Appendix M-1
Biological Assessment

BIOLOGICAL ASSESSMENT

FOR

PROJECT ICEBREAKER

Lake Erie and City of Cleveland
Cuyahoga County, Ohio

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FIGURES

COMMONLY USED ACRONYMS and ABBREVIATIONS

BA	Biological Assessment
BBCS	Bird Bat Conservation Strategy
CPP	Cleveland Public Power
DOE	U.S. Department of Energy
EA	Environmental Assessment
EDR	Environmental Design & Research, Landscape Architecture, Engineering, & Environmental Services, D.P.C.
ESA	Endangered Species Act of 1973
FAA	Federal Aviation Administration
FOWIC	Fred Olsen Windcarrier
HDD	Horizontal Directional Drilling
kV	Kilovolt
LEEDCo	Lake Erie Energy Development Corporation
MB	Mono Bucket
mph	miles per hour
m/s	meters per second
MW	Megawatts
MWh	Megawatt hours
O&M	Operations and Maintenance
ODNR	Ohio Department of Natural Resources
ROV	Remotely Operated Vehicles
UF	Universal Foundation
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WEST	Western EcoSystems Technology, Inc.
WNS	White-nose Syndrome

1.0 INTRODUCTION

1.1 PURPOSE OF THE BIOLOGICAL ASSESSMENT

The U.S. Department of Energy (DOE) is proposing to authorize the expenditure of federal funding to support the design, permitting, construction, and decommissioning of a proposed offshore wind energy demonstration project in Lake Erie. Project Icebreaker (the Project) would be an approximately 21 megawatt (MW) offshore wind energy demonstration project consisting of six wind turbine generators in Lake Erie, approximately 8-10 miles from Cleveland, Ohio (Figure 1). DOE is the lead federal agency responsible for the preparation of an Environmental Assessment (EA) for the Project. The U.S. Army Corps of Engineers (USACE) and the U.S. Coast Guard (USCG) are cooperating agencies. USACE is responsible for reviewing impacts pursuant to Section 404 and 408 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. USCG is responsible for reviewing impacts related to navigation and the USCG mission.

This Biological Assessment (BA) was prepared in accordance with Section 7 of the Endangered Species Act of 1973 (ESA), which requires that all Federal agencies ensure that any action they authorize, fund, or execute will not jeopardize the continued existence of any federally-listed threatened or endangered species (i.e., listed species) or result in the destruction or adverse modification of any critical habitat of such species.

Five federally-listed species may occur in Cuyahoga County, Ohio at some point in their life cycles. Thus, these are the federally-listed species that could potentially be affected by the proposed action:

- Indiana bat (*Myotis sodalis*) – Endangered
- Northern long-eared bat (*Myotis septentrionalis*) – Threatened
- Kirtland's warbler (*Setophaga kirtlandii*) – Endangered
- Piping plover (*Charadrius melodus*) – Endangered
- Rufa red knot (*Calidris canatus rufa*) – Threatened

There are no candidate species, proposed listed species, or proposed or designated critical habitats in Cuyahoga County, Ohio.

The purpose of this BA is to review the proposed Project in sufficient detail to determine to what extent the proposed action may affect any of the threatened and endangered species listed above.

1.2 PROPOSED ACTION

1.2.1 Federal Action

The DOE Wind Energy Technology Office seeks to provide support for regionally-diverse Advanced Technology Demonstration Projects through collaborative partnerships. By providing funding, technical assistance, and government coordination to accelerate deployment of these demonstration projects, DOE can help eliminate uncertainties, mitigate risks, and help create a robust U.S. offshore wind energy industry. The Advanced Technology Demonstrations Program for Offshore Wind began in 2012 with the selection of seven projects, including Project Icebreaker. In May 2016, DOE evaluated the seven projects against established milestones, and determined that three projects (including Project Icebreaker) had demonstrated significant progress toward being successfully completed and producing power. In December 2016, it was determined that funding for one of the three would not be continued. If all appropriate milestones are met, the two remaining projects will be eligible to receive additional federal funding. The Federal proposed action is to issue this funding to support Project Icebreaker.

1.2.2 LEEDCo's Action

Lake Erie Energy Development Corporation (LEEDCo) is proposing to construct and operate Project Icebreaker, six offshore wind turbines in Lake Erie, 8-10 miles from the Cleveland shoreline. The electricity would be collected and transmitted to shore via approximately 12 miles of new 34.5 kilovolt (kV) buried transmission cable, which would link each turbine (inter-array cables) and connect the turbine array to shore (export cable). The export cable would transverse from the turbines in a southeasterly direction underneath the Cleveland Harbor Breakwater to a new Project Substation located at the existing Cleveland Public Power (CPP) Substation. LEEDCo would construct approximately 150 feet of new 138 kV overhead generator lead line, to transmit electricity from the Project collector substation to the CPP Substation. Each of these project components is described below.

2.0 PROJECT DESCRIPTION

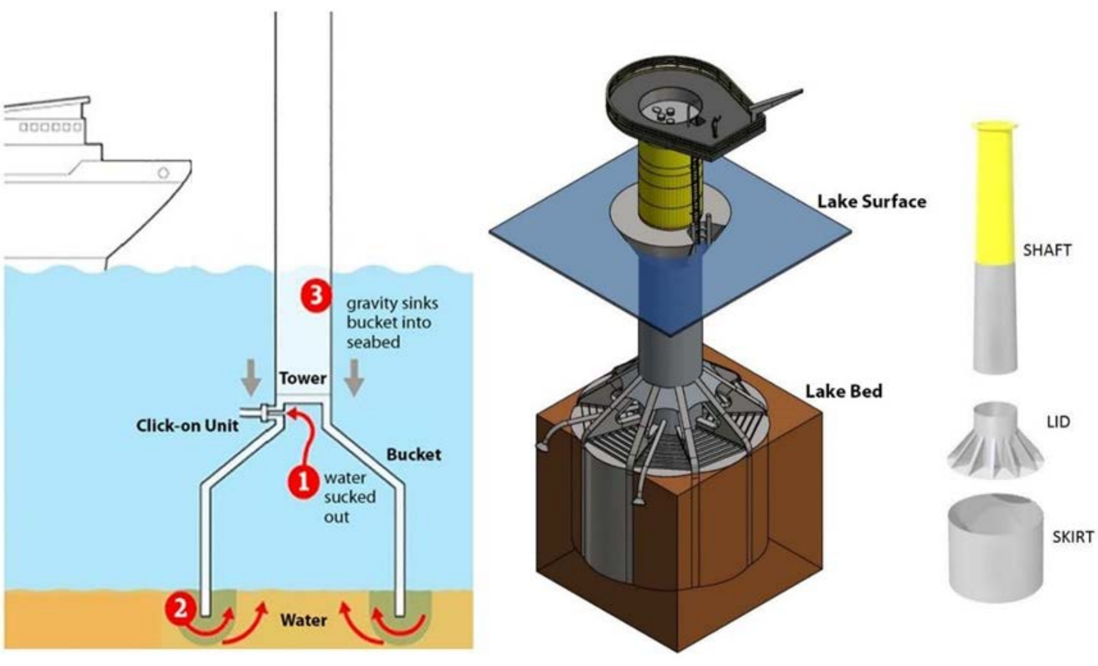
2.1 DESCRIPTION OF MAJOR EQUIPMENT

2.1.1 Wind Turbines

The Project would consist of six Mitsubishi Heavy Industries Vestas Offshore Wind - Vestas 3.45 MW offshore wind turbines (V126-3.45 MW), to be installed on Mono Bucket foundations. Each wind turbine consists of three major components: the tower sections, the nacelle, and the rotor with blades. The Project is expected to operate for approximately 8,200 hours annually, and have an approximate capacity factor of 41.4%, generating approximately 75,000 megawatt-hours (MWh) of electricity each year.

2.1.1.1 <u>Foundation</u>

The Mono Bucket (MB) would be utilized as the turbine foundation for the Project. The MB combines elements of gravity base, monopile, and suction bucket foundation designs. 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 (Inset 1).



Inset 1. Mono Bucket Foundation, General Arrangement

The MB foundation is installed using both gravity and a suction pump system including skirt nozzles and internal pressure chambers. When the 500 to 600 ton foundation is placed on the lakebed, the steel skirt initially self-penetrates from its weight into the substrate to a depth of about 3 to 6 feet. Water is then pumped from the bucket causing the foundation to penetrate into the lakebed due to the higher external pressure from the water outside of the bucket. Once the bucket has achieved the specified penetration, the pump would be stopped. At that time the bucket would have captured a large volume of lakebed sediment (approximately 3,500 tons), effectively becoming a gravity-based foundation embedded into the lakebed. A heavy lift crane vessel would be utilized to perform the lifting operations related to the foundation and turbine installation processes. It would consist of a barge outfitted with legs that can be raised and lowered. The legs are lowered to the lakebed and the barge is jacked-up via the legs to stabilize the barge during lifting operations. A mobile crane would be deployed on the barge. 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 seafastening (structural elements providing horizontal and uplift support of a component during sea transport operations). The entire operation is monitored by Remotely Operated Vehicles (ROV) and no divers are required. However, divers would be on standby in case the need arises (e.g., ROV stops working, water clarity is too low to see with ROV).

This installation method eliminates the need for pile driving or dredging, and no lakebed preparation would be necessary (dredging, leveling, or drilling).

Approximate foundation dimensions are listed below in Table 1.

Table 1. Approximate Foundation Dimensions

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

. The Port of Cleveland ("the Port") has been selected as the quayside staging area for the proposed Project. The Great Lakes Towing facility on the Cuyahoga River in Cleveland, Ohio has been identified as the best location for the O&M Center, due to the quality of the existing infrastructure and its close proximity to the proposed Project.

2.1.1.2 Turbine

The tubular 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. The majority of the turbine, including the blades, would be painted a light gray (RAL 7035) consistent with the Federal Aviation Administration (FAA) and USCG guidance. The portion of the turbine between the low water datum and the work platform would be painted yellow. Table 2 presents the dimensions of the V126-3.45 MW wind turbine.

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. Approximate Turbine Dimensions

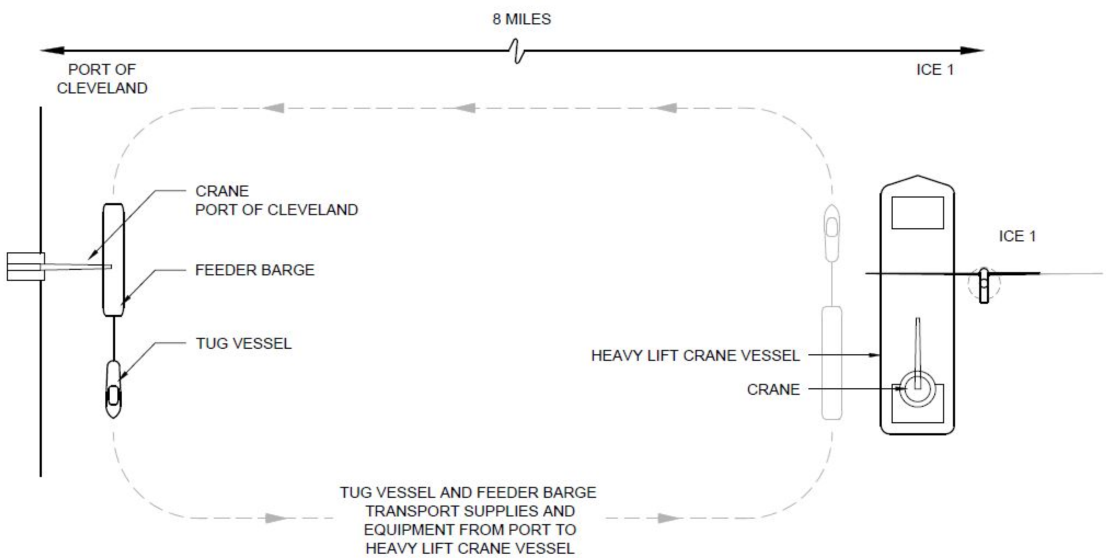
Turbine Model	Hub Height	Rotor Diameter	Blade Length	Total (Tip) Height
V126-3.45 MWTM IEC IIA	83 meters (272 feet)	126 meters (413 feet)	62.9 meters (206 feet)	146 meters (479 feet)

The main mechanical components of the wind turbine are housed in the nacelle. These components include the drive train, gearbox, and generator. The nacelle is housed in a steel reinforced fiberglass shell that protects internal machinery from the environment and dampens sound emissions. The housing is designed to allow for adequate ventilation to cool internal machinery and prevent excess moisture. The nacelle is equipped with an external anemometer and a wind vane that signals wind speed and direction information to an electronic controller. The nacelle is mounted on a yaw ring bearing that allows it to rotate ("yaw") into the wind to maximize wind capture and energy production.

One red flashing FAA obstruction warning light (upward facing) would be mounted on the nacelle of each turbine and would flash synchronously. In addition, synchronously flashing (flashing pattern to be determined) amber marine navigation lights, visible up to 5 nautical miles, would be mounted on the platforms of Turbines 1 and 6. 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 6 turbine platforms to provide visibility 360º 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 is mounted to the nacelle to operate upwind of the tower. Each rotor consists of three composite blades that would be 206 feet in length, which yields a rotor diameter of 413 feet. The rotor attaches to the drive train at the front of the nacelle. Hydraulic motors within the rotor hub rotate each blade according to wind conditions, which enables the turbine to operate efficiently at varying rotor speeds. The wind turbines would begin generating energy at wind speeds as low as 3 meters per second (m/s) [6.7 miles per hour (mph)], and cut out at maximum wind speeds of 27.5 m/s (61.5 mph). LEEDCo has agreed to feather the turbine blades up to the manufacturer's cut in speed during fall migration to reduce risk of mortality to bats.

