Appendix A
Public Scoping Documents

LEEDCo Project Icebreaker Environmental Assessment (DOE/EA-2045)

DOE received 95 public comment letters and/or emails during public scoping period, including three from federal agencies. The public scoping issues identified in letters and emails from the public are presented below. The scoping comments from the federal agencies are summarized in a separate table. DOE will conduct analysis of the scoping issues raised by the public and by the federal agencies and include this analysis in the draft Environmental Assessment (EA). DOE will consult with other agencies, including but not limited to the United States Fish and Wildlife Service and the State Historic Preservation Office, in support of the analysis presented in the draft EA as appropriate. DOE will notify the public when the draft EA is complete and available for public review and comment.

Scoping Issue Identified	Number of comment letters that addressed this Issue
Geology, Sediments, Soils, Shore Erosion and Accretion	14
Water Resources and Hydrology- Quality and Supply, Wetland Protection, Spills, Flood and Floodplain Hazards	30
Biological Resources, Lake and Terrestrial Flora and Fauna-including Bat, Fisheries, and Protected Species	52
Public Health and Safety, including Waste Management and Hazardous Waste	12
Air Quality and Climate Change	21
Siting	21
Lake Use (Commercial and Recreational Fisheries, Commercial Shipping and Recreational Boating)	18
Traffic and Transportation (including Navigation Risk and Ice Floes), Land Use and Infrastructure, Cultural Resources	16
Economics, Socioeconomics and Environmental Justice	38
Aesthetics and Visual Resources, Design and Noise	33

DOE also received comments that included statements in favor of and against the proposed project, comments that identified or included specific research or articles, and comments which were not related to the proposed project. DOE has reviewed all of the comments recieved, reviewed all included attachments, and reviewed all research and articles submitted or cited in the comment. DOE will include this information in the draft EA as appropriate.

LEEDCo Project Icebreaker Environmental Assessment (DOE/EA-2045)

Local, State and Federal Agency Comments Received During the Public Scoping Period

Agency	Summary of Comment
US Environmental Protection Agency (EPA)	The EPA letter referenced the list of resource areas and topics published in DOE's Notice of Scoping to be considered in the EA, and indicated that it is a robust list of relevant topics. EPA had comments on some topics to ensure thorough analysis of impact and consideration of possible mitigation measures: 1) Alternatives - Recommended that the EA summarize the range of alternative sites considered in project development and the rationale for selection of the proposed site and elimination of other sites. Should summarize studies and provide full studies as appendices to the EA or as links on project website. For a demonstration project, the EA should describe what design and operational factors of this project, once built, would be studied further to inform other possible future offshore wind projects in the Great Lakes. 2) Geology, Sediments and Soils - Recommended that the EA describe the quality of sediments and soils in the project's offshore and onshore footprints, and describe how installation of turbine foundations and cables would avoid areas of contamination. Describe how this project would avoid, minimize and mitigate any suspension of sediment in water column and associated impacts to water quality and fisheries. Explain how dredged sediments would be tested for contamination and identify location for disposal of clean sediments. 3) Biological Resources - The EA should summarize and document studies done to date and ongoing coordination with USFWS and ODNR on fisheries, birds, bats, federally/state listed species. Look at tower lighting and turbine operational parameters as means of minimizing/mitigating impacts to birds and bats. Describe monitoring measures to gauge effectiveness of minimization/mitigation measures. Discuss the extent to which the USFWS and ODNR bird/bat monitoring protocols for land-based wind projects can be adapted to the offshore environment. Also describe how submerged portions of towers will be maintained to minimize habitat use by aquatic nuisance species (zebra mussels, quagga mussels). 4) Air Quality and Climate Change - Recommended that the EA quantify air emissions, including GHGs, associated with onshore and offshore equipment and lake vessels used in construction, operation, maintenance and decommissioning. EPA's Construction Emission Control Checklist is attached and provides strategies that could be used in reducing emissions from the project. Need to analyze effects of climate change on the project (letter provides example.). Also the EA should quantify the air pollution and GHG emissions that would be displaced from existing electric power sources. 5) Traffic and Transportation - In addition to navigation impacts and ice floes, the EA should include discussion of how the project will comply with FAA safety standards. 6) Environmental Justice - Use EPA's website EJSCREEN, free online tool. Also recommended incorporating recommendations from Interagency Working Group for Environmental Justice (see letter). 7) Permitting and Interagency Coordination - Recommended that the EA summarize in a table all permits and approvals that will be required (federal, state, local) and include correspondence relevant to interagency coordination in an appendix.
US Fish and Wildlife Service (USFWS)	The letter states that USFWS is providing comments pursuant to the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, the Endangered Species Act, and the Fish and Wildlife Act (statutory citations found in the letter). The letter summarizes discussions/meetings with LEEDCo and ODNR that have occurred since 2008, and previous pre-construction wildlife surveys conducted by LEEDCo. USFWS provides comments under various categories: 1) General Comments - USFWS states that because of unknown consequences of developing offshore wind energy in Great Lakes, the pre- and post-construction evaluations of potential impacts on wildlife much meet greater standard of rigor than land-based wind projects. USFWS states that it is essential to have scalable pre-and post-construction studies to evaluate impacts. 2) Migratory Bird Comments - USFWS recommends that LEEDCo develop a Bird and Bat Conservation Strategy to address pre- and post-construction monitoring to assess risk to migratory birds and bats and to identify measures to minimize risk and identify potential mitigation actions if risk is too high. USFWS states that the data from the 2010 radar study is not sufficient to inform risk and that until they have the results of new radar studies to be conducted in 2017, they cannot assess the potential impact of the project on migratory birds. 3) Bald Eagle Comments - USFWS is working with LEEDCo to develop study protocol that will inform bald eagle risk during the winter. Until this study is completed, USFWS cannot assess the potential impact of the project on bald eagles. 4) Endangered Species Comments - The project does not provide suitable habitat for most of the listed species. There may be some concern about impact during migration for certain species; however, additional acoustic surveys proposed by LEEDCo will help evaluate risk. 5) Fisheries Comments - Until studies developed jointly between ODNR and USFWS are complete, USFWS is unable to evaluate the potential impacts of the project on interjurisdictional fisheries. 6) Bat Comments - USFWS is working with LEEDCo to develop a new radar and acoustic monitoring protocol that will evaluate bat activity within the project area. Until these 2017 studies are complete, USFWS is unable to evaluate the potential risk to bats from the project. USFWS requests that if project is constructed, they curtail turbines during nights with low wind speed to reduce bat mortality. 7) Post-Construction Monitoring - Project needs valid post-construction monitoring plan that is approved by ODNR and USFWS. 8) NEPA Comments - USFWS provides citations from CEQ NEPA regulations and argues that the project warrants an EIS-level analysis and recommends DOE conduct an EIS, not an EA, for the project.
National Oceanic and Atmospheric Administration (NOAA)	The letter provides input from the NOAA Great Lakes Environmental Research Laboratory (GLERL) on scope of the EA for the Porject. Many of the issues that NOAA believes should be addressed were listed in the 9/14/16 Notice of Public Scoping. Other recommendations for including in the EA: 1) Cultural resource review should include shipwrecks and other submerged maritime artifacts, coastal hazards issues should include consideration of the effects of ice and storms on installation. EA should also address consistency with Ohio Coastal Management Program as required by CZMA. 2) Other recommendations from NOAA scientists: Cable design and connection to the six structures should permit the attachment of physical, biological and water quality monitoring sensors for real-time monitoring (specs for connections listed in the letter); Impacts of ice and storms on the structures should be considered to prevent damage/failure. 3) A document "Offshore Wind Energy: Understanding Impacts on Great Lakes Fishery and Other Aquatic Resources" is attached to the letter. The attached document supports how complex and uncertain the impacts are but makes the following suggestions: (1) a second workshop for fishery experts, (2) timely sharing of results, (3) advisory committee to advise regulators and managers.

