

---

Draft  
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



**US Army Corps  
of Engineers**  
Buffalo District  
*BUILDING STRONG*

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

August 2017

---

This page intentionally left blank.

## SUMMARY

<b>DOE Proposed Action:</b>	Expenditure of federal funding to support the development, including design, construction, and commissioning of an offshore wind advanced technology demonstration project.
<b>Type of Document:</b>	Draft Environmental Assessment (EA)
<b>Lead Agency:</b>	U.S. Department of Energy (DOE)
<b>Cooperating Agencies:</b>	U.S. Army Corps of Engineers (USACE), Buffalo District U.S. Coast Guard (USCG)
<b>Project Location:</b>	Lake Erie, City of Cleveland, Cuyahoga County, Ohio
<b>Comment Opportunities:</b>	Comments on this Draft EA are accepted through October 10, 2017.
<b>For Further Information:</b>	U.S. Department of Energy Golden Field Office National Environmental Policy Act (NEPA) Division 15013 Denver West Parkway Golden, CO 80401  ProjectIcebreaker@ee.doe.gov

### 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* (Number 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 Draft 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 – 138 kilovolt (kV) Lake Road Substation.

## ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AIS	Automatic Identification System
APE	Area of Potential Effect
ATON	Aids to Navigation
AWOIS	Automated Wreck and Obstruction Information System
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
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

## Acronyms and Abbreviations

---

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
mg/L	milligrams per liter
MHz	megahertz
MOU	Memorandum of Understanding
MP/FW	monopile with a friction wheel
mph	miles per hour
MW	megawatts
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
NOAA	National Oceanic and Atmospheric Administration
NO <sub>x</sub>	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
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
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
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

## Acronyms and Abbreviations

---

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

SECTION 1 Introduction.....	1-1
1.1 National Environmental Policy Act.....	1-1
1.2 Background.....	1-1
1.3 Cooperating Agencies.....	1-2
1.3.1 USACE Regulatory Authorities.....	1-3
1.3.2 USCG Regulatory Authorities.....	1-3
1.4 Purpose and Need.....	1-3
1.4.1 DOE Purpose and Need.....	1-3
1.4.2 USACE Purpose and Need.....	1-4
1.4.3 USCG Purpose and Need.....	1-5
1.5 Public and Agency Involvement.....	1-5
SECTION 2 Proposed Action and Alternatives.....	2-1
2.1 Proposed Action.....	2-1
2.2 Project Icebreaker - Proposed Project.....	2-1
2.2.1 Description of the Proposed Project.....	2-1
2.2.2 Wind Turbine and Foundation Design.....	2-4
2.2.3 Installation of Turbines and Foundations.....	2-9
2.2.4 Submerged Electric Collection Cable Route and Installation.....	2-12
2.2.5 Substation and Associated Electric Transmission.....	2-18
2.2.6 Construction Laydown Areas.....	2-18
2.2.7 Construction Sequence.....	2-19
2.2.8 Operations and Maintenance.....	2-19
2.2.9 Decommissioning.....	2-22
2.3 No-Action Alternative.....	2-22
2.4 Alternatives Considered During Planning and Design.....	2-22
2.4.1 Selection of the Proposed Project Location.....	2-22
2.4.2 Selection of Proposed Turbine Layout.....	2-27
2.4.3 Selection of Proposed Turbine Foundation Design.....	2-27
2.4.4 Selection of Proposed Substation Location.....	2-28
2.4.5 Selection of Proposed Cable Route.....	2-28
2.5 Public Input Summary.....	2-28
2.5.1 DOE Notice of Scoping and Notification of Public Scoping Meeting.....	2-28

Contents

---

2.5.2	Comments Received during the DOE Public Scoping Period .....	2-29
2.5.3	USACE Public Input.....	2-29
2.5.4	US Coast Guard Public Input.....	2-29
2.5.5	LEEDCo Community Outreach.....	2-29
2.6	Permitting.....	2-30
2.6.1	USACE Permitting.....	2-30
2.6.2	Ohio Environmental Permitting.....	2-33
2.6.3	Permits and Authorizations.....	2-34
2.7	Applicant Committed Measures.....	2-35
2.7.1	Aquatic Resources.....	2-35
2.7.2	Birds and Bats.....	2-35
2.7.3	Spill Prevention, Control, and Countermeasure Plan.....	2-36
2.7.4	Inadvertent Return Contingency Plan.....	2-36
2.7.5	Traffic and Transportation.....	2-36
2.7.6	Cultural Resources.....	2-37
2.7.7	Socioeconomic.....	2-37
SECTION 3 Affected Environment and Environmental Impacts.....		3-1
3.1	Environmental Resources Evaluated and Dismissed from Detailed Analysis.....	3-1
3.1.1	Currents and Waves.....	3-3
3.1.2	Groundwater.....	3-3
3.1.3	Aquatic and Terrestrial Vegetation.....	3-4
3.1.4	Terrestrial Amphibians, Reptiles, and Mammals.....	3-4
3.1.5	Wetlands.....	3-4
3.1.6	Shore Erosion and Accretion.....	3-5
3.1.7	Flood Plain and Flood Plain Hazards.....	3-5
3.1.8	Land Use and Infrastructure.....	3-5
3.1.9	Intentional Destructive Acts.....	3-6
3.2	Physical Resources.....	3-6
3.2.1	Affected Environment.....	3-6
3.2.2	Environmental Impacts Related to Physical Resources.....	3-14
3.2.3	No-Action Alternative.....	3-16
3.3	Water Resources.....	3-16
3.3.1	Affected Environment.....	3-16
3.3.2	Environmental Impacts Related to Water Resources.....	3-20
3.3.3	No-Action Alternative.....	3-26

---

Contents

---

3.4	Biological Resources .....	3-27
3.4.1	Affected Environment.....	3-27
3.4.2	Environmental Impacts Related to Biological Resources .....	3-42
3.5	Health and Safety .....	3-58
3.5.1	Affected Environment.....	3-58
3.5.2	Environmental Impacts Related to Health and Safety .....	3-58
3.5.3	No-Action Alternative.....	3-61
3.6	Air Quality .....	3-61
3.6.1	Affected Environment.....	3-61
3.6.2	Environmental Impacts Related to Air Quality.....	3-62
3.6.3	No-Action Alternative.....	3-65
3.7	Climate Change.....	3-65
3.7.1	Affected Environment.....	3-65
3.7.2	Environmental Impacts Related to Climate Change .....	3-65
3.7.3	No-Action Alternative.....	3-67
3.8	Lake Use .....	3-67
3.8.1	Affected Environment.....	3-67
3.8.2	Environmental Impacts Related to Lake Use.....	3-69
3.8.3	No-Action Alternative.....	3-70
3.9	Traffic and Transportation .....	3-70
3.9.1	Affected Environment.....	3-70
3.9.2	Environmental Impacts Related to Traffic and Transportation.....	3-72
3.9.3	No-Action Alternative.....	3-78
3.10	Cultural Resources .....	3-78
3.10.1	Affected Environment.....	3-78
3.10.2	Environmental Impacts Related to Cultural Resources.....	3-79
3.11	Aesthetics and Visual Resources .....	3-80
3.11.1	Affected Environment.....	3-80
3.11.2	Environmental Impacts Related to Aesthetics and Visual Resources.....	3-81
3.11.3	No-Action Alternative.....	3-88
3.12	Noise .....	3-88
3.12.1	Affected Environment.....	3-88
3.12.2	Environmental Impacts Related to Noise.....	3-90
3.12.3	No-Action Alternative.....	3-94
3.13	Economics and Socioeconomics .....	3-94

## Contents

---

3.13.1	Affected Environment.....	3-96
3.13.2	Environmental Impacts Related to Economics and Socioeconomics .....	3-99
3.13.3	No-Action Alternative.....	3-102
3.14	Environmental Justice .....	3-102
3.14.1	Affected Environment.....	3-102
3.14.2	Environmental Impacts Related to Environmental Justice .....	3-103
3.14.3	No-Action Alternative.....	3-104
3.15	Summary of Impacts .....	3-104
3.16	Irreversible and Irretrievable Commitments of Resources .....	3-105
3.17	The Relationship between Local Short-Term Uses of the Human Environment and the Maintenance and Enhancement of Long-Term Productivity .....	3-105
SECTION 4	Cumulative Impacts .....	4-1
4.1	Cumulative Projects .....	4-1
4.1.1	Onshore and Nearshore Projects .....	4-1
4.1.2	Offshore Projects.....	4-2
4.2	Cumulative Impacts .....	4-2
SECTION 5	References .....	5-1
SECTION 6	List of Preparers.....	6-1

### List of Tables

2-1	Approximate Turbine Dimensions
2-2	Approximate Foundation Dimensions
2-3	Permit Table
3.1-1	Resources Not Carried Forward for Detailed Analysis
3.4-1	Federally Listed Species Occurring in Cuyahoga County
3.4-2	Indiana Bat Population Estimates for the Midwest Recovery Unit
3.4-3	State-Listed Species Occurring in Cuyahoga County
3.6-1	Emissions Estimates by Engine Type as a Percentage of 2014 Cuyahoga County Annual Totals in 2014
3.6-2	Total Emissions of Criteria and Greenhouse Gas Pollutants for Cuyahoga County, Ohio in 2014
3.9-1	Weather Limitations for Offshore Installation Activities
3.12-1	Maximum Sound Levels from Various Construction Equipment
3.12-2	Sound Levels from HDD
3.13-1	Countywide Population Trends
3.13-2	Population Projections
3.13-3	Local Labor Force and Unemployment
3.13-4	Employment and Payroll by NAICS Sector in Cuyahoga County
3.14-1	Cuyahoga County and City of Cleveland Population Hispanic or Latino and Race
3.15-1	Summary of Impacts

**List of Figures**

- 2-1 Proposed Project Icebreaker Layout
- 2-2 Proposed Substation Location
- 2-3 Turbine Design
- 2-4 Mono Bucket General Arrangement
- 2-5 Preliminary Mono Bucket Design
- 2-6 Sediment Deposition on to MB Foundation Lid
- 2-7 Project Component Installation Sequence
- 2-8 Installation Vessel Plan View
- 2-9 Turbine and Heavy Lift Crane Vessel
- 2-10 Typical 34.5 kV Submarine Cable
- 2-11 Horizontal Directional Drilling Design
- 2-12 Connection Between HDD and the Export Cable
- 2-13 Mono Bucket and Cable Lakebed Interface
- 2-14 Great Lakes Towing Building Proposed for Use as O&M Center
- 2-15 Potential Project Areas Evaluated in the 2009 Feasibility Study
- 2-16 Study Areas Evaluated and Final Proposed Layout
- 2-17 Constraint Map
- 2-18 Typical Layouts Analyzed by NREL Wind Optimized Study
- 3.2-1 Bathymetric Map of Lake Erie (NOAA)
- 3.2-2 Existing Features, Sheet 1
- 3.2-2 Existing Features, Sheet 2
- 3.2-2 Existing Features, Sheet 3
- 3.2-3 Location of Cargill Salt Mine in Relation to Proposed Project
- 3.3-1 Water Monitoring and Gauging Stations
- 3.3-2 Drinking Water Resources
- 3.3-3 2016 Lake Bottom Current Velocity and Direction at ICE4
- 3.3-4 NASA Satellite Image from November 25, 2015 Showing Widespread Sediment Re-suspension Across Lake Erie
- 3.3-5 Turbidity Measurements at Two Cleveland Area Water Intake Cribs from June 2016 to May 2017
- 3.3-6 Aerial Image from June 2, 2017 on Lake Erie Showing Sediment Disturbance from Passing Ships
- 3.4-1 Results from the ODNR Aerial Avian Survey
- 3.11-1 Visual Simulation from Viewpoint 7: USS Cod
- 3.11-2 Visual Simulation from Viewpoint 52: U.S. Coast Guard Cleveland Harbor Station
- 3.11-3 Visual Simulation from Viewpoint 19: Bicentennial Park.
- 3.11-4 Visual Simulation from Viewpoint 17: Cleveland Mall.
- 3.12-1 Map of Proposed Project Area with LimnoTech Sampling Stations and Transects
- 3.12-2 Recording Locations of 2016 ICE04 and REF1 Locations (red circles), Relative to Previous Cornell Acoustic Recordings in 2014 (black crosses).
- 3.13-1 Proposed Project Study Area

**List of Appendices**

A	Public Scoping Documents
B	Substation Layout Plan
C	Favorability Analysis Map
D	Substation and Cable Route Design Report
E	Final LimnoTech Report
F-1	Alpine Geophysical Survey Report
F-2	McNeilan Windfarm Ground Conditions Report
F-3	McNeilan Harbor & Nearshore Ground Conditions Report
G	Sediment Quality Evaluation Technical Memorandum
H	Substation Geotechnical and Subsurface Exploration Report
I	Aquatic Ecological Resource Characterization and Impact Assessment
J	WEST NEXRAD Analysis
K	Tetra Tech Bird Survey Report
L	WEST Summary of Risks to Birds and Bats
M	Biological Assessment
N	ODNR Division of Wildlife Letter
O	Summary of Current Information Related to Electromagnetic Field Impacts on Fish and LEEDCo Proposed Transmission Cable
P	LimnoTech Boat Survey
Q	Ice Load Data
R	Navigational Risk Assessment
S	Gray & Pape Cultural Resources Report
T	Section 106 Geophysical Survey Review
U	Visual Impact Assessment
V	Cultural Resources Effects Analysis
W	Socioeconomic Report from EDR, January 2017

## 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 proposed action. This requirement applies to DOE's decisions about whether to provide federal funding through financial assistance agreements.

In compliance with these regulations, this Draft 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 these requirements before making a final decision to proceed with any proposed federal action that could cause adverse impacts to human health or the environment. This Draft EA provides DOE and other decision makers the information needed to make an informed decision about the Proposed Action. The Draft EA 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 Draft 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 U.S.:

- 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 DOE EERE Golden Field Office fiscal year 2012 funding opportunity announcement *U.S. Offshore Wind: Advanced Technology Demonstration Projects* under Funding Opportunity Announcement (FOA) Number DE-FOA-0000410 (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 and into the PJM<sup>1</sup> Interconnection wholesale market.

DOE has prepared this Draft EA to evaluate the potential environmental impacts of providing 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 and will be analyzed in this EA as part of the Proposed Action. This Draft EA also evaluates the impacts that could occur if DOE did not provide funding (No-Action Alternative), 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 Draft EA, that the Proposed Project would not proceed without its funding. If the Proposed Project proceeded without DOE funding, the potential impacts would be essentially identical to those under the DOE Proposed Action (that is, providing funding that enables the Proposed Project to proceed).

### 1.3 Cooperating Agencies

There are two cooperating agencies involved in the preparation of this draft EA: the U.S. Army Corps of Engineers (USACE) and the U.S. Coast Guard (USCG). The USACE is a cooperating agency because of their 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 their responsibility and authority related to navigation and safety in the waters of Lake Erie.

---

<sup>1</sup> 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, and an application for these permits will be submitted to the USACE.

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**

Through the *U.S. Offshore Wind: Advanced Technology Demonstration Projects* FOA, DOE is providing support for regionally diverse advanced technology demonstration projects through collaborative partnerships to support DOE's and DOI's National Offshore Wind Strategy. The purpose of the Advanced Technology Demonstration Projects FOA is to verify innovative designs and technology developments and validate full performance and cost under real operating and market conditions. The Proposed Action would fulfill DOE's goals of installing 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 LCOE.

Offshore wind energy can help the nation reduce its greenhouse gas 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. Accordingly, there is a need to reduce the cost of energy through technology

development to ensure competitiveness with other electrical generation sources; and to reduce deployment timelines and uncertainties limiting U.S. offshore wind project development.

### 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 with regard to 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 in light of 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 and Agency Involvement**

NEPA requirements help ensure that environmental information is made available to the public during the decision-making process and prior to actions being taken. The premise of NEPA is that the quality of decisions will be enhanced if proponents provide information to the public and involve the public in the planning process.

DOE, along with the USACE and USCG, held a public information and Draft EA scoping meeting in Lakewood, Ohio on September 28, 2016. The public comment period for scoping of the Draft EA remained open until October 21, 2016. A comment response matrix and a copy of agency comments received during the public scoping period is attached in Appendix A. All comments were considered in the preparation of the Draft EA. In addition, this Draft EA will be made available for public comment prior to issuance of a Final EA. Any public comments received will be considered during the preparation of the Final EA.

Public input and agency consultation has also been completed as part of the design and permitting process for the Proposed Project and is described in Section 2.5 of this Draft EA.

## **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 Draft 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 ir retrievable 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)<sup>2</sup>. The energy generated by the Proposed Project would deliver power to a single point of interconnection on the existing Cleveland Public Power (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 overhead cable, 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.

---

<sup>2</sup> 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.

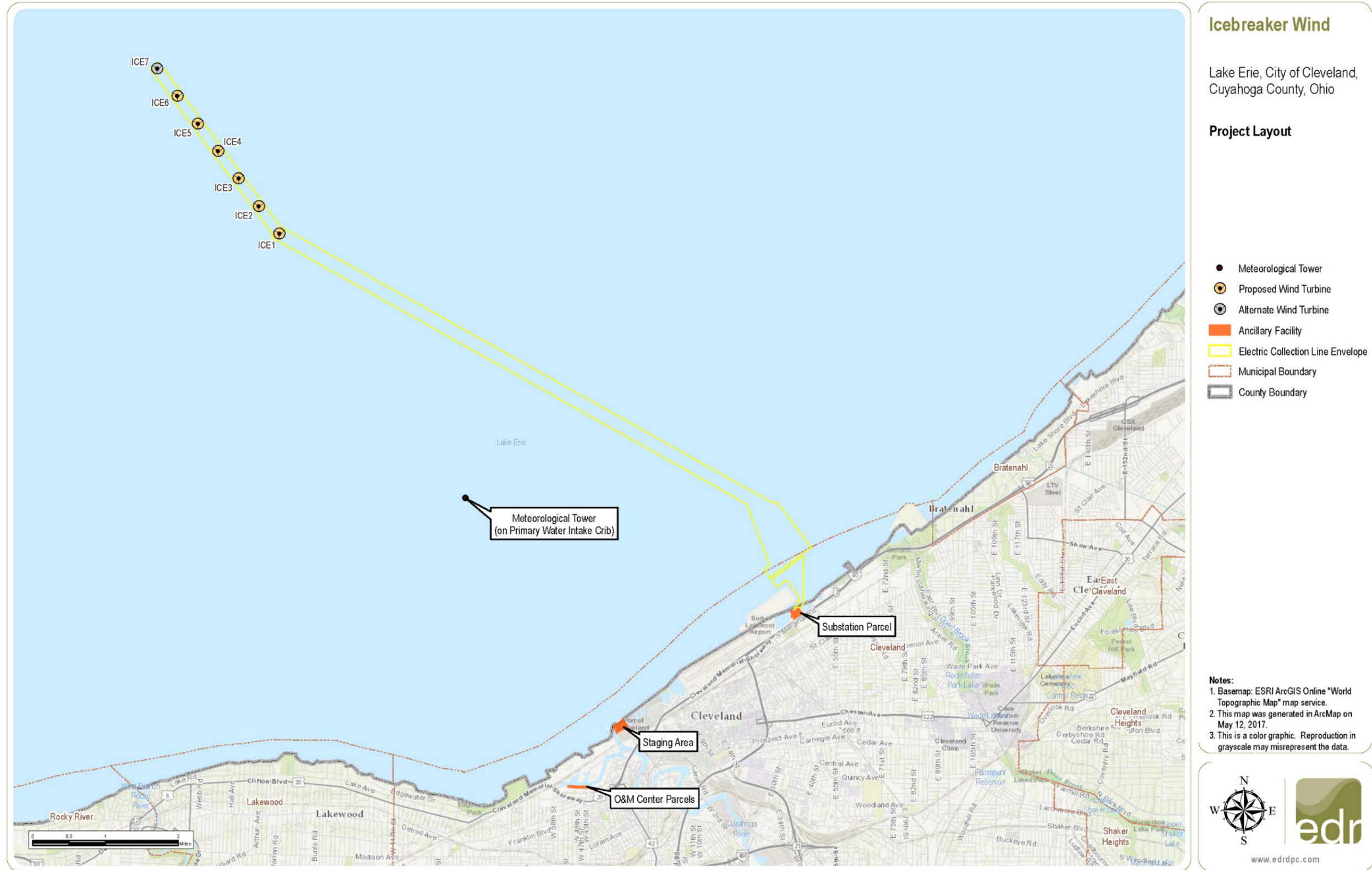


Figure 2-1. Proposed Project Icebreaker Layout



**Icebreaker Wind**

Lake Erie, City of Cleveland, Cuyahoga County, Ohio

**Substation Location**

- Notes:** 1. Basemap: ESRI ArcGIS Online "World Imagery" map service.  
 2. This map was generated in ArcMap on May 12, 2017.  
 3. This is a color graphic. Reproduction in grayscale may misrepresent the data.

-  Cable Route Envelope
-  Approximate Project Substation Location



www.edrdpc.com

**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 overhead cable and then transitioned to an underground concrete duct bank (Figure 2-2).

