian Journal of Fisheries and Aquatic Sciences, 71(5), pp.775-794.

Marine Cadastre. 2016. *Data Registry.* Bureau of Ocean Energy Management (BOEM), NOAA. http://marinecadastre.gov/data/. Accessed September 2016.

Masters, A., S. Malcolm, and L. Brower. 1988. "Monarch Butterfly (*Danaus Plexippus*) Thermoregulatory Behavior and Adaptations for Overwintering in Mexico." *Ecology*, 458-458.

Mayfield, H. F. 1988. *Do Kirtland's Warblers Migrate in One Hop?* The Auk 105: 204-205.

Mayfield, H. F. 1996. *Kirtland's Warblers in Winter*. Birding 28(1): 34-39.

McCarty, J.F. 2012. *Kirtland's Warblers on the Comeback Trail: Aerial View*. The Plain Dealer. October 30, 2012. http://www.cleveland. com/neobirding/index.ssf/2012/10/huge_success_story_for_little.html. Accessed October 2016.

Michigan Sea Grant. 2017. *About the Great Lakes.* http://www.miseagrant.umich.edu/explore/about-the-great-lakes/. Accessed May 8, 2017.

Moegling, Scott, Water Quality Manager, Cleveland Water Department. 2017. Personal communication (email) with Ed Verhamme, LimnoTech. July 19.

Monarch Watch. 2015. *Monarchs Over Lake Erie Waters: Citizen Scientist Observations, October 14, 2015*. Monarch Watch.org. http://monarchwatch.org/blog/2015/10/14/monarchs-over-lake-erie-waters-citizen-scientist-observations/. Accessed February 2017.

National Aeronautics and Space Administration (NASA). 2015. Earth Observatory. Sediments Aswirl in Lake Erie. Accessed June 2017.

National Oceanic and Atmospheric Administration (NOAA). 1987. The Climatology of Lake Erie's South Shoreline. NOAA Technical Memorandum NWS ER-74.

NOAA. 2003. *National Data Buoy Center: Station 45005*. http://www.ndbc.noaa.gov/station_history.php?station=45005. Accessed September 2016.

NOAA. 2016a. United States Coast Pilot 6. Great Lakes: Lakes Ontario, Erie, Huron, Michigan and Superior, and St. Lawrence River. 47th Edition. https://www.nauticalcharts.noaa.gov/nsd/coastpilot/files/cp6/CPB6_E47_20170714_1813_WEB.pdf. Accessed June 27, 2017.

NOAA. 2016b. BookletChart™. Cleveland Harbor, NOAA Chart 14839. August 2016.

NOAA. 2016c. *Wrecks and Obstructions Database*. Office of Coast Survey. http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html. Accessed September 2016.

NOAA. 2017a. *About Our Great Lakes: Lake by Lake Profiles*. Great Lakes Environmental Research Laboratory. https://www.glerl.noaa.gov/education/ourlakes/lakes.html. Accessed May 8, 2014.

NOAA. 2017b. *Lake Erie and Lake Saint Clair Geomorphology*. National Geophysical Data Center. http://www.ngdc.noaa.gov/mgg/greatlakes/lakeerie_cdrom/html/e_gmorph.htm. Accessed May 8, 2014.

NOAA. 2017c. *Bathymetry of Lake Erie & Lake Saint Clair*. National Geophysical Data Center. http://www.ngdc.noaa.gov/mgg/greatlakes/erie.html. Accessed May 8, 2014.

NOAA. 2017d. *Average Lake Erie Water Temperatures.* National Weather Service. http://www.weather.gov/cle/avg_lake_erie_water_temps. Accessed February 2017.

NOAA. 2017e. Climate Change: Annual Greenhouse Gas Index. Last updated July 19, 2017. https://www.climate.gov/news-features/understanding-climate/climate-change-annual-greenhouse-gas-index. Accessed July 2017.

NOAA. 2017f. *Great Lakes Water Level Forecasts.* Great Lakes Environmental Research Laboratory. https://www.glerl.noaa.gov/data/wlevels/#modelsAndForecasts. Accessed March 2017.