UNITED STATES DEPARTMENT OF THE INTERIOR
U.S. Fish and Wildlife Service
Ecological Services Office
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October 21, 2016

Mr. Roak Parker
U.S. Department of Energy
15013 Denver West Parkway,
Golden, CO 80401

TAILS: 03E15000-2016-TA-1571

Re: Development of an Environmental Assessment for the Icebreaker Wind Facility, DOE/EA-2045

Dear Mr. Parker:

This is in reference to the development of an Environmental Assessment for Lake Erie Energy Development Corporation's ("LEEDCo") proposed Icebreaker Wind Facility. The proposed project involves the installation of up to six wind turbine generators, underground collection cables, and connection to an existing substation. The total generating capacity of the facility will not exceed 20.7 MW.

The project is located in Lake Erie, approximately eight to ten miles off the coast of Cleveland, OH in Cuyahoga County. This project plans to connect to an existing substation in Cleveland, thus transmission lines will be trenched into the substrate of Lake Erie from the shoreline to the project (~12 miles). The majority of this project will occur within Lake Erie with only the substation interconnection occurring on land; no impacts to wetlands or forested area are anticipated.

The following comments are being provided pursuant to the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d; BGEPA), the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, 87 Stat. 884; ESA), the Fish and Wildlife Act of 1956 (16 U.S.C. 742a-742j, not including 742 d-l; 70 Stat. 1119), as amended.

The U.S. Fish and Wildlife Service (Service), LEEDCo, their representatives, and the Ohio Department of Natural Resources (ODNR) have been involved in discussions regarding this proposed project since 2008. We have participated in numerous meetings, conference calls, and correspondence regarding this project. LEEDCo initiated some pre-construction wildlife studies in 2010 based on recommendations from the Service and ODNR. These included bat acoustic monitoring April 1 – November 10, 2010 and radar monitoring March 31-October 12, 2010 (Svedlow et al. 2012). Two additional surveys were conducted that were not part of the studies recommended by ODNR and the Service (avian acoustic surveys, and boat based nocturnal surveys). Due to the potential impacts to fisheries ODNR and the Service requested several surveys to assess the importance of the area as a fishery. LEEDCo is currently working with

ODNR and the Service to undertake the fisheries studies. Substantial complications occurred during the 2010 radar studies that rendered the study results uninformative to the proposed project area. Further, the radar and acoustic studies did not include the currently proposed project area. Thus, the Service and LEEDCo are working on developing a new radar and acoustic study protocol (among other studies) to be implemented in 2017 that should help inform risk to wildlife from the proposed project at the proposed location.

GENERAL COMMENTS:

Construction of offshore wind turbines presents a very different set of challenges than land-based turbines in terms of wildlife impact mitigation. Not only are common techniques for quantifying mortality impossible to implement (e.g. carcass surveys), large inland water bodies such as the Great Lakes have unique hydrological, biotic, and ecological properties compared to sea and land installations, for which there is no data and no precedent. Because of the unknown consequences of developing offshore wind energy in the Great Lakes and the precedent-setting nature of this project, the pre- and post-construction evaluations of potential impacts on wildlife necessarily must meet a standard of rigor greater than wind projects on land. Further, this project has always been, and continues to be, proposed as a "demonstration project" or "pilot-project." Information gathered from this project will be used to assess the feasibility of developing commercial-scale wind facilities in Lake Erie, or the Great Lakes as a whole. As such, it is essential to have scalable pre- and post-construction studies to evaluate potential impacts.