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. 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). 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 Wind Turbine and Foundation Design

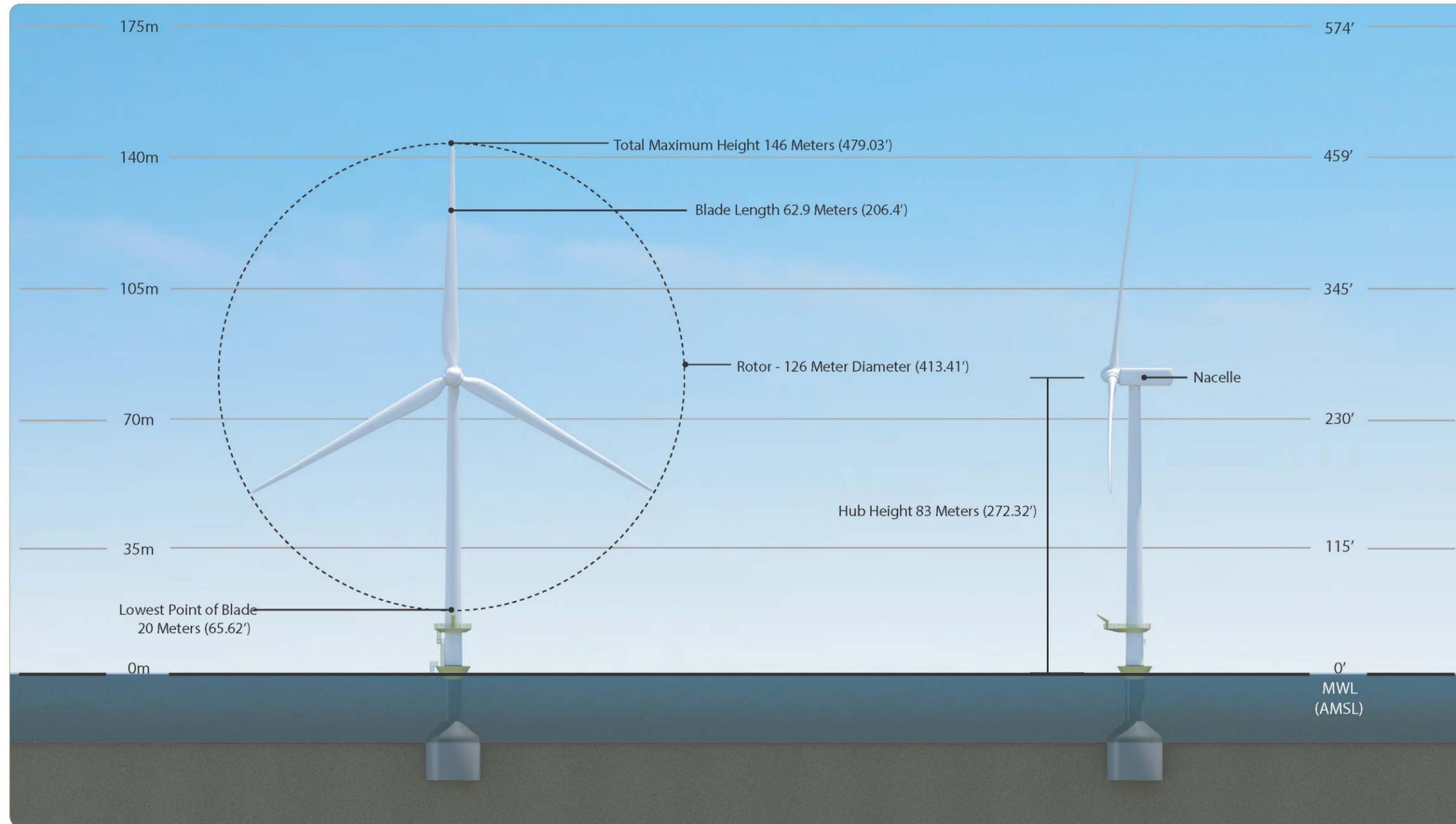
### 2.2.2.1 Wind Turbine Design

The Proposed Project would consist of six Mitsubishi Heavy Industries Vestas Offshore Wind - Vestas 3.45 MW offshore wind turbines. 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 2-3. 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 2-1 and Figure 2-3 present the dimensions of the V126-3.45 MW in feet and meters. Hub height is the height to the center of the rotor, as measured from the chart datum water level, 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 2-1. Approximate Turbine Dimensions**

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



**Icebreaker Wind**  
 Lake Erie, City of Cleveland, Cuyahoga County, Ohio  
**Turbine Design**  
 March 2017



**Figure 2-3. 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 (RAL 7035) color consistent with the Federal Aviation Administration (FAA) and USCG guidance. The portion of the tower between the low water datum 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.

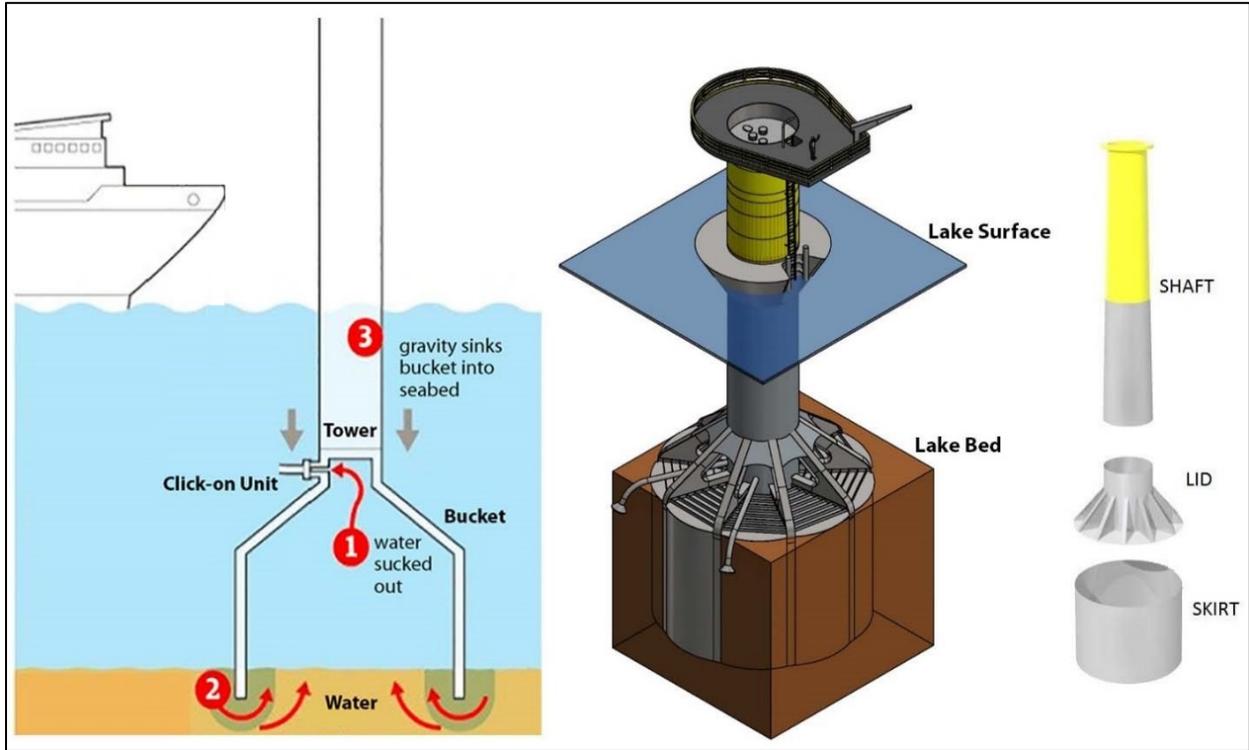
A rotor assembly would be mounted to the nacelle to operate upwind of the tower. Each rotor would consist of three composite blades that would be 206 feet (62.9 meters) in length, which would yield a rotor diameter of approximately 413 feet (126 meters). The blades would be painted a light gray (RAL 7035) color consistent with FAA and USCG guidance. The rotor would attach to the drive train at the front of the nacelle. 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). LEEDCo has agreed to feather the turbine blades up to the manufacturer's cut in speed during certain periods of the year to reduce the risk of bat collisions (see Section 3.4.2.5).

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.

#### **2.2.2.2 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 2-4).



**Figure 2-4. 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 bucket remains operational to this day and the dynamic load performance has been monitored continuously for 15 years, resulting in a deep understanding of dynamic and cyclic loading (Universal Foundation, 2012). Three MB installations in the North Sea have withstood sustained waves greater than 70 feet, far more than extreme wave heights of 15 to 20 feet recorded in Lake Erie (National Oceanic Atmospheric Administration [NOAA], 2016a).

Preliminary designs of the MB foundation have been completed (Figure 2-5), and approximate dimensions are listed below in Table 2-2. The portion of the foundation above the water line would be painted yellow.

**Table 2-2. Approximate Foundation Dimensions**

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

Section 2 Proposed Action and Alternatives

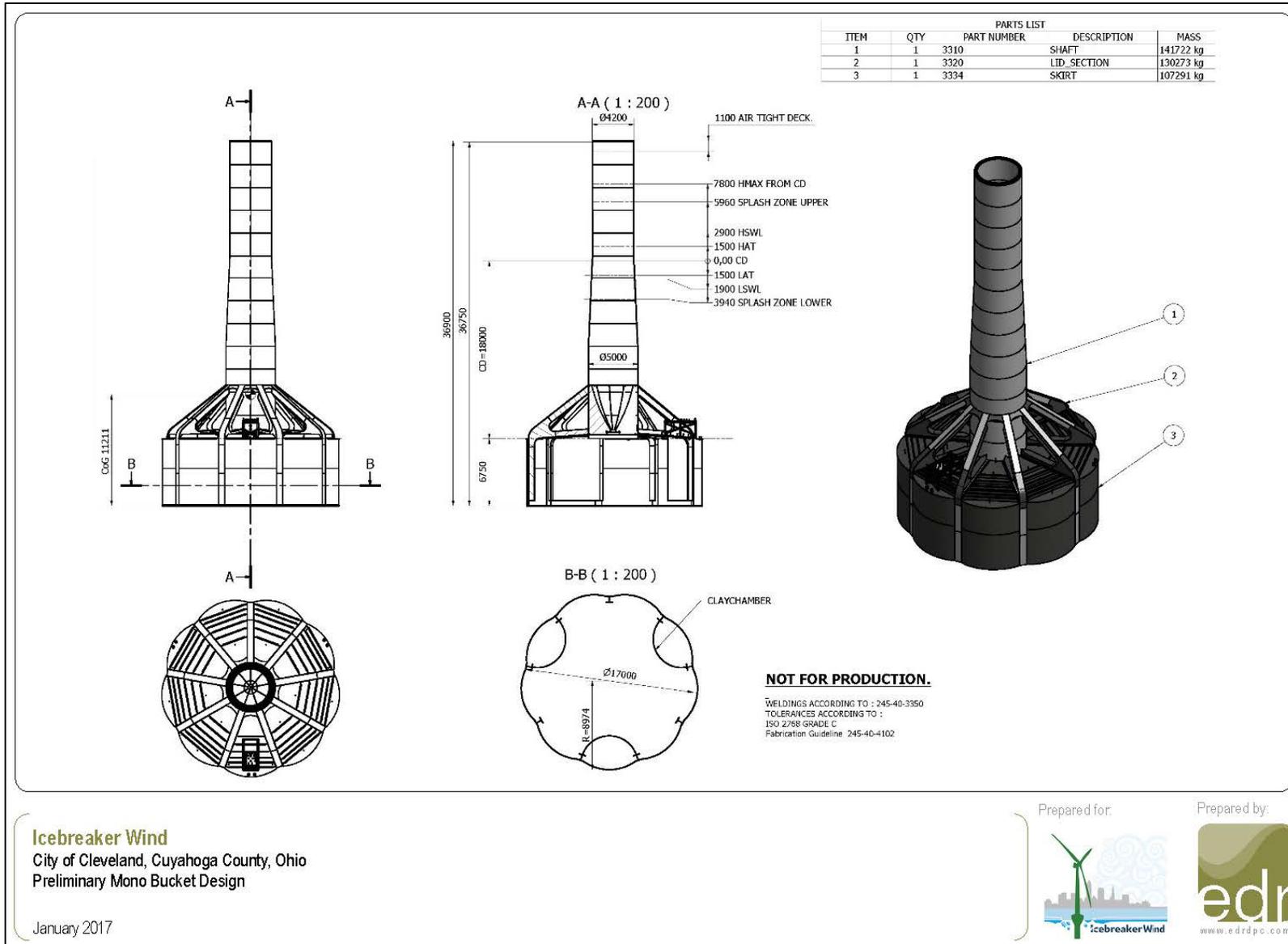


Figure 2-5. Preliminary Mono Bucket Design

### **2.2.3 Installation of Turbines and Foundations**

LEEDCo proposes to use the Port as the quayside staging area for the Proposed Project. Four U.S. fabricators have been qualified and short-listed to compete for the fabrication contract. The selection would be based on a final competitive bid process, and therefore, the final assembly and delivery logistics vary based on each of the fabricators. 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 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.

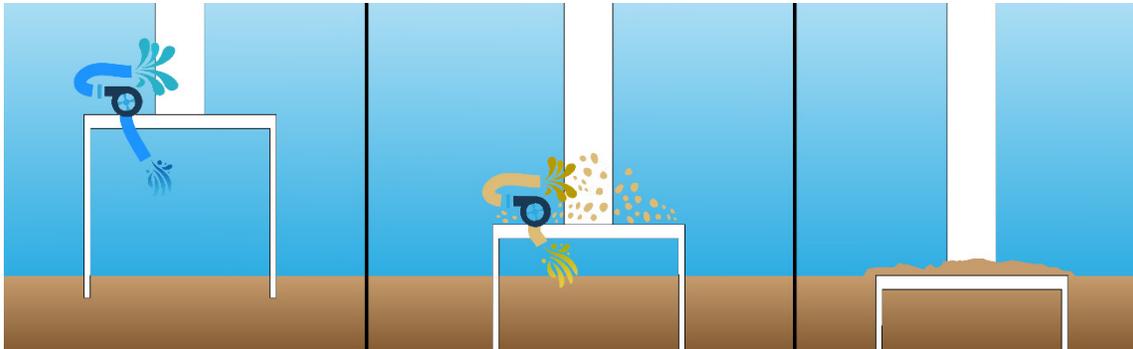
- Configuration A: A jack-up vessel would perform the heavy lift operations for both the foundation and turbine installation. A crane would be deployed on the vessel. A tug boat would be used if the vessel is not self-powered. The jack-up vessel would be a barge or hull outfitted with three to six legs 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 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.
- 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.

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 75 cubic meters (98 cubic yards). 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).

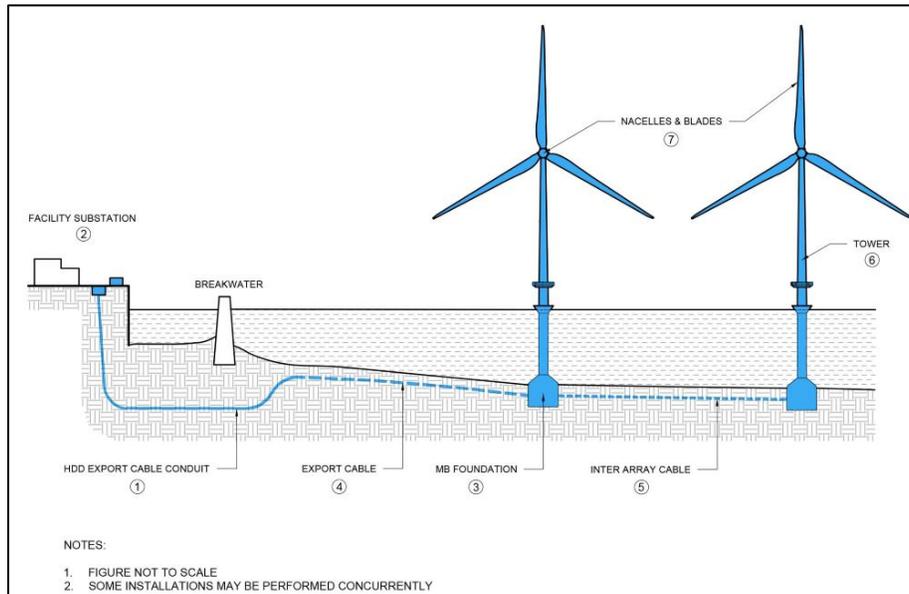
Because the foundation uses suction technology, no lakebed preparation would be necessary (dredging, leveling, or drilling) for installation. The foundation installation would not require any pile driving.

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.

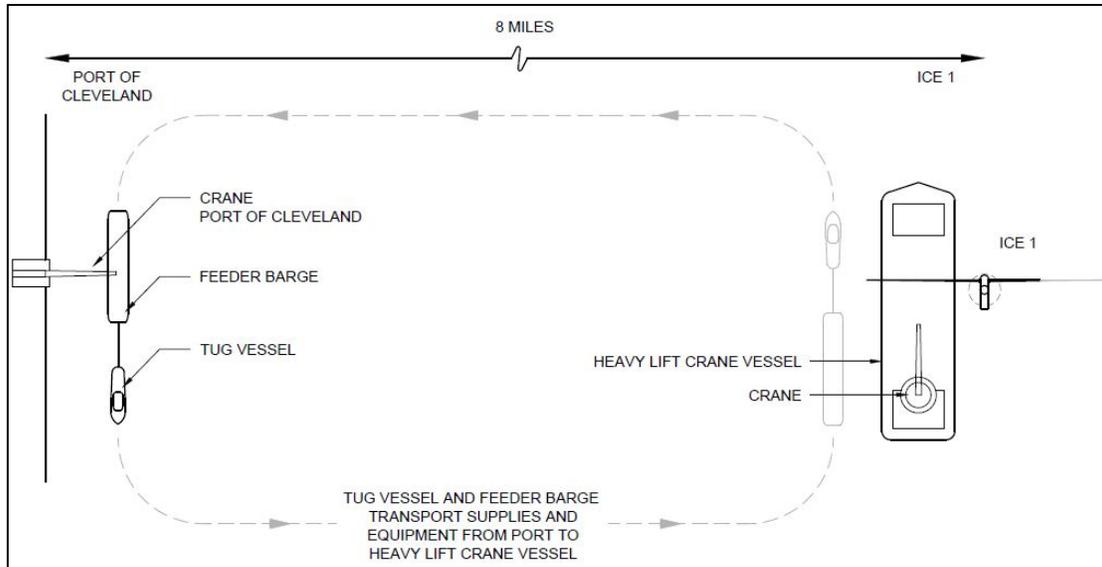
### 2.2.3.2 Turbine Installation

It is anticipated that the turbine components, including nacelle, blades, and tower, would be transported to the Port by barge. 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.

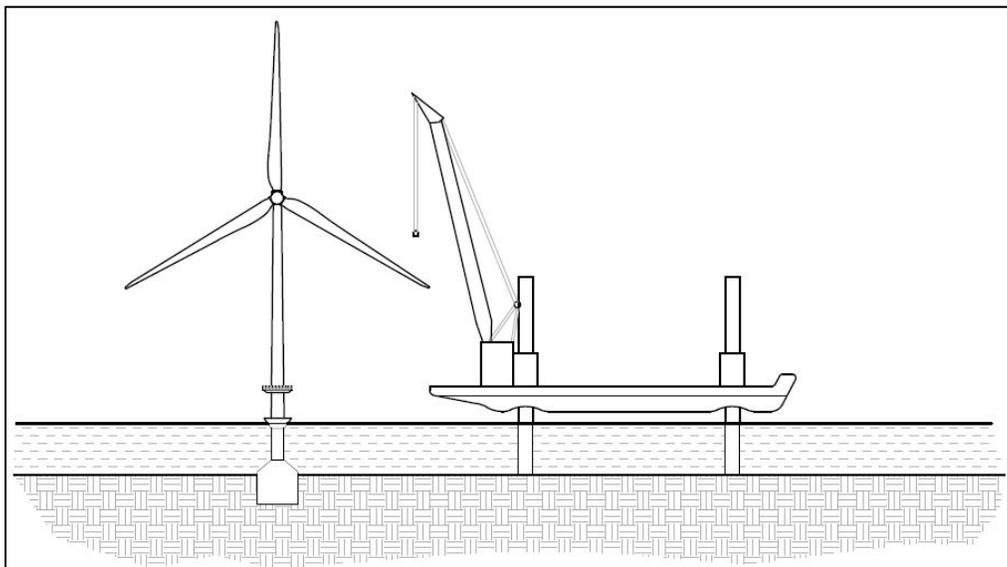


**Figure 2-7. Project Component Installation Sequence<sup>3</sup>**

<sup>3</sup> Blue components are new-build Project components. Numbers under each component represent order of installation.