It is anticipated that the turbine components, including nacelle, blades, and tower, would be transported to the Port by barge. The same heavy lift crane vessel is planned to be utilized for both foundation and turbine installation. Installation of the turbines would occur after the MB foundations and the buried transmission cables are installed. The installation vessel would already be positioned at the respective 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 (Inset 2). The tower sections would be picked off the feeder barge and then installed using the crane mounted on the heavy lift installation vessel. Assembly work inside the towers 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 of tower and turbine installation. The heavy lift crane vessel and the feeder barge would use a tow tug to transit between the port and turbine sites.



Inset 2. Installation Vessel Plan View

2.1.2 Transmission Cables

There would be two cable components for the proposed Project: the inter-array cables, which connect the wind turbines together electrically, and the export cable, which transmits the wind turbine output to the shore. The export cable size would be identical to the inter-array cable. The proposed cables are rated at 34.5 kV and would be composed of a three-core copper conductor with cross-linked polyethylene or ethylene propylene rubber insulation. Optical fibers for data transmission would be embedded between the cores. The cable solution designed for the Project would be a three-conductor, single armored underwater power cable, with an approximate overall diameter of 4.45 inches. LEEDCo has not yet selected a manufacturer for the cable. Type of cable and insulation would be dependent on manufacturer. Prior to installation, a debris clearance operation would be conducted along all cable routes to identify and remove debris and obstructions. The clearance includes a relatively small work boat towing a grapnel along the routes. All 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). The launch pit for the HDD would be located either at the CPP Lake Road Substation or on a barge on the north side of the breakwater. The final determination would be made by the installer for the electric collection lines (not yet selected). A drawback machine would be used to drill an approximately 18-inch diameter bore from the shore landing site to an exit point approximately 0.7 mile offshore. Drilling operations use drilling fluids to stabilize the bore hold and to lubricate the drilling process, and operations would be planned to minimize the possibility of drilling fluid discharging into the lake. The bore would be lined with high-density polyethylene conduit. A messenger wire would be placed in the bore to pull the export cable ashore using a pull-in winch. The bore would be capped off until the start of the cable installation operations.

The cables would be installed using a deck barge with a cable installation and burial spread mobilized on board. The baseline approach for the export cable is bury-while-lay. The inter-array cables, which are the last of the cables to be installed, would be buried post-lay due to the limited lengths between the turbines. The cables would be buried 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 lakebed forming a trench into which the cable is laid. A jetting tool equipped with high-pressure water jets would assist the burial process by fluidizing the sediments within a narrow trench into which the cable is lowered. The majority of sediments that are disturbed by the process would subsequently settle back onto the lakebed, providing a degree of back-fill. No reclamation would be required, and if there is a slight depression of the lakebed directly over the cable, the depression would fill in with ambient sediments over several weeks.

2.1.3 Substations, Switching Substations, and Transformers

A propsed Project Substation would be constructed on CPP Property adjacent to the existing Lake Road Substation. The area surrounding the existing substation is disturbed/developed, consisting almost entirely of unpaved, 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 Project Substation including bus structures, switch gear, the step-up transformer, and a 14-foot by 37-foot building for control equipment.

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

The 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 substation. Major equipment, including transformer and control house, would be delivered via truck and placed on foundations using an overhead crane. Final color of all equipment would be ANSI 70 gray. Bus support structures and dead-end H-Frame would be gray galvanized steel.

2.1.4 Meteorological Towers

A permanent meteorological tower was installed at the Cleveland Water Intake Crib (the “Crib”) in 2005. The 125-foot tower was custom-engineered for installation on the Crib. Total tower height is 166 feet above lake level. The tower and measurement system was developed by GEO, in consultation with AWS Truewind, following the guidelines for wind monitoring set forth in the National Renewable Energy Laboratory's Wind Resource Assessment Handbook (NREL, 1997). The tower has six booms that are each 10 feet long: two booms at each height of 98 feet, 131 feet, and 164 feet. Three booms are oriented northwest (315°) and three are oriented south (180°) to minimize the effect of wind speed shadowing from the tower. Each boom has an NRG-40 anemometer and an NRG-200P wind vane. LEEDCo does not anticipate making any modifications to this meteorological tower or the existing Crib structure.

2.1.5 Transportation Facilities, Access Roads, and Crane Paths

LEEDCo does not anticipate building access roads, as a road network would only be needed to support onshore components of the Project (the O&M Center and the new Substation), and LEEDCo intends to utilize locations and existing structures that currently have permanent road access. The existing rail system may be used for the transportation of turbine components and equipment other than the foundation, but LEEDCo does not anticipate a need to make any modifications to the system. Depending on the selected foundation fabricator, the foundations may arrive completely by barge, and never be off-loaded, or may arrive in pieces by barge and/or truck with final assembly at the Port. Similarly, depending on the selected cable supplier/installer, the cable may arrive completely by barge, and never be off-loaded, or it may arrive by rail and be off-loaded and staged at the Port. There would be no site preparation or reclamation for crane paths, as the cranes would be transported to port by trucks on existing roads and assembled at the Port.

LEEDCo is working with Cuyahoga County and the affected municipalities within the County to ensure the proposed Project would not have an adverse impact to existing roads and bridges. As mentioned, most components would arrive at the Project via barge. Any trucks that would be needed to deliver components would meet weight requirements as posed by the Ohio Department of Transportation.

2.1.6 Construction Laydown Areas

LEEDCo would lease space from the Port of Cleveland to stage the major components including the turbines, foundations, and transmission cable. The site would also be used to pre-assemble and test some of the components prior to installation. The turbine components, the MB foundations and the cable would be loaded out from the quayside onto feeder barges and transported to the installation sites. The Port site that would be utilized by LEEDCo is approximately 12 acres. The site currently consists of large paved and unpaved staging areas adjacent with access to the quayside for loadout. Site preparation would be limited to minor and temporary construction of security fencing, temporary office trailers, and secured storage areas. The materials would consist of conventional galvanized chain link fencing. Cranes and other material handling equipment would be mobilized to the site to support the unloading of components and materials and storage in the staging area, movement around the staging area, and load out onto feeder barges for transport to the final turbine sites. Following the completion of proposed Project construction, the material handling equipment would be demobilized and returned to the supplier; the chain link fencing would be disassembled and removed; and the office trailers would be returned to the supplier.

2.2 CONSTRUCTION

Pending the receipt of all required permits, construction is scheduled to start in the spring/summer and be completed by September of the same year. Construction activities are anticipated to employ approximately 160 workers. Project construction is anticipated to proceed in the following sequence, with multiple activities being performed concurrently:

- Install HDD conduit for export cable
- Construct new substation
- Mobilize floating equipment
- Stabilize installation barge
- Transport MB foundation from port 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
- Complete substation and commission landside power into grid

2.3 OPERATION AND MAINTENANCE

The wind turbines would begin generating energy at wind speeds as low as 3 m/s (6.7 mph) and cut out at maximum wind speeds of 27.5 m/s (61.5 mph). A control center capable of remotely monitoring and controlling the Project would be manned 24 hours a day. The control center would be staffed by trained personnel and contain charts indicating 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. While nacelles would be capable of being opened from the outside for rescue and maintenance operations when seaborne approaches are not feasible, all safety hatches and doors to turbine towers and nacelles are secured and locked when the unit is unmanned.

Maintenance activities consist of scheduled maintenance, unscheduled maintenance, and electrical system maintenance, each of which are described below. In general, wind energy facility maintenance involves periodic activities conducted during daylight hours, typically inside turbines or other structures. LEEDCo would be responsible for the operation, inspection, and maintenance requirements of all Project components.

Scheduled Maintenance

Routine and preventative wind turbine maintenance activities would be scheduled at six 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. All surplus lubricants and grease-soaked rags would be removed and disposed of as required by applicable regulations.

Unscheduled Maintenance

Modern wind turbines are very reliable and the major components are designed to operate for up to 30 years. However, wind turbines are large and complex electromechanical devices with rotating equipment and many components. As a result, 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.

<u>Electrical System Maintenance</u>

The substation and generator lead line would require periodic preventative maintenance. Routine maintenance would include condition assessment for above-ground infrastructure and protective relay maintenance of the substation in addition to monitoring of the secondary containment system for traces of oil. Finally, vegetation control could be required around the transmission line to prevent any damage to the line and ensure safe operation. As the electrical system would be located in an impacted area of fill, it is anticipated that vegetative clearing would be minimal, but there are many plant species that will grow in extremely disturbed fill areas. Vegetative controls around the transmission line could include removal and/or pruning.

All operation and maintenance activities would be conducted in accordance with applicable federal, state, and local permits and associated conditions/requirements.

2.4 PROJECT MAP

The proposed location for each Project component is illustrated in Figure 2.

2.5 CONSERVATION MEASURES

Risk assessments performed for wildlife suggest a low level of risk to birds and bats (WEST, 2016, 2017; LimnoTech, 2017). Minimizing risk to wildlife and their habitats was an important consideration in Project siting and design, and Project construction would be timed to minimize impacts to wildlife and their habitats.

Bat collision impacts at turbines are understood to be most frequent on calm nights when winds are low, especially during the late summer when migrating. To reduce mortality to migrating bats, turbine operation would be curtailed up until the manufacturer's cut-in speed is reached at night during the fall migration (i.e., the Project's turbines would not start rotating until winds reach 3 m/s [6.7 mph]).

Use of the Project Area by birds and bats is expected to be limited primarily to nocturnal migratory flights by songbirds and similar birds, and low density use by 4-6 species of widespread and abundant water birds. LEEDCo would follow lighting recommendations per the U.S. Fish and Wildlife Service (USFWS) land-based wind energy guidance documents (USFWS, 2012a). Bird collision risk at communication and other towers has been shown to increase dramatically with particular types of lighting. Fatality rates at towers with steady burning lights were higher when compared to towers with flashing lights. The Project would utilize flashing red lights on turbines for bird safety, and as stipulated by the FAA. The work platforms at the base of the turbines would utilize flashing yellow lights, in compliance with USCG requirements. The substation lights would be down-shielded so as to not attract birds.

LEEDCo would also develop a Bird Bat Conservation Strategy (BBCS) to conduct thorough post-construction monitoring of Project impacts, and to undertake adaptive management measures, if necessary. The purpose of the post-construction monitoring program would be to determine the nature and intensity of any avian and/or bat avoidance, attraction, displacement, or collision effects occurring as a result of Project operation. Mitigation and adaptive management measures would be implemented if actual impacts exceed expectations. Adaptive management measures could include adjusting the pitch of the turbine blades (i.e., blade feathering) during specific seasons, hours of the day, and weather conditions should those factors contribute to higher than expected impacts to bats.

3.0 ACTION AREA

As defined in 50 CFR 402.02, the term "Action Area" includes all areas that may be affected directly or indirectly by the Federal action, and not merely the immediate area involved in the action. It encompasses the geographic extent of environmental changes (i.e., the physical, chemical and biotic effects) that would result directly and indirectly from the action. The Action Area is typically larger than the area directly affected by the action.

For the proposed Project, the Action Area consists of:

1. The underwater area in Lake Erie including the footprint of the turbine foundations and the inter-array and export cable routes (see, Figure 2 Sheet 1);
2. the CPP Property where the Project Substation would be located (and the HDD launch pit for the export cable installation (see, Figure 2 Sheet 2-5));
3. the Great Lakes Towing facility where space would be leased for the O&M Center (see, Figure 2 Sheet 5);
4. the Port and Harbor of Cleveland where construction staging would occur (see, Figure 2 Sheet 6); and
5. the air space around the proposed Project.

The physical and biological attributes of the Action Area are described below.

3.1 THE UNDERWATER AREA WITHIN LAKE ERIE

The proposed Project would be located in Lake Erie's central basin, in an area of relatively uniform lakebed topography that slopes downward from southeast to northwest with water depth increasing linearly with increasing distance from shore. Water depth ranges from 0 feet at the Cleveland shoreline to approximately 60 feet at the proposed turbine site furthest from shore. The depth to the lakebed at the location of the proposed turbines is approximately 60 feet with a generally uniform and smooth lake bottom comprised of soft, silty, sediments.

The inter-array cables, which connect the wind turbines together electrically, would be located within the same area as the proposed turbines. The export cable, which transmits the electricity generated by all wind turbines to the shore, would run from shore to the turbine location. Water depth is approximately 33 feet immediately north of the breakwater, and steadily increases along the export cable route (CSR, 2016). The lakebed along the export cable route is dominated by sand/gravel with small patches of silt/clay.

3.2 CLEVELAND PUBLIC POWER PROPERTY

The area surrounding the new Substation is either water (i.e., Lake Erie) or developed land. The CPP property contains landscaping trees and shrubs around the existing buildings, and a narrow row of trees lining much of the immediate lakeshore, which is hardened shoreline. The narrow, vegetated area between the existing substation buildings and the lakeshore is less than 40 feet and contains trees and grasses.