NOAA. 2017g. Official U.S. Government Information About the Global Positioning System (GPS) and Related Topics. http://www.gps.gov/systems/gps/. Accessed October 2016.

National Park Service (NPS). 1990. *How to Apply the National Register of Historic Places Criteria for Evaluation*. National Register Bulletin No. 15. National Register Branch, National Park Service, U.S. Department of the Interior, Washington, D.C. http://www.nps.gov/nr/publications/bulletins/pdfs/nrb15.pdf. Accessed July 2017.

National Renewable Energy Laboratory (NREL). 2010. Large-Scale Offshore Wind Power in the United States. Assessment of Opportunities and Barriers. September 2010.

New Jersey Audubon Society. 2008a. *Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority – Jersey Atlantic Wind Power Facility*. Periodic report covering work conducted between 20 July and 31 December, 2007. New Jersey Audubon Society, Cape May Court House, NJ.

New Jersey Audubon Society. 2008b. *Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority – Jersey Atlantic Wind Power Facility*. Periodic report covering work conducted between 1 August and 30 September, 2008. New Jersey Audubon Society, Cape May Court House, NJ.

New Jersey Audubon Society. 2009. *Post-Construction Wildlife Monitoring at the Atlantic City Utilities Authority – Jersey Atlantic Wind Power Facility*. Project status report IV (monitoring period: January 1 through August 31, 2009). New Jersey Audubon Society, Cape May Court House, NJ.

Niemuth, N. D., J. A. Walker, J. S. Gleason, C. R. Loesch, R. E. Reynolds, S. E. Stephens, and M. A. Erickson. 2013. "Influence of Wind Turbines on Presence of Willet, Marbled Godwit, Wilson's Phalarope and Black Tern on Wetlands in the Prairie Pothole Region of North Dakota and South Dakota." *Waterbirds* 36: 263-276.

Normandeau Associates, Inc. 2011. *New Insights and New Tools Regarding Risk to Roseate Terns, Piping Plovers, and Red Knots from Wind Facility Operations on the Atlantic Outer Continental Shelf, Final Report.* Prepared by C. Gordon for the U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement. New Orleans, Louisiana. BOEMRE 048-2011. June 2011. http://www.data.boem.gov/PI/PDFImages/ ESPIS/4/5119.pdf. Accessed December 2016.

Norris, J. and K. Lott. 2011. *Investigating Annual Variability in Pelagic Bird Distributions and Abundance in Ohio's Boundaries of Lake Erie*. Final Report for Funding Award #NA10NOS4190182 from the National Oceanic and Atmospheric Administration, US Department of Commerce, through the Ohio Coastal Management Program, Ohio Department of Natural Resources, Office of Coastal Management.

O'Brien, M., R. Crossley, and K. Karlson. 2006. *The Shorebird Guide*. Houghton Mifflin Company, New York.

Ohio Department of Natural Resources (ODNR). 2007a. *Warblers of Ohio CD Guidebook*. Division of Wildlife, Publication 349. December 2007.

ODNR. 2007b. *Ohio Coastal Atlas Second Edition.* Office of Coastal Management.

ODNR. 2015. *How is Fish Habitat Affected? Lake Erie's Deadzone*. Division of Wildlife. Old Woman Creek National Estuarine Research Reserve. Technical Bulletin No. 3. July 2015. https://wildlife.ohiodnr.gov/portals/wildlife/pdfs/public%20areas/OWC_TechBull3.pdf. Accessed May 2017.

ODNR. 2016a. *Ohio's Lake Erie Fisheries, 2015. Annual Status Report.* Gedera Aid in Fish Restoration Project F-69-P. Division of Wildlife, Lake Erie Fisheries Units, Fairport and Sandusky. P. 106.

ODNR. 2016b. "Cuyahoga County." *State Listed Wildlife Species*. Division of Wildlife. Updated June 2016. http://wildlife.ohiodnr.gov/portals/wildlife/pdfs/species%20and%20habitats/state-listed%20species/cuyahoga.pdf. Accessed August 2016.