**Figure 2-8. 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).

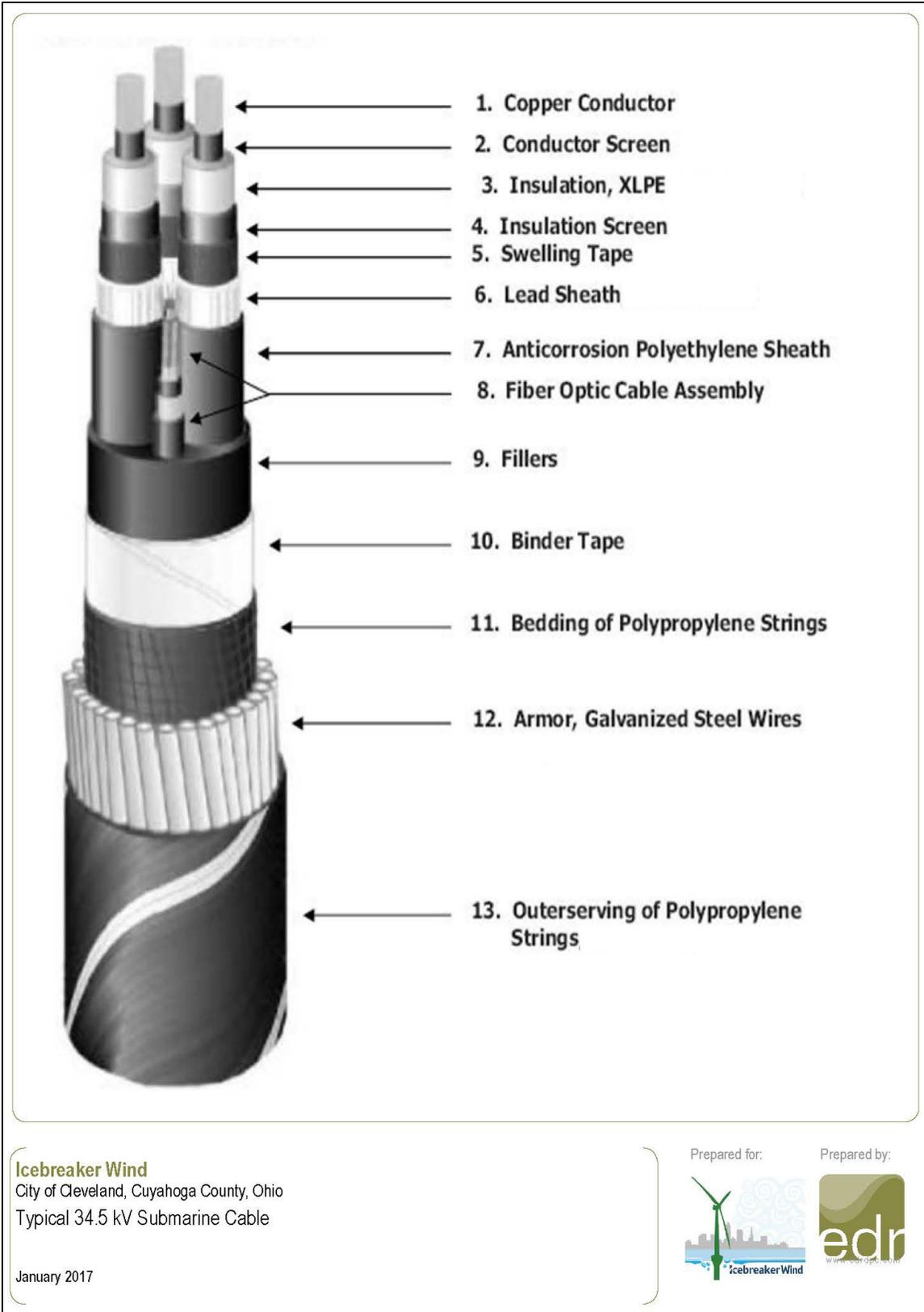


Figure 2-10. Typical 34.5 kV Submarine Cable

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. The driller anticipates the HDPE string being 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 2.7.4. 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 for additional details on sediment suspension. Figure 2-13 depicts the cable interface with the MB and lakebed.

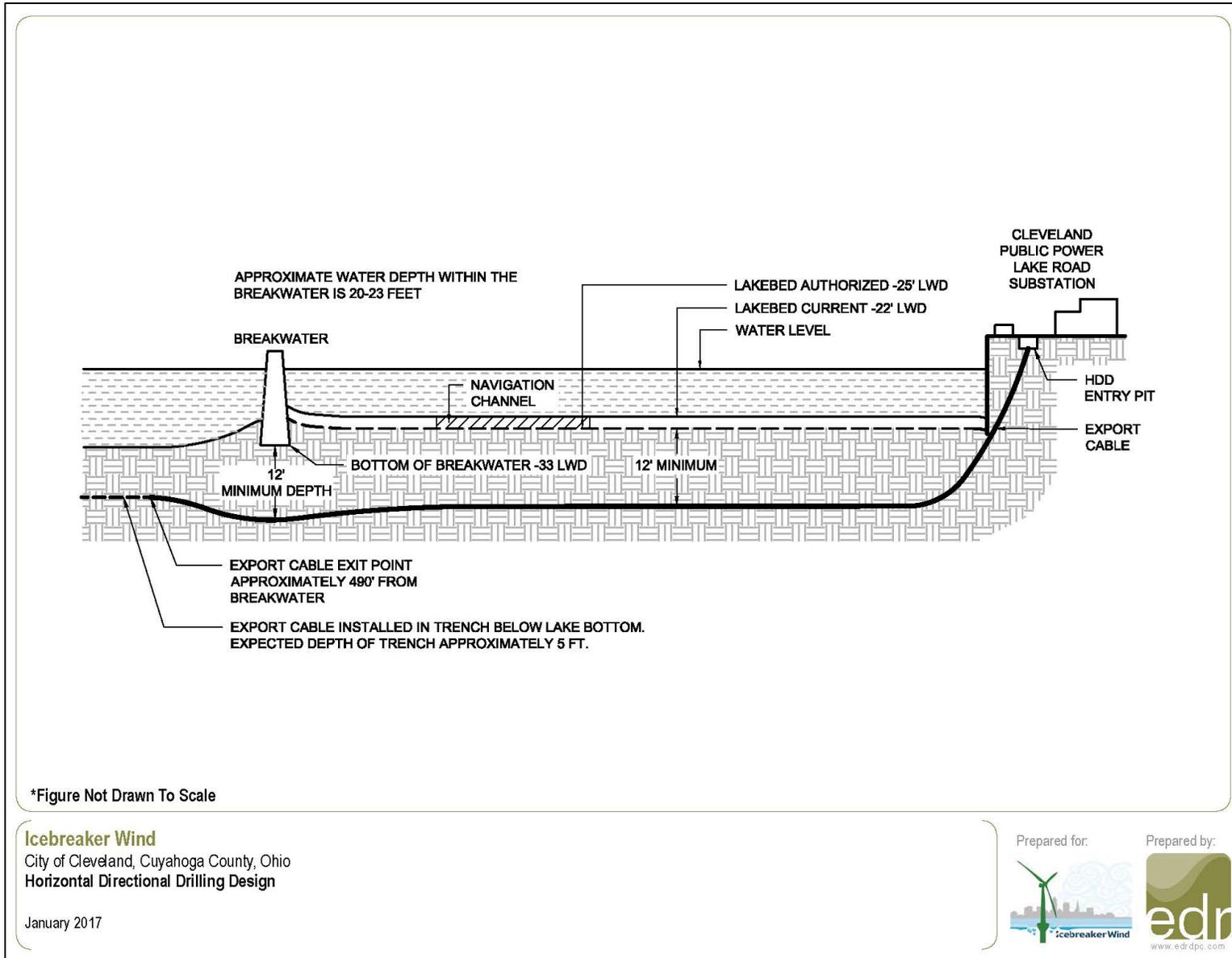
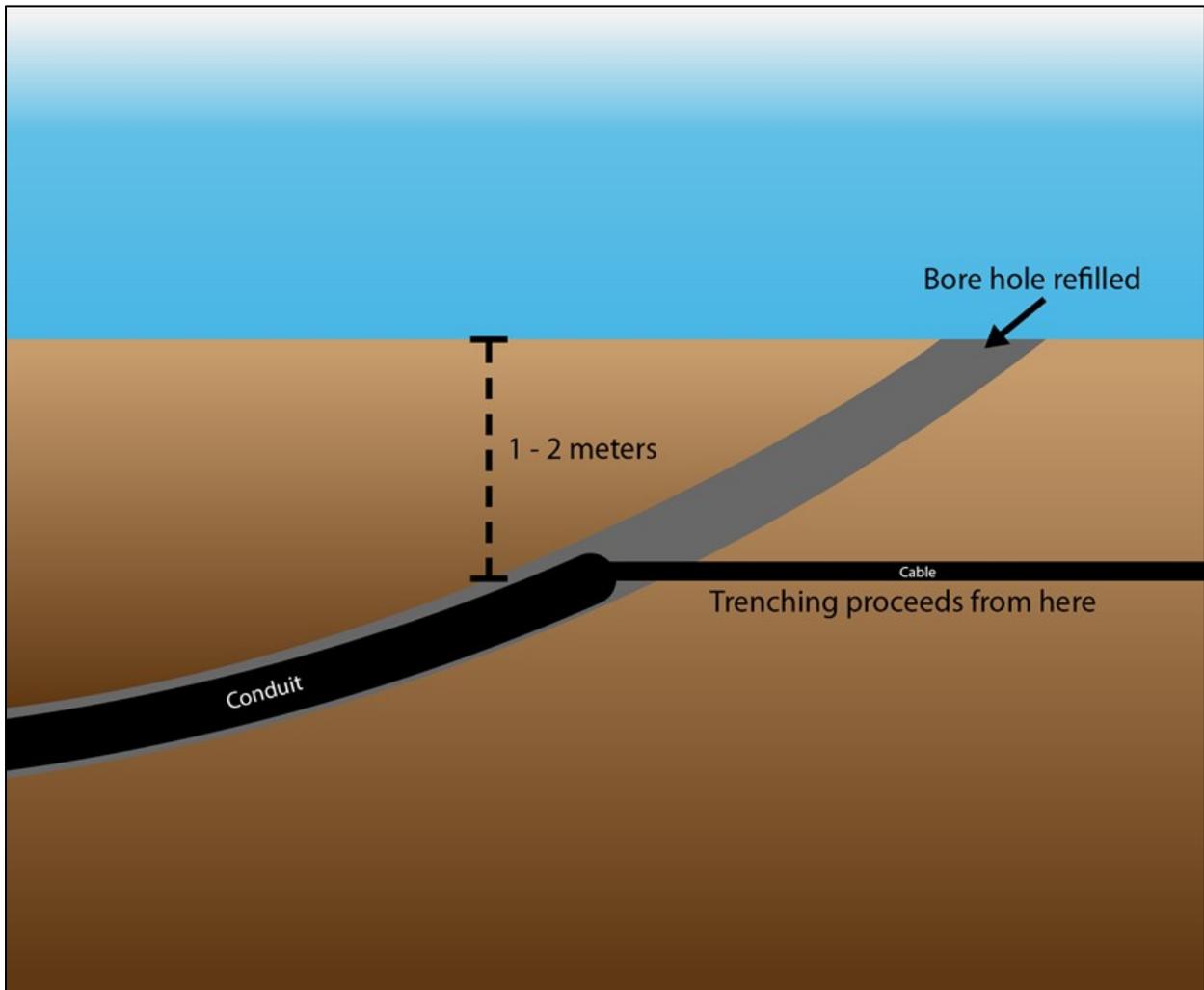
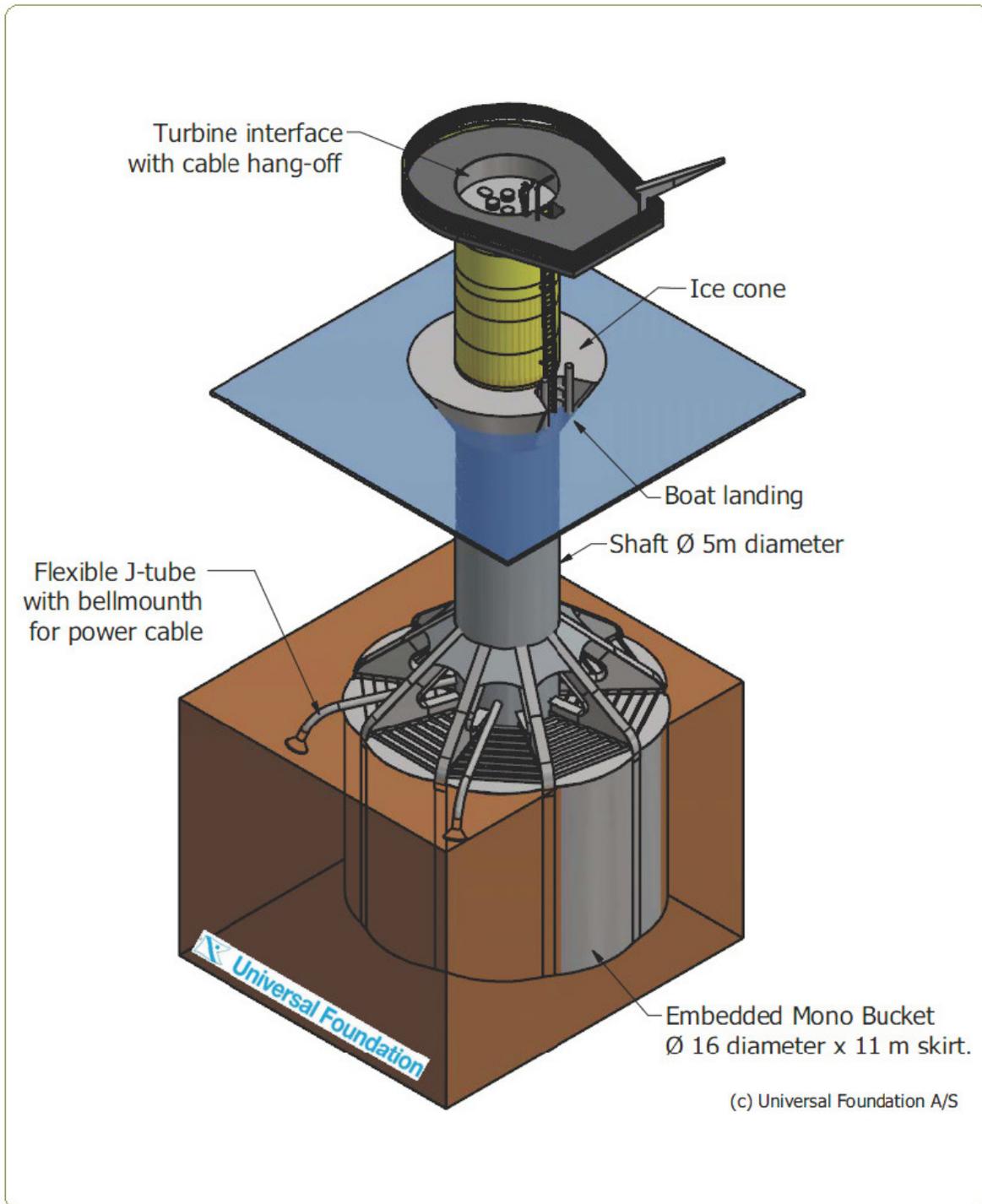


Figure 2-11. Horizontal Directional Drilling Design



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



**Icebreaker Wind**  
Lake Erie, City of Cleveland, Cuyahoga County, Ohio



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

### **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). None of the work discussed under this section of the Draft EA would occur below the ordinary high water elevation of Lake Erie. The ordinary high water line is the shoreward extent of USACE jurisdiction.

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, 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 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 overhead cable and then transitioned to an underground concrete duct bank (Figure 2-2). 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 150 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, the material handling equipment would be demobilized and returned to the supplier, the chain link fencing would be disassembled and returned to the supplier, and the office trailers would be returned to the supplier.

### **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 approximately in November of the year of construction and continue until the end of the 25-year expected operational life of the facility.

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.

#### *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.

#### *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. Maintenance would be done by removing the turbine from service and having two to three wind technicians climb the tower to spend a full day carrying out maintenance activities. 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.

Additionally, inspections of the underwater structures and lakebed would be performed periodically throughout the life of the Proposed Project.

#### *Unscheduled Maintenance*

The major components of modern wind turbines are designed to operate for up to 30 years. However, wind turbines are large and complex electromechanical devices with rotating equipment and many components. Thus, at times, turbines would require 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.

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.

As access to the turbines could only be achieved by vessel, lake conditions would dictate when service may be performed. Heavy annual work would be scheduled to occur during summer months when conditions for accessing the turbines are typically suitable (waves less than 5 feet). 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.

Service crews would board a crew transfer vessel based in the Cleveland area. Personnel would gain access to the turbines by the ladder 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.

No oils or other waste would be intentionally discharged during service events. Appropriate measures would be implemented to provide for containment and collection of hazardous material spills (oil, fuels, hydraulic fluids, and lubricants) should they occur. 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.

### **2.2.8.1 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.

### **2.2.8.2 Operation and Maintenance Center**

LEEDCo proposes to lease space in an existing building from Great Lakes Towing (GLT), located on Division Road approximately 0.37 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.

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. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

## **2.4 Alternatives Considered During Planning and Design**

### **2.4.1 Selection of the Proposed Project Location**

In 2009, a Feasibility Study was completed for the Great Lakes Wind Energy Task Force (juwi GmbH, 2009)<sup>4</sup>. 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

---

<sup>4</sup> The Task Force issued a request for proposals and selected juwi GmbH from Germany to conduct the analysis.

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. The location of these sites is illustrated in Figure 2-15 and in juwi GmbH (2009).

After completion of the Feasibility Study, the Ohio Department of Natural Resources (ODNR) Office of Coastal Management released its 2009 Wind Turbine Placement Favorability Analysis (Favorability Analysis). The Favorability Analysis incorporated much of the same data used in the Feasibility Study, including shipping lanes and navigable waterways, bird and fish habitat, commercial and sport fishery efforts, shipwrecks, restricted areas, industry, and utilities. The resulting Favorability Map (see Appendix C) identified more extensive limiting factors closer to shore and only minimal limiting factors further offshore. In response to the Favorability Analysis, LEEDCo revised its assessment of potential project areas. LEEDCo considered the following factors when choosing the Proposed Project area:

- Existing uses – Existing uses of the area, including air navigation and civilian and military radar facilities; weather forecasting; commercial and recreational maritime uses, such as sailing race courses, fishing grounds, and shipping channels; reefs and shoals; dumping grounds; military practice ranges; sub-lake salt mine; distance to shipwrecks, water intake and sewer outfall pipes; the ODNR Favorability Analysis; the Feasibility Study; and existing submerged lands leases.
- Wind resources – An evaluation of wind resources from the meteorological tower installed on the Cleveland Water Intake Crib, combined with output from mesoscale models for the region, was conducted to evaluate average wind speed and the resulting turbine class for each potential location. Wind resources were determined to be favorable at the Proposed Project Area.
- Environmental conditions – Assessments of avian and bat risk, aquatic ecology, geology, water depth, and effects of icing, wind, and waves have been performed by Cuyahoga County, Case Western Reserve University, Germanischer Lloyd, LEEDCo, and ODNR since 2008. This included avian and bat risk assessments completed in 2008, 2013, and 2016. Aquatic monitoring and risk assessments were conducted in 2016 and 2017.
- Conceptual turbine foundation design – Evaluations of geology, foundations, and turbine designs were conducted to determine the suitability of the MB foundation for Lake Erie and the Proposed Project Area.
- Interconnection and offshore cabling – Evaluations of onshore grid interconnection capacity and proximity and offshore cabling options were performed to determine location and feasibility of an interconnection point.

Figure 2-16 indicates the study areas evaluated for potential project location after review of the Feasibility Study, Favorability Analysis, and factors above, along with the proposed final turbine locations at a 1:75,000 scale. A constraint map of the Proposed Project Area showing shipping lanes, the breakwater, water intakes, and existing electric transmission lines is included as Figure 2-17. Because the Proposed Project Area is located approximately 8 to 10 miles offshore, turbine setbacks from residences, property lines, and public rights-of-way are not applicable siting constraints for the wind generators, and are not illustrated in Figure 2-17.