3.3 GREAT LAKES TOWING FACILITY

The Great Lakes Towing (GLT) facility is located on the Cuyahoga River in Cleveland, Ohio, approximately 1.6 miles upriver of the confluence with Lake Erie. The GLT property is approximately 6.3 acres. However, the anticipated area to be leased would not exceed 0.5 acre in size and would include a small space in the existing GLT building for storage of spare parts, and a condition for LEEDCo to share space with GLT for access to water and locker room/bathroom facilities. No modifications to the existing building are proposed.

3.4 PORT AND HARBOR OF CLEVELAND

The Port of Cleveland (the Port) has been selected as the quayside staging area for major components including the turbines, foundations, and submarine cable. 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. 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 to the quayside with access for load-out. The proposed work on site would be limited to temporary installation of security fencing, office trailers, and secured storage areas.

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 outer harbor is formed by a series of breakwaters that run parallel to the shore and extend about 1 mile west and 4 miles east of the mouth of the Cuyahoga 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 channel opposite the mouth of the Cuyahoga River. Additional entrances include one at the east end and one at the west end for small craft. The outer harbor is separated into an east and west basin by the Cuyahoga River. Depths are 29 feet in the approach of the entrance from deeper water in the lake, then 28 feet through the entrance channel to the mouth of the river and in the west basin and 27-28 feet in the east basin. The inner harbor consists on dredged channels that lead upstream into the Cuyahoga River and the Old River. In the inner harbor, depths are 27 feet in the Cuyahoga River from the mouth to the junction with Old River, then 23 feet at the upstream limit, and 27 feet in Old River (NOAA, 2016b).

3.5 AIRSPACE NEAR PROJECT

The State of Ohio Environmental Protection Agency (Ohio EPA) Division of Air Pollution Control publishes air quality data for the State of Ohio annually. The most recent summary of air quality data available for the state is the Division of Air Pollution Control 2013 Annual Report (Ohio EPA, 2014). Included in this report are a summary of 2013 air quality data, a discussion of toxics monitoring projects, and trend studies for selected pollutants. Pollutants monitored over 13 monitoring sites in Cuyahoga County include carbon monoxide, particulate matter (2.5 micron, 2.5 micron continuous, and 2.5 micron speciation), total suspended particulate, nitrogen dioxide, ozone, lead, and sulfur dioxide. There were violations of National Ambient Air Quality Standards (NAAQSs) reported at monitoring stations in Cuyahoga County for 2.5 micron particulate matter (three year average of annual average), ozone (4th highest 8-hour concentration), and lead (highest 3 month concentration).

Air emissions in the area are 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; the Medical Center Company, approximately 5 miles southeast of the Cleveland Harbor; Cleveland Electric Illuminating Co., Lake Shore Plant, located along the Cleveland Harbor; and Cleveland Thermal LLC, located less than 1 mile from the Cleveland Harbor (Ohio EPA, 2016).

4.0 STATUS OF LISTED SPECIES IN THE ACTION AREA

The potential for Project Icebreaker to impact ESA-listed species has been addressed using information gathered and synthesized in risk assessments and baseline studies over an eight-year period from 2009 through 2017. This section summarizes the potential risk that the proposed Project construction and operation may pose to each of the ESA-listed species that occur in the Action Area, on the basis of the information that has been gathered to date for each species.

4.1 INDIANA BAT

The species was originally listed as in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001), and is currently listed as endangered under the Endangered Species Act of 1973, as amended (ESA). In 1965, based on hibernating populations, the U.S. Indiana bat population was estimated at approximately 883,300 individuals rangewide. From 1965 to 2001, Indiana bats experienced a 57 percent population decline to 381,156 (USFWS, 2007). The revised 2007 Draft Recovery Plan lists destruction/degradation of hibernation habitat; loss/degradation of summer habitat, migration habitat, and swarming habitat; disturbance of hibernating bats; disturbance of summering bats; disease and parasites; and natural and anthropogenic factors as threats to the species (USFWS, 2007). From 2001 to 2007, rangewide populations steadily increased, reaching an estimated rangewide population of approximately 635,349 individuals in 2007, a 28 percent increase from 2001 (USFWS, 2015a). However, this increase was significantly diminished since the winter of 2006-2007 with the onset and proliferation of white-nose syndrome (WNS). Millions of bats in the U.S. and Canada have died from WNS, which has become the single greatest threat to rangewide Indiana bat survival and recovery. The most recent 2017 rangewide Indiana bat population estimate is 530,705 individuals, a 13.7% decrease from 2009 (USFWS, 2017).

The federally- and state-listed endangered Indiana bat is largely distributed throughout the central and eastern United States (22 states) and southeastern Canada. The Draft Recovery Plan 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.

4.1.1 Life History

Indiana bats migrate seasonally between their summer habitats and winter hibernacula, which are large, climatically stable caves and mines. Specifically, these hibernacula support temperatures around 3 to 6 degrees Celsius (°C) with chimney-effect airflow and multiple chambers (Tuttle & Kennedy, 2002). Indiana bats are generally not found hibernating in artificial roosts, such as buildings. Indiana bats hibernate in dense, large groups, with up to 300 individuals occupying a square foot (Clawson et al., 1980). During hibernation, the insectivorous bats have a diminished food supply, and therefore rely solely on limited stored fat reserves to sustain them until spring. All hibernating bats periodically arouse from torpor throughout the hibernation period. Arousal is an active process that involves an increase in the rate of heat production, which is derived from stored fat (Hayward & Ball, 1966). The reason for these arousals is unknown. Possible reasons include: to drink (Speakman & Racey, 1989), to mate (Tidemann, 1982), to move to different microclimates within the cave (Clawson et al., 1980), to boost immune function (Burton & Reichman, 1999), or to satisfy a necessary biochemical need (Park et al., 2000). Each of these arousals is energetically costly, with one arousal equivalent to roughly 65 days of hibernation for a little brown bat (Thomas et al., 1990). Therefore, any extra arousals caused by human disturbance or WNS can cause the bats to excessively burn their fat reserves, thus threatening winter survival. In recent years, some cave Indiana bat populations have benefited from the installation of proper cave gates, reduction in cave tour-related disturbances, and alarm systems to deter vandalism (Johnson et al., 2002).

Indiana bats exhibit post-migratory behavior called “swarming,” characterized by flight across the openings of hibernacula. Swarming occurs in the autumn, sometimes as early as late July (Cope & Humphrey, 1977; Brack, 1983; Brack et al., 1983; Brack, 2006). Males arrive before females, and swarming peaks by September or October, at which time the sex ratios even out (Cope & Humphrey, 1977, Tuttle & Kennedy, 2005). Mating season occurs at this time, and the females store the immotile sperm prior to entering the hibernacula, and do not become pregnant until the spring after they emerge from hibernation (Guthrie, 1933). Spring staging typically begins with emergence from hibernation in mid-April, during which time bats begin foraging and may engage in daily cycling in and out of torpor (Barbour & Davis, 1969; Cope & Humphrey, 1977). Spring staging is followed by a seasonally segregated migration. Females migrate prior to males (Cope & Humphrey, 1977), and become pregnant within a few days of arousal, shortly after emergence, just as they initiate migration (Wimsatt & Kallen, 1957; Thomson, 1982). 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 & Murray, 2002). Radio telemetry studies have documented Indiana bats migrating to summer habitats as close as 34 miles and as far as 357 miles from winter hibernacula (USFWS, 2007). Reproductive females migrate to their summer habitats where they form maternity colonies of typically 20 to 100 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 & Hamilton, 1998). Most females switch between 10-20 alternate roost trees, presumably to gain ideal thermoregulatory conditions as their reproductive needs change throughout gestation, parturition, and lactation (USFWS 2007). Females give birth to a single pup each year between June and July, and pups becomes volant, or capable of flight at 3 to 5 weeks after birth (Humphrey et al., 1977; Whitaker & Brack, 2002). Roosting individually or in small groups, males and non-reproductive females are typically dispersed throughout the range, with some preferring to remain in areas near hibernacula (Whitaker & Brack, 2002). 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 require a mosaic of habitats for feeding. They typically avoid urban habitats, and prefer to forage along streams/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% canopy cover), and a large diameter tree are important factors in Indiana bats selecting a suitable roost site (Foster & Kurta, 1999; Kurta, 2004). The preference of tree species likely varies depending on the region, and Indiana bats have been documented using both live and dead trees, although females prefer dead or dying trees (Gardner et al, 1991, Kurta et al. 1996; Callahan et al., 1997; Foster & Kurta, 1999; Timpone et al., 2010). When live trees are used, they are typically shagbark hickories (*Carya ovata*) (Humphrey et al., 1977; Gardner et al., 1991). Dead or nearly-dead trees provide an unstable habitat from year-to-year. Therefore, locations with a variety of large-diameter, usually old trees are ideal (Miller et al., 2002).

4.1.2 Historic and Local Abundance

Historically, Indiana bats congregated in large numbers at a few select caves located in the karst topography typical of the east-central United States. However, after European settlement, bat populations seemed to disperse and/or decline due to hibernacula disturbances, including mining, tourism, and cave alterations. As of October 2006, the USFWS had records of extant winter populations of Indiana bats at approximately 281 hibernacula in 19 states and 269 maternity colonies in 16 states. This likely represented only about 6% to 9% of the 2,859 to 4,574 colonies thought to exist based on the estimated total wintering population in 2006 (Whitaker & Brack, 2002; USFWS, 2007). The locations of most maternity colonies remain unknown (USFWS, 2007).

Indiana bat hibernacula are categorized into the following four different priority groups based on population size: Priority 1 (P1, ≥10,000 Indiana bats), Priority 2 (P2, 1,000-9,999 Indiana bats), Priority 3 (P3, 50-999 Indiana bats), and Priority 4 (P4, 1-49 Indiana bats). Since the release of the first Indiana bat Recovery Plan in 1983, the USFWS has implemented a biennial monitoring program at P1 and P2 hibernacula in an effort to monitor the overall Indiana bat population (USFWS, 2007). In 2013, almost 94% of the estimated total population hibernated in nine P1 hibernacula. Due in part to WNS reductions in the eastern areas of the species' range, over 70% of the estimated range-wide population hibernated in Missouri and Indiana in 2015 (USFWS, 2015a). The overall abundance of Indiana bats has declined substantially as a result of WNS, particularly in the eastern United States where the disease first emerged.

The Action Area falls within the Midwest Recovery Unit, which includes the range of Indiana bat in Ohio, Indiana, Michigan, Kentucky, Georgia, Alabama, and Mississippi, along with the portions of Tennessee and Virginia that lie west of the Appalachian Mountains. The Indiana bat population in the Midwest Recovery Unit represents approximately 49.6% of the 2015 overall rangewide population. As shown in Table 3, USFWS population estimates indicate that the overall Indiana bat population in the Midwest Recovery Unit has declined by approximately 14% since 2009 (USFWS, 2017).

Table 3. Indiana Bat Population Estimates for the Midwest Recovery Unit

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

Source: USFWS, 2017

The number of Indiana bats within Ohio has always been a small fraction of the rangewide population, even before WNS. According to the 2015 USFWS population estimates, Indiana bats hibernating in Ohio represented 1.2% of the rangewide population in 2007, 1.6% in 2009, 1.6% in 2011, 1.6% in 2013, and 0.9% in 2015. Within the Midwest Recovery Unit, approximately 1.9% of the Indiana bats hibernated in Ohio in 2015. Since the onset of WNS, the population of Indiana bats in Ohio is declining faster than the overall Midwest Recovery Unit, declining 69% since 2009 compared to 14% across the entire unit (USFWS, 2017).

There are seven known Indiana bat hibernacula in the state of Ohio, and of these, two have extant winter populations (i.e., at least one record since 1995). The two extant 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 Project site are both P4 hibernacula located in Lawrence and Beaver Counties, in Pennsylvania, more than 70 miles southeast of the Project Area. 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 offshore sites to date (Ahlén et al., 2009; Pelletier et al., 2013; Boezaart & Edmonson, 2014) is consistent with the basic observation that bats are primarily terrestrial animals. Pre-construction bat acoustic surveys were conducted in 2010 to evaluate offshore bat use of Lake Erie near the Project site. Tetra Tech biologists conducted a bat acoustic survey 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 Project Icebreaker. 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% in the spring and 2.2% 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% of the total number of call sequences were recorded offshore in the spring and fall, respectively (Tetra Tech, 2012).

There is no undisturbed forested area typically utilized as summer habitat by Indiana bats in the vicinity of the Offshore Study Area or the shoreline monitoring sites. Since there are no known colonies of Indiana bats in Ontario and the species is almost unknown in Ontario, it is unlikely that these bats migrate across the lake or are present in the Offshore Study Area. 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 in very small numbers.

4.1.3 White-Nose Syndrome

WNS is the most severe threat facing Indiana bat populations rangewide. WNS was first discovered during the winter of 2006-2007 in Howes Cave in Schoharie County, New York and has since spread steadily in all directions (Blehert et al., 2009). Because of the severity of the disease, its rapid spread, and the lack of effective management actions to reduce the virulence of the disease, the effects of WNS on Indiana bats (Thogmartin et al., 2012) and other bat species have been significant (USFWS 2016a; Turner et al., 2011). Since 2006, it has spread to a total of 29 states (Alabama, Arkansas, Connecticut, Delaware, Georgia, Illinois, Indiana, Iowa, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, North Carolina, Ohio, Pennsylvania, Rhode

Island, South Carolina, Tennessee, Vermont, Virginia, Washington, West Virginia, and Wisconsin) and five Canadian provinces (New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Quebec). From 2006 to 2011, the disease was responsible for an estimated 5.7 to 6.7 million bat fatalities (USFWS, 2012c, USFWS, 2016a).