MIGRATORY BIRD COMMENTS:

The Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA) implements four treaties that provide for international protection of migratory birds. The MBTA prohibits taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for allowing unauthorized take, the Service recognizes that some birds may be taken during activities such as wind turbine operation even if all reasonable measures to avoid take are implemented. The Service's Office of Law Enforcement carries out its mission to protect migratory birds not only through investigation and enforcement, but also through fostering relationships with individuals and industries that proactively seeks to eliminate their impacts on migratory birds. Although it is not possible under the MBTA to absolve individuals, companies, or agencies from liability (even if they implement avian mortality avoidance or similar conservation measures), the Office of Law Enforcement focuses on those individuals, companies, or agencies that take migratory birds with disregard for their actions and the law, especially when conservation measures have been developed but are not properly implemented.

The Service strongly encourages developers to coordinate with Service biologists regarding their projects. Proper coordination will help developers make informed decisions in siting, constructing, and operating their facilities. Additionally, the Service hopes to work cooperatively with wind developers to advance the state of the art of wind power siting, construction, and operation. Advancements in these areas will represent great strides towards the environmentally safe development of this otherwise renewable and clean source of energy. The Service recommends that LEEDCo develop a Bird and Bat Conservation Strategy (BBCS) to address

pre- and post-construction monitoring to assess risk to migratory birds and bats, to identify minimization measures that will be implemented to minimize risk, and to identify potential mitigation actions to implement if such risk reaches high levels.

The proposed project location is between 8-10 miles off the coast of Cleveland, thus does not provide habitat for many species of birds that breed in Ohio. But, millions of migrating birds move through the Great Lakes region during spring and fall migration each year (Rich et al. 2004, France et al. 2012, Horton et al. 2016).

The waters around Cleveland provide important overwintering habitat for gulls (herring, ring-billed, Bonaparte's, great black-backed, etc.), ducks (greater and lesser scaup, red-breasted and common mergansers, goldeneye, bufflehead, redhead, canvasback), common loons and horned grebes. During winter, flocks of over 10,000 birds are not uncommon near Cleveland. Additionally, several locations (Wendy Park, Edgewater Park, Cleveland Lakefront Preserve, etc.) along the lakeshore are known for their large concentrations of passerines during migration. The site is approximately 4.5 miles from an area designated by The Audubon Society as the Cleveland Lakefront Important Bird Area (IBA). This area was selected as an IBA due to the large concentrations of birds that congregate there during spring and fall migration (also wintering waterfowl, gulls, and eagles). Within the 2013 Avian Risk assessment it contends that "the Icebreaker site does not appear to be on a heavily used migration path for waterfowl or seabirds." While large numbers of birds may not feed within the area, they likely cross through the area to reach their overwintering areas near shore. These large concentrations of birds may attract raptors. Peregrine falcons have been observed hunting from the Cleveland crib (~3 miles from shore); therefore turbines may provide similar foraging opportunity for species like peregrines.

While the intent of the 2010 radar study was to help quantify the risk to migratory birds from construction and operation of the LEEDCo project, due to radar malfunctions, the site where the radar was located, the time when the radar was operational, and other factors, the data obtained was not sufficient to inform risk. The Service is now working with LEEDCo to design a radar project (both pre- and post-construction) to address our concerns and provide critical information for assessing the potential impacts of offshore wind facilities in the Great Lakes. We anticipate that this new radar study will occur in 2017. Until we have the results of this study we cannot assess the potential impact of the project on migratory birds.

BALD EAGLE COMMENTS:

The project lies within the range of the bald eagle (*Haliaeetus leucocephalus*). Bald eagles are protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712; MBTA), and are afforded additional legal protection under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d, BGEPA). The BGEPA prohibits, among other things, the killing and disturbance of eagles.

Bald eagles nest in super canopy trees and typically forage on fish, mammals, and carrion. The project area does not support suitable nesting habitat, and it is unlikely that eagles would forage eight to ten miles offshore during the summer, when plentiful food resources are present much closer to their nesting habitats. The Service anticipates that take of eagles is unlikely during the

summer due to the distance this facility is from the shoreline. Conversely, in winter when ice forms along the shoreline it may force wintering birds closer to the proposed facility. Within the last several years Lake Erie has almost completely frozen over. As the ice builds along the shoreline it forces ducks, gulls, etc. further into the lake. Eagles, which will feed on fish and waterfowl, will congregate long the leading edge of the ice, or near open leads in the ice. Should the ice extend far enough, as it did this past winter, it may put waterfowl and eagles in close proximity to the turbines. The Service is currently working with LEEDCo to develop a study protocol that will inform bald eagle risk during the winter. Until this study is completed, we cannot assess the potential impact of the project on bald eagles. If take of eagles cannot be avoided, LEEDCo should work with the Service's Division of Migratory Birds to obtain an eagle take permit.

ENDANGERED SPECIES COMMENTS:

The proposed project is located in Cuyahoga County, in Ohio. There are five species of birds or bats that are federally endangered, threatened, proposed, or candidate species that may occur in Cuyahoga County. Indiana bat (*Myotis sodalis,* endangered), northern long-eared bat (*Myotis septentrionalis*, threatened) Kirtland's warbler (*Setophaga kirtlandii,* endangered), piping plover (*Charadrius melodus,* endangered), and red knot (*Calidris canutus rufa,* threatened).

Cuyahoga County has confirmed records for Indiana and northern long-eared bats. Suitable summer habitat for Indiana bats and northern long-eared bats consists of a wide variety of forested/wooded habitats where they roost, forage, and travel and may also include some adjacent and interspersed non-forested habitats such as emergent wetlands and adjacent edges of agricultural fields, old fields and pastures. This includes forests and woodlots containing potential roosts (i.e., live trees and/or snags ≥3 inches diameter at breast height (dbh) that have any exfoliating bark, cracks, crevices, hollows and/or cavities), as well as linear features such as fencerows, riparian forests, and other wooded corridors. These wooded areas may be dense or loose aggregates of trees with variable amounts of canopy closure. Individual trees may be considered suitable habitat when they exhibit the characteristics of a potential roost tree and are located within 1,000 feet (305 meters) of other forested/wooded habitat. Northern long-eared bats have also been observed roosting in human-made structures, such as buildings, barns, bridges, and bat houses; therefore, these structures should also be considered potential summer habitat. Both of these species may travel several hundred miles between their summering habitat and winter hibernacula (Griffin 1945, Winhold and Kurta 2006). In the winter, Indiana bats and northern long-eared bats hibernate in caves and abandoned mines.