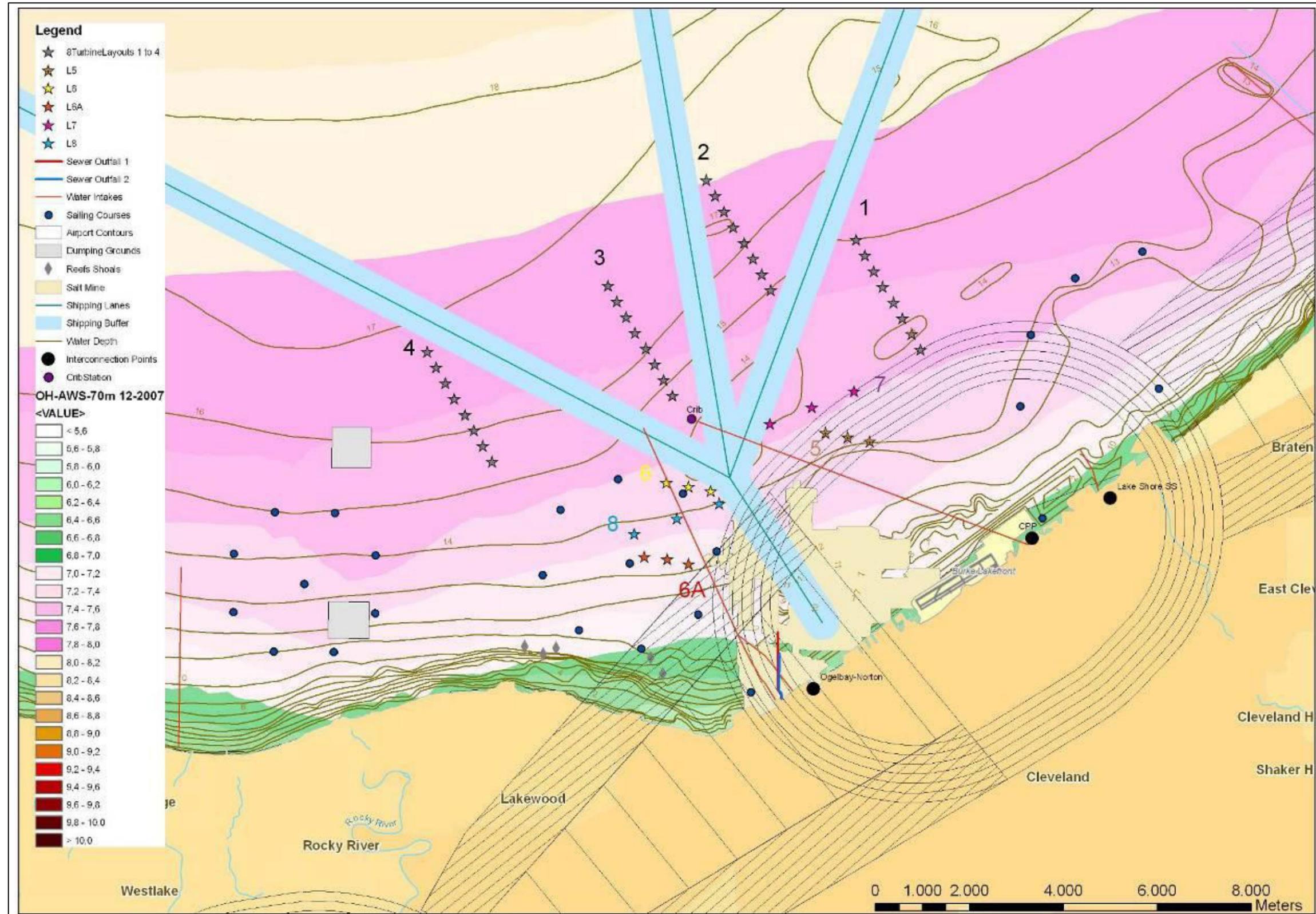
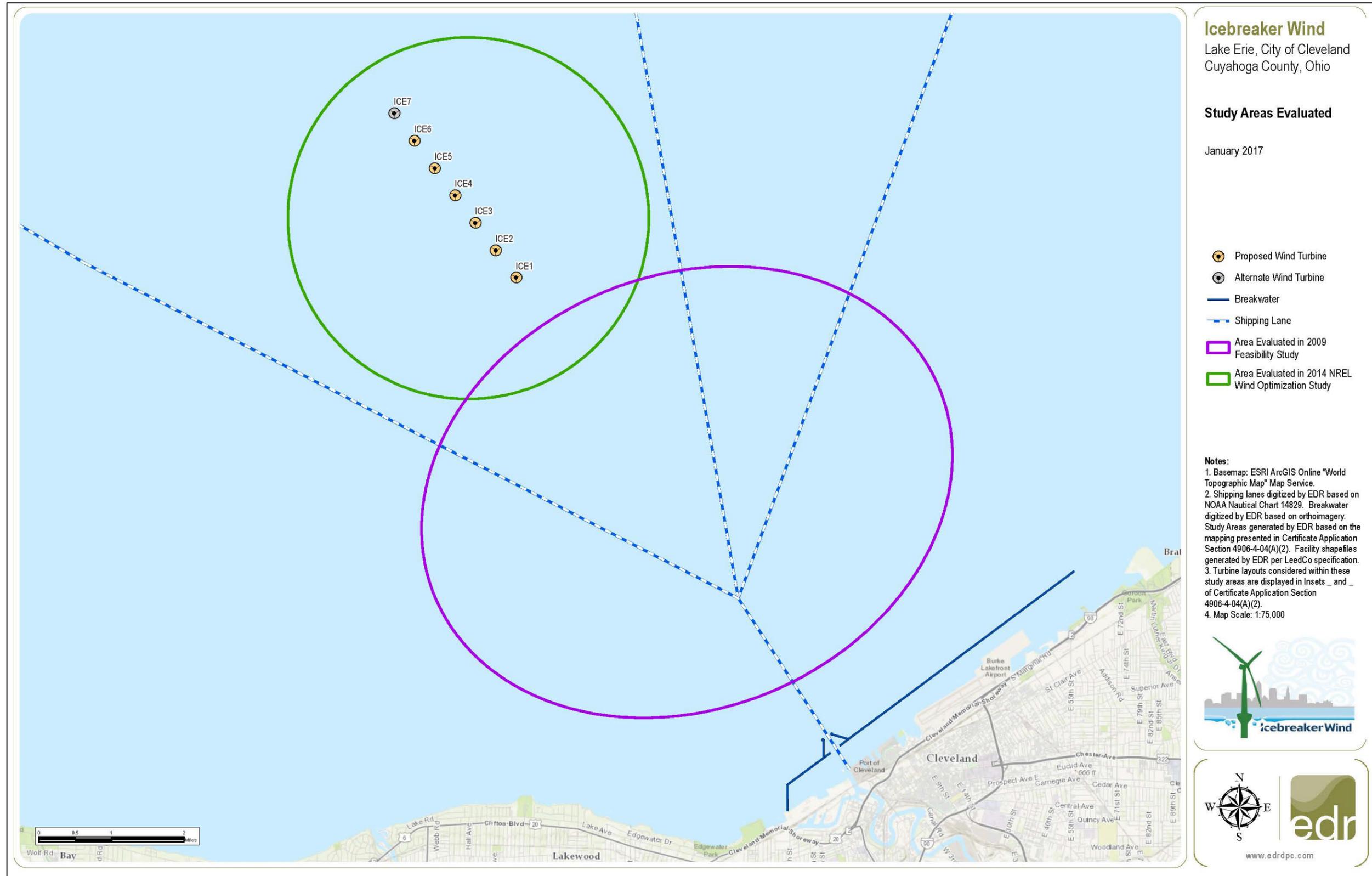


Figure 2-15. Potential Project Areas Evaluated in the 2009 Feasibility Study



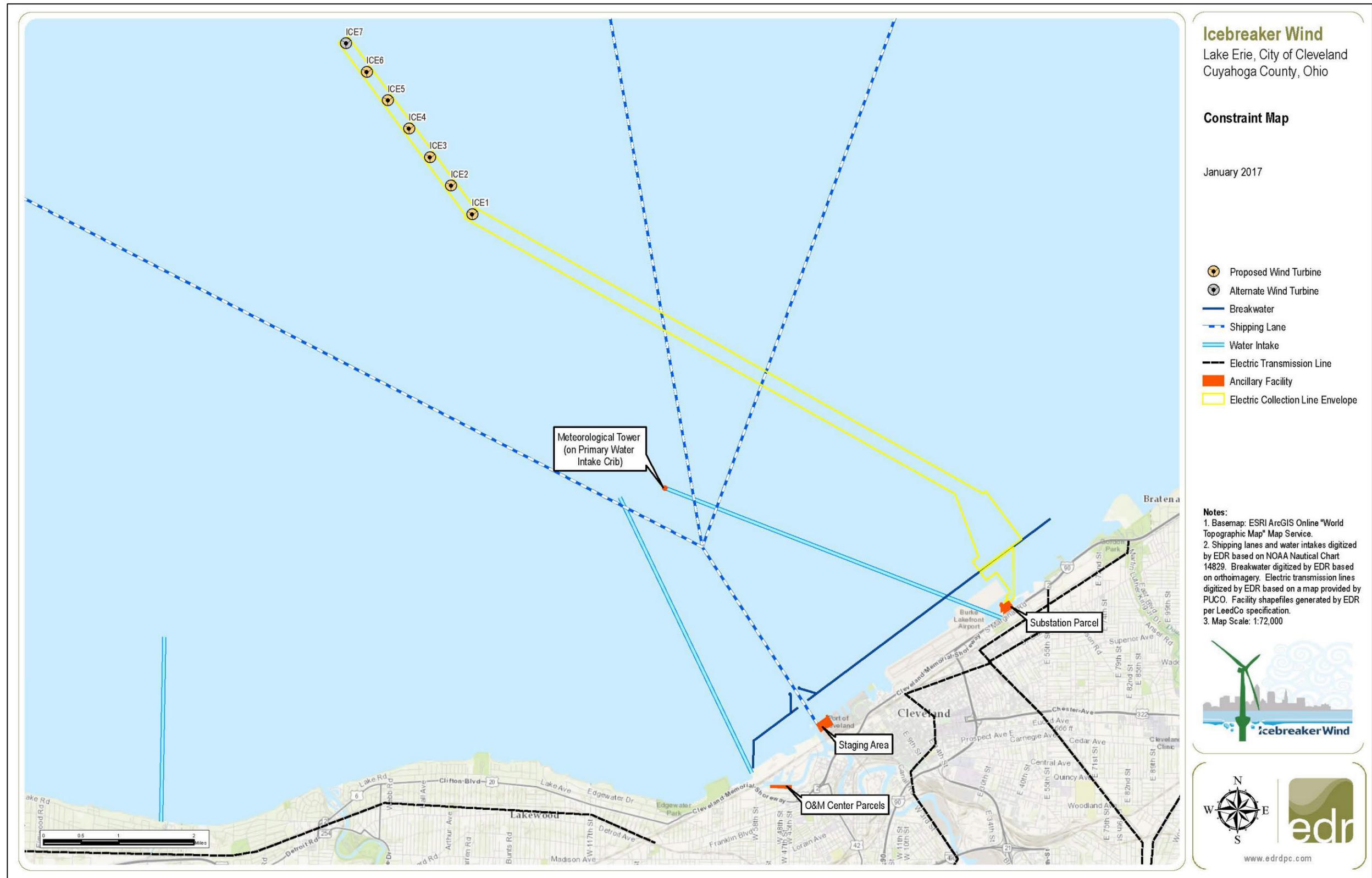


Figure 2-17. Constraint Map

### 2.4.2 Selection of Proposed Turbine Layout

A wind turbine layout optimization study was conducted by the National Renewable Energy Lab (NREL) for the Proposed Project to evaluate its energy output and performance under a variety of layouts. Factors used to compare layouts included net energy production, turbine net capacity factor, and wake losses. Environmental and cost factors were not analyzed. Potential layouts studied included 11 linear layouts varying between five and nine turbines, two 2-row layouts, a 3-row layout, and an optimized layout designed by OpenWind Enterprise (see Figure 2-18). Based, in part, on the NREL study, a six-turbine linear array layout was selected as the final proposed layout (Figure 2-16).<sup>5</sup>

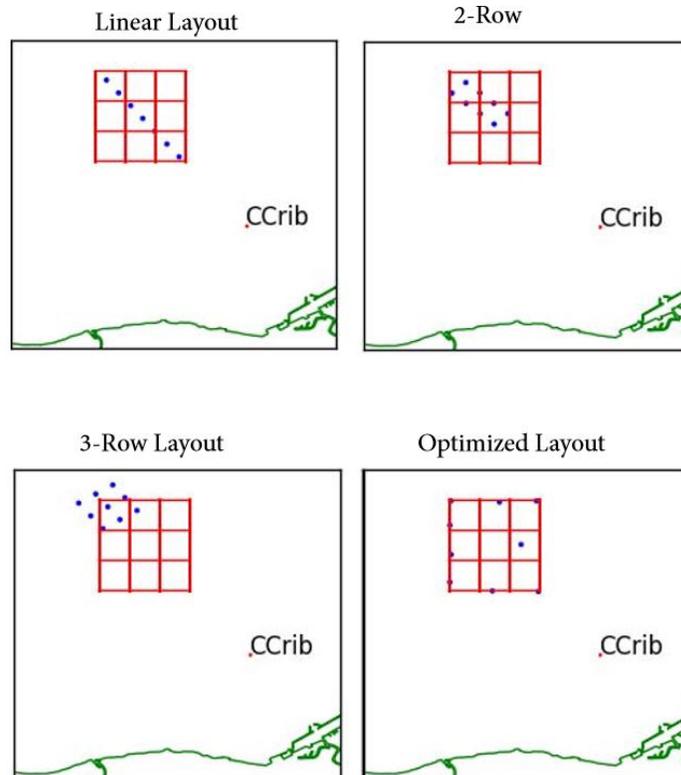


Figure 2-18. Typical Layouts Analyzed by NREL Wind Optimized Study

### 2.4.3 Selection of Proposed Turbine Foundation Design

In 2013, after an examination of four potential foundation types (circular cell, tripod pile, gravity base, and monopile with a friction wheel [MP/FW]) and their performance in loose glacial till sediments common to Lake Erie, specifically at the Proposed Project Area, a MP/FW foundation concept was chosen by LEEDCo. Subsequently, a fifth foundation type, the MB suction pile, was also considered. A comparative analysis between the MP/FW and MB suction pile was completed in 2015 to determine the most suitable foundation design for the Proposed Project.

The selection of the proposed foundation considered all aspects of both technologies. While the MP/FW uses well-proven technology, its large size and pile driving equipment makes installation challenging,

<sup>5</sup> Seven turbine sites were initially investigated as depicted on Figure 2-16. The six turbine sites (ICE1 – ICE6) exhibiting the most optimal geotechnical characteristics were selected for the final proposed layout.

requiring three offshore lifts. The MB technology requires the use of one offshore lift and does not require any pile driving. Therefore, the installation costs are significantly lower (33 percent) for the MB technology. While both foundations meet the technical performance requirements for Lake Erie's sediment and winter weather conditions, the MB is lighter, quicker to install, and can be fabricated competitively in the U.S. By eliminating pile driving and reducing sediment disturbance, the MB foundation lessens environmental impacts when compared with conventional foundations. Given these advantages, the MB was selected as the proposed foundation.

#### **2.4.4 Selection of Proposed Substation Location**

Three potential interconnection locations were evaluated by LEEDCo: Cleveland Electric Illuminating Co. (CEI) Lakeshore Substation, CEI Oglebay-Norton Tap, and Lake Road Substation. Feasibility, cost of required equipment, and anticipated impact were elements considered. The Lake Road Substation was chosen as the proposed location as it was the closest potential interconnection location to the Proposed Project Area, thereby reducing cabling distance and cost. This site would also require minimal upgrades to existing infrastructure and would have sufficient land to construct necessary equipment for the Proposed Substation.

#### **2.4.5 Selection of Proposed 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. Six potential cable routes were identified. To connect the export cable to the Proposed Substation, the cable route would need to cross or go around the breakwater, then cross the harbor to the Lake Road Substation. A confined disposal facility (CDF) is located within the harbor along the direct path to the Lake Road Substation. Six different cable route options for crossing the breakwater, CDF, and harbor were identified. A comparative analysis was conducted to assess the benefits and risks of five of the options (Appendix D). Subsequently, further analysis was performed to assess a variant of one of the options resulting in a total of six options that were assessed.

Criteria considered included cable length, suitability of HDD, potential damage from third parties, environmental aspects, thermal bottleneck potential, permitting considerations, potential Port and City of Cleveland development plans, and USACE dredging of the navigational channel near the shore crossing. The proposed option would route the cable in a conduit installed using HDD from the Lake Road Substation, under the harbor, around the east side of the CDF, and then under the breakwater to the open water just north of the breakwater. The remainder of the cable route from north of the breakwater to the first proposed turbine site would be similar for all six options identified: direct path from north of the breakwater to the first proposed turbine site. That portion of the cable would be buried in the lakebed. An in-depth geotechnical and geophysical survey for the entire proposed cable route was performed in October 2016.

### **2.5 Public Input Summary**

#### **2.5.1 DOE Notice of Scoping and Notification of Public Scoping Meeting**

A Notice of Scoping and Notification of Public Scoping Meeting was issued on September 14, 2016 to request public input on the scope of the Draft EA for the Proposed Project (see Appendix A). The Notice stated that DOE, USACE, and USCG would hold a public scoping meeting on September 28, 2016 and that

they welcomed input on the proposed scope of the EA. The Notice requested that all comments be provided on or before October 21, 2016.

A postcard with a summary of the scoping notice, including notice of the scoping meeting, and a link to additional online information was mailed to approximately 5,200 recipients, which includes individuals or organizations who have expressed an interest in the project. Notice of scoping and of the scoping meeting was published in the federal register and published in the Cleveland Plain Dealer. Notice was also distributed by email to the DOE Wind and Water list serve distribution list. The public meeting was held on September 28, 2016, as described in the Notice.

### **2.5.2 Comments Received during the DOE Public Scoping Period**

A total of 95 comments were received from the public during the public scoping period. Agency comments were received from 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.

### **2.5.3 USACE Public Input**

On September 20, 2016, the USACE Buffalo District Public Affairs Office posted a 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.

Once the DOE, as the lead federal agency, issues a notice that the Draft EA is available for public comment, USACE would concurrently issue a one-page notice announcing the availability of the Draft EA. The USACE public comment period is 30 days. The USACE one-page notice would refer the reader to the Draft EA for details and would request input from federal and state agencies, adjacent property owners, and the public.

### **2.5.4 US Coast Guard Public Input**

The USCG released the Notice of Scoping and the Notification of Public Scoping Meeting using the USCG 9th District Public Affairs' Twitter and Facebook accounts on September 16, 2016. Additionally, the USCG communicated directly with Lake Carriers Association and Interlake Steamship Company concerning the Proposed Project to provide additional time for comments.

### **2.5.5 LEEDCo Community Outreach**

Since 2006, LEEDCo has participated in over 400 meetings and presentations about the Proposed Project to share information with local stakeholders and local communities. In 2013, LEEDCo made 15,000 face-to-face contacts across Northeast Ohio to determine public opinion and willingness to buy electricity generated from an offshore wind project, even at a higher price.

## 2.6 Permitting

### 2.6.1 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 Draft EA is presented as follows.

The USACE will seek 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.

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.

LEEDCo will apply for a USACE Section 10/404 Permit for the installation of the offshore wind turbines and electric collection line. USACE received a Section 408 application from LEEDCo on February 6, 2017 for alterations to, or temporary or permanent occupation or use of, USACE, federally authorized, civil work projects.

#### **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 Draft 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 Draft 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 Draft EA.

**b. Economics**

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

**c. Aesthetics**

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

**d. General Environmental Concerns**

**1. Noise**

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

**2. Air**

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

**e. Wetlands**

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

**f. Historic Properties**

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

**g. Fish and Wildlife Values**

**1. Benthos**

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

**3. Fish Resources**

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

**5. Birds and Bats**

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

**h. Flood Hazards**

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

**i. Floodplain Values**

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

**j. Land Use**

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

**k. Navigation**

**1. Lake Navigation**

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

**2. Aviation**

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

**m. Recreation**

The affected environment and environmental impacts related to recreation are described in Sections 3.8 and 3.9 of the Draft 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 Draft EA. The environmental impacts related to water supply and conservation are described in Section 3.3.2.2 of the Draft EA.

**o. Water Quality**

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

**p. Energy Needs**

The Proposed Project would consist of the construction, operations, maintenance, and eventual decommissioning of an approximate 20.7 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 Draft EA.

**q. Safety**

**1. Waste Management**

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

**2. Hazardous Materials**

The affected environment related to hazardous materials is described in Section 3.5.1.2 of the Draft EA. The environmental impacts related to hazardous materials are described in Section 3.5.2 of the Draft 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 Draft 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 Draft EA. This public interest review factor was not evaluated further in the Draft 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 Draft 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.

**2.6.2 Ohio Environmental Permitting**

**2.6.2.1 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 will be included as a part of the Section 10/404 permit application. The USACE will forward the Section 10/404 permit application to ODNR and coordinate with ODNR for its review of the coastal zone consistency.

**2.6.2.2 Ohio Environmental Protection Agency**

LEEDCo will submit a Section 401 application once the Section 10 and 404 permit application public notice is issued. The Ohio Environmental Protection Agency (OEPA) is responsible for evaluating the application for a Section 401 Water Quality Certification. Pre-application meetings with the OEPA were held on March 1 and May 5, 2017.

**2.6.2.3 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. The Application was assigned Case No. 16-1871-EL-BGN. Ninety days prior to its filing, on November 3, 2016, LEEDCo held a public information meeting to present information and answer questions on the Proposed Project. On April 3, 2017, the OPSB notified LEEDCo that it would require two Memoranda of Understanding (MOUs) between LEEDCo and the ODNR. One MOU relates to pre-, during, and post-construction monitoring and analyses for potential project impacts on fisheries and aquatic resources, while the second relates to potential impacts on birds and bats. The MOUs were submitted on July 20, 2017. On July 25, 2017, the Application was determined complete by OPSB. Next, the OPSB staff will issue notice, set an intervention deadline, conduct discovery, issue a staff report, hold a public hearing in the Proposed Project vicinity, hold adjudicatory hearings at OPSB offices, and then issue a decision. A decision is expected during the fourth quarter of 2017.