WNS is caused by a fungus (*Pseudogymnoascus destructans*) that thrives in the cold environments where bats hibernate (Minnis & Linder, 2013). Hibernating bats with white-nose syndrome often display this white fungus on their noses and on other hairless parts of their bodies including their wings (Blehert et al., 2009). Bats affected with WNS do not always have obvious fungal growth, but they may behave strangely within and outside of their hibernacula. WNS often results in bats arousing prematurely from torpor during winter, and losing their fat reserves, which they need to survive hibernation (Turner & Reeder, 2009; Cryan et al., 2010; Warnecke et al., 2012; USFWS, 2016a). WNS is known to affect seven North American bat species: the big brown bat (*Eptesicus fuscus*), eastern small-footed bat (*Myotis leibii*), gray bat (*Myotis grisescens*), Indiana bat, little brown bat (*Myotis lucifugus*), northern long-eared bat, and tri-colored bat (*Perimyotis subflavus*). Five other North American bat species tested positive for the fungus associated with WNS, but were not found to be infected. Following the discovery of WNS in the winter of 2006 and 2007, observed bat populations declined by over 75 percent at surveyed hibernacula within 2 years (Blehert et al., 2009). If the current infection and mortality trend continues, it is predicted that the little brown bat could potentially become extinct in the next 20 years in the northeastern United States (Frick et al., 2010).

In Ohio, WNS was first observed at an Indiana bat hibernaculum in Lawrence County in 2011, and was confirmed in five other Ohio counties in 2012, as well as ten additional Ohio counties in 2013 (USFWS, 2016a). The number of Indiana bats in Ohio has been affected by WNS, declining by 71% since the disease was discovered in the state in 2011 (USFWS, 2017).

4.2 NORTHERN LONG-EARED BAT

Prior to the onset of WNS, the northern long-eared bat was a relatively common bat species in the northeastern and north-central U.S., along with much of southern Canada (Barbour & Davis, 1969). The global status of the northern long-eared bat was recently changed to G1G2, a designation applied to species that are imperiled to critically imperiled (NatureServe, 2015). In April 2015, the northern long-eared bat was federally-listed as threatened under the ESA (80 FR 17974). The Service subsequently published a final 4(d) rule for northern long-eared bat January 14, 2016 (81 FR 1900). The final 4(d) rule exempts the incidental take of northern long-eared bats resulting from most otherwise lawful activities[1] from the take prohibitions under Section 9 of the ESA, including incidental take of northern long-eared bats due to the operation of wind turbines.

4.2.1 Life History

In spring, females leave hibernacula and form maternity colonies of up to 65 individuals in natural roosts, although colony size decreases from pregnancy through post-lactation (Sasse & Perkins, 1996; Foster & Kurta, 1999; Lacki & Schwierjohann, 2001). Females give birth to a single pup between May and July (Easterla, 1968; Kunz, 1971; Whitaker & Hamilton, 1998; Broders et al., 2006). Parturition (birth) dates and subsequent weaning are likely dependent on regional conditions (Foster & Kurta, 1999). A study completed by Broders et al. (2006) over a three-year period in New Brunswick, Canada found parturition to occur in mid- to late July. Other studies suggest that southeastern population parturition dates occur between mid-May and mid-June (Caire et al., 1979; Cope & Humphrey, 1972). Generally, female northern long-eared bats roost communally, while males select solitary roosts (Caceres & Barclay, 2000). Northern long-eared bats have shown high site fidelity related to summer roost habitat (Sasse & Perkins, 1996; Patriquin et al., 2010; Perry, 2011). They are believed to have lower fidelity to individual trees (Sasse & Perkins, 1996), which may reflect a propensity to select unstable sites for roosting. Jackson (2004) found that northern long-eared bats use an average of 8.6 trees (range 2-11), and various studies have indicated that these bats change roosts approximately every two days (Sasse & Perkins, 1996; Foster & Kurta, 1999; Jackson, 2004; Carter & Feldhamer, 2005; Timpone et al., 2010)

There is little information available regarding spring emergence and dispersal of northern long-eared bats from hibernacula. However, the length of hibernation period can change with different regions and climate differences (Caceres & Barclay, 2000). Depending on the specific climate patterns and the region in which the bats are hibernating, spring emergence may occur from March to May (Caire et al., 1979; Fenton, 1969; Nagorsen & Brigham, 1993; Whitaker & Rissler, 1992). Shortly after emergence, northern long-eared bats migrate to their summer habitat. Spring migration direction of northern long-eared bats may be similar to little brown bats and appears to radiate outward from hibernacula during migration, with the bats migrating directly to the natal sites, rather than moving primarily north or south (Davis & Hitchcock, 1965; Fenton, 1970; Griffin, 1970; Humphrey & Cope, 1976).

[1] The final 4(d) rule published January 14, 2016 (81 FR 1900), exempts all incidental take of northern long-eared bats from otherwise lawful activities from take prohibitions under Section 9 of the ESA, except: take of northern long-eared bats in their hibernacula in areas affected by white-nose syndrome; take resulting from tree removal within 0.25 mile (0.4 km) of a known northern long-eared bat hibernaculum; and take resulting from removal of a known northern long-eared bat maternity roost tree or tree removal within a 150-foot (45-meter) radius of a known northern long-eared bat maternity roost tree during the pup season (June 1 through July 31). Incidental take resulting from hazard tree removal for protection of human life and property is exempt from take prohibitions regardless of where and when it occurs.

Northern long-eared bats most frequently utilize mature-growth forests during the summer maternity season (Lacki & Schwierjohann, 2001; Ford et al., 2006; Foster & Kurta, 1999). Day and night roosts are utilized 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 & Kurta, 1999; Owen et al., 2003; Broders & Forbes, 2004). Variation in roost selection criteria has been reported between northern long-eared bat sexes, with females forming maternity colonies in snags and solitary males roosting in live tree cavities (Caceres & Barclay, 2000; Lacki & Schwierjohann, 2001; Broders & Forbes, 2004). Broders and Forbes (2004) further reported that maternity colonies were more often in shade-tolerant deciduous stands and in tree species that are susceptible to cavity formation. This is supported by Lacki and Schwierjohann (2001) findings that colony roosts were more likely to occur in stands with a higher density of snags. Though some may roost alone, females often roost colonially (Foster & Kurta, 1999). Maternity colonies are generally small, consisting of 30 (Whitaker & Mumford, 2009 as cited in 80 FR 17974) to 60 (Caceres & Barclay, 2000) individuals, though maternity colonies of up to 100 individuals have been observed (Layne, 1978; Dickinson et al., 2009; Whitaker & Mumford, 2009 as cited in 80 FR 17974).

Northern long-eared bats do not forage in intensively harvested forest stands or open agricultural areas, generally restricting movement to intact forests (Patriquin & Barclay, 2003; Henderson & Broders, 2008). Northern long-eared bats are believed to use aerial hawking to catch insects along forested ridges, hillsides, and riparian areas (Kunz, 1973; Clark & Stromberg, 1987; Brack & Whitaker, 2001; Ratcliffe & Dawson, 2003, Whitaker, 2004), but unlike most *Myotis* species, they are also known to glean prey from substrates (Faure et al., 1993). 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). Northern long-eared bats have low wing loading, a low aspect ratio, and high maneuverability in forested habitats, making them well-adapted to foraging in dense vegetation (Patriquin & Barclay, 2003; Carter & Feldhamer, 2005). This species is also frequently observed to forage in close proximity to ephemeral upland pools (Brooks & Ford, 2005; Owen et al., 2003). In managed forests of West Virginia, northern long-eared bats utilized home ranges averaging 160.6 acres, and patches significantly smaller than this likely represent unsuitable habitat (Owen et al., 2003). Females have been reported to move up to 6,500 feet and males 3,300 feet between roost sites (Broders et al., 2006).

Little is known about migration for northern long-eared bats, but there is evidence that portions of the population may move seasonally. 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. Short migratory movements between 35 miles and 55 miles from hibernacula to summer habitat are most common (Nagorsen & Brigham, 1993, as cited in 80 FR 17974; Griffin, 1945), suggesting northern long-eared bats are regional migrants. The longest recorded migration distance for the species is 60 miles (97 km) (Griffin, 1945).

Northern long-eared bats begin arriving at hibernacula in August, and by mid-September large numbers can be seen flying about the entrances to certain caves and mines (Boyles et al., 2009). Although copulation occurs outside of hibernacula during swarming behavior, fertilization does not occur until spring (Caceres & Barclay, 2000). Mine and cave sites have been most often reported as hibernacula for northern long-eared bats (Whitaker & Winter, 1977; Stones, 1981; Griffin, 1940). 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 & Barclay, 2000), and often go unnoticed until spring emergence. Rarely are there more than 100 individuals per hibernation colony (Barbour & Davis, 1969; Caire et al.; 1979). Northern long-eared bats generally exhibit strong philopatry to hibernacula, and have also been reported to occasionally move between hibernacula during the winter (Whitaker & Rissler, 1992).

4.2.2 Historic and Local Abundance

The northern long-eared bat occurs in forested areas throughout much of the eastern half of North America (BCI, 2016; Brack et al., 2010). This species occurs in a widespread but irregular, patchy distribution, rarely in large numbers (Barbour & Davis, 1969), and is more common in the northern part of its range (Harvey, 1992; CBD, 2010).

Little is known about overall population size of northern long-eared bat or historic, pre-WNS population trends. Small maternity colony size is characteristic of all recorded occurrences (Schmidt, 2001; CBD, 2010). Across the species range, broader-scale population decline associated with habitat loss and disturbance to hibernacula have been noted, while within portions of its range some surveys have reported stable populations (e.g., Trombulak et al., 2001; CBD, 2010).

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 Action Area, regardless of WNS. 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 Action Area, as the species has been documented in Ontario, along the northern shores of Lake Erie (Dzal et al., 2009).

As described above in Section 4.1.2, 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% in the spring and 2.2% in the fall). Since 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. For all bat species detected, the acoustic data indicate that offshore activity levels were substantially less than onshore activity levels (Tetra Tech, 2012).

4.2.3 White-Nose Syndrome

Recent losses due to WNS have been substantial. Dead northern long-eared bats have been recorded at many WNS-affected hibernacula (Blehert et al., 2009). Before the discovery of WNS in 2006, this species was common in northeastern United States bat surveys; after the arrival of WNS, survey numbers for northern long-eared bats declined to zero (Hicks et al., 2008, as cited in CBD, 2010; NatureServe, 2015). Northern long-eared bat populations have declined an estimated 99% (from hibernacula data) in the northeastern portion of the species' range due to the emergence of WNS, and the disease is likely to spread throughout the species' entire range within a short time (80 FR 17974).

4.3 KIRTLAND'S WARBLER

This songbird was originally listed as being in danger of extinction under the Endangered Species Preservation Act of 1966 (32 FR 4001), and is currently listed as endangered under the ESA. The geographic range of the Kirtland's warbler is extremely limited in both summer and winter habitats. Furthermore, the habitat requirements for nesting birds are both highly specific and disturbance-dependent. Consequently, it is unlikely that this species was ever particularly abundant. The size of the Kirtland's warbler population has likely fluctuated historically with the general trends in the extent of suitable habitat.

4.3.1 Life History

The Kirtland's warbler may have the most geographically restricted distribution of any mainland bird in the continental U.S. (USFWS, 2012b). Until 1995, the breeding range was generally confined to the northern Lower Peninsula of Michigan. Although 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 & Haney, 1989; Mayfield, 1996; USFWS, 2012b). The young of the year are the earliest arrivals, reaching the Bahamas in late August, with many adults remaining in the nesting range into late September. Spring departure from the Bahamas is estimated to occur from mid-April to early May, based on spring landfall records in the southeastern U.S. 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).

Nesting habitat consists of nearly homogeneous fire-generated stands of dense, scrubby jack pine (*Pinus banksiana*), interspersed with small openings. Almost all nesting sites occur in areas with 5- to 23-year old jack pines on Grayling sand soils, with minimal ground cover, little or no hardwoods, and level or gently rolling topography (USFWS, 1985, 2012b). Optimal habitat can be characterized as large jack pine stands, composed of 8 to 15-year old trees that regenerated after wildfires, with 35 to 65% canopy cover, and more than 3,000 stems/acre. Habitat tends to be suitable only for periods of about 10-15 years (Probst & Weinrich, 1993). When trees reach a height of 16 to 20 feet, low branches with live needles no longer occur, habitat becomes increasingly unfavorable, and populations decline. Habitat tracts of less than 80 acres are seldom used for nesting (USFWS, 1985; Mayfield, 1993). Nests are on the ground, well concealed under arching plants near the bases of pines. In winter, Kirtland's warblers occur mainly in low broadleaf scrub, including transient early successional habitats dominated by *Lantana*, generally in habitat patches of 5-8 aces or larger (Miller & Conroy 1990, Mayfield, 1996).