The LEEDCo project area does not provide suitable summer or hibernation habitat for Indiana bats or northern long-eared bats. Thus, no impact to these species is anticipated during the summer or winter. The only potential risk periods for either of these species are during spring and fall migration.

The Indiana bat range does not extend into Canada north of the project area. Thus, there is no reason to expect that Indiana bats would be flying across Lake Erie during spring or fall migration. Therefore we do not anticipate that this species will be impacted by the proposed project.

The range of the northern long-eared bat does include Canada north of the project area. However, northern long-eared bats are thought to be short-distance migrants. Short migratory movements between summer roost and winter hibernacula between 56 km (35 mi) and 89 km (55 mi) have been documented most often (Nagorsen and Brigham 1993 p. 88; Griffin 1945, p. 53). However, movements from hibernacula to summer colonies may range from 8 to 270 km (5 to 168 mi) (Griffin 1945, p. 22). Thus it is unlikely that northern long-eared bats would be migrating long distances across the open waters of Lake Erie (~50 miles of open water from the Cleveland shore to the Canada shore). Additional acoustic surveys proposed to occur offshore are currently being developed by the Service and LEEDCo and will help to evaluate potential risk to this species from offshore wind development.

Piping plovers, red knots, and Kirtland's warblers all migrate through Ohio but none are known to nest or overwinter here.

The Great Lakes population of piping plover nests primarily in Michigan and consists of approximately 63 pairs of birds. These birds overwinter primarily along the Atlantic coast, with some along the Gulf coast (USFWS 2009). While their migration paths are unknown, they have been documented to stop over on sand beaches along the shore of Lake Erie in Ohio. It is unknown if they migrate across the open waters of Lake Erie, or if their migration path would take them through the proposed project area.

Kirtland's warblers nest in young stands of Jack pines primarily in Central Michigan. Their current population is over 3,000 individuals (USFWS 2012a). They overwinter in the Bahamas. Individual birds have been banded during spring and fall migration, and geo-locators have indicated at least some of these birds are likely to have migrated across open waters of Lake Erie. Further, Kirtland's warblers have been documented to stop over all along the Lake Erie shoreline in Ohio (USFWS 2012a).

Red knots nest in the high arctic, and winter along both coasts of North America. While the vast majority of the red knot population migrates along the Atlantic and Pacific coastlines, occasionally small numbers of birds have been found in Ohio, typically along marshes in the western basin of Lake Erie. The proposed location for the facility does not have suitable habitat for these species. Most observations of these species in Ohio occur along the shoreline of the western basin of Lake Erie where there is more stopover habitat.

FISHERIES COMMENTS:

One of the responsibilities of the Service is to manage interjurisdictional fisheries, i.e., fisheries that are managed by more than one state or nation. The waters of Lake Erie are managed by four states (Michigan, Ohio, Pennsylvania, and New York), and Canada. A component of the pre-construction survey project developed jointly between ODNR and the Service were studies to assess the fisheries in the proposed project area and to evaluate potential risk to fish during construction and operation of the project, including the electrical lines. These studies are underway, but have yet to be completed. Until these studies are complete we are unable to evaluate the potential impacts of the project on interjurisdictional fisheries.

BAT COMMENTS:

Less than a decade ago the biggest threats to bat populations were loss of hibernacula and destruction of summer habitat. Since then the spread of white-nose syndrome (WNS), a novel fungal disease rapidly spreading across the Midwest, has caused the death of millions of cave hibernating bats (USFWS 2012b). As of September 2011, the 13,361 installed MW of wind energy in the Midwestern U.S. is anticipated to cause mortality of, on average, 106,000 bats per year (Arnett and Baerwald 2013). The majority of these are long-distance migrating tree bats. Populations of cave bats have declined so significantly, mostly attributed to WNS, that the Service has recently listed the northern long-eared bat as a threatened species. The Service is currently conducting status reviews for two additional species, the little brown bat (*Myotis lucifugus*) and tri-colored bat (*Perimyotis subflavus*) due to declines associated with WNS. Both of these species were documented in acoustic surveys conducted in 2010 (Svedlow et al. 2012).

LEEDCo's Bat Risk Assessment states that "relatively small numbers of migratory bats are likely to encounter the project." Long distance migrants including the eastern red (*Lasiurus borealis*), hoary (*Lasiurus cinereus*), and silver-haired (*Lasionycteris noctivagans*) bats are the species most susceptible to mortality at wind turbines (Arnett and Baerwald 2013). These species are known to cross large bodies of water and can be found far from shore (Pelletier et al. 2013). The results of the acoustic study (Svedlow et al. 2012) state that 4 bat passes/detector-night were recorded offshore at the Cleveland crib during acoustic surveys in 2009. Ninety five percent of the calls recorded were of the three bat species most susceptible to collisions with wind turbines (Svedlow et al. 2012, Arnett and Baerwald 2013). There are several factors that confound the results of acoustic surveys. Since all monitoring had to be conducted from the Cleveland Crib, acoustic monitoring sites were co-located with radar monitoring locations. Radar has been shown to reduce bat activity, potentially due to electromagnetic fields causing discomfort (Nicholls and Racey 2007). Large concentrations of insects were also observed swarming above the Cleveland Crib. Bats have been observed pausing during migration to take advantage of congregations of insects around offshore wind turbines (Ahlén et al. 2007, 2009). Thus the acoustic monitoring included a factor that may reduce bat activity, and one that may increase bat activity. It is unknown if either factor influenced the number of detections recorded at this site.