**2.6.3 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	Status
Certificate of Environmental Compatibility and Public Need	OPSB	Construction and Operation	February 1, 2017	Pending
Section 10 of the Rivers and Harbors Act	USACE	Construction and Operation	Submission pending	
Section 404 of the Clean Water Act	USACE	Construction	Submission pending	
Coastal Zone Consistency	ODNR	Construction and Operation	Submission pending	
401 Water Quality Certification	OEPA	Construction	Submission pending	
Section 408 Permit to Alter, Impact, or Encroach upon a Federal Navigation Project	USACE	Construction and Operation	February 3, 2017	Pending

**Table 2-3. Permit Table**

Permits	Agency	Project Phase	Submitted	Status
FAA Determination of No Hazard	FAA	Operation	July 22, 2017	Received - February 22, 2017
Permit for Private Aid to Navigation	USCG	Operation	Submission pending	

## 2.7 Applicant Committed Measures

LEEDCo has made commitments, listed below by resource area, to avoid or minimize potential impacts that were identified during the development of the Proposed Project and preparation of the Draft EA. These commitments, and any additional measures identified through permitting or Memoranda of Understanding, would be incorporated and binding through the DOE financial assistance award. The measures below were not necessarily included 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 would be required as a condition of the DOE financial assistance award to further reduce the likelihood of impacts and to ensure the Proposed Project is carried out in an environmentally responsible manner.

### 2.7.1 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 the agency and LEEDCo was signed June 15, 2017 and filed with the OPSB July 20, 2017 (link to MOU: <http://dis.puc.state.oh.us/TiffToPDF/A1001001A17G20B35707J00358.pdf>).

### 2.7.2 Birds and Bats

LEEDCo has had discussions with ODNR and the USFWS to develop a sampling 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 (link to MOU: <http://dis.puc.state.oh.us/TiffToPDF/A1001001A17G20B35707J00358.pdf>).

LEEDCo would develop a Bird and Bat Conservation Strategy to conduct thorough post-construction monitoring of Proposed Project impacts, and to undertake adaptive management measures, if necessary. Mitigation and adaptive management measures would be implemented if actual impacts exceed expectations.

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.

LEEDCo would 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 that "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.

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 should work with USFWS to ensure that they comply with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. 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 and ODNR, as well as compliance with agreed upon measures, would be required as a condition of the DOE financial assistance award.

### **2.7.3 Spill Prevention, Control, and Countermeasure Plan**

LEEDCo would comply with federal and state regulations for management of fluids and fuels, including maintaining and implementing a spill prevention, control, and countermeasure (SPCC) plan. Vessels would be navigated by trained, licensed vessel operators who would adhere to navigational rules and regulations, and would be equipped with spill handling materials adequate to control or clean up any accidental spill.

### **2.7.4 Inadvertent Return Contingency Plan**

An Inadvertent Return Contingency Plan would be 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 would describe 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 would be submitted as part of the USACE Section 404 permit application.

### **2.7.5 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.

**2.7.6 Cultural Resources**

While no evidence of items of archeological or cultural significance have been identified, LEEDCo would continue to monitor for items of archeological or cultural significance and immediately notify the appropriate agencies of discovery of any previously unknown historic or archeological remains during construction.

**2.7.7 Socioeconomic**

LEEDCo would use designated truck routes which are designed to minimize impacts on residential areas and sensitive receptors (e.g., hospitals, schools, daycare facilities, etc.) to the extent possible.

## **SECTION 3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS**

Section 3 describes the existing environmental resources associated with the Proposed Project, 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. 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 effects or impacts are described 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).

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 are beneficial, insignificant, or discountable.
- May affect, and is likely to adversely affect: An adverse effect to listed species 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 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		<ul style="list-style-type: none"> <li>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.</li> </ul>
Groundwater		X		<ul style="list-style-type: none"> <li>Minor excavation for construction of the Proposed Substation would be shallow; approximately 3 feet.</li> <li>The remainder of the onshore Proposed Project elements do not require excavation and have no potential to impact groundwater.</li> </ul>
Aquatic and Terrestrial Vegetation			X	<ul style="list-style-type: none"> <li>Insufficient sunlight necessary for plant growth at depths beyond 52 feet; turbines proposed to be in 58 to 63 feet to the lakebed.</li> <li>HDD would prevent impacts to nearshore submerged aquatic vegetation.</li> <li>Potentially occurring aquatic vegetation that may be affected by cable burial would be expected to return to pre-installation conditions shortly after construction.</li> <li>The onshore cable route and Proposed Substation would be constructed on developed land and would not require vegetation clearing at the site.</li> </ul>
Terrestrial Amphibians, Reptiles, and Mammals			X	<ul style="list-style-type: none"> <li>Land-based wildlife in the Proposed Project Area are all highly urbanized species and have adapted to human activities such as construction.</li> <li>Species that could be present during construction are highly mobile, and could actively avoid construction and decommissioning activities.</li> <li>No impacts would be expected from decommissioning.</li> </ul>
Wetlands	X			<ul style="list-style-type: none"> <li>No wetlands occur within 100 feet of the Proposed Project.</li> </ul>
Shore Erosion and Accretion		X		<ul style="list-style-type: none"> <li>Shoreline is hardened near the proposed landfill, Lake Road Substation, Proposed Substation, HDD boring pit, as well as the Port used for the quayside staging area.</li> <li>Erosion and sediment control best management practices would minimize sediment runoff impacts to Lake Erie.</li> </ul>
Flood Plain and Flood Plain Hazards		X		<ul style="list-style-type: none"> <li>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.</li> <li>Proposed wind turbine area is located 8 to 10 miles offshore and would be unaffected by flooding events.</li> </ul>
Land Use and Infrastructure			X	<ul style="list-style-type: none"> <li>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.</li> <li>Export cable would be buried in open lakebed.</li> <li>Proposed Substation would have a footprint of 0.22 acre on existing industrial land, adjacent to the Lake Road Substation.</li> </ul>

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

Resource	Not Present	No Potential for Impact	Negligible Impact	Considerations
				<ul style="list-style-type: none"> <li>O&amp;M Center and the Port staging area would be located on existing industrial land.</li> </ul>
Intentional Destructive Acts			X	<ul style="list-style-type: none"> <li>Proposed Project would not transport, store, or use radioactive, explosive, or toxic materials.</li> <li>Proposed Project would be a single component of a diversified power grid.</li> <li>Proposed Project would not be considered to offer targets for intentional destructive acts.</li> </ul>

### 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.

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) 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 overhead uninsulated cable 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 150 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 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.

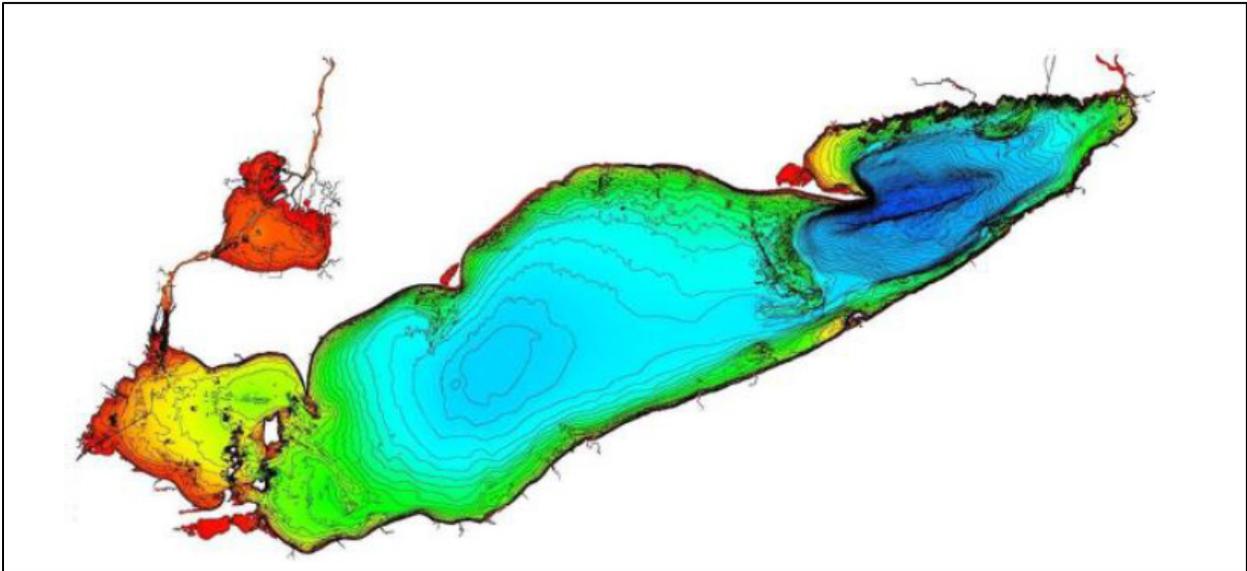
## **3.2 Physical Resources**

### **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 ship wrecks (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

**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). 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*. 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.

### ***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).

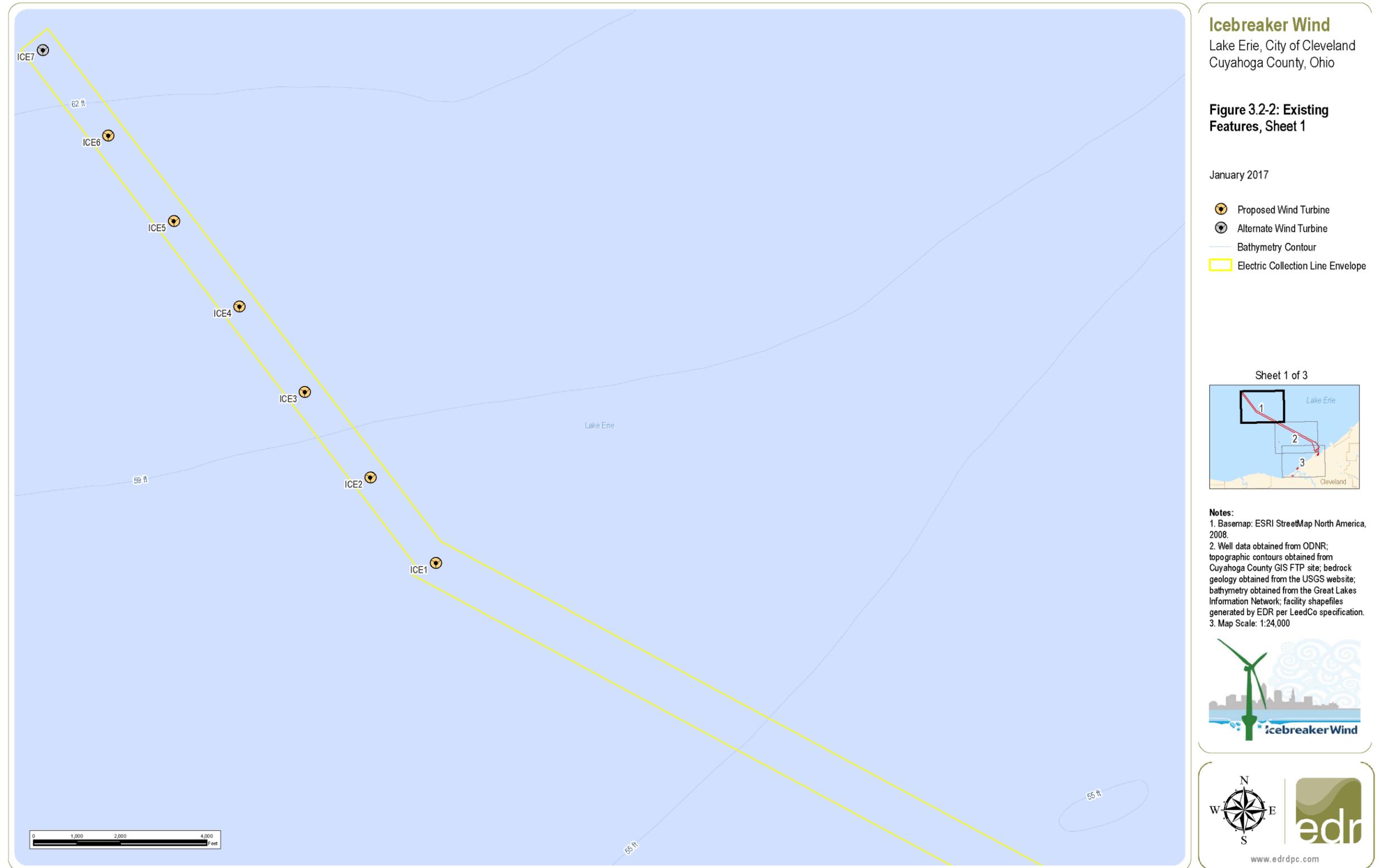


Figure 3.2-2. Existing Features, Sheet 1

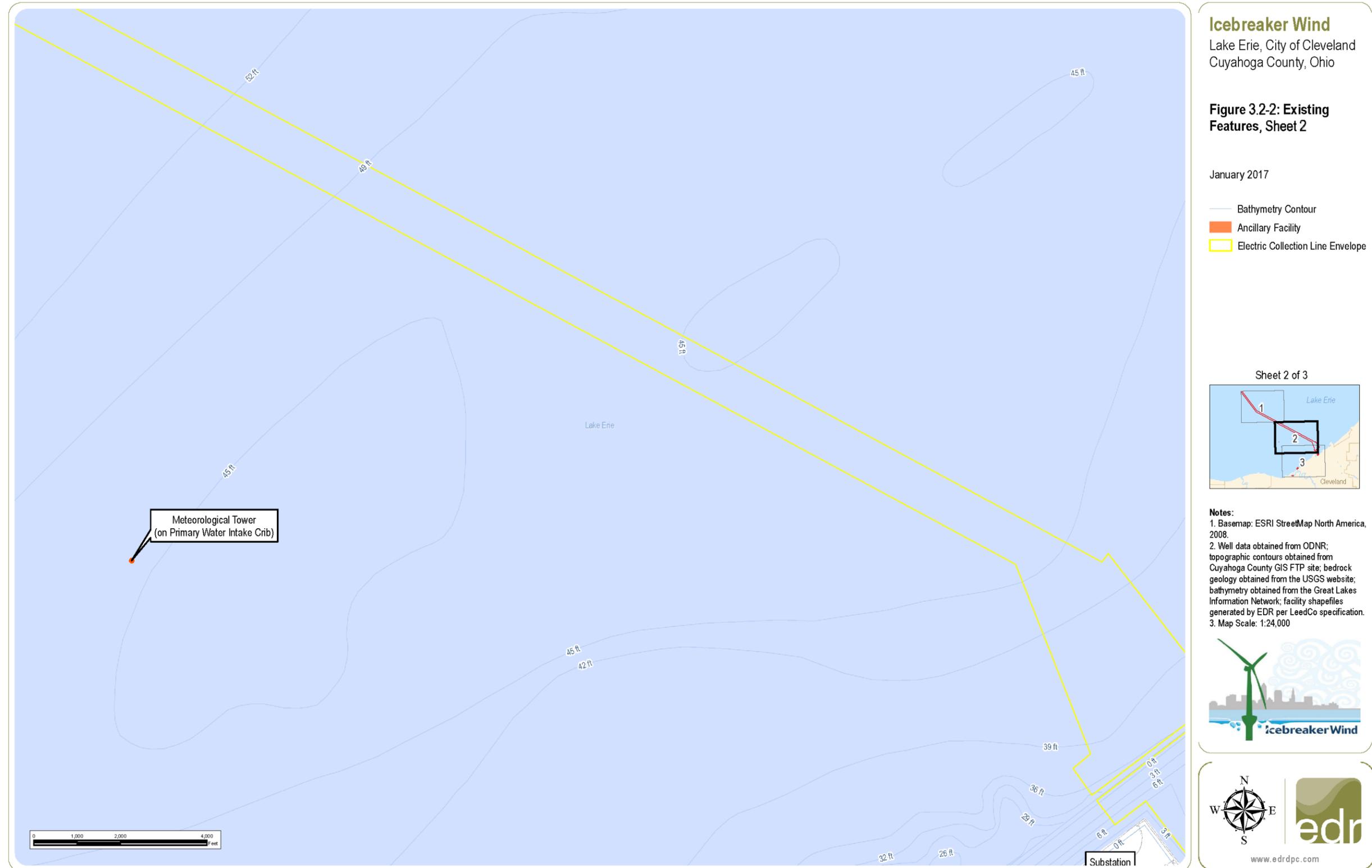


Figure 3.2-2. Existing Features, Sheet 2

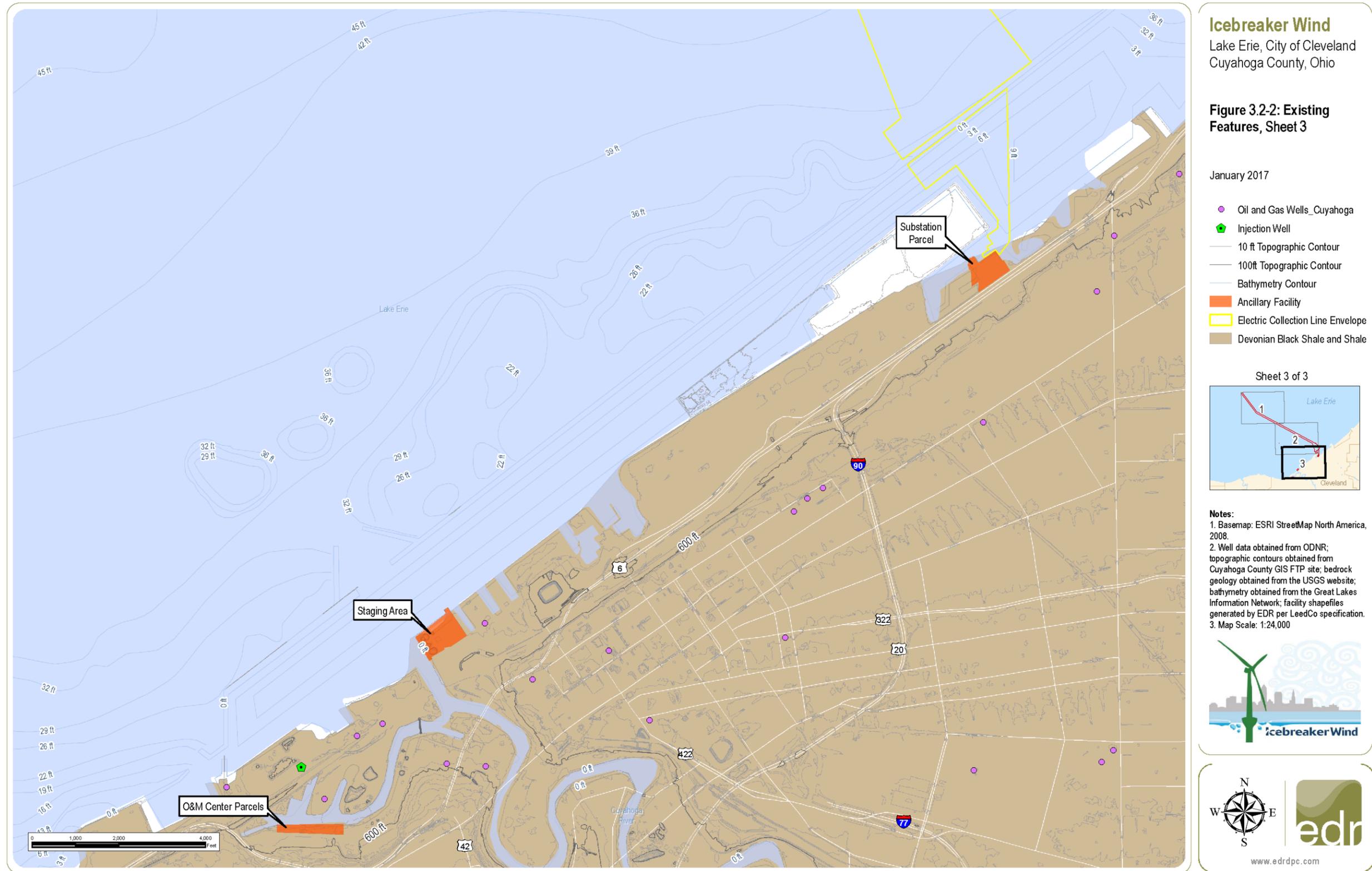


Figure 3.2-2. Existing Features, Sheet 3

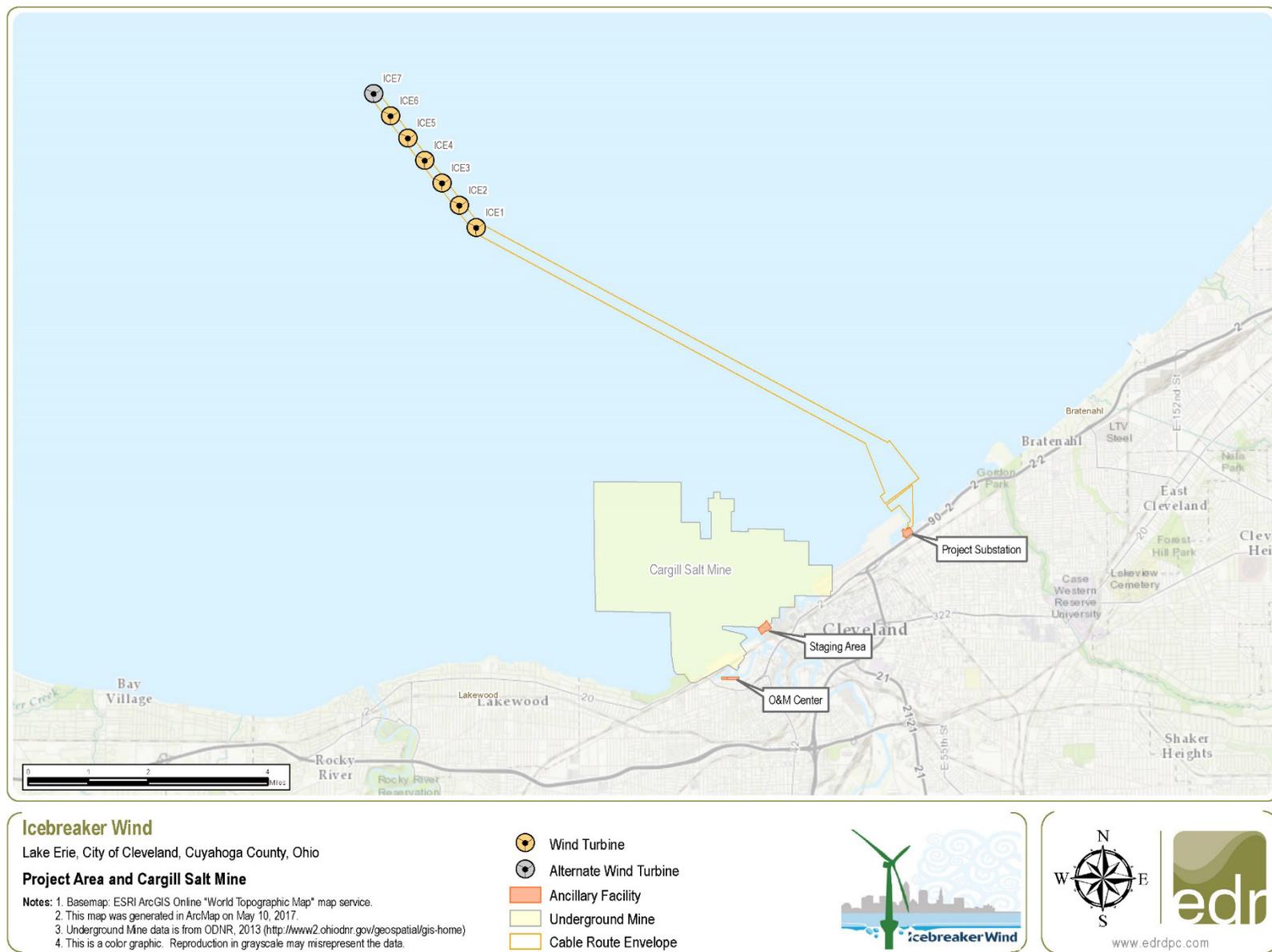


Figure 3.2-3. Location of Cargill Salt Mine in Relation to Proposed Project

### ***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. The codes provide design standards for buildings and infrastructure such as highways, bridges, and utilities. The higher the seismic hazard value is, the greater the potential hazard. The seismic hazard in the Proposed Project Area is low.