Kirtland’s warblers are primarily insectivorous, and forage by gleaning pine needles, leaves, and ground cover. Kirtland’s warblers have been observed foraging on a wide variety of food items, including various types of insect larvae, as well as adult moths, flies, beetles, grasshoppers, ants, aphids, spittlebugs, blueberries, pine needles, and pitch from jack pine (DeLoria et al., 2001; USFWS, 2012b).

4.3.2 Historic and Local Abundance

Comprehensive surveys of the entire Kirtland’s warbler population began in 1951. Population numbers prior to that have been extrapolated from anecdotal observations and knowledge about habitat conditions. It is thought that the Kirtland’s warbler population likely peaked in the late 1800s, a time when conditions across the species distribution were universally beneficial. Wildfires associated with intensive logging and agricultural burning in the Great Lakes region created an estimated 200,000 acres of early-successional jack pine forest annually, with most of it in large tracts. Brown-headed cowbirds (a nest parasite) had not yet become established within the Kirtland’s warbler breeding range. In the Bahamas, widespread agriculture was also decreasing, and suitable winter habitat consisting of early-successional and dense, broadleaf vegetation was becoming more abundant (Sykes & Clench 1998; USFWS, 2012b). During this time, Kirtland’s warblers were found on nearly all of the islands in the Bahamas, and reports of migratory strays originated far west of the known breeding range (Mayfield, 1993; USFWS, 2012b). By the 1920s, agriculture in the north woods was being discouraged in favor of industrial tree farming and systematic fire suppression (Brown, 1999). The number of wildfires decreased, as did the size of forest tracts that burned, resulting in a significant decrease in the available jack pine habitat suitably aged for Kirtland's warblers, which decreased to approximately 100,000 acres (Radtke & Byelich, 1963). Brown-headed cowbirds had also become common within the Kirtland's warbler nesting range by this time (Mayfield, 1993), and Kirtland's warblers declined to the point where they occupied only a fraction of the available breeding habitat (USFWS, 2012b).

A singing male census was established in 1951 that continues to provide a robust, relative index of Kirtland's warbler population change. The census was repeated 10 years later in 1961, and then again in 1971 (Ryel, 1975; Probst et al., 2005). The 1951 census documented a population of 432 singing males, confined to 28 townships in eight counties in northern Lower Michigan (Mayfield, 1953). Results were similar in 1961, with 502 singing males counted in 22 townships in nine counties (Mayfield, 1962). However, when the third decennial census was conducted in 1971, the Kirtland's warbler population had decreased 60% to just 201 singing males, restricted to just 16 townships in six counties in northern Lower Michigan (Mayfield, 1972; USFWS, 2012b). In response to the dramatic population decline, a Kirtland's warbler Advisory Committee formed to initiate a cowbird control program, define research needs, propose restrictions in human activity in nesting areas, and locate funding. In 1975, the Kirtland's Warbler Recovery Team was appointed under the authority of the ESA (USFWS, 1985; Probst, 1986). The cowbird control program was successful in reducing cowbird parasitism, and the population of Kirtland's warblers remained relatively stable at approximately 200 singing males through the mid-1980s, experiencing record lows of only 167 singing males in 1974 and again in 1987. By 1990, Kirtland's warbler populations had begun a dramatic increase, reaching a record high of 2,365 singing males in 2015 (USFWS, 2012b, 2016b).

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 1-2 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, 2007). 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, 2012b). There were only five documented sightings of Kirtland's warbler in the Cleveland region between 1950 and 2004 (McCarty, 2012).

4.4 PIPING PLOVER

The piping plover is a small migratory shorebird that nests in the three separate geographic areas in the U.S.: the Great Plains, the shores of the Great Lakes, and the shores of the Atlantic coast. The Great Lakes population of piping plovers was listed as endangered under provisions of the ESA on January 10, 1986; at the same time, the Great Plains and Atlantic coast populations were listed as threatened.

4.4.1 Life History

In the Great Lakes region, piping plovers breed and raise young on the shores of the Great Lakes, spending approximately 3-4 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. Nest territories are actively defended by both adults. Nest cups are shallow depressions approximately 6 cm (2.3 inches) in diameter and 2 cm (0.8 inches) deep, usually lined with light-colored pebbles and shell fragments (Greenwald, 2009; Cairns, 1982; USFWS, 2003). Females lay an egg approximately every other day, laying a total of three or four eggs per clutch. Both sexes share incubation duties that last 22 to 31 days (Wilcox, 1959; Haig & Oring, 1988). At Great Lakes nesting sites, eggs typically hatch from late May to late July. Precocial chicks usually hatch within one half to one day of each other and are able to feed themselves within a few hours (Wilcox, 1959). Brooding responsibilities are shared by both parents. Adults and chicks rely on their cryptic coloration to avoid predators. Adults also use distraction displays, such as feigning injury and false brooding, to lure intruders away from their territories. Chicks fledge approximately 25-35 days after hatching (Cairns, 1982; Wilcox, 1959; USFWS, 2003).

Piping plovers depart Great Lakes breeding areas from mid-July to early September. Adult females typically depart first, followed in order by unpaired males, males with fledglings, and unaccompanied young. Piping plovers begin arriving on the wintering grounds in July, with some late-nesting birds arriving in September. Migration of piping plovers is nocturnal, and 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 & Plissner, 1993; USFWS, 2003).

Although scattered individuals can be found on the wintering grounds throughout the year, sightings are rare in late May, June, and early July. Behavioral observations suggest that piping plovers spend the majority of their time on the wintering grounds foraging (Nicholls & Baldassarre, 1990; Zonick, 2000; Noel, 2006). Primary prey for wintering plovers includes polychaete marine worms, various crustaceans, insects, and occasionally bivalve mollusks. Foraging usually takes place on moist or wet sand, mud, or fine shells, which may be covered by a mat of blue-green algae. When not foraging, plovers can be found roosting, preening, bathing, in aggressive encounters (with other piping plovers and other species), and moving among available habitat locations. The habitats used by wintering birds include beaches, mud flats, sand flats, algal flats, and washover passes. Individual plovers tend to return to the same wintering sites year after year. Piping plovers begin departing the wintering grounds in mid-February, although peak migration departure occurs in March (USFWS, 2003).

4.4.2 Historic and Local Abundance

Piping plovers once nested on Great Lakes beaches in Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and Ontario, Canada (USFWS, 2003). Based on review of historic records and historically suitable habitat, Russell (1983) estimated a total population of 492-682 breeding pairs in the Great Lakes region in the late 1800s. Of these, 215 pairs or more were attributed to Michigan, 152-162 to Ontario, and 125-130 to Illinois. Indiana, Ohio, and Wisconsin were estimated to have 100 or fewer breeding pairs each, and Minnesota, New York, and Pennsylvania fewer than 30 (Russell, 1983). By the late 1970s, piping plovers were extirpated from Great Lakes beaches in Illinois, Indiana, New York, Pennsylvania, and Ontario, although occasional nesting has occurred since then. Few piping plovers nested in Wisconsin after the 1970s, and no nests were found in the state between 1983 and 1997. The small number of pairs that nested in Minnesota had abandoned the area by 1986 (USFWS, 2003).

In 1977, the Great Lakes population was estimated at 31 nesting pairs, and by 1985 had declined to approximately 17 pairs. When the piping plover was listed as endangered in 1986, the Great Lakes population nested exclusively at a few sites on the northeastern shore of Lake Michigan and southeastern shore of Lake Superior in Michigan, the state with the most habitat remaining. Between 1986 and 2002, nests were recorded at 34 breeding sites in 12 counties in Michigan and two counties in Wisconsin. From 1984 to 2001, the Great Lakes piping plover population ranged from 12 to 32 breeding pairs. In 2002, 51 pairs were observed nesting in the Great Lakes, 50 pairs in Michigan and one pair in Wisconsin (USFWS, 2003). In 2008, there were 63 breeding pairs in the Great Lakes, 53 in Michigan, six pairs in Wisconsin, and four pairs in Ontario (USFWS, 2009b). In 2009, a pair nested on the Lake Michigan shoreline in Illinois, the first nest in Illinois in 30 years. With some fluctuations, the population has continued to gradually increase, with 70 pairs observed in 2014 (USFWS, 2015b), and 75 pairs in 2015, including one pair on the eastern shore of Lake Ontario, the first nest in New York State in over 30 years (Figura, 2016).

Based on the wide distribution of historical records and the similarity of the shoreline to Indiana's, the former population of breeding piping plovers in Ohio has been estimated at 50-100 pairs (Russell, 1983). The piping plover disappeared from southern Lake Erie's shores somewhat earlier than from the other lakes. Although Ohio historically had a fairly broad stretch of beach along much of the shoreline, heavy industrialization and a high human population in the area left no undisturbed beaches within the state by the 1940s. Historic breeding records are known from Lucas, Ottawa, Erie, Lorain, Lake, and Ashtabula Counties along the Lake Erie shoreline and on the Lake Erie islands. The mostly regular shoreline and lack of significant dunelands likely precluded any major breeding concentrations. Nevertheless, the wide distribution of breeding records indicates that the plover was historically a breeding species along much of the Ohio shoreline. Continued heavy recreational activity along Ohio beaches would seem to eliminate any possible future reestablishment (Russell, 1983).

Despite the 2001 designation of two critical habitat units in Ohio (i.e., OH-1 near Sandusky and OH-2 near Painesville [66 FR 22967], piping plovers do not currently breed in Ohio. 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 (Tetra Tech, 2012).

4.5 RUFA RED KNOT

Effective January 12, 2015, the rufa red knot (*Calidris canutus rufa*) was federally-listed as threatened under the ESA. The USFWS made this determination based on sustained decline in rufa red knot populations numbers; loss of both breeding and nonbreeding habitat; likely effects related to disruption of natural predator cycles on the breeding grounds; reduced prey availability throughout the nonbreeding range; and increasing frequency and severity of asynchronies in the timing of the birds' annual migratory cycle relative to favorable food and weather conditions (79 FR 73706).

4.5.1 Life History

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, small to moderate numbers of rufa red knots are reported annually across the interior United States (i.e., greater than 25 miles from the Gulf or Atlantic Coasts) during spring and fall migration. 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, marine worms, and horseshoe crab eggs. At some stages of migration, a very high proportion of the population of rufa red knots uses a single migration staging regions to prepare for long flights, leaving populations vulnerable to loss of key resources, the prime example being the Delaware Bay during the rufa red knots' spring migration (USFWS, 2014b).

Breeding areas are primarily located in inland Nunavut, Canada, near arctic coasts. Rufa red knots generally nest in dry, slightly elevated tundra locations, often on windswept slopes with little vegetation. Most nests are located in proximity to wetlands and/or lake edges. Nests may be scraped into patches of mountain avens (*Dryas octopetala*) plants; in low spreading vegetation on hummocky ground containing lichens, leaves, and moss; or in exposed areas of glacial/shattered rocks and mudboils (Niles et al., 2008; USFWS, 2104b). After the eggs hatch, rufa red knot chicks and adults quickly move away from high nesting terrain to lower, wetland habitats (Niles et al., 2008). On the breeding grounds, the rufa red knot's diet consists mostly of terrestrial invertebrates, though early in the season, before insects and other macroinvertebrates are active and accessible, red knots will eat grass shoots, seeds, and other vegetable matter (Niles et al., 2008; USFWS, 2104b).

The start of breeding for rufa red knot varies with snowmelt conditions. Upon arrival, or as soon as favorable conditions exist, male and female rufa red knots occupy breeding habitat, and territorial displays begin. Pair bonds form soon after arrival on breeding grounds and remain intact until shortly after the eggs hatch. Female rufa red knots lay only one clutch per season, typically with four eggs. The incubation period lasts approximately 22 days, and both sexes participate equally in egg incubation. Chicks are precocial, leaving the nest within 24 hours of hatching and foraging for themselves. Females are thought to leave the breeding grounds and start moving south soon after the chicks hatch in mid-July. Thereafter, parental care is provided solely by the males, but about 25 days later, they also abandon the newly fledged juveniles and move south. Juveniles soon follow (Niles et al., 2008; USFWS, 2104b).

Breeding success of High Arctic shorebirds, such as rufa red knot, varies dramatically among years in a somewhat cyclical manner. Two main factors seem to be responsible for this annual variation: abundance of arctic lemmings (*Dicrostonyx torquatus* and *Lemmus sibericus*) and weather. Arctic fox (*Alopex lagopus*) and snowy owl (*Nyctea scandiaca*) feed largely on lemmings, which are easily caught when their abundance is high. However, in years when lemming numbers are low, the predators turn to alternative prey, such as shorebird eggs, chicks, and adults. Production of shorebird young is also very sensitive to adverse weather during the breeding season. Chicks grow poorly during cold weather due to higher rates of energy expenditure, shorter foraging periods, and reduced prey availability (Piersma & Lindström 2004; Schekkerman et al., 2003; USFWS, 2014b). Growth rate of red knot chicks is high compared to similarly sized shorebirds nesting in more temperate climates and is strongly correlated with weather-induced and seasonal variation in availability of invertebrate prey (Schekkerman et al., 2003). Successful rufa red knot reproduction occurs almost exclusively during peak lemming years when snowmelt is early (Piersma & Lindström 2004; Blomqvist et al., 2002; USFWS, 2014b).