The results of the offshore acoustic monitoring conducted as part of LEEDCo's application showed higher numbers of bat calls than similar monitoring that has occurred at two existing wind facilities in Ohio. These two onshore wind projects, Timber Road and Blue Creek, recorded 2.78 and 1.31 passes/detector-night respectively. Both projects have resulted in higher than anticipated bat fatalities, based on post-construction monitoring conducted over three years of operation. Based upon this information it is unclear if the LEEDCo project will pose greater or lesser bat fatalities than onshore facilities.

The Service is working with LEEDCo to develop a new radar and acoustic monitoring protocol that will evaluate bat activity within the proposed project area. These studies are anticipated to be completed in 2017. Until these studies are complete, we are unable to evaluate the potential risk to bats from the proposed project.

To date the only mechanism known to reduce bat mortality at wind turbines is to curtail turbines during nights of low wind speed, which is the period when bats are most susceptible to being struck. Should this facility be constructed, the Service requests that at a minimum, turbines should be curtailed (the blades should be oriented such that they do not catch the wind) until the manufacturer's cut-in speed is reached. If, based on the results of the acoustic or radar study, bat mortality is anticipated to be high a higher cut-in speed may be warranted during periods of time when bats are most at risk.

POST-CONSTRUCTION MONITORING:

In order to assess the actual impact of the project in migratory birds, bats, fish, and the aquatic environment, post-construction monitoring is critical. Further, one of the purposes of a small-scale demonstration project is to assess the viability and potential impacts of the project. This project should have a valid post-construction monitoring plan that is approved by both the ODNR and Service. LEEDCo recently provided the Service with several potential methods for assessing impacts. These are currently being reviewed by the Service and ODNR.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) COMMENTS:

The National Environmental Policy Act (NEPA) requires federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. An Environmental Impact Statement (EIS) is required for any project subject to Federal control and responsibility that significantly affects the quality of the human environment (42 U.S.C. § 4332(C); 43 C.F.R. § 46.100(a)). Conversely, if impacts are not anticipated to be significant, an Environmental Assessment (EA) may be completed. Currently the DOE proposes to complete an EA. According to the CEQ NEPA regulations, the following are some of the issues that should be considered when evaluating whether a project's effect on the environment is significant:

a) *The degree to which the effects on the quality of the human environment are likely to be highly controversial (40 C.F.R. § 1508.27(b)(4)).* There is significant public interest in wind power and potential impacts from wind power on wildlife (particularly birds and bats). The Service has been contacted by multiple non-government entities regarding wildlife concerns over small wind projects near Lake Erie recently; we were subject to a lawsuit over a wind project's impact on bats in central Ohio several years ago; and one conservation group sent a notice of intent to sue over the NEPA analysis for a single turbine project on federal land in northwest Ohio in 2014. Overall, we anticipate a high degree of interest in this project, and substantial concerns from groups associated with conservation of wildlife resources. Further, because the extent of impacts to wildlife is uncertain (see additional discussion below), we anticipate more controversy than for a project on land.

b) *The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks (40 C.F.R. § 1508.27(b)(5)).* This project presents unique risks to migratory bats and migratory birds including the bald eagle due to the proximity of the project area to significant migratory bird and bat habitat and concentration areas, specifically the offshore waters of Lake Erie. Because the turbines will be sited in an open water environment, conventional post-construction mortality monitoring to determine impact of the project and birds and bats will be impossible to implement. Thus, innovative new methods for monitoring bird and bat mortality in the offshore environment will have to be developed and implemented, and their effectiveness is unknown. Regardless, it will be difficult to monitor and quantify the impact of the project on birds and bats.

c) *The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration (40 C.F.R. § 1508.27(b)(6)).* This will be the first installation of wind turbines in a freshwater ecosystem anywhere in the world. It will be the first installation of offshore wind anywhere in the Great Lakes, and likely only the second offshore wind facility in the western hemisphere. The manner in which this project is evaluated and permitted will be a model for future similar projects. LEEDCo calls this a "demonstration" project and has indicated to audiences in prior years that the intent of the demonstration project is to show that freshwater offshore wind power in the Great Lakes is possible and to provide a roadmap for future development. Although the current project is described as a pilot project, LEEDCo indicated in a December 12, 2012, "Media Advisory Notice" that the ultimate intent is to expand from an initial 20-30 megawatt demonstration project to a 1,000 MW build-out by 2020. Thus, it is not unreasonable to expect that, if the demonstration project is found to be economically viable, it may likely be expanded to a much larger project, itself, as well as serve as a model for other full-scale projects elsewhere in the Great Lakes and other areas in the U.S. Given the precedent-setting nature of this demonstration project and potential influence on potential future off-shore wind project development, we believe an EA is inadequate to fully address the potentially significant, precedent setting aspects of this project.

We believe that the three factors above indicate that the project warrants an EIS-level analysis. We recommend that the DOE conduct an EIS to document the significance of the proposed project on fish and wildlife resources.

This letter provides technical assistance only and does not serve as a completed section 7 consultation document. If project plans change, if portions of the proposed project were not evaluated, or if additional information on listed or proposed species or their critical habitat becomes available, it is our recommendation that you reinitiate coordination with this office. We recommend that the project be coordinated with the Ohio Department of Natural Resources due to the potential for the project to affect state listed species and/or state lands. Contact John

Kessler, Environmental Services Administrator, at (614) 265-6621 or at john.kessler@dnr.state.oh.us.

If you have questions, or if we can be of further assistance in this matter, please contact our office at (614) 416-8993 or ohio@fws.gov.