#### **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.

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***

###### **Mono Bucket Foundations**

The MB foundation would require no 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 75 cubic meters (2,649 cubic feet). 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.

Additionally, 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). 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. 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 DP vessel is used to perform the foundation heavy lift operations, there would be no direct impact to the lakebed because DP 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-foot wide. During installation of the cable, bottom sediment would become suspended within the water column; however, the impact would be 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.

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 be anticipated to 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, the salt mine, or seismicity that would result from operations and maintenance activities associated with the Proposed Project.

#### ***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.

The export cable and inter-array cables would remain buried and therefore 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 minimal 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 and 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. 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<sup>6</sup>, 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, 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,

---

<sup>6</sup> 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.

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). 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.

### **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

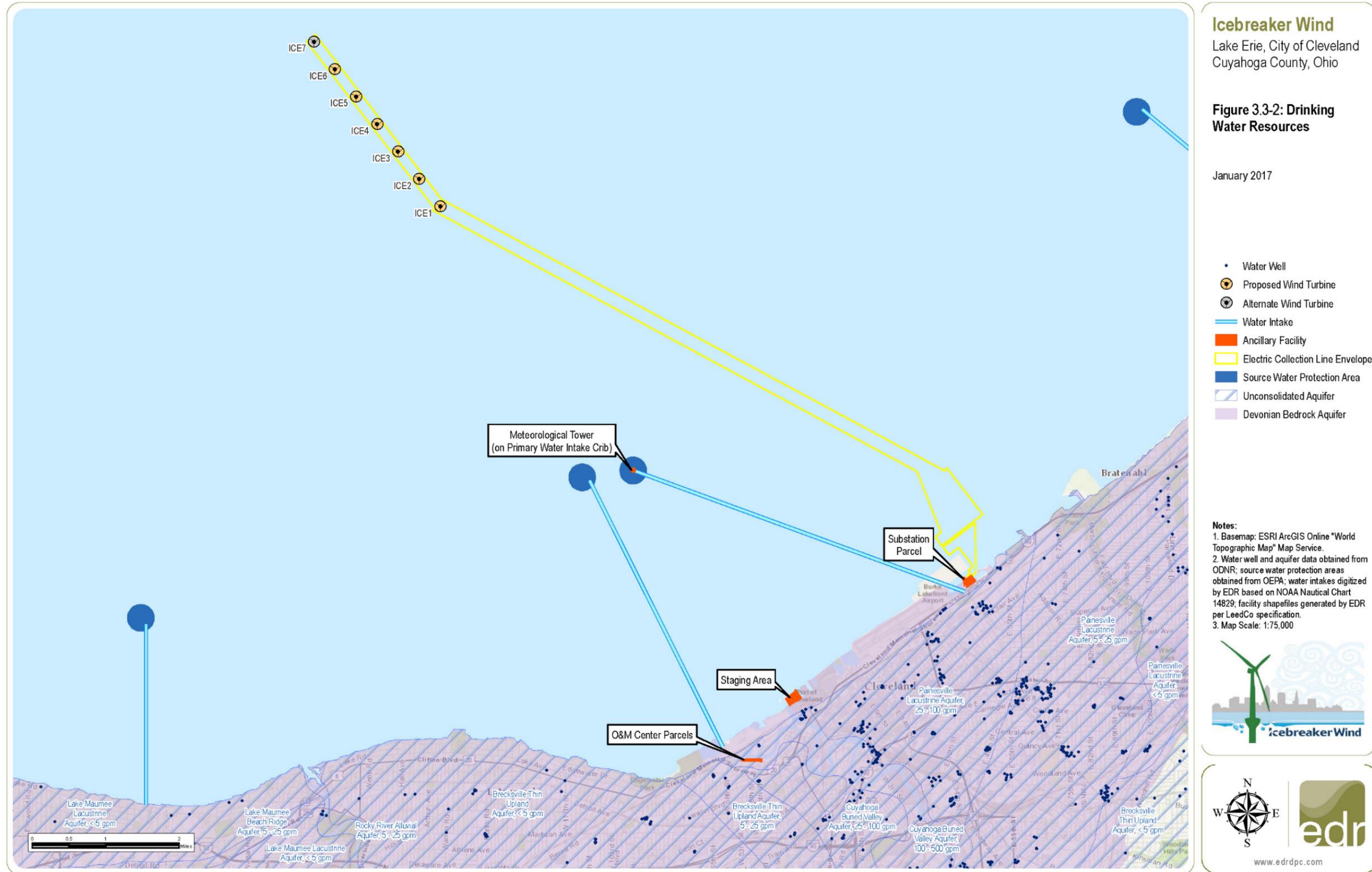


Figure 3.3-2. Drinking Water Resources

### 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.

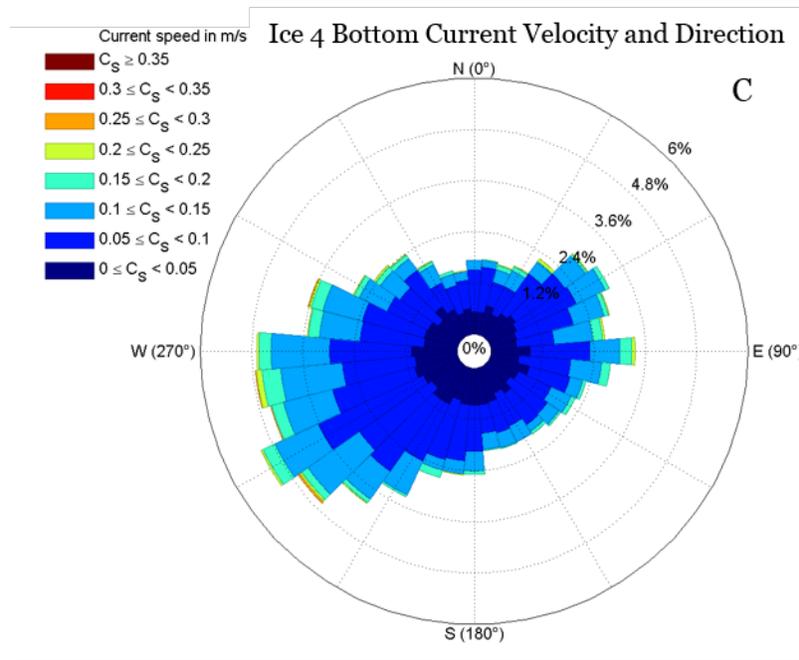
Installation of the submerged electric cables (inter-array and export) would result in short-term, localized sediment suspension. Sediments would be disturbed along the approximately 12-mile length of the inter-array and export cables. Data from a similar project in Lake Erie and site-specific data were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

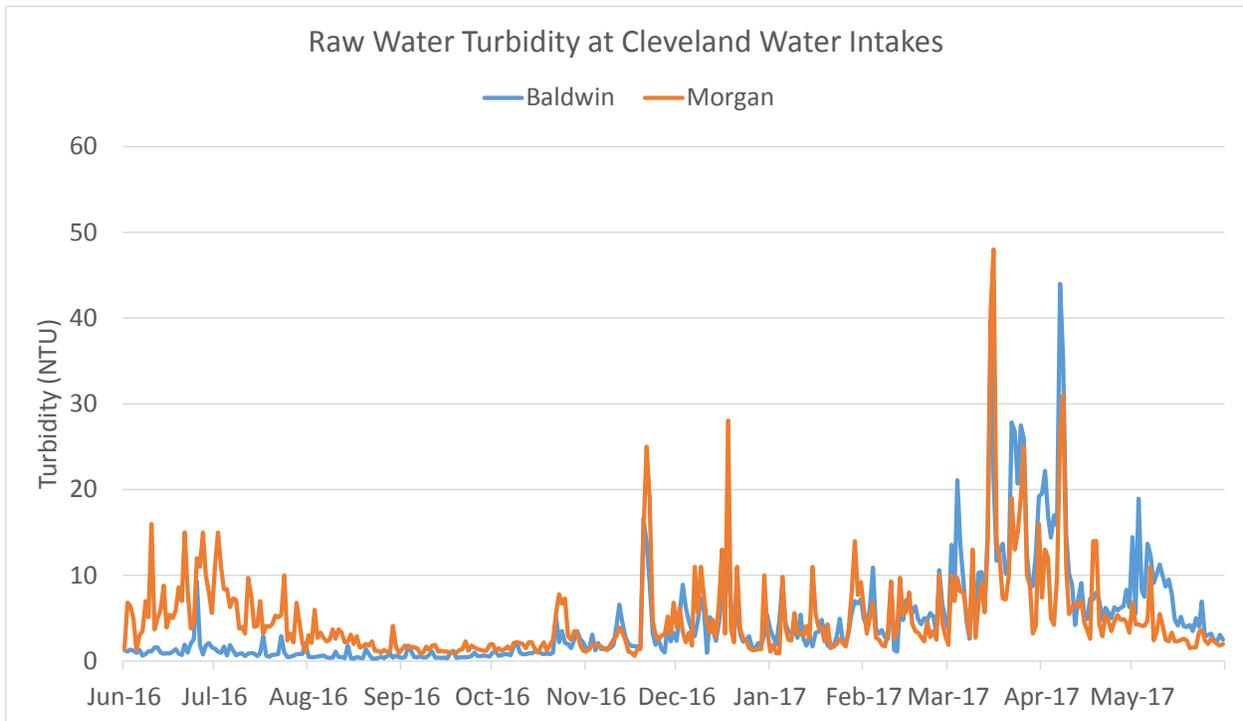
**Figure 3.3-3. 2016 Lake Bottom Current Velocity and Direction at ICE4**

Ice scouring during winter months frequently creates large cuts and scars in the sediment bed that disturb sediment and displace aquatic life (USACE, 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**

Additional sources of significant turbidity increases in Lake Erie are 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 cable during the summer would also lower transport distances of re-suspended sediments as 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 3.2.1.1, 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*. Results from this evaluation indicate that existing sediment quality at these four locations would pose a low potential for toxicity to aquatic receptors. 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 are expected to be temporary, 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 2.7 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 would be prepared to address the potential risk of an inadvertent release of drilling fluids (refer to Section 2.7.4 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 little 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). In the extremely rare incident of failure of all three containment systems, any fluid that may leak into the environment would be inherently biodegradable. Most maintenance would occur inside the turbines, thereby reducing the risk of a spill, and no oils or other waste would be discharged during service events. 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 is expected to be negligible.

As with vessels associated with construction, any vessels used for operations and maintenance activities (approximately one per week) would comply with USCG regulations and applicable SPCC plans; therefore, potential impacts from spills are unlikely.

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 are expected to 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 minor and short-term.

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. As shown in Section 2.2.4, the project cables would not use any insulating fluids that could migrate into the water column.

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 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. Discussions with Cleveland Water indicate 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 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. 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). These precautions and mitigation measures would greatly 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 are expected from these activities.

#### *Operations and Maintenance*

The operation of the Proposed Project is not anticipated to impact public water supplies. 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, impacts to water supply during decommissioning would not be anticipated.

### **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. 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 and once in October 2016. All benthos collected in May 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 fell into the same three groups, though a few crustaceans and nematodes (roundworms) were also collected in October. The densities of benthos were relatively consistent across the three sampling locations during the May and October 2016 sampling events. Detailed results of the site-specific benthic sampling can be found in Appendix E.

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 would be located within the Lake Erie Dead Zone and therefore offer poor habitat for macroinvertebrates. The Lake Erie Dead Zone (a large hypoxic zone) 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).

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 there is minimal fish activity because of hypoxic (low DO) conditions that are reached in the late summer. The ODNR fish habitat analysis indicated that as well as being in the Dead Zone, 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. 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.

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 I.

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 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 Migratory Bird Treaty Act (16 USC 703-712) which prohibits taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the DOI. The Proposed Project would be located between 8 to 10 miles off the coast of Cleveland, a location that provides minimal or negligible habitat for anything other than migratory transit. Significant numbers of birds do 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 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. This area was selected as an IBA primarily because of the large concentration of red-breasted mergansers and other migratory water birds that use the Lake 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 Bald and Golden Eagle Protection Act (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*

Previously completed and ongoing surveys were reviewed 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.

A region-wide analysis of next-generation radar (NEXRAD) was conducted to study nocturnal bird migration patterns for the entirety of spring and fall migratory periods. The central Lake Erie basin 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 strengthened 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 survey 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 survey indicated that bird abundance drops rapidly at distances 2 miles (year 1) and 5 to 7 miles (year 2) from the Lake Erie shoreline and was negligible (year 1) or minimal (year 2) at distances between 8 and 10 miles from shore, where the turbines 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).

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

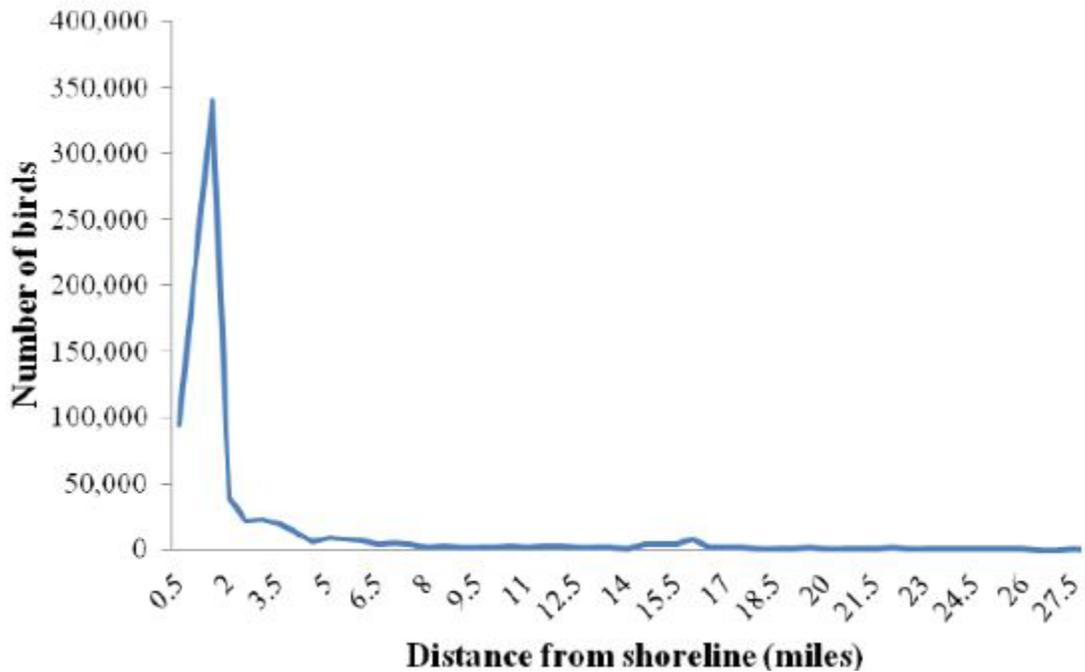
#### ***Raptors and Eagles***

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). 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).

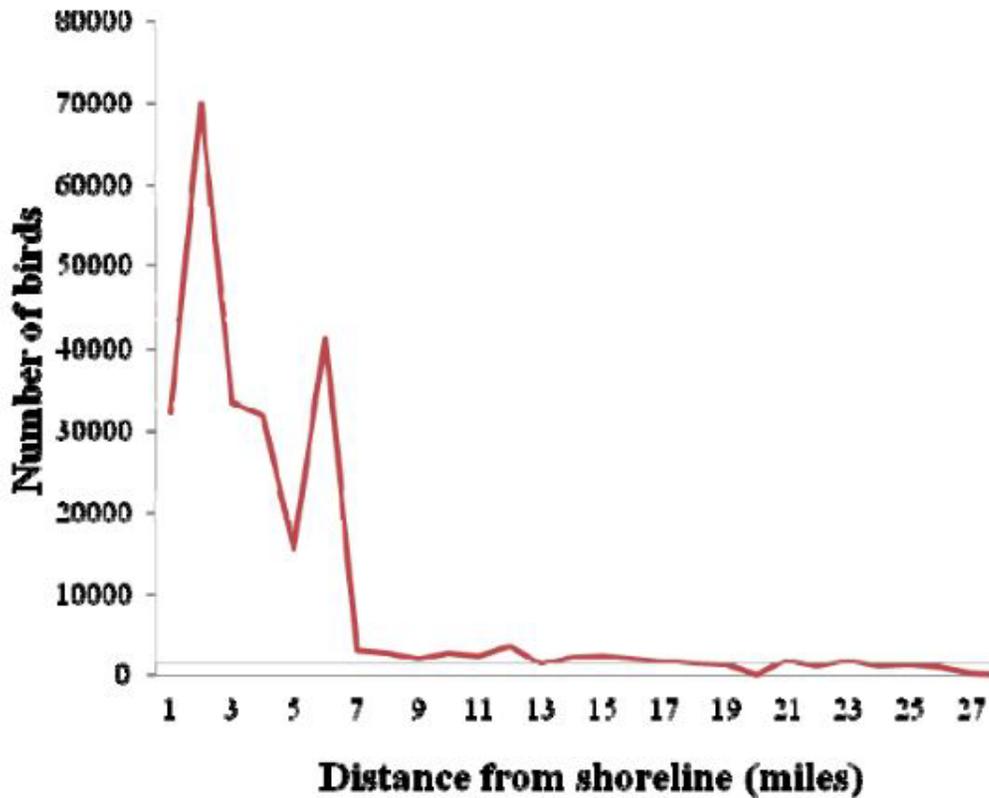
Although bald eagles and osprey (*Pandion haliaetus*) both regularly forage over water for fish, these species are typically restricted to areas within several miles of shore (Buehler, 2000; Poole et al., 2016). This general pattern was evidenced specifically for the proposed turbine sites and vicinity 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 of 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

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). Several recent studies employing marine radar in shoreline environments have demonstrated relatively high densities of nocturnal migrant birds along the shorelines of Lake Erie and Lake Ontario, reinforcing the understanding that such migrants tend to concentrate along coastlines and avoid flying over large water bodies, such as Lake Erie, if possible (Rathbun et al., 2016; Horton et al., 2016). 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, it is worth noting that migration intensity was more than 7 times higher over eastern Lake Erie than over the Proposed Project Area in central Lake Erie (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). 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 provides a more detailed discussion of protected species). These bats are known to migrate long distances, 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.