ODNR. 2016c. *Rare Plants of Ohio*. Division of Natural Areas and Preserves. http://naturepreserves.ohiodnr.gov/rareplants. Accessed August 2016.

ODNR. 2017a. *Nuisance Wildlife*. Division of Wildlife. http://wildlife.ohiodnr.gov/species-and-habitats/nuisance-wildlife. Accessed April 2017.

ODNR. 2017b. Peregrine Falcon. Division of Wildlife. http://wildlife.ohiodnr.gov/species-and-habitats/species-guide-index/birds/peregrine-falcon. Accessed May 2017.

ODNR. 2017c. *Species and Habitats, Monarch.* Division of Wildlife. http://wildlife.ohiodnr.gov/species-and-habitats/species-guide-index/butterflies-skippers/monarch. Accessed February 2017.

ODNR. 2017d. *Piping Plover – Charadrius melodus. Species Guide Index.* Division of Wildlife. http://wildlife.ohiodnr.gov/species-and-habitats/species-guide-index/birds/piping-plover. Accessed July 18, 2017.

ODNR. 2017e. *Red Knot – Calidris canutus. Species Guide Index.* Division of Wildlife. http://wildlife.ohiodnr.gov/species-and-habitats/species-guide-index/birds/red-knot. Accessed July 18, 2017.

ODNR. 2017f. *Species Guide Index.* Division of Wildlife. http://wildlife.ohiodnr.gov/species-and-habitats/species-guide-index. Accessed July 18, 2017.

Ohio Department of Transportation (ODOT). 2013. *Cuyahoga County Annual Average Daily Traffic 2013.* Office of Technical Services Traffic Monitoring Section. http://www.dot.state.oh.us/Divisions/Planning/TechServ/traffic/Traffic_Survey_Flow_Maps/2013_Survey_Flow_Maps/cuy_tsr_2013.pdf. Accessed January 2017.

ODOT. 2017. Cleveland Urban Core Projects. http://www.dot.state.oh.us/projects/ClevelandUrbanCoreProjects/Pages/default.aspx. Accessed May 2017.

Ohio Development Services Agency. 2017. *Population Characteristics and Projections (2020 and 2030 projections for Cuyahoga County)*. https://development.ohio.gov/reports/reports_pop_proj_map.htm. Accessed July 2017.

Ohio Environmental Protection Agency (OEPA). 2003. *Drinking Water Source Assessment for the City of Cleveland*. Division of Surface Water. Twinsburg, OH. December 2003. http://wwwapp.epa.ohio.gov/gis/swpa/OH1801212.pdf. Accessed July 2016.

OEPA. 2010. *Guidance on Evaluating Sediment Contaminant Results*. Division of Surface Water, Standards and Technical Support Section. January. http://www.epa.ohio.gov/portals/35/guidance/sediment_evaluation_jan10.pdf. Accessed June 6, 2018.

OEPA. 2014a. *Ohio 2014 Integrated Water Quality Monitoring and Assessment Report*. Division of Surface Water, Columbus, OH. http://www.epa.ohio.gov/Portals/35/tmdl/2014intreport/Cover_and_Intro_IR2014_Final.pdf. Accessed July 2016.

OEPA. 2014b. *Emission Inventory System: Facility, Emission Unit, Emissions, Process Data for 2014 Emissions*. Division of Air Pollution Control, Columbus, OH. http://www.epa.state.oh.us/portals/27/aqmp/eiu/eis2014.zip. Accessed July 19, 2017.

OEPA. 2015. *Ohio Air Quality 2015.* Division of Air Pollution Control. http://epa.ohio.gov/dapc/ams/amsmain#127237263-reports. Accessed May 2018.

OEPA. 2017a. Division of Materials and Waste Management (DMWM). http://epa.ohio.gov/dmwm/Home.aspx. Accessed July 19, 2017.

OEPA. 2017b. Water Quality Certification and Isolated Wetland Permits. http://epa.ohio.gov/dsw/401/permitting.aspx. Accessed May 2017.