Sincerely,

Dan Everson
Field Supervisor

cc: Scudder Mackey, ODNR (via e-mail)
Kate Parsons, ODNR (via e-mail)
Jeff Gosse, USFWS Region 3 (via e-mail)

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
OFFICE OF OCEANIC AND ATMOSPHERIC RESEARCH
Great Lakes Environmental Research Laboratory
4840 South State Road
Ann Arbor, Michigan 48108-9719

October 24, 2016

Roak Parker
NEPA Document Manager
U.S. Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

Dear Mr. Parker,

We are submitting to you the NOAA Great Lakes Environmental Research Laboratory (GLERL) response to the Notice of Scoping and Notification of Public Scoping Meeting for the Project Icebreaker Offshore Wind Project Environmental Assessment, Cleveland, Ohio, (DOE/EA-2045, Department of Army Processing No. 2010-00223). We are pleased to provide input on the scope of an Environmental Assessment (EA) for Project Icebreaker, an offshore wind energy demonstration project consisting of up to six turbines in Lake Erie approximately eight miles from Cleveland, Ohio (the proposed project).

NOAA GLERL's mission is to conduct scientific research on the Great Lakes and share knowledge and information to serve Great Lakes communities and provide stewardship of the lakes. We offer our input based upon the decades of expertise our scientists have working on Great Lakes issues. Comments were solicited from the researchers at the Great Lakes Environmental Research Laboratory and the NOAA Great Lakes Regional Collaboration Team. They were asked to identify issues that should be considered in the EA and provide input on the proposed scope of the EA after review of the Description of the Proposed Project (included in the Notice of Scoping), i.e. "Department of Energy Environmental Assessment Public Scoping Process for Project Icebreaker Description of the Proposed Project." The following comments were received.

Many of the issues that NOAA's Office for Coastal Management (OCM) believes should be addressed in the EA have been listed in the September 14, 2016 Notice of Scoping for Project Icebreaker from Department of Energy's NEPA Compliance Officer Kristeni Kerwin, specifically biological resources, wetlands, coastal hazards (shore erosion/accretion and flood/floodplain hazards), and cultural resources. In addition, OCM recommends the EA should ensure that cultural resource review includes shipwrecks and other submerged maritime artifacts, and that coastal hazards issues include consideration of the effects of ice and storms on the installation. OCM also recommends that the EA should address consistency with the enforceable policies of the federally-approved Ohio Coastal Management Program, implemented by the Ohio Department of Natural Resources' (DNR) Office of Coastal Management, as required under the federal consistency provisions of the Coastal Zone Management Act (CZMA) section 307 (16 U.S.C. 1456) and NOAA's regulations at 15 C.F.R. Part 930. The Ohio DNR's Office of Coastal Management is involved in coordinating state-level project review, and federal actions associated with Project Icebreaker need to be submitted to their office for CZMA federal consistency review. Depending on who is conducting the

activity and whether federal permits or funding is involved will determine which subpart of NOAA's CZMA federal consistency regulations apply.

NOAA GLERL scientists provided input based upon their longstanding research and observational missions within the Great Lakes. It is recommended that the cable design and attachment to the six structures permit the attachment of physical, biological and water quality monitoring sensor connections supporting continuous real-time monitoring of ecosystem conditions to assess the health of the lakes and monitor the impacts of the structures. Connections should be capable of supporting 100 Mb/s transmission bandwidth overall and 1kW power at each turbine. Connections should be below the waterline to prevent ice damage. NOAA GLERL also recommends that the impacts of ice and storms on the structures be considered in order to prevent damage and failure and resulting negative environmental impacts.

NOAA GLERL also refers Department of Energy to enclosed document, "Offshore Wind Energy: Understanding Impacts on Great Lakes Fishery and Other Aquatic Resources," for your review and consideration. This report was generated as a result of a workshop held November 28 and 29, 2012, on the potential cumulative effects of offshore wind farms on the larger ecosystem in the Great Lakes. Over 40 experts offered their contributions to this report.

Thank you for the opportunity to comment on the notice of scoping for Project Icebreaker. Please contact me if NOAA GLERL can provide further guidance or support for the assessment of the environmental impacts of the project.

Sincerely,

Deborah H. Lee, PE, PH, D.WRE
Director and Great Lakes Regional Team Lead

Enclosure

GREAT LAKES WIND COLLABORATIVE

OFFSHORE WIND ENERGY

Understanding Impacts on Great Lakes Fishery and Other Aquatic Resources

WORKSHOP SUMMARY

SPRING 2013

A product of the Great Lakes Commission and the Great Lakes Wind Collaborative based on the workshop held November 28-29, 2012, in Ann Arbor, Michigan.

Great Lakes Wind Collaborative

Great Lakes Commission des Grands Lacs

Table of Contents

1) Background and Introduction

Existing international studies have looked at local effects of offshore wind (OSW) farms, but very little is known about the cumulative effects on the larger ecosystem. It is recognized that the transition toward greater renewable energy sources, including offshore wind, has the potential to dramatically reduce carbon dioxide emissions, water usage by power plants and associated fish mortality within the Great Lakes. However, without adequate knowledge of potential impacts, both physical and biological, decisionmakers are poorly equipped to evaluate the extent to which OSW development might impact the fishery and ecosystem or to recommend appropriate mitigation measures to protect critical habitat and preserve self-sustaining fish populations.

This document summarizes discussions from the workshop *Offshore Wind Energy – Understanding Impacts on Great Lakes Fishery and Other Aquatic Resources.* Organized by the Great Lakes Commission, through the Great Lakes Wind Collaborative, the workshop took place on November 28-29, 2012, at the National Oceanic and Atmospheric Administration's Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, Michigan. Primary funding support for the workshop came from the Great Lakes Fishery Trust.

The need for the workshop grew out of a 2011 report by the Great Lakes Wind Collaborative (*State of the Science Report: Ecological Impacts of Wind Energy in the Great Lakes Region*). That report noted that Great Lakes region-specific research, particularly as it relates to offshore wind, is notably lacking. Additional research and studies are needed to direct how wind projects are planned, sited and operated in the region.