4.5.2 Historic and Local Abundance

Reliable rangewide population data is not available for rufa red knot. No population information exists for the breeding range because breeding rufa red knots are thinly distributed across a huge and remote area of the Arctic. Because there can be considerable annual fluctuations in rufa red knot counts, longer-term trends are more meaningful (USFWS, 2014b). Rufa red knot populations in the United States declined sharply in the late 1800s and early 1900s due to excessive sport and market hunting. Subsequent hunting restrictions led to signs of population recovery by the mid-1900s (Urner & Storer, 1949). However, it is unclear whether the rufa red knot population fully recovered its historical numbers following the period of unregulated hunting. More recent long-term survey data from the Tierra del Fuego wintering area and the Delaware Bay spring stopover site show a roughly 75 percent decline in rufa red knot numbers since the 1980s, with declines since 2000 believed to have been driven primarily by reduced prey availability at spring migratory stopover sites, caused by the commercial harvest of horseshoe crab eggs (Clark et al., 2009; Morrison et al., 2004; 79 FR 73706).

Small numbers of rufa red knots pass through Ohio, with more moving through in the fall than in the spring (ODNR, 2012). Away from the Gulf coast, between 25 and 100 birds are recorded annually in spring and 100-200 in the autumn, the majority along the shores of Lakes Michigan and Erie. Most of these records are of singles, pairs, or small flocks of 3-10 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 Offshore Study Area during boat-based visual observation surveys or avian acoustic monitoring, both conducted during the spring and fall migration periods (Tetra Tech, 2012).

5.0 EFFECTS ANALYSIS

As described in Section 1.1, the federally-listed species that could occur in the Action Area consist of Indiana bat, northern long-eared bat, Kirtland's warbler, piping plover, and rufa red knot.

The effects analysis summarizes the risks to listed species from the proposed Project. Potential impacts associated with construction of the proposed Project could include loss of habitat and disturbances associated with the presence or activity of construction equipment. Potential impacts related to operation could include disturbances, such as barriers to flight paths due to the presence of the turbines, and the risk of collision with wind turbines. Impacts associated with decommissioning activities would be expected to be similar to construction activities.

5.1 INDIANA BAT

5.1.1 Direct and Indirect Effects

Indiana bats have been documented to fly over Lake Erie. However, this is not thought to be a frequent event. Indiana bat was not documented in Ontario when Dobbyn (1994) produced the mammal atlas for that province, and it is scarce in Michigan (USFWS, 2007). There have been no documented Indiana bats breeding north of Lake Erie, and as a consequence, there is no biological reason for Indiana bats to cross the lake. The Indiana bat occurs in Ohio but is unlikely to occur in the vicinity of the proposed Project. There is one known Indiana bat maternity colony in Cuyahoga County and no known hibernacula (USFWS, 2007). All of the terrestrial components of the proposed Project occur on developed land in an urban area within the City of Cleveland that is unsuitable as Indiana bat habitat. Undisturbed forested habitat typically occupied by Indiana bats does not occur in the vicinity of the proposed Project. Therefore, it is unlikely that Indiana bats breed close enough to the lake to forage offshore in this area with any frequency. They were not identified in the acoustic survey in 2010 (Tetra Tech, 2012).

5.1.2 Actions to Reduce Adverse Effects

Bat collision impacts at turbines are understood to be most frequent on calm nights when winds are low, especially during the late summer when migrating and swarming bats are most active. To address this concern, LEEDCo has agreed that the Project's turbines would not start rotating until winds reach 6.7 mph.

LEEDCo would develop a Bird Bat Conservation Strategy (BBCS) to conduct thorough post-construction monitoring of Project impacts, and to undertake adaptive management measures, if necessary. Mitigation and adaptive management measures would be implemented if actual impacts exceed expectations. LEEDCo would be prepared to adjust the pitch of the turbine blades (e.g., blade feathering) during specific seasons, hours of the day, and weather conditions that are high risk for bats.

5.1.3 Conclusion

Indiana bats are not likely to occur near the proposed Project site. Therefore, the proposed Project may affect but is not likely to adversely affect Indiana bats and population-level impacts are not expected.

5.2 NORTHERN LONG-EARED BAT

5.2.1 Direct and Indirect Effects

As described above in Section 4.2.2, the *Myotis* species group was recorded at both onshore and offshore detectors, but represented a small percentage of the total calls recorded (2.4% in the spring and 2.2% in the fall). Since bat acoustic monitoring cannot reliably distinguish between the high frequency calls of multiple *Myotis* species, the Tetra Tech (2012) study could neither confirm nor rule out the presence of northern long-eared bats at the proposed Project site.

The range of northern long-eared bats is typically associated with mature interior forests. Although they are most often found in densely forested areas, northern long-eared bat may also use small openings or canopy gaps as well. All of the terrestrial components of the proposed Project area occur on already developed land in an urban area in the City of Cleveland. 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.” Forested habitat typically occupied by northern long-eared bats does not occur in the vicinity of the proposed Project.

It is possible that northern long-eared bats could migrate through the Action 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. Northern long-eared bats are unlikely to cross Lake Erie, and therefore, unlikely to come into contact with the turbines.

5.2.2 Actions to Reduce Adverse Effects

Bat collision impacts at turbines are most frequent on calm nights when winds are low, especially during the late summer when migrating and swarming bats are most active. As indicated previously, the Project’s turbines would not start rotating until winds reach 6.7 mph.

In addition, LEEDCo would develop a Bird Bat Conservation Strategy (BBCS) to conduct thorough post-construction monitoring of Project impacts, and to undertake adaptive management measures, if necessary. Mitigation and adaptive management measures would be implemented if actual impacts exceed expectations. Again, LEEDCo would be prepared to adjust the pitch of the turbine blades (e.g., blade feathering) during specific seasons, hours of the day, and weather conditions that are high risk for bats.

5.2.3 Conclusion

Northern long-eared bats are unlikely to cross Lake Erie. Therefore, the proposed Project may affect but is not likely to adversely affect Northern long-eared bats and population-level impacts are not expected.

5.3 KIRTLAND'S WARBLER

5.3.1 Direct and Indirect Effects

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, 2016c). It is thought that "all or nearly all" of the Kirtland's warbler population passes through Ohio during migration (ODNR, 2007). 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 Project. The model predicted that, over the 30-year lifespan of the Project, the take of Kirtland's warbler may be estimated at 0.002 warblers per year (one Kirtland's warbler death every 500 years). The USFWS model demonstrated no measurable risk for the species (Kerlinger & Guarnaccia, 2013).

Details of the Kirtland's warbler migration and specific habitat used during migration are not well understood (USFWS, 2012b). 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. Although there is little data specific to Kirtland's warbler, nocturnally migrating songbirds generally exhibit low susceptibility to collisions with wind turbines.

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 Project's turbines (Kerlinger & Guarnaccia, 2013).

5.3.2 Actions to Reduce Adverse Effects

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 utilize flashing red lights on turbines, as stipulated by FAA for bird safety.

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

5.3.3 Conclusion

Kirtland's warbler could potentially migrate through the Action Area. However, no Kirtland's warblers 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 (Tetra Tech, 2012). Furthermore, only five sightings of Kirtland's warblers were recorded in the Cleveland area between 1950 and 2004 (McCarty, 2012). Although Kirtland's warbler fatalities have not been documented at wind energy facilities to date, very infrequent Kirtland's warbler mortality could occur as a result of collisions with the Project turbines. Based on the USFWS model for assessing risk of collision mortality, the estimated take for the species is one warbler every 500 years. Therefore, the proposed Project may affect but is not likely to adversely affect Kirtland's warbler and population-level impacts are not expected.

5.4 PIPING PLOVER

5.4.1 Direct and Indirect Effects

Piping plovers used to nest on the larger Lake Erie beaches, but due to loss/disturbance of their habitat, the species has disappeared as an Ohio breeder. The piping plover is now considered only a migrant species in Ohio (ODNR, 2012). 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 (Tetra Tech, 2012), the possibility exists that piping plovers could migrate through the Action 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 Action Area and OH-2 near Painesville is located approximately 30 miles to the east of the Action 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 proposed Action 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]) (Richardson, 1979), well above the rotor swept area. 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 in spite of this project's location adjacent to coastal habitat within one of the most concentrated shorebird migration corridors on the east coast of the US (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 as a result of the Project. The estimated take for piping plovers was one piping plover every 2,500 years.

5.4.2 Actions to Reduce Adverse Effects

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 utilize flashing red lights on turbines, as stipulated by FAA for bird safety.

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

5.4.3 Conclusion

Piping plovers likely migrate along Lake Erie, through the Action Area. However, no piping plovers were found in the Offshore Study Area during boat-based visual observation surveys or avian acoustic monitoring, conducted during both the spring and fall migration periods (Tetra Tech, 2012). Although it is unlikely, very infrequent piping plover mortality (estimated at 1 take every 2,500 years) may result as a consequence of collisions with the rotating blades. Therefore, the proposed Project may affect but is not likely to adversely affect Piping plover and population-level impacts are not expected.

5.5 RUFA RED KNOT

5.5.1 Direct and Indirect Effects

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, 2012). 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 (Tetra Tech, 2012), the potential exists for the species to migrate through the Action Area.

Although there are no documented instances of red knot mortality from wind energy facilities, Project operation could result in red knot mortality as a result of 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 Project 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 Project, it is expected that birds would cross the proposed Project Area well above the rotor-swept area (Gordon & Nations, 2016).

5.5.2 Actions to Reduce Adverse Effects

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 Project would utilize flashing red lights on turbines, as stipulated by FAA for bird safety.

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

5.5.3 Conclusion

Red knots could potentially migrate through the Action Area. However, 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 (Tetra Tech, 2012), or during aerial avian surveys conducted in 2009-2011 by the ODNR (Norris & Lott, 2011). Therefore, the proposed Project may affect but is not likely to adversely affect rufa red knot and population-level impacts are not expected.

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5.6 CUMULATIVE EFFECTS

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, and/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). These types of activities would also be reasonably anticipated in the future.

The Ohio Department of Transportation (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 five 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 two-mile stretch, improve green space, biking and pedestrian facilities, increase development potential and simplify connections along the now limited-access freeway.

The ITC Lake Erie Connector Project is located approximately 80 miles east of the proposed Project. It consists of an approximately 35-mile submerged cable route within Lake Erie.

Other than the ITC Lake Erie Connector Project, there are no known or reasonably anticipated to be implemented offshore 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.

No wind energy projects beyond this proposed Project were identified within the onshore, nearshore, or offshore environment.

As no other offshore projects were identified, no wind projects were identified, and onshore projects identified include routine maintenance of near shore facilities (e.g. docks), routine maintenance and construction of buildings, and ongoing roadway projects, cumulative impacts to would be expected to be negligible.

6.0 CONCLUSION

Section 7 of the ESA requires that all federal agencies ensure that any action they authorize, fund, or execute will not jeopardize the continued existence of any listed species or result in the destruction or adverse modification of any critical habitat of such species. Five federally-listed species may occur in Cuyahoga County at some point in their life cycles: Indiana bat, northern long-eared bat, Kirtland's warbler, piping plover, and rufa red knot. There are no candidate species, proposed listed species, or proposed or designated critical habitats in Cuyahoga County. This BA summarizes the best available information on the status of the listed species in the Action Area, and evaluates the anticipated direct, indirect, and cumulative effects of the proposed action on these species and their habitats.

Under Section 7 of the ESA, the lead federal agency must make a finding for each listed species or critical habitat potentially affected by a proposed action. Generally, one of the following three determinations apply:

- "No effect" means there will be no impacts, positive or negative, to listed or proposed resources. Generally, this means no listed resources will be exposed to action and its environmental consequences. Concurrence from the USFWS is not required.
- "May affect, but not likely to adversely affect" means that all effects are beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to the species or habitat. Insignificant effects relate to the size of the impact and include those effects that are undetectable, not measurable, or cannot be evaluated. Discountable effects are those extremely unlikely to occur. These determinations require written concurrence from the USFWS.
- "May affect, and is likely to adversely affect" means that listed resources are likely to be exposed to the action or its environmental consequences and will respond in a negative manner to the exposure.

Existing data, site-specific studies, and evaluation of the Project by the USFWS indicate that Project Icebreaker is unlikely to have an adverse impact on any federally-listed threatened or endangered species. The Project Area does not contain any critical nesting, foraging, or roosting habitat for any of these species. Their occurrence, if any, 8-10 miles offshore in Lake Erie would be limited to transitory/migratory movements. However, even their possible occurrence in this capacity is unlikely based on the following facts:

1. There is little or no habitat for these species at the nearest shoreline locations.
2. In the case of the listed species of bats, there is little chance that they would occur at the proposed Project Area, given known information about their regional distributions and migration patterns.
3. In the case of the listed species of birds, their occurrence is more likely in the western basin of Lake Erie. Only small numbers are likely to occur in the Action Area, and such occurrence is largely or exclusively limited

to migratory flights, during which the birds are expected to fly at altitudes above the rotor swept zone of the proposed Project's turbines.

4. The small size of the proposed Project, in combination with the factors described above, minimizes any risk of collision with the proposed turbines.