Ohio Power Siting Board (OPSB). 2015. Chapter 4906-4 Certificate Applications for Electric Generation Facilities. Effective December 11, 2015. http://Codes.ohio.gov/oac/4906-4. Accessed September 13, 2016.

Owen, S., M.A. Menzel, M.W. Ford, B.R. Chapman, K.V. Miller, J. Edwards, and P. Wood. 2003. *Home Range Size and Habitat Use by Northern Myotis (Myotis septentrionalis)*. The American Midland Naturalist 150: 352-359.

Patriquin, K.J. and R.M.R. Barclay. 2003. *Foraging by Bats in Cleared, Thinned and Unharvested Boreal Forest*. Journal of Applied Ecology 40(4): 646-657

Patriquin, K.J., M.L. Leonard, H.G. Broders, and C.J. Garroway. 2010. *Do Social Networks of Female Northern Long-Eared Bats Vary with Reproductive Period and Age?* Behavioral Ecology and Sociobiology 64: 899-913.

Pelletier, S.K., K.S. Omland, K.S. Watrous, and T.S. Peterson. 2013. *Information Synthesis on the Potential for Bat Interactions with Offshore Wind Facilities*. Final Report. US Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, Virginia. OCS Study BOEM 2013-01163. 119 pp.

Perry, R.W. 2011. *Fidelity of Bats to Forest Sites Revealed from Mist-Netting Recaptures.* Journal of Fish and Wildlife Management 2(1): 112-116.

Poole, A.F., R.O. Bierregaard, and M.S. Marell. 2016. Osprey (Pandion haliaetus). In P.G. Rodewald (ed.): Birds of North America Online. Cornell Lab of Ornithology, Ithaca, New York.

Port of Cleveland 2017. About the Port. http://www.portofcleveland.com/about-the-port/. Accessed June 26, 2017.

Rathbun, N.A., T.S. Bowden, R.L. Horton, D.C. Nolfi, E.C. Olson, D.J. Larson, and J.C. Gosse. 2016. *Great Lakes Avian Radar Technical Report; Niagara, Genesee, Wayne, and Jefferson Counties, New York; Spring 2013*. US Department of Interior, Fish and Wildlife Service, Biological Technical Publication FWX/BTP-3012-2016.

Resource Systems Group, Inc. 2013. *Noise Impact Study for Scioto Ridge Wind Farm.* http://dis.puc.state.oh.us/TiffToPDf/A1001001A13G01B01522F56439.pdf. Accessed August 2016.

Rich, T.D., C.J. Beardmore, H. Berlanga, P.J. Blancher, M.S.W. Bradstreet, G.S. Butcher, D.W. Demarest, E.H. Dunn, W.C. Hunter, E.E. Iñigo-Elias, J.A. Kennedy, A.M. Martell, A.O. Panjabi, D.N. Pashley, K.V. Rosenberg, C.M. Rustay, J.S. Wendt, T.C. Will. 2004. Partners in Flight North American Landbird Conservation Plan. Cornell Lab of Ornithology. Ithaca, NY

Richardson, W.J. 1978. *Timing and Amount of Bird Migration in Relation to Weather: A Review*. Oikos 30: 224-272.

Richardson, W.J. 1979. *Southeastward Shorebird Migration over Nova Scotia and New Brunswick in Autumn: A Radar Study*. Canadian Journal of Zoology 57: 107-124.

Richardson, W.J. 1990. *Timing of Bird Migration in Relation to Weather: Updated Review*. In E. Gwinner (ed.): Bird Migration: Physiology and Ecophysiology. Springer-Verlag, Heidelberg and Berlin, Germany.

Ryan, P., R. Knight, R. MacGregor, G. Towns, R. Hoopes, and W. Culligan. 2003. Fish-community goals and objectives for Lake Erie. Special Publication, Great Lakes Fishery Commission 3:56.

Sasse, D.B. and P.J. Pekins. 1996. *Summer Roosting Ecology of Northern Long-Eared Bats (Myotis septentrionalis) in the White Mountain National Forest*, pp. 91–101 in R.M.R. Barclay and R.M. Brigham (eds.): Bats and Forests Symposium. British Columbia Ministry of Forests, Victoria, Canada.