As such, the November 2012 workshop aimed to build knowledge about the potential impacts of offshore wind energy on the Great Lakes fishery and related aquatic resources by

- sharing scientific and related policy and management information about what is known about the impacts of offshore wind farms on aquatic resources;
- identifying the most important questions that need to be addressed to effectively review permit applications for offshore wind development; and
- identifying knowledge gaps and priority areas for future research to answer the most important questions that decisionmakers face when determining whether and how wind projects are planned, sited and operated in the waters of the Great Lakes.

Approximately 40 individuals participated in the November 2012 *Fishery Impacts Workshop*, including fishery managers from most of the Great Lakes states, natural resource regulators and wind energy interests. Participants heard from experts on physical and biological aspects of the Great Lakes, and from researchers from outside the region. Importantly, the workshop featured research and environmental impact assessment case studies from two European offshore wind farms (see Box 1) one of which was the world's first OSW project in freshwater: Lake Vanern in Sweden (see Appendix A: Workshop Agenda). The workshop helped to minimize or eliminate some previously held concerns and identified knowledge gaps. Although the workshop did not produce definitive recommendations about offshore wind and related fishery impacts, it did elevate participant knowledge about potential impacts and which ones should be the focus of future research and management efforts. As such, the workshop findings presented here offer a step forward to advance the region's capacity, ensuring that public policy goals

related to clean, renewable energy, are compatible with, and when possible, even mutually supportive of policy goals to protect and enhance fisheries and related natural resources. [1]

Box 1 – European Case Studies

Project: Lake Vanern

Åke Petersson Frykberg[2], and Tore Wizelius[3] presented on the construction and financing logistics, as well as environmental impacts, on the freshwater environment of the Lake Vanern wind farm. The pros of constructing a freshwater OSW farm were discussed: regular land turbines can be used since there's no risk of corrosion, which lowers costs, and deepwater turbine installation is more feasible. This wind farm was built with the support of local municipalities and private companies. The project was also a national pilot project, receiving 7 percent of total costs from the Swedish Government due to OSW construction technology needs. Construction costs were kept relatively low by using a unique "rock adaptor foundation" construction and retrofitting a barge with pontoons to accommodate a mobile crane. Their rock adaptor foundation, in contrast to a monopole foundation, uses vertical wires to attach the foundation to solid rock. Ten 3 MW wind turbines were installed in shallow waters (4-12 m depth) providing electricity for 20,000 households (90 GWh/year). The project became fully operational after 10 years in 2009.

Interesting Fact: Lake Vanern and the Great Lakes share several congeneric fish species such as the European zander (*Sander lucioperca*) and the American walleye (*Sander vitreus*).

Project: Egmond aan Zee

Dr. Erwin Winters[4] reviewed studies on potential impacts of OSW on fish, conducted in the context of the Dutch demonstration wind farm, Egmond aan Zee, which is located in the North Sea. Thirty-six 3 MW windmills have been installed in soft sediment at average depths of 20 meters and provide renewable electricity for at least 100,000 households. Egmond aan Zee receives a subsidy from the Ministry of Economic Affairs under the CO_2 Reduction Scheme of the Netherlands; part of the selection procedure for OSW developers was their ecological research study plan. To assess the impacts of the wind farm on fish (abundance, composition, length, behavior), both local (only inside the wind farm) and large-scale (outside and inside the farm) studies were conducted. However, GLERL's Ed Rutherford noted that although the studies were well designed and used a before/after control/ impact (BACI) design, they had relatively low statistical power of detecting an impact of wind farms.

2) Offshore Wind in the U.S. and Canada

Although no OSW turbines have been installed in U.S. or Canadian waters, the momentum for OSW is continuing to grow. The United States has no national renewable energy policy, but the Obama Administration has issued policy documents confirming the Administration's commitment to renewable energy. The 2011 *National Offshore Wind Strategy,* published in February 2011 by the U.S. Department of Energy (DOE) and U.S. Department of the Interior (DOI), calls for the development of a world-class OSW

[1] At the time this summary was being prepared, a new major report was released on the potential effects of offshore wind power projects on fish and fish habitat in the Great Lakes by Sarah Nienhuis and Erin S. Dunlop. See. Province of Ontario Aquatic Research Series 2011-01 at http://www.mnr.gov.on.ca/stdprodconsume/groups/lr/@mnr/@aquatics/documents/document/stdprod_103058.pdf

[2] Åke Petersson Frykberg: CEO of ReWind Offshore

[3] Tore Wizelius: a project manager with ReWind Offshore

[4] Dr. Erwin Winter is an ecologist at the Institute for Marine Sciences and Ecosystem Studies in the Netherlands

industry in the United States to achieve 54 GW of OSW deployment at a cost of energy of $0.07 / kWh by the year 2030, with an interim scenario of 10 GW at $0.10 / kWh by 2020 (DOE and DOI, 2011). More recently, In January 2013, the U.S. Congress extended the renewable energy Production Tax Credit (PTC) (AWEA, 2012). Additionally, and of particular relevance to the Great Lakes, the DOE announced funding of seven OSW advanced technology demonstration projects for offshore wind in December 2012.

The Canadian federal government has no policies to enable large-scale renewable energy adoption (DSF, no date); Ontario and Québec each have policies to promote renewable energy (Government of Ontario, 2010; Gouvernement du Québec, 2012).

In March 2012, the U.S. Fish & Wildlife Service released voluntary guidelines designed to help onshore wind energy project developers avoid and minimize impacts of land-based wind projects on wildlife and their habitats (USFWS, 2012). Similar federal, state or provincial guidelines do not exist for offshore wind. Although the Great Lakes Wind Collaborative's 2009 OSW guidelines offer a stopgap measure (GLC, 2009), more specific research and development of similar guidelines are needed for OSW.