#### **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. On December 14, 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. After the status reviews, the USFWS was told to issue 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 of 10 to 15 feet, 12 to 45 feet, 20 to 30 feet, 20 to 60 feet, and 60 to 100 feet above the water. Many observers also noted that monarchs appear to continue their migration with northerly winds but may roost along the shoreline if strong southerly winds and/or storm fronts are present (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
<b>Birds</b>			
Kirtland’s Warbler	<i>Setophaga kirtlandii</i>	Endangered	None
Piping Plover	<i>Charadrius melodus</i>	Endangered	None
Red Knot	<i>Calidris canutus rufa</i>	Threatened	None
<b>Mammals</b>			
Indiana Bat	<i>Myotis sodalis</i>	Endangered	None
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Threatened	None

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

**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%
<b>Total</b>	<b>281,977</b>	<b>308,352</b>	<b>300,699</b>	<b>257,748</b>	<b>243,401</b>	<b>-5.6%</b>
<b>Range-wide Total</b>	<b>612,337</b>	<b>628,234</b>	<b>610,512</b>	<b>550,224</b>	<b>530,705</b>	<b>-3.5%</b>

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,  $\geq 10,000$  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).

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 in the Action 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.

#### ***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). 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 <sup>1</sup>
<b>Plants</b>			
<i>Calopogon tuberosus</i>	grass-pink	wet areas	T
<i>Carex louisianica</i>	Louisiana sedge	forested swamps	E
<i>Cyperus schweinitzii</i>	Schweinitz's umbrella-sedge	sandy areas	T
<i>Cypripedium reginae</i>	showy lady’s-slipper	wet areas	T
<i>Elymus trachycaulus</i>	bearded wheat grass	variety	T
<i>Epilobium strictum</i>	simple willow-herb	wet areas	T
<i>Hieracium umbellatum</i>	Canada hawkweed	dry, sandy areas	T
<i>Juncus platyphyllus</i>	flat-leaved rush	various open	E
<i>Juniperus communis</i>	ground juniper	various open	E
<i>Melampyrum lineare</i>	cow-wheat	variety	T
<i>Monarda punctata</i>	dotted horsemint	dry, sandy areas	E
<i>Oryzopsis asperifolia</i>	large-leaved mountain-rice	well-drained areas	E

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

<b>Species Name</b>	<b>Common Name</b>	<b>Habitat</b>	<b>State Status<sup>1</sup></b>
<i>Plagiothecium latebricola</i>	lurking leskea	swamps, marshy areas	T
<i>Sisyrinchium montanum</i>	northern blue-eyed grass	wet areas	T
<i>Solidago puberula</i>	dusty goldenrod	dry areas	E
<i>Solidago squarrosa</i>	leafy goldenrod	rocky woods, thickets	T
<i>Viburnum alnifolium</i>	hobblebush	moist woods	T
<b>Insects</b>			
<i>Chimarra socia</i>	a black caddisfly	High velocity water	E
<i>Euphyes bimacula</i>	two-spotted skipper	wetlands	SC
<i>Speyeria idalia</i>	regal fritillary	prairies	E
<i>Tricholita notata</i>	marked noctuid	prairies	E
<b>Aquatic Invertebrates</b>			
<i>Alasmidonta marginata</i>	elktoe	streams, small/medium rivers	SC
<i>Lasmigona compressa</i>	creek heelsplitter	creeks, small rivers	SC
<i>Ligumia recta</i>	black sandshell	medium/large rivers	T
<i>Orconectes propinquus</i>	Great Lakes crayfish	rapidly running streams	SC
<i>Orconectes virilis</i>	northern crayfish	rocky streams	SC
<i>Ptychobranhus fasciolaris</i>	kidneyshell	medium/large rivers	SC
<b>Fish</b>			
<i>Notropis dorsalis</i>	bigmouth shiner	stream pools, sandy substrates	T
<i>Percina copelandi</i>	channel darter	shorelines	T
<i>Rhinichthys cataractae</i>	longnose dace	rocky streams/shorelines	SC
<i>Salvelinus namaycush</i>	lake trout	deep water basin	SC
<b>Reptiles and Amphibians</b>			
<i>Clemmys guttata</i>	spotted turtle	wetlands	T
<i>Emydoidea blandingii</i>	Blanding's turtle	wetlands	T
<i>Hemidactylium scutatum</i>	four-toed salamander	wetlands	SC
<b>Birds</b>			

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

Species Name	Common Name	Habitat	State Status <sup>1</sup>
<i>Accipiter striatus</i>	sharp-shinned hawk	woodlands	SC
<i>Charadius melodus</i>	piping plover	migrant	E <sup>2</sup>
<i>Setophaga kirtlandii</i>	Kirtland's warbler	migrant	E <sup>2</sup>
<i>Dolichonyx oryzivorus</i>	bobolink	grasslands, prairies, pastures	SC
<i>Falco peregrinus</i>	peregrine falcon	variety	T
<i>Gallinula chloropus</i>	common moorhen	marshes	SC
<i>Rallus limicola</i>	Virginia rail	marshes	SC
<i>Sphyrapicus varius</i>	yellow-bellied sapsucker	wet, deciduous forests	SC
<b>Mammals</b>			
<i>Condylura cristata</i>	star-nosed mole	near lakes or streams	SC
<i>Eptesicus fuscus</i>	big brown bat	woodlands	SC
<i>Lasionycteris noctivagans</i>	silver-haired bat	woodlands	SC
<i>Lasiurus borealis</i>	red bat	woodlands	SC
<i>Lasiurus cinereus</i>	hoary bat	woodlands	SC
<i>Microtus pinetorum</i>	woodland vole	woodlands	SC
<i>Mustela erminea</i>	ermine	variety	SC
<i>Myotis lucifugus</i>	little brown bat	woodlands	SC
<i>Myotis septentrionalis</i>	northern long-eared bat	woodlands	SC
<i>Myotis sodalis</i>	Indiana bat	woodlands	E
<i>Napaeozapus insignis</i>	woodland jumping mouse	brushy areas near water	SC
<i>Peromyscus maniculatus</i>	deer mouse	variety	SC
<i>Sorex fumeus</i>	smoky shrew	birch and hemlock forests	SC
<i>Synaptomys cooperi</i>	southern bog lemming	low damp bogs and meadows	SC
<i>Taxidea taxus</i>	badger	variety	SC
<i>Ursus americanus</i>	black bear	woodlands	E

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

<sup>1</sup> 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.

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 less than 0.1 acre of substrate habitat associated with the legs 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 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 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 0.3 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). These mussels can cause significant biofouling of structures. Depending on depth, the quagga mussel may be increasingly significant to 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), 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 ( $\mu\text{T}$ ). The level of the naturally occurring magnetic field from the earth is around 50  $\mu\text{T}$ , 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  $\mu\text{T}$  and average 7.8  $\mu\text{T}$ . More details on the comparison study can be found in the LimnoTech Report (Appendix E). 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 less than 0.1 acre associated with the legs 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).

##### ***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 are expected to 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.

##### ***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  $\mu$ T, 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 a significant 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 ( $\mu\text{Pa}$ ) at 1 meter (3.3 feet), a small boat outboard engine (at 20 knots) will produce a source level of 160 dB re 1  $\mu\text{Pa}$  at 1 meter (3.3 feet), and an operating wind

turbine will produce a source level of 151 dB re 1  $\mu$ Pa at 1 meter (3.3 feet)<sup>7</sup> (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 are not anticipated to 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. However, because Lake Erie experiences frequent boat traffic from commercial shipping and fishing and recreation, no significant additional underwater noise impacts would be anticipated 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 are expected to 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**

An avian and bat risk analysis was prepared by WEST in 2016 to identify the relevant ecological resources in and around the Proposed Project Area and evaluate the level of risk to birds and bats posed by the Proposed Project. WEST reviewed and summarized baseline data and other publicly available data on bird and bat use including post-construction monitoring results of other offshore wind energy facilities and land-based wind energy facilities in the region, as well as other information about the Proposed Project's environment, for the purpose of evaluating the level of risk posed by the Proposed Project to birds and bats. The WEST report is provided as Appendix L.

#### *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 at abundances that can be considered above negligible or occasional in the vicinity

---

<sup>7</sup> Hydrophones measure sound pressure, normally expressed in units of  $\mu$ Pa. 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  $\mu$ Pa at 1 meter) was selected to match human hearing sensitivity. A different reference level is used for underwater sound (1  $\mu$ Pa at 1 meter). Because of these differences in reference standards, noise levels cited in air do NOT equal underwater levels.

of the Proposed Project Area. By contrast, the ODNR survey effort documented markedly higher bird species richness and abundance closer to shore. 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 such low abundance, statistically significant displacement effects would be difficult to detect and would not be expected to 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). Therefore, the potential for adverse effects from avoidance behavior during construction is likely 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. 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 the 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 do have the potential to generate both behavioral avoidance and attraction effects in some groups of birds or bats. Although the passage rates of migrating birds through the area of the proposed turbines are expected to be lower than on land, along the shore of Lake Erie, or in near-shore waters, some migrating birds and bats from a variety of taxa are likely to migrate through the Proposed Project Area regularly. After construction, some migrating birds and bats may detect the presence of the wind turbines and fly around them. 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). Therefore, the potential for adverse effects from avoidance behavior is likely negligible.

Other birds and bats flying in the vicinity may be attracted to the proposed wind turbines and platforms as structures to perch or roost. This 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. 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. This attraction effect 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).

### ***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 proposed wind turbines are not likely to generate population-level effects for any species. These conclusions are based primarily on the low use of offshore environments within the central Lake Erie basin by birds and bats, as well as the small size of the Proposed Project, and are also influenced by known patterns of taxon-specific collision susceptibility, behavioral and morphological factors, and species' geographic ranges (Appendix L). As seen in the following discussion, the collision risks for the categories of birds and bats that may use the Proposed Project area are low. As such, the potential impacts to birds and bats would be considered minor.

### **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). Therefore, collision risk would be unlikely for migrating eagles and other raptors. 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, even 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). 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. As a group, nocturnally migrating songbirds and similar birds exhibit low general susceptibility to collisions with wind turbines based on land-based wind energy facilities bird fatality studies. 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).

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. 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.

WEST's report (Appendix L) compared studies conducted at operational, land-based wind energy facilities with 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, which the Proposed Project would not include. Therefore, using the total bird fatality rates for predicting nocturnal migrant songbird fatality rates at the Proposed Project would likely 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 21 to 42 total bird fatalities per year for the Proposed Project.

Based on the preference for migrating along shorelines and nocturnal migrant birds lack of attraction to flashing red lights, and also the size of the Proposed Project, the overall collision risk for nocturnally migrating songbirds and similar birds would be low, and unlikely to have population-level impact on any species of nocturnal migrant birds (Appendix L).

#### 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 density 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, the overall risk of collision for waterfowl and waterbirds from the Proposed Project would be considered low.

#### Bats

Bat use of the airspace around the proposed turbines is expected to be largely limited to migratory transit (Appendix L). 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 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. However, the baseline information on bat abundance in the offshore environment of the central Lake Erie basin can be compared with publicly available, bias-corrected bat fatality rates for land-based wind energy facilities in the Great Lakes region.

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).

WEST (2016) applied such comparisons to make rough, quantitative predictions of the Proposed Project’s collision fatality rates for bats. Such comparisons indicate that bat fatality rates would most likely be on the order of one to four bats per MW per year, which would lead to roughly 21 to 83 total bat fatalities per year for the Proposed Project. WEST noted that bat fatality rates could be as high as 20 to 30 bats per MW per year if there is a substantial behavioral attraction effect, but the small size of the Proposed Project limits the magnitude of this risk to a moderate level in relation to other regional wind energy facilities, even under this worst-case scenario.

Overall, long-term adverse impacts to bats from operations and maintenance of the Proposed Project would be minor.

### *Decommissioning*

Adverse impacts to bird and bat species associated with decommissioning activities are expected to be minimal 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.

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 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 flight heights of the migrating monarch butterfly, and limited time in which the monarch butterfly migrates through the area, adverse impacts during operation and maintenance are expected to 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 are anticipated to 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 has been prepared for the purpose of the ESA Section 7 consultation with USFWS. This consultation is in progress to review and determine to what extent, if any, the Proposed Project would affect the federally listed threatened and endangered species discussed in Section 3.4.1.5.

WEST completed a bird and bat risk analysis for the Proposed Project (Appendix L) which is discussed in more detail in Section 3.4.2.3 Birds and Bats.

### *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.

#### ***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).

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.

## **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, and the former CPP site as a Brownfield property (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.

### *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's project partner, Fred. Olsen Windcarrier, and outlined in its parent company, Fred. Olsen Ocean's 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 Proposed 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 short-term and minor during construction.

### **3.5.2.2 Operation and Maintenance**

#### *Waste Management*

For the most part, 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.

### *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.

### *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 (Appendix 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 would be long-term and minor during operation and maintenance.

### **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.

### *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.

### *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 short-term and minor during decommissioning.

### **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. 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 *Division of Air Pollution Control 2013 Annual Report* (OEPA, 2014b). Included in that report is a summary of 2013 air quality data, a discussion of toxics monitoring projects, and trend studies for selected pollutants. Pollutants monitored over 13 monitoring sites in Cuyahoga County include carbon monoxide, particulate matter (2.5 micron, 2.5 micron continuous, and 2.5-micron speciation), total suspended particulate, nitrogen dioxide, ozone, lead, and sulfur dioxide. There were violations of National Ambient Air Quality Standards (NAAQS) reported at monitoring stations in Cuyahoga County for 2.5-micron particulate matter (3-year average of annual average), ozone (4th highest 8-hour concentration), and lead (highest 3-month concentration) (OEPA, 2014b).

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, 2014c).

#### *General Conformity*

The Clean Air Act (CAA), as amended in 1990, requires the EPA to set 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 (2014b), violations of NAAQS were reported for 2.5-micron particulate matter (3-year average of annual average), ozone (4th highest 8-hour concentration), and lead (highest 3-month concentration).

The 1990 CAA amendments prohibit federal entities from taking actions in nonattainment and maintenance areas that do not conform to 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<sub>x</sub>) 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<sub>x</sub>. 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. Emissions Estimates by Engine Type as a Percentage of 2014 Cuyahoga County Annual Totals in 2014**

Vessel/ Vehicle Type		Large lift crane barge	Large lift crane barge	Material supply barge	Tow tug	Crew boat	Inspection boat	Heavy lift vessel	Generators	Totals
Emissions (tons per year) Total	CO <sub>2</sub>	1,019.661	1,113.600	0.000	14,683.115	2,141.288	2,141.288	7,647.456	6,681.600	35428
	CO	1.736	5.280	0.000	24.999	3.646	3.646	13.020	31.680	84
	NO <sub>2</sub>	20.833	23.040	0.000	299.989	43.748	43.748	156.244	138.240	726
	SO <sub>2</sub>	6.266	7.766	0.000	90.224	1.326	1.326	46.992	46.598	200
	VOC	0.789	0.616	0.000	11.363	1.657	1.657	5.918	3.695	26
	PM	0.742	0.672	0.000	10.681	0.630	0.630	5.563	4.032	23

Source: EPA, 2017b

*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**

The Proposed Project would be located in an area that reported violations to NAAQS. Therefore, it would be within a designated nonattainment area. LEEDCo 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 dioxide, particulate matter, volatile organic compounds, and NO<sub>x</sub> were estimated to be less than the EPA de minimis threshold values. Furthermore, as shown in Table 3.6-2, the estimated offshore emissions of air pollutants during construction and operation of the Proposed Project would be 1 percent or less than the 2014 emission totals for Cuyahoga County (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. Because of this, the potential impacts to air quality from the Proposed Project would be negligible.

**Table 3.6-2. Total Emissions of Criteria and Greenhouse Gas Pollutants for Cuyahoga County, Ohio in 2014**

	<b>Cuyahoga County 2014 Annual Total Emissions (Tons)</b>	<b>Project Icebreaker Construction Emissions (Tons/Year)</b>	<b>Cuyahoga County 2014 Annual Total Emissions (Tons)</b>	<b>Percent Emissions from Project Icebreaker towards Total Emissions for Cuyahoga County in 2014</b>
<b><i>Criteria Pollutants</i></b>				
Nitrogen Oxides (NO <sub>x</sub> )	457,982.71	726	457,982.71	<b>0.158%</b>
Volatile Organic Compounds (VOCs)	668,528.65	26	668,528.65	<b>0.004%</b>
Sulfur Dioxide (SO <sub>2</sub> )	377,375.78	200	377,375.78	<b>0.053%</b>
Carbon Monoxide (CO)	2,011,156.20	84	2,011,156.20	<b>0.004%</b>

**Table 3.6-2. Total Emissions of Criteria and Greenhouse Gas Pollutants for Cuyahoga County, Ohio in 2014**

	<b>Cuyahoga County 2014 Annual Total Emissions (Tons)</b>	<b>Project Icebreaker Construction Emissions (Tons/Year)</b>	<b>Cuyahoga County 2014 Annual Total Emissions (Tons)</b>	<b>Percent Emissions from Project Icebreaker towards Total Emissions for Cuyahoga County in 2014</b>
Primary PM, Filterable and Condensable Portions (All Less than 1 Micron) (PE)	658,030.10	23	658,030.10	<b>0.003%</b>
Lead (Pb)	32.21			
<b><i>Greenhouse Gas Pollutants</i></b>				
Carbon Dioxide (CO <sub>2</sub> )	73,976,902.87	35,428	73,976,902.87	<b>0.048%</b>

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. 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*

The Proposed Project would be constructed between 2018 and 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. Ice load data were investigated using multiple approaches, and are 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 final ice analysis reviewed all previous calculations and data to confirm that the Proposed Project foundation design would meet design requirements 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. 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. 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 R).

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 (Appendix E) 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, 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 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).

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 plenty of 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 at 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 is not expected to have an impact on commercial ferry traffic or recreational sailing events during operation.

Overall, the anticipated 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. 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, 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, effects from potential vessel avoidance of turbines are not anticipated.

***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 are anticipated to 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 are anticipated to 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 are anticipated to 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 described in Appendix R 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. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

## **3.10 Cultural Resources**

### **3.10.1 Affected Environment**

The Proposed Project's review of cultural resources included archaeological resources and historic-architectural resources. Archaeological resources have the potential to be directly impacted through 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 (including wind turbines) would be visible and where there is a potential for a significant visual effect (a change in a historic property's visual setting). 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 National Historic Preservation Act of 1966 (NHPA) requirements (Appendix T).

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 (Appendices T and U). 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 maintains a record of vessel losses and obstructions to shipping, AWOIS. 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 with the Ohio Historic Preservation Office 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 APE for direct effects. Though four shipwrecks are located within 3.5 nautical miles of the APE for direct effects, no shipwrecks from the Ohio Sea Grant Shipwreck map, Cleveland Underwater Explorers Shipwreck Database, or Cleveland Underwater Explorers Historical Lake Erie Nautical chart collection are present within the APE for direct effects (Appendix T).

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 (Appendix T). 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, and the APE for indirect effects are discussed in Section 3.11.

### **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 and concluded that the Proposed Project was unlikely to impact significant archaeological resources. No further investigation nor need for mitigation was recommended (Appendices T and U). The Proposed Project would have no impact on lake-based cultural resources through construction, operations, maintenance, or decommissioning activities.

#### **3.10.2.2 Land-Based Cultural Resources**

There would be no impact, over the short- or long-term, to land-based archaeological resources that would result from construction, operations, maintenance, or decommissioning activities associated with the Proposed Project. Construction of the Proposed Project would not require the demolition or physical alteration of any buildings or other potential historic-architectural resources or properties; therefore, no direct physical effects to historic-architectural resources would occur as a result of the Proposed Project. 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. 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.

In Gray & Pape's literature review and analysis of historic properties for the Proposed Project (Appendix S), the report included preliminary recommendations regarding the extent of the APE for indirect effects and noted that because of the nature of a wind project sited along open water, it is challenging to determine precisely where visual impacts would occur from the lack of obstructions. Therefore, it was recommended that the APE for indirect effects include the area parallel to the shoreline for 29.6 miles on either side of the Proposed Project Area to ensure that navigation markers, lights, and traditional use areas within the lake that might have a view of the turbines are included. Because of the amount of development along the lake shore, views of the lake are fragmentary or non-existent beyond the first road south of the lake shore. Accordingly, the APE for indirect effects along the shore has been limited to the area immediately adjacent to the lake, as bounded by easily identifiable roads.