Consequently, any predicted take of these species would be discountable and/or insignificant. In addition, to minimize the potential for any adverse effect on non-listed bird and bats associated with operation of the Project, LEEDCo has agreed to feather the turbine blades below cut-in speed, conduct post-construction monitoring studies, implement adaptive management and additional mitigation if impacts exceed those predicted, and operate the Project in accordance with a Bird and Bat Conservation Strategy developed in consultation with the USFWS and the ODNR. Although not specifically targeting federally-listed species (because they are not expected to encounter the facility), these measures will further reduce risk to protected species.

Based on the best available information, as presented herein, the proposed action may affect, but is not likely to adversely affect Indiana bat, northern long-eared bat, Kirtland's warbler, piping plover, and rufa red knot (i.e., all five federally-listed species that could occur in the Action Area). Furthermore, because no critical habitat is designated in the action area, none will be affected by the proposed action.

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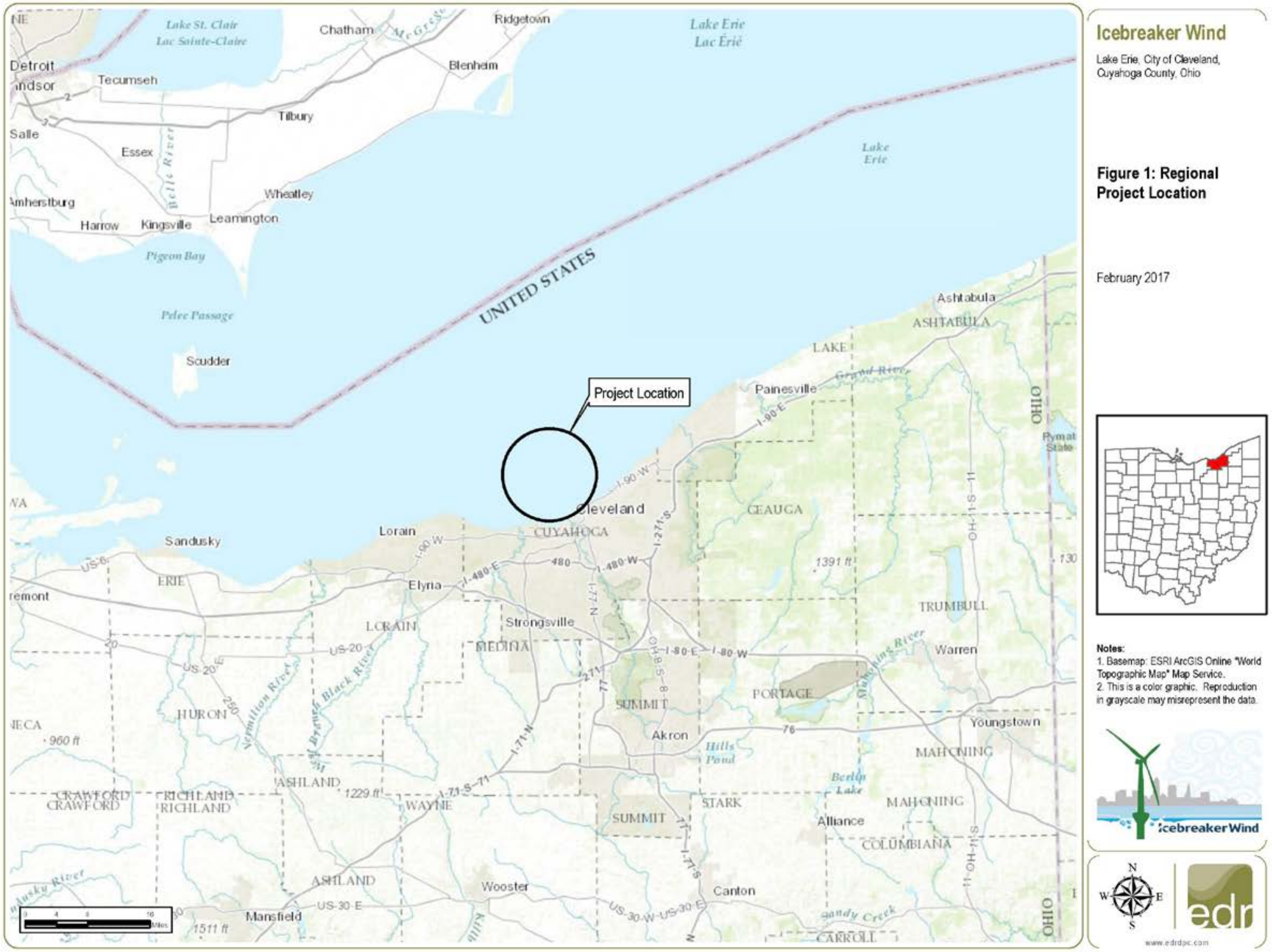
Icebreaker Wind
Lake Erie, City of Cleveland, Cuyahoga County, Ohio
Figure 1: Regional Project Location
February 2017
Notes:
1. Basemap: ESRI ArcGIS Online "World Topographic Map" Map Service.
2. This is a color graphic. Reproduction in grayscale may misrepresent the data.
IcebreakerWind
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Project Location
Lake Erie
Lac Érié
Lake St. Clair
Lac Sainte-Claire
UNITED STATES
Detroit
Tecumseh
Chatham
Ridgetown
Blenheim
Tilbury
Essex
Wheatley
Leamington
Kingsville
Harrow
Pigeon Bay
Pelee Passage
Scudder
Sandusky
Lorain
Elyria
Cleveland
CUYAHOGA
Painesville
LAKE
Ashtabula
ASHTABULA
GEAUGA
Strongsville
MEDINA
LORAIN
ERIE
HURON
ASHLAND
WAYNE
SUMMIT
Akron
PORTAGE
TRUMBULL
Warren
Youngstown
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Canton
COLUMBIANA