3) Status of OSW in the Great Lakes

In the United States, the Great Lakes region has the greatest OSW potential, significantly dominating all the other regions when considering all depths in aggregate (Musial et al., 2010 in DOE and DOI, 2011). Also, all of the Great Lakes states and provinces have Renewable Portfolio Standards (RPS) or equivalent policies that promote renewable energy (IREC, 2012). Despite these renewable energy policies and the high quality wind resource over the Great Lakes, OSW has not been vigorously pursued for a variety of reasons including: 1) cost compared to other forms of energy (e.g., price of natural gas), 2) inconsistent public support, 3) incomplete federal and state permitting programs, and 4) a lack of knowledge about potential impacts to the Great Lakes aquatic resources.

Nonetheless, signs of continued interest in OSW remain. In March 2012, the bipartisan federal-state Memorandum of Understanding (MOU) for Offshore Wind in the Great Lakes[5] was signed by five Great Lakes governors (Illinois, Michigan, Minnesota, New York, Pennsylvania) and 10 federal agencies. More recently, in December 2012, DOE awarded $4 million to the Lake Erie Development Corporation[6] (LEEDCo) to advance their 27 MW OSW project, *Icebreaker,* which intends to install nine turbines seven miles off the coast of Cleveland (DOE, 2012). LEEDCo, a regional public-private partnership based in Cleveland, Ohio, was one of the seven recipients of the national OSW demonstration awards noted above.

4) Workshop Discussion and Findings

a. Physical and Biological Context

The Great Lakes basin is vast and climate, topography and soil types vary among regions. Hence, there are significant natural differences in the physical and biological features of each lake. Great Lakes ecosystems have been drastically altered over the past two centuries by human activities, including commercial logging and fishing, industrialization, hydrological alterations, agricultural intensification and expanding urbanization (US EPA & EC, 1995; Beeton, 2002). Resulting impacts such as pollution, habitat

[5] http://www1.eere.energy.gov/wind/pdfs/great_lakes_offshore_wind_energy_consortium_mou.pdf
[6] http://www.leedco.org/

degradation and destruction, and introductions of aquatic invasive species, have led to significant changes in aquatic ecosystem structure and function as well as species composition.

Among the most important physical aspects for siting offshore wind farms is depth. Lake Erie is the shallowest of all of the Great Lakes, a likely rationale for siting the first offshore Great Lakes wind farm in this lake. Lake Huron and Lake Ontario are the second and third shallowest lakes while Lake Michigan and Lake Superior are the deepest.

Lake Erie is the most productive of the Great Lakes and is generally classified as a mesotrophic system with some portions of the eastern basin considered oligotrophic and a few embayments in the western basin that are eutrophic (GLFC, 2009). The other lakes are less productive. Lake Huron is considered oligotrophic with the exception of Saginaw Bay and a few other nearshore areas (GLFC, 2009). Lake Ontario is the third deepest lake and generally considered oligotrophic; recent declines in productivity are primarily due to reductions in phosphorous loading in the system (GLFC, 2007). Lake Michigan, similar to Lake Huron, is mostly oligotrophic with some mesotrophic and eutrophic locations in Green Bay. Lake Superior is the deepest and largest of the Great Lakes.

Each of the Great Lakes supports commercial fishing. Fishing pressure will vary based on the habitats that each species prefers. Therefore, this report lists the species that are most often caught commercially for each lake to give a representation of the types of habitat that will be important to consider prior to wind farm construction. Lake Erie has a very valuable commercial fishery including, walleye, yellow perch, rainbow smelt, lake whitefish, white perch and white bass. Lake Ontario's commercial fishery is mainly walleye, yellow perch and lake whitefish. Lake Huron's commercial fishery is dominated by lake whitefish; lake trout and walleye are also important. Lake Superior's commercial fishery is dominated by lake whitefish; cisco and lake trout are also important. Lake Michigan's commercial fishery is dominated by lake whitefish with lake trout also being important. Limited fisheries exist for bloaters and yellow perch.

Invasive species including dreissenid mussels, round gobies, smelt, and alewives play substantial roles in restructuring Great Lakes ecosystems. The influence of wind turbines on distribution and abundance levels of invasive species will need consideration.

Restoration efforts for lake trout, lake sturgeon and cisco are occurring throughout the Great Lakes and these need to be recognized as species of concern when considering siting and mitigation actions for wind farms.

Box 2 – GIS-based Mapping as a Screening Tool

GIS mapping tools can help screen physical and biological criteria in support of siting decisions through the use of GIS mapping tools. Workshop participants learned about such a tool being developed for the Great Lakes: the Great Lakes Lakebed Alteration Decision Support tool. This interactive tool maps several key natural features of interest to fishery managers: known spawning and nursery sites, studied benthos species, substrate, ice, wind and waves, and circulation. See http://glgis.org/ladst.

b. Potential Impacts on Fish

1) Noise

Potential Impact

Anthropogenic noise in the marine environment often exceeds ambient noise from natural sources and is significant in the 10 Hz to 1 kHz range (Greene, 1987; Hildebrand, 2009 in Preston 2012). Continuous sound in the Great Lakes may be produced by machinery, ships and wind turbines. A second source of noise called impulsive noise is more extreme and may be derived from sources such as pile driving and air guns (Greene, 1987; Hildebrand, 2009 in Preston 2012) and could potentially compromise spawning, nursery or feeding area habitat, interrupt migratory patterns and/or relocate native and invasive species. Pile driving noise can also impact fish through auditory tissue damage and even mortality. Fish bladders are filled with gas and are particularly vulnerable to high noise levels (GLC, 2011; Winter, 2012b).

Discussion/Presentations

While anthropogenic noise was initially a topic of concern, presentations from the European speakers and Preston Wilson showed that noise issues were less critical than previously thought.

Dr. Winter and his colleagues conducted fish larvae studies to determine the lethal effect of noise from wind farm construction using a device named the "Larvaebrator" (Bolle *et al.*, 2012). This device re-created pile-driving sound typical for the Egmond aan Zee wind farm (i.e., 25 m depth, 4 m pile, sandy bottom) at representative distances from 100 meters to 2 km from the pile. The same sound metrics were used as in U.S. studies based on the Ainslie's (