Seaman, W. Jr., Editor. 2000. *Artificial reef evaluation -- with application to natural marine habitats.* CRC Press, Boca Raton. 246 pp.

Skov, H., M. Desholm, S. Heinänen, J. A. Kahlert, B. Laubek, N. E. Jensen, R. Žydelis, and B. P. Jensen, 2017. Patterns of migrating soaring migrants indicate attraction to marine wind farms. Biology Letters 12:20160804.

Slabbekoorn, Hans, Niels Bouton, Ilse van Opzeeland, Aukje Coers, Care ten Cate, and Arthur N. Popper. 2010. A Noisy Spring: The Impact of Globally Rising Underwater Sound Levels on Fish. *Trends in Ecology and Evolution*. Article in press.

Sparks, D.W., C.M. Ritzi, J.E. Duchamp, and J.O. Whitaker. 2005. *Foraging Habitat of the Indiana bat (Myotis sodalis) at an Urban-Rural Interface*. Journal of Mammalogy 86(4): 713–718.

Stantec. 2012. *Noise Impact Study – Horizontal Directional Drilling for Bluewater River Crossing Placement Project.* August 9, 2012. https://docs.neb-one.gc.ca/ll-eng/llisapi.dll/fetch/2000/90464/90550/555627/792060/863796/A3A2F6_-_Bluewater_River_Crossing_Replacement_Noise_Impact_Study.pdf?nodeid=863906&vernum=-2. Accessed August 2016.

Stantec. 2016. *Long-term bat monitoring on islands, offshore structures, and coastal sites in the Gulf of Maine, mid-Atlantic, and Great Lakes*. Final Report. Prepared for U.S. Department of Energy, award # DE-EE005378, by Stantec Consulting Services, Inc., Topsham, ME. https://www.osti.gov/scitech/servlets/purl/1238337. Accessed June 27, 2017.

Stones, R.C. 1981. *Survey of Winter Bat Populations in Search of the Indiana bat in the Western Upper Peninsula of Michigan.* Report submitted to Michigan Department of Natural Resources. 20 pp.

Sullivan, R.G., Kirchler, L.B., Cothren, J., & Winters, S.L. 2013. "Offshore wind turbine visibility and visual impact threshold distances." *Environment Practice*, 15(1), 33–49.

Tetra Tech. 2012. *Spring – Fall 2010 Avian and Bat Studies Report, Lake Erie Wind Power Study*. Prepared for Cuyahoga County Department of Development by A. Svedlow, L. Gilpatrick, and D. McIlvain, Cincinnati, Ohio. July 11, 2012.

U.S. Army Corps of Engineers-Research and Development Center (USACE-ERDC). 2000. *Assessment of Millennium Pipeline Project Lake Erie Crossing. Ice Scour, Sediment Sampling, and Turbidity Modeling.* James H. Lever, Editor. August 2000. http://www.dtic.mil/dtic/tr/fulltext/u2/a382997.pdf. Accessed June 27, 2017.

U.S. Army Corps of Engineers (USACE). 2009. *Draft Cleveland Harbor Dredged Material Management Plan & Environmental Impact Statement*. August 2009.

U.S. Census Bureau. 2016. American Community Survey County - Household and Population Characteristics. http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed August 2016.

U.S. Census Bureau. 2017a. American Fact Finder, Community Facts, Cuyahoga County and Cleveland City, Ohio. Profile of General Population and Housing Characteristics: 2010, 2010 Demographic Profile Data. https://factfinder.census.gov/. Accessed March 2017.

U.S. Census Bureau. 2017b. American Fact Finder, Community Facts, Cuyahoga County and Cleveland City, Ohio. Selected Economic Characteristics, 2011-2015 American Community Survey 5-Year Estimates. https://factfinder.census.gov/. Accessed March 2017.

U.S. Coast Guard (USCG). 2007. *Guidance on the Coast Guard's Roles and Responsibilities for Offshore Renewable Energy Installations.* Navigation and Inspection Circular No. 02-07.