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Mansfield
CRAWFORD
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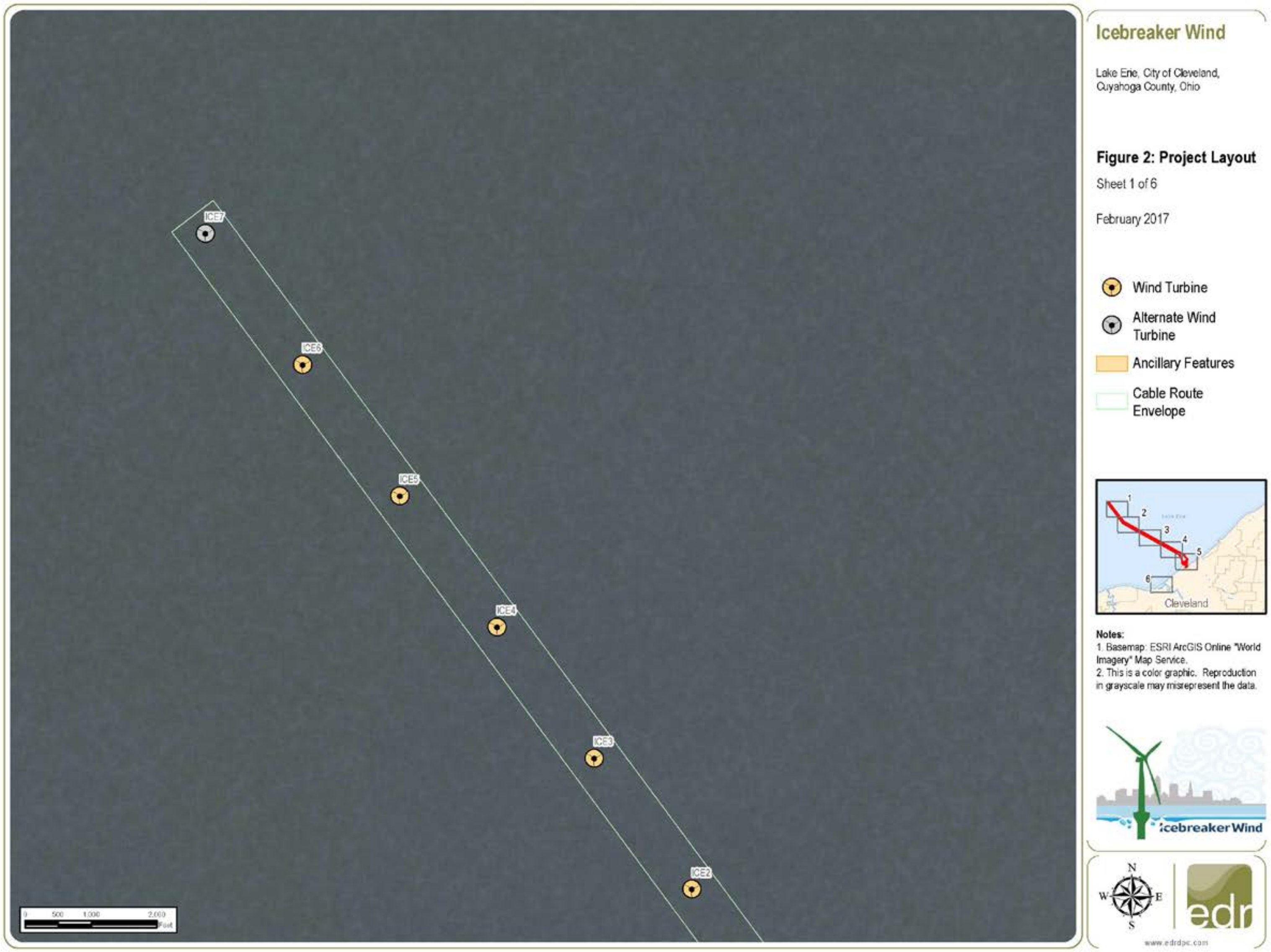
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ICE6
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Icebreaker Wind
Lake Erie, City of Cleveland, Cuyahoga County, Ohio
Figure 2: Project Layout
Sheet 1 of 6
February 2017
Wind Turbine
Alternate Wind Turbine
Ancillary Features
Cable Route Envelope
Cleveland
Notes:
1. Basemap: ESRI ArcGIS Online "World Imagery" Map Service.
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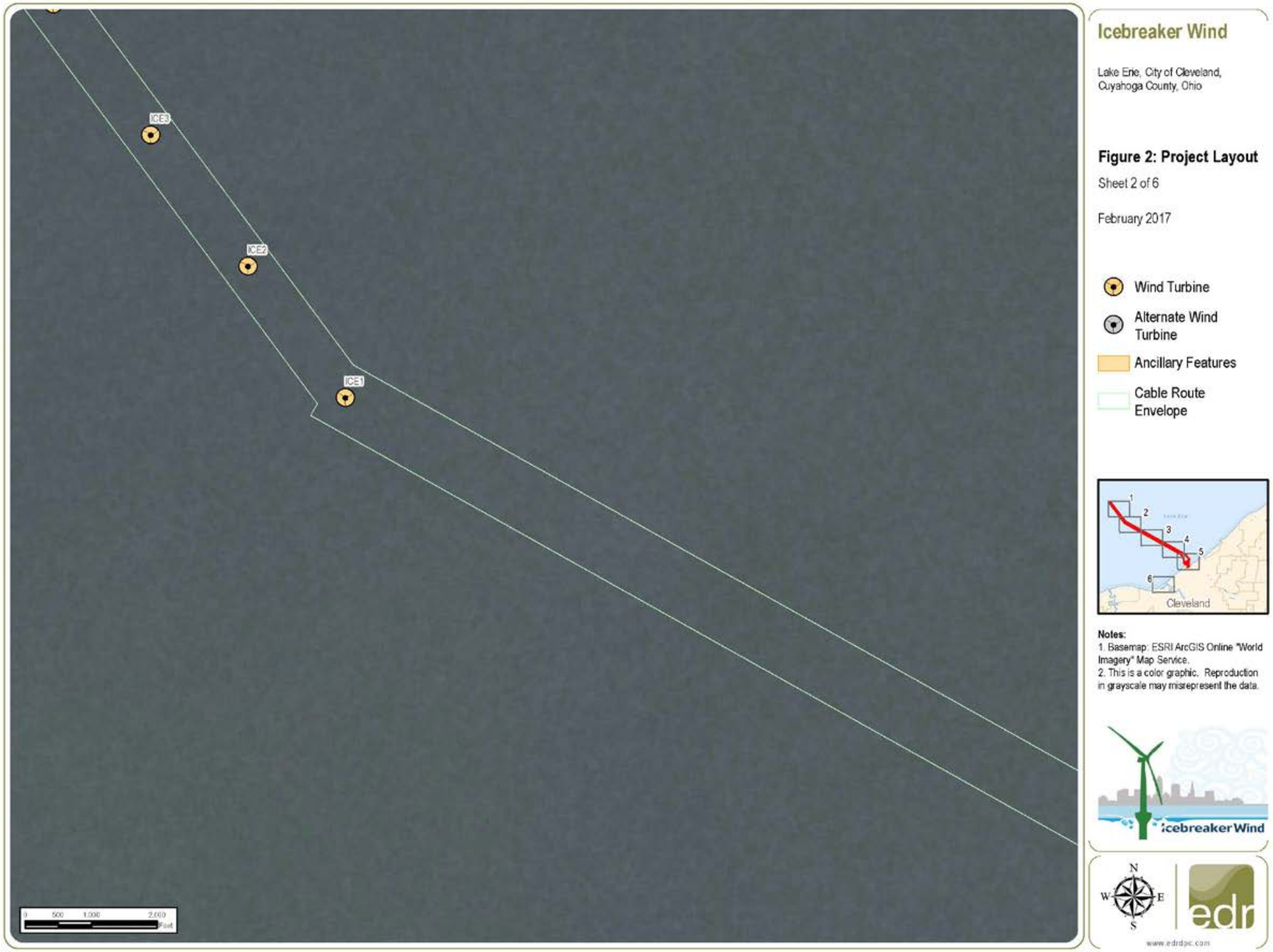
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Icebreaker Wind
Lake Erie, City of Cleveland, Cuyahoga County, Ohio
Figure 2: Project Layout
Sheet 2 of 6
February 2017
Wind Turbine
Alternate Wind Turbine
Ancillary Features
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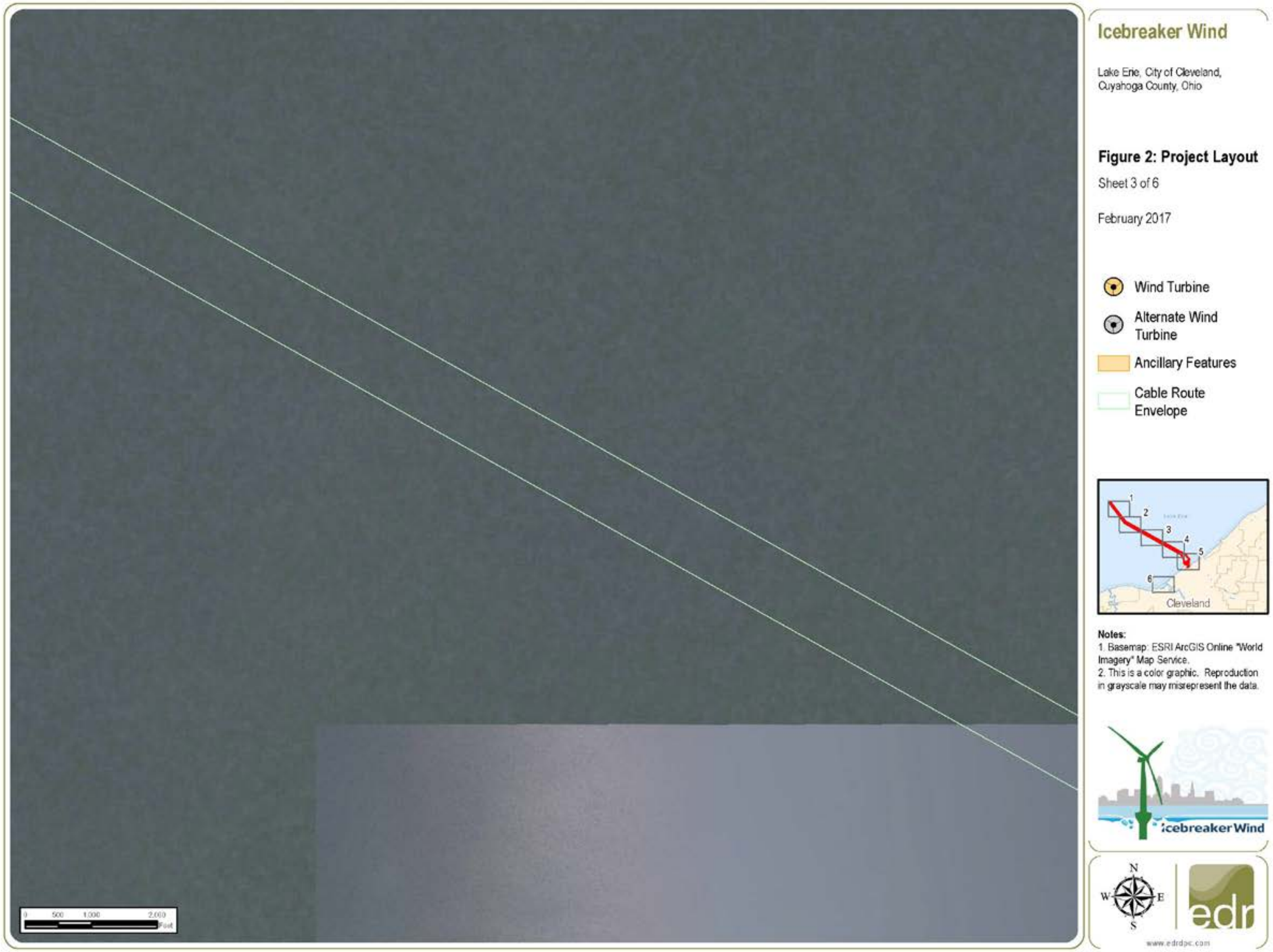
Icebreaker Wind
Lake Erie, City of Cleveland, Cuyahoga County, Ohio
Figure 2: Project Layout
Sheet 3 of 6
February 2017
Wind Turbine
Alternate Wind Turbine
Ancillary Features
Cable Route Envelope
Cleveland
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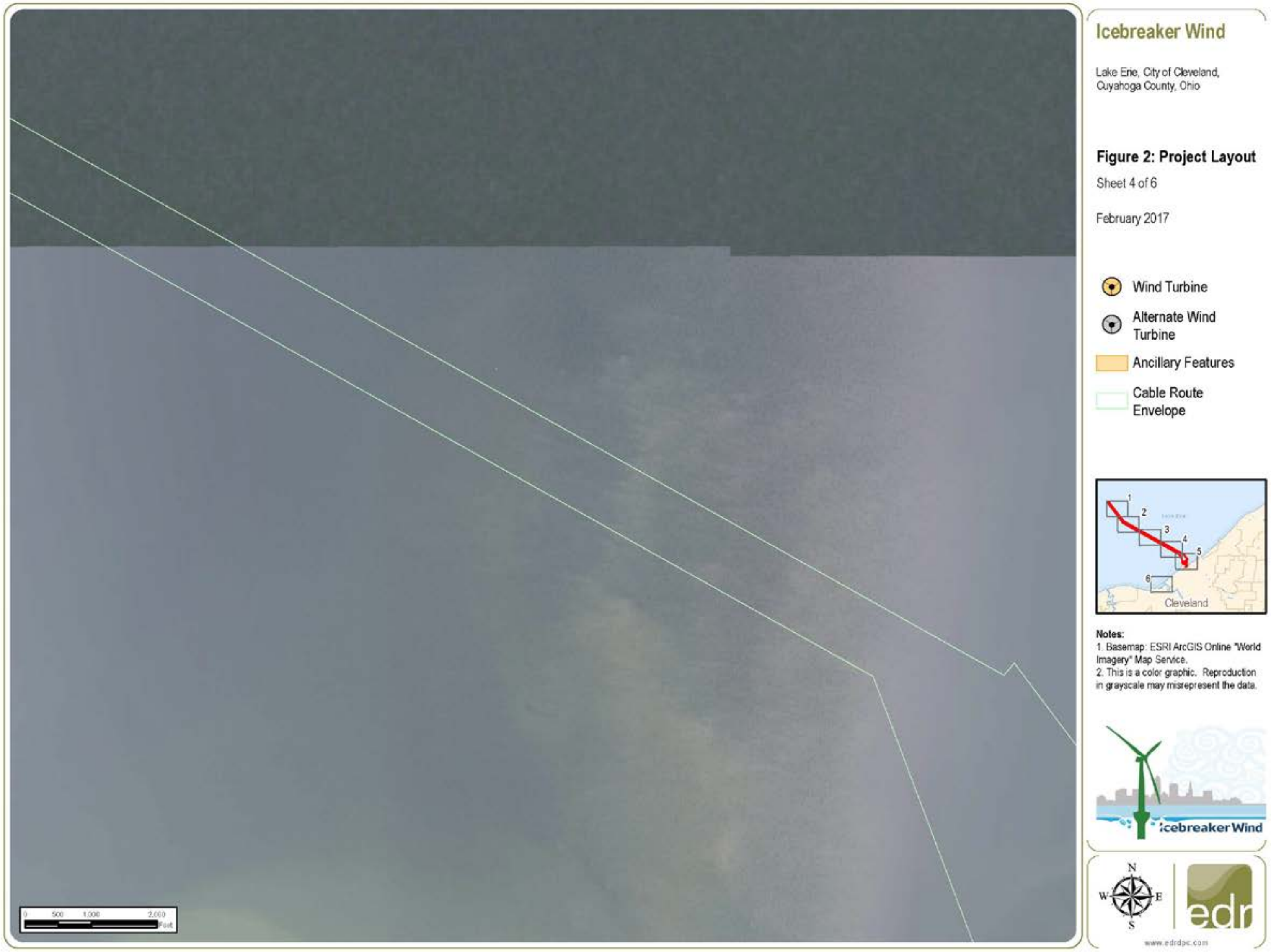
Icebreaker Wind
Lake Erie, City of Cleveland,
Cuyahoga County, Ohio
Figure 2: Project Layout
Sheet 4 of 6
February 2017
Wind Turbine
Alternate Wind Turbine
Ancillary Features
Cable Route Envelope
Cleveland
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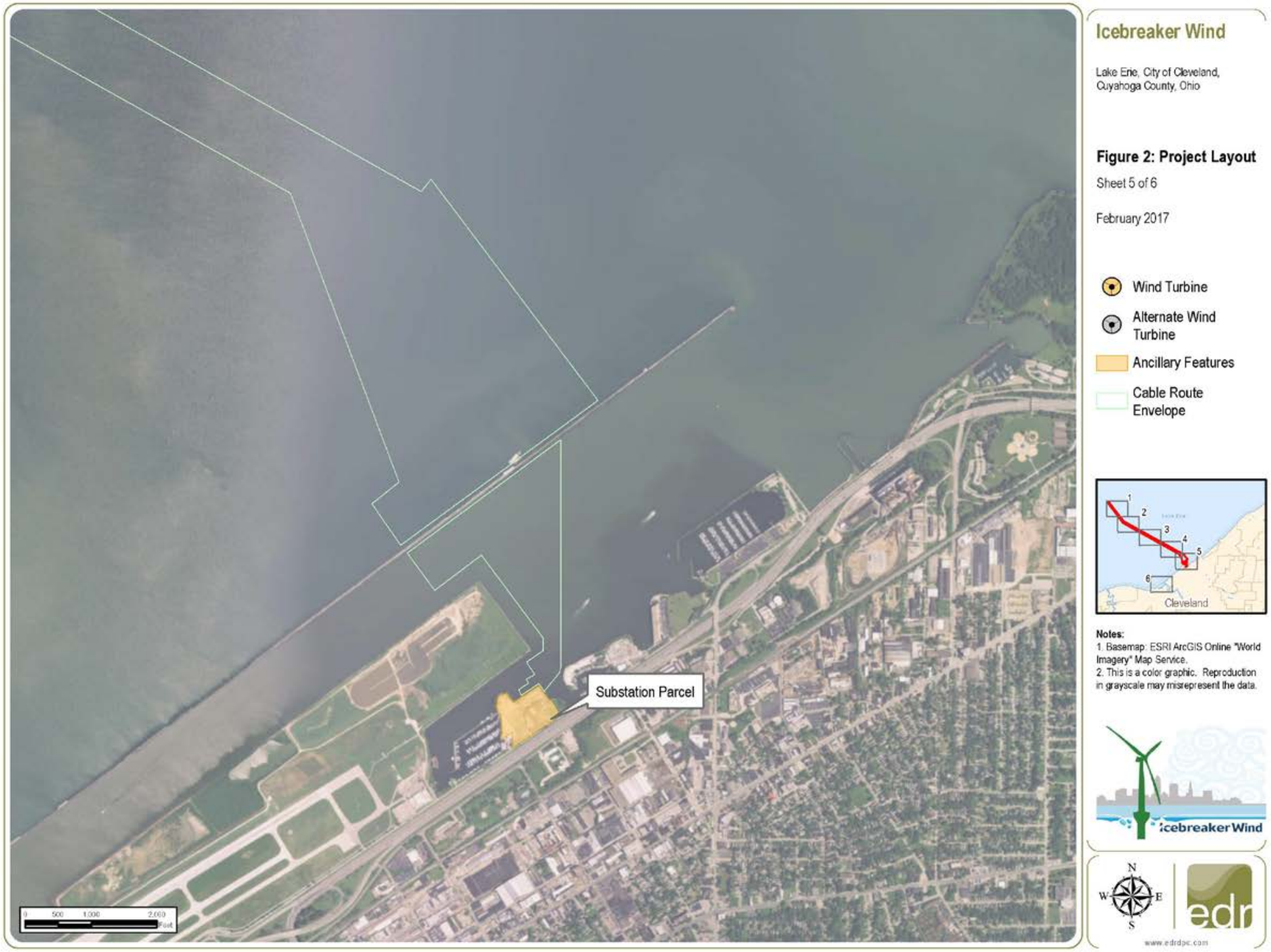
Substation Parcel
Icebreaker Wind
Lake Erie, City of Cleveland, Cuyahoga County, Ohio
Figure 2: Project Layout
Sheet 5 of 6
February 2017
Wind Turbine
Alternate Wind Turbine
Ancillary Features
Cable Route Envelope
Cleveland
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Icebreaker Wind
Lake Erie, City of Cleveland, Cuyahoga County, Ohio
Figure 2: Project Layout
Sheet 6 of 6
February 2017
Wind Turbine
Alternate Wind Turbine
Ancillary Features
Cable Route Envelope
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