The report also noted that the APE for indirect effects should be "limited to areas where the Proposed Project can affect the characteristics of a historic property qualifying it for inclusion in or eligibility for the [NRHP]" (Appendix S). Therefore, the APE for indirect effects is not based solely on potential visibility of the Proposed Project, but also on the distance within which visibility of the Proposed Project could result in a significant effect on the visual setting of a given historic property. Previous visual studies have shown that significant visual effects of land-based wind power projects are generally concentrated within 3.5 miles of a project site (Eyre, 1995; Bishop, 2002). Based on viewer reaction to simulations of turbines at various distances (albeit substantially smaller turbines than those proposed for the Proposed Project), Bishop (2002) concluded that, in the absence of atmospheric reduction in contrast, turbine detection or recognition occurred for only about 5 percent of people at a distance of 18.6 miles and just 10 percent at 12.4 miles. Most of the reduction in turbine detection rates occurred between 5.0 and 7.4 miles in clear conditions and between 4.3 and 5.6 miles in light haze. Guidance for offshore wind projects in the United Kingdom suggests visual effects will be minor at distances over 15 miles, and that 22 miles generally represents the limit of visual impact (Enviros Consulting, 2005). A recent study concluded that offshore wind facilities were judged to be a major focus of visual attention at distances up to 10 miles; were noticeable to casual observers at distances of almost 18 miles; and were visible with extended or concentrated viewing at distances beyond 25 miles (Sullivan et al., 2013).

A Visual Impact Assessment (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). 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 VIA evaluated a 10-mile radius study area. Therefore, based on the recommendations in Chapter 4906-4-08(D)(4) of the OAC, the findings in the VIA, and supported by the findings of recent studies regarding the visibility and visual effect of offshore wind turbines (Sullivan et al., 2013), 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.

The records review completed by Gray & Pape (Appendix S) documented the following previously identified historic and cultural resources that would potentially experience indirect (visual) effects from the Proposed Project. The review area was 1 mile from the coast of Lake Erie, purposefully large to include any adjacent significant properties and potential alteration of the APE, if needed.

- 39 sites individually listed in the NRHP, including one National Historic Landmark (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 and districts listed in the NRHP (including the USS Cod submarine NHL) and 186 properties included in the OHI. Additional information about these resources can be found in Appendix S.

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).

### 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 including a viewshed analysis and field verification with visual simulations for the Proposed Project was completed by EDR (Appendix U). The results of this analysis are summarized as follows.

#### *Visual Impact Assessment*

As described in more detail in Appendix V, 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).

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).

*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. 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).

*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.

*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.

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.

Cultural resources with greater than 50 percent wind turbine visibility would include Cleveland East and West Pierhead Lights (NRHP-listed and OHI), the USS Cod (NRHP-listed, NHL, OHI), Federal Knitting Mills (NRHP-listed), Main Avenue Bridge (NRHP-eligible), East 9th Street Pier (OHI), Buckeye Insulation (OHI), Burke Lakefront Airport (OHI), Bridges and Docks Office (Formerly Harbor Masters House; OHI), AB Bartoszewicz Block Building (Formerly A&P Grocery Building; OHI), Advanced OMS&S Co Building, Burke Lakefront Service Company Hangar (OHI), and Mall “C” Park (OHI). No Designated Cleveland Landmarks are anticipated to have greater than 50 percent Proposed Project visibility.

Full size images of all the simulations included in the VIA are included in Appendix U. The simulations that best represent the potential visual effect on historic resources or properties include the simulations from Viewpoints 7, 17, 19, and 52 included as Figures 3.11-1 to 3.11-4 with an evaluation of the Proposed Project’s potential visual effect at each of these locations, as presented in the VIA (Appendix U).

Viewpoint 7 (Figure 3.11-1) would be located approximately 8.4 miles from the nearest turbine and would be the view from the USS Cod submarine, which is an NRHP-listed site, a NHL, and included in the OHI. Viewpoint 52 (Figure 3.11-2) would be 8.1 miles from the nearest turbine, and would be the view from USCG Cleveland Harbor Station, which is an NRHP-listed site, a Designated Cleveland Landmark, and an OHI site. Viewpoint 52 also includes the Cleveland East and West Pierhead Light, which are also listed on the NRHP and OHI. These sites are examples of historic resources that are associated with maritime themes, where the maritime setting (including views of the lake) contribute to the significance of the property. The VIA states that in the simulations of the proposed wind turbines from these viewpoints the wind turbines would be less of a focus in the view when compared to viewpoints from less developed locations, because the turbines appear relatively compact, and would be viewed in the context of other existing offshore features. The presence of existing built features in a view generally reduces the contrast presented by the Proposed Project, especially when the Proposed Project would be viewed at distances at excess of 8 miles as it would be from these two viewpoints. When viewed at these distances, the turbines would not appear out of scale with other built features in the view. In addition, the limited number of turbines, their clean, delicate lines, and their orderly arrangement would not significantly increase visual clutter, or decrease scenic quality. Additionally, under more overcast sky conditions, turbine visibility, color contrast, and competition as a focal point in these types of views would be further reduced (Appendix V).

Viewpoint 19 (Figure 3.11-3) would be located approximately 8.2 miles from the nearest turbine and would be the view from Bicentennial Park, which is adjacent to the East 9th Street Pier OHI site. Viewpoint 19 is classified as a “Developed Shoreline View” in the VIA, which is defined as a public vantage point in open space settings with some level of shoreline development in the immediate foreground. The VIA states that, from this location, the proposed wind turbines would add a relatively minor new developed feature to the existing views. Even though the turbines would be very large structures, when viewed at a distance of 7.5 miles they would appear relatively small compared to the other developed features along the shoreline and in the near-shore area. The turbines would interrupt the skyline and would be unexpected in an offshore setting. As such, the turbines would be a focal point in the view, but would also compete with other on shore and offshore features for viewer attention. Because they are viewed in the context of other developed features, their land use contrast and effect on scenic quality would be minimal. Due to their distant offshore setting, and the presence of competing features and activities occurring along the developed shoreline, the presence of the turbines should not adversely affect viewer activity or enjoyment of the view (Appendix V).



**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.**

Viewpoint 17 (Figure 3.11-4) would be located approximately 8.5 miles from the nearest turbine and 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).

In general, the VIA states that the Proposed Project’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. However, 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.



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

Additionally, visual setting 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 and/or association with a specific architect, builder, or style, and because they retain their overall integrity of design and materials. The visual setting for these properties – typically a developed urban neighborhood – often includes features from a variety of time periods (including modern features). While the setting provides context for these properties, it is not a prominent consideration in determinations of significance. In general, these properties would retain the characteristics that caused them to be recommended eligible after the introduction of modern features such as wind turbines into their visual settings. For these types of resources, the potential change in the setting resulting from the Proposed Project would not necessarily result in diminished public enjoyment and appreciation of a given historic property, or impair its character or quality (Appendix V).

As described previously, because of the screening effect of buildings and vegetation within the City of Cleveland, areas with potential visibility of the Proposed Project are generally restricted to areas along the Lake Erie waterfront. Many of the historic resources within the APE for indirect effects, such as the USS Cod and USCG Cleveland Harbor Station, are located on the waterfront because of their association with maritime activities, and the lake is therefore a significant feature in the visual setting for those properties. As noted in the VIA for the Proposed Project and herein, the proposed wind turbines would be a new modern feature in the visual setting of the lake. Because of their scale and novel form, they are likely to attract viewer attention. However, as noted in the VIA, the Proposed Project's distance from the shoreline viewpoints substantially mitigates this impact. The closest point to shore from the turbines is 7.1 miles. Even at this closest distance, the Proposed Project will occupy a relatively small portion of an expansive lakeward view, and thus will not dominate the horizon (EDR, 2017). Therefore, 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 of the Proposed Project on the setting associated with historic resources located on the shoreline of Lake Erie (Appendix V). In summary, the Proposed Project's overall effect on the visual setting associated with historic properties would be a long-term, but relatively minor, impact.

### *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. 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**

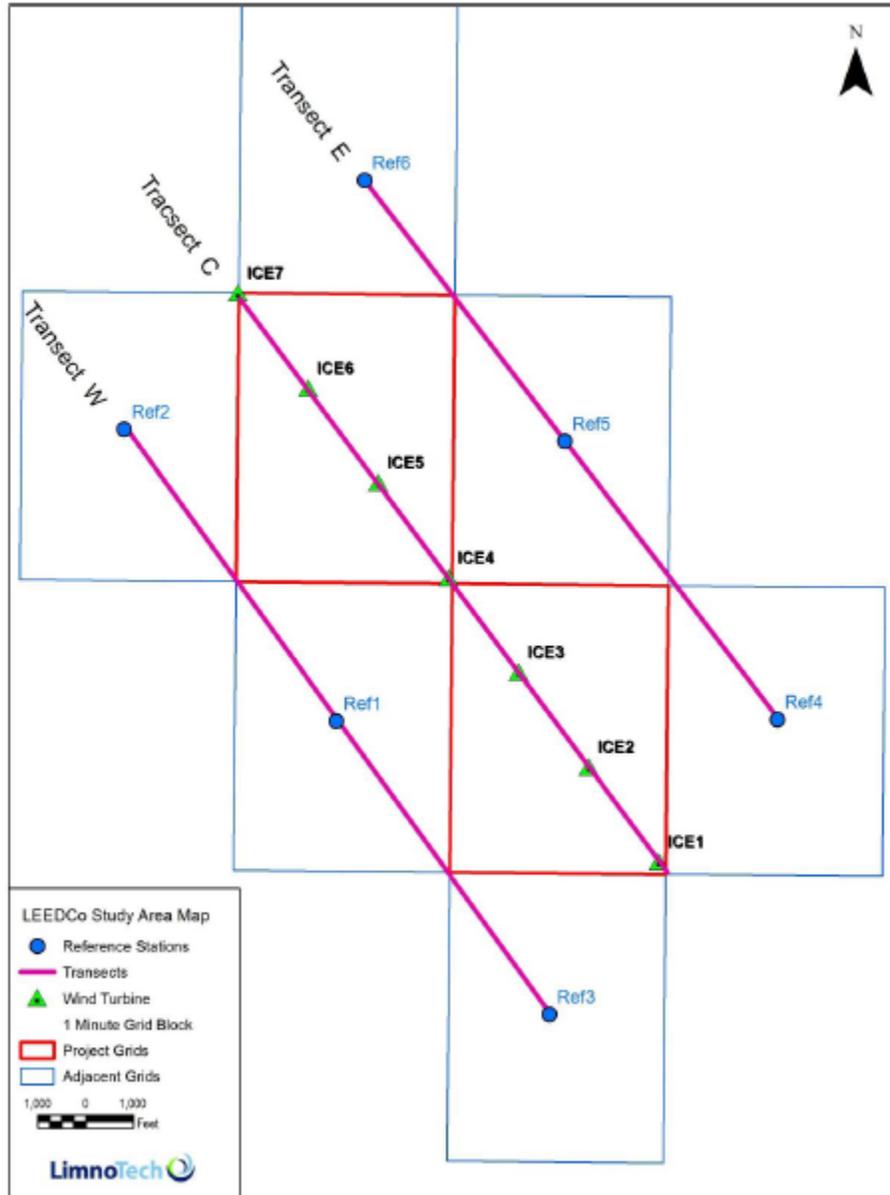
##### **3.12.1.1 Above Water Sound**

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, Appendix E

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

LimnoTech's final report with details of the preconstruction noise monitoring is provided in Appendix E. 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 Final Report, Appendix E

**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 are no anticipated noise impacts to the nearest onshore property.

People who could be aware of noise during construction include recreational boaters on Lake Erie or individuals on public-use areas along the shoreline. Exposure to construction-based noise to boaters 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. Additionally, the area also experiences high levels of ambient noise because of traffic from nearby I-90. In addition, existing heavy traffic areas are adjacent to the onshore areas, which contribute to the current elevated noise levels. No residents are located near the proposed onshore or nearshore activities. The nearest property owner is the City of Cleveland, whose 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 HPU	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 approached 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).

***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 that because of its use by humans or other sensitive species and the importance of reduced noise levels to such use, is designated for management to limit the noise level from long-term or continuous noise producing sources, 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 anticipated to 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 be anticipated to 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 expected to 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 a significant 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. 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 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  $\mu$ Pa 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  $\mu$ Pa and 160 dB re 1  $\mu$ Pa 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 are not anticipated to 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 be anticipated 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 expected to 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. 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<sup>8</sup>):

- 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.

---

<sup>8</sup> The 5-mile study radius is based on OPSB regulations.

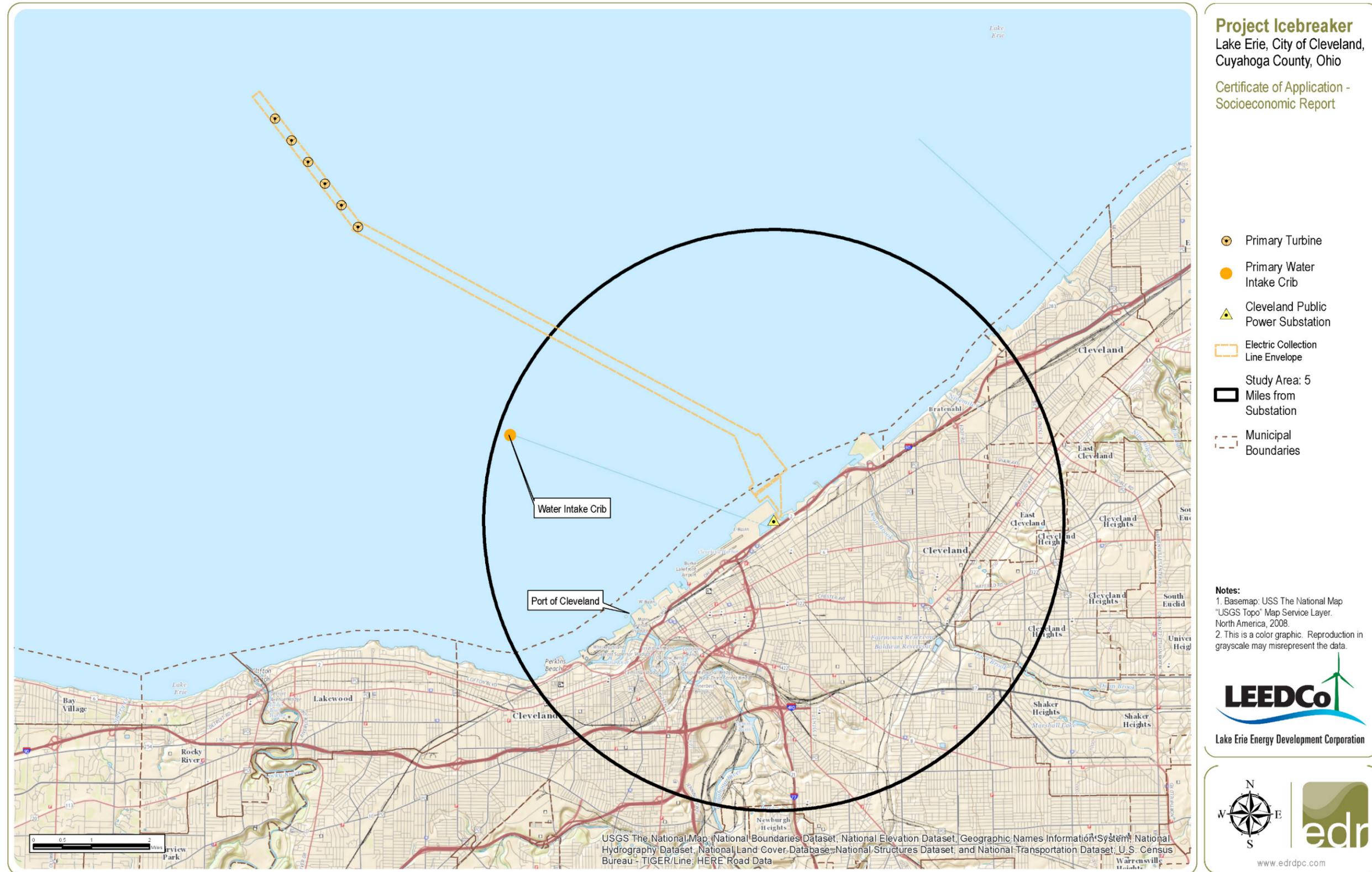


Figure 3.13-1. Proposed Project Study Area

### 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	290,866	-29%
City of Cleveland Heights	49,958	46,797	-6%	43,836	40,875	-13%
City of Shaker Heights	29,405	28,458	-3%	27,541	26,625	-6%
City of East Cleveland	27,217	19,426	-29%	13,865	8,304	-57%
Village of Cuyahoga Heights	599	547	-9%	500	452	-17%
Village of Newburgh Heights	2,389	2,108	-12%	1,860	1,612	-24%
Village of Bratenahl	1,337	1,369	2%	1,402	1,435	5%
<b>Total</b>	<b>589,308</b>	<b>507,926</b>	<b>-14%</b>	<b>439,047</b>	<b>370,169</b>	<b>-27%</b>

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 be anticipated to generate impacts to population growth within the area.

##### *Decommissioning*

Similar to construction, decommissioning of the Proposed Project would be short-term and therefore not anticipated to impact population.

### **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 2018 to 2020 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 20.7 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. 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 federal agencies to identify and address, as appropriate, any disproportionate adverse human health or environmental effects of their actions on minority and low-income populations. 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 overhead cable, 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	
<b>Total population</b>	<b>1,280,122</b>	<b>100.0</b>	<b>396,815</b>	<b>100.0</b>
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
White alone	785,977	61.4	132,710	33.4

**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	
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 be expected during operations and maintenance.

#### *Decommissioning*

Similar to construction, no adverse impacts would be expected 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. Any potential beneficial or adverse effects to the physical, natural, or socioeconomic resources would not be realized.

### 3.15 Summary of Impacts

A summary of 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.

**Table 3.15-1. Summary of Impacts**

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

**Table 3.15-1. Summary of Impacts**

<b>Resource Area</b>	<b>Level of Expected Impact</b>
<b>Aesthetic and Visual Resources</b>	Minor, Long-term Adverse Impact
<b>Noise</b>	Minor, Short-term Adverse Impact
<b>Economics and Socioeconomics</b>	Negligible with Some Short-Term Beneficial Impacts
<b>Environmental Justice</b>	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.

#### 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 projects or offshore wind projects in Lake Erie in the area of the Proposed Project.

Activities 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 Draft 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.

#### ***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.

#### ***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.

#### ***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.

***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 Mammalogists.
- 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. Accessed May 2017. [http://www.city.cleveland.oh.us/sites/default/files/forms\\_publications/2017CapitalImprovementProgram.pdf](http://www.city.cleveland.oh.us/sites/default/files/forms_publications/2017CapitalImprovementProgram.pdf).
- 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.
- Cornell University. 2017. Birds of North America. The Cornell Lab of Ornithology. Accessed June 27, 2017. <https://birdsna.org/Species-Account/bna/home>.
- 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. Available at <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. Accessed June 27, 2017. <http://bna.birds.cornell.edu/bna/species/002>.
- 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 septentrionalis) 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.

- 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.
- 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.ercd.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 Mammalogists 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*. [https://tethys.pnnl.gov/sites/default/files/publications/Utgrunden\\_Underwater\\_Noise\\_2003.pdf](https://tethys.pnnl.gov/sites/default/files/publications/Utgrunden_Underwater_Noise_2003.pdf). June 17, 2003. 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, 2008).
- 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. Whiteloni, 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](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](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. 47<sup>th</sup> Edition. [https://www.nauticalcharts.noaa.gov/nsd/coastpilot/files/cp6/CPB6\\_E47\\_20170714\\_1813\\_WEB.pdf](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](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 8 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](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](http://www.weather.gov/cle/avg_lake_erie_water_temps). Accessed February 2017.
- NOAA. 2017e. Climate Change: Annual Greenhouse Gas Index. <https://www.climate.gov/news-features/understanding-climate/climate-change-annual-greenhouse-gas-index>. Last updated July 19, 2017. 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](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](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. Accessed May 2017. <http://www.dot.state.oh.us/projects/ClevelandUrbanCoreProjects/Pages/default.aspx>.
- 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](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. 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](http://www.epa.ohio.gov/Portals/35/tmdl/2014intreport/Cover_and_Intro_IR2014_Final.pdf). Accessed July 2016.
- OEPA. 2014b. *Division of Air Pollution Control 2013 Annual Report*.
- OEPA. 2014c. *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. *Emission Inventory System: Facility, Emission Unit, Emissions, Process Data for 2015 Emissions*. <http://www.epa.state.oh.us/portals/27/aqmp/eiu/eis2015.zip>. Accessed May 2017.
- 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. Accessed June 26, 2017. <http://www.portofcleveland.com/about-the-port/>
- 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.
- 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*. [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](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). August 9, 2012. 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. Accessed June 27, 2017. <https://www.osti.gov/scitech/servlets/purl/1238337>.
- 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 (USACE). 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.
- 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.
- 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. 2014 National Emissions Inventory (NEI) Data. Air Emissions Inventories. <https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data>. Last updated April 5, 2017.
- 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](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. <http://www.fws.gov/wetlands/Data/Mapper.html>. Updated January 19, 2016. Accessed February 25, 2016.

## Section 5 References

---

- 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. <https://www.fws.gov/midwest/endangered/lists/ohio-city.html>. Accessed July 18, 2017. Last updated May 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/nshmc/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](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](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**

Joseph W. Krawczyk

Buffalo District, Regulatory Branch

Biologist

#### **U.S. Coast Guard**

K. S. Wheatley, Commander

Chief, Prevention Department

Sector Buffalo

### **Third Party Contractor:**

#### **CH2M HILL Engineers, Inc**

18 Tremont Street

Suite 700

Boston, MA 02108