USCG. 2009. U.S. Coast Guard Assessment of Potential Impacts to Marine Radar as it Relates to Marine Navigation Safety from the Nantucket Sound Wind Farm as Proposed by Cape Wind, LLC. January 2009.

U.S. Department of Energy (DOE). 2011. Final Environmental Assessment for University of Maine's Deepwater Offshore Floating Wind Turbine Testing and Demonstration Project. USDOE Office of Energy Efficiency and Renewable Energy, Gulf of Maine.

DOE. 2012. *U.S. Offshore Wind: Advanced Technology Demonstration Projects.* Office of Energy Efficiency and Renewable Energy (EERE). DE-FOA-0000410.

DOE. 2013. Draft Champlain Hudson Power Express Transmission Line Project Environmental Impact Statement: Volume I – Impact Analyses. U.S. DOE Office of Electricity Delivery and Energy Reliability, Washington, DC.

DOE. 2016. *Lake Erie Connector Project. Draft Environmental Assessment. Volume 1 – Main Document.* DOE/EA-2019.

U.S. Department of Homeland Security and U.S. Coast Guard (USCG). 2005. *Aids to Navigation Manual Administration, Short Range Aids to Navigation.* March 2, 2005.

U.S. Department of the Interior (DOI). 2008. *Resource Management Plan, Navajo Reservoir Area, Colorado and New Mexico.* Final Environmental Assessment and Finding of No Significant Impact. June 2008. https://www.usbr.gov/uc/envdocs/ea/navajo/. Accessed January 2017.

DOI. 2017. *Solicitor's Opinion M-37050 – The Migratory Bird Treaty Act Does Not Prohibit Incidental Take*. Office of the Solicitor. Issued December 22. https://www.doi.gov/sites/doi.gov/files/uploads/m-37050.pdf. Accessed June 6, 2018.

U.S. Department of Labor, Bureau of Labor Statistics. 2013-2015. Local Area Unemployment Statistics. https://www.bls.gov/data/. Accessed August 2016.

U.S. Environmental Protection Agency (EPA). 2017a. Envirofacts, Cleveland, Ohio. https://oaspub.epa.gov/enviro/enviroFACTS.quickstart?minx=-81.750641&miny=41.473860&maxx=-81.630478&maxy=41.535567&ve=12,41.504749298095696,-81.6907196044922&pSearch=cleveland,ohio. Accessed March 2017.

EPA. 2017b. General Conformity, De Minimis Tables. https://www.epa.gov/general-conformity/de-minimis-tables. Accessed June 22, 2018.

U.S. Fish and Wildlife Service (USFWS). 1985. *Kirtland's Warbler Recovery Plan*. Prepared by Kirtland's Warbler Recovery Team, 1976; Updated 1985.

USFWS. 2003. *Recovery Plan for Great Lakes Piping Plover (Charadrius melodus)*. Great Lakes-Big Rivers Region. September 2003.

USFWS. 2006. *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.* U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, Census Bureau. https://wsfrprograms.fws.gov/subpages/nationalsurvey/nat_survey2006_final.pdf. Accessed May 2017.

USFWS. 2007. *Indiana Bat (Myotis sodalis) Recovery Plan: First Revision*. Department of the Interior, USFWS, Region 3.

USFWS. 2009a. *Indiana Bat (Myotis sodalis) 5-Year Review: Summary and Evaluation.* Midwest Region – Region 3, Bloomington Ecological Services Field Office. Bloomington, Indiana. 45 pp.

USFWS. 2009b. *Piping Plover (Charadrius melodus) 5-Year Review: Summary and Evaluation*. Northeast Region, Hadley, MA and the Midwest Region's East Lansing Field Office, MI. September 2009.

USFWS. 2012. *Kirtland's Warbler (Dendroica kirtlandii) 5-Year Review: Summary and Evaluation*. East Lansing Field Office, East Lansing, MI. August 2012.

USFWS. 2014a. *Northern Long-eared Bat Interim Conference and Planning Guidance*. USFWS Regions 2, 3, 4, 5, & 6. January 6, 2014.

USFWS. 2014b. *Rufa Red Knot Background Information and Threats Assessment*. Supplement to Endangered and Threatened Wildlife and Plants; Final Threatened Status for Rufa Red Knot (*Calidris canutus rufa*), Docket No. FWS-R5-ES-2013-0097; RIN AY17. Northeast Region, New Jersey Field Office. Pleasantville, NJ. November 4014.

USFWS. 2016. National Wetland Inventory. Updated January 19, 2016. http://www.fws.gov/wetlands/Data/Mapper.html. Accessed February 25, 2016.

USFWS. 2017a. *Assessing the status of the monarch butterfly.* https://www.fws.gov/savethemonarch/SSA.html. Accessed February 2017.

USFWS. 2017b. *County Distribution of Federally-listed Endangered, Threatened, and Proposed Species.* Midwest Region, Endangered Species Program. Last updated May 2017. https://www.fws.gov/midwest/endangered/lists/ohio-cty.html. Accessed July 18, 2017.

USFWS. 2017c. *2017 Indiana Bat (Myotis sodalis) Population Status Update*. https://www.fws.gov/midwest/Endangered/mammals/inba/pdf/2017IBatPopEstimate5July2017.pdf. Accessed July 2017.

U.S. Geological Survey (USGS). 2014. "Two-percent probability of exceedance in 50 years map of peak ground acceleration." Earthquakes Hazard Program, Seismic Hazard Maps, 2014 Long Term Model. ftp://hazards.cr.usgs.gov/web/nshm/conterminous/2014/2014pga2pct.pdf. Accessed May 2017.

USGS. 2017. Earthquakes Hazard Program, Magnitude/Intensity Comparison. https://earthquake.usgs.gov/learn/topics/mag_vs_int.php. Accessed May 2017.

Universal Foundation. 2012. *Case Study: Frederikshavn.* http://universal-foundation.com/case-studies/frederikshavn/. Accessed November 2016.

Wahlberg, Magnus, and Håkan Westerberg. 2005. *Hearing in Fish and their Reactions to Sounds from Offshore Wind Farms.* Marine Ecological Progress Series, Vol. 288: 295-309.

Whitaker, J.O, Jr. and W. Hamilton. 1998. *Mammals of the Eastern United States*. Ithaca, New York: Cornell University Press.

Whitaker, J.O., Jr. and F.A. Winter. 1977. *Bats of the Caves and Mines of the Shawnee National Forest, Southern Illinois.* Illinois State Academy of Science 70(3/4): 301-13.

Wilhelmsson, D., T. Malm, And M.C. Ohman. 2006. "The Influence of Offshore Windpower on Demersal Fish." *ICES Journal of Marine Science* 63: p.775–784.

Williams, K.A., I.J. Stenhouse, E.E. Connelly, and S.M. Johnson. 2015. Mid-Atlantic Wildlife Studies: Distribution and Abundance of Wildlife along the Eastern Seaboard 2012-2014. Biodiversity Research Institute. Portland, Maine. Science Communications Series BRI 2015-19.32 pp.

Xodus Ltd. 2015. *Brims Underwater Noise Assessment Report, SSE Renewables Developments (UK) Ltd.* July 22, 2015. http://marine.gov.scot/datafiles/lot/Brims_Tidal/Supporting_Documents/Brims%20Underwater%20Noise%20Assessment%20Report.%20Xodus%20(2015).pdf. Accessed August 2016.

SECTION 6 LIST OF PREPARERS

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy
Roak Parker
Golden Field Office
NEPA Document Manager

Kristin Kerwin
Golden Field Office
NEPA Compliance Officer

Cooperating Agencies:

U.S. Army Corps of Engineers
Diane Kozlowski
Chief, Regulatory Branch
Buffalo District

U.S. Coast Guard
K. S. Wheatley, Commander
Chief, Prevention Department
Sector Buffalo

Third Party Contractor:

CH2M HILL Engineers, Inc (now Jacobs)
18 Tremont Street
Suite 700
Boston, MA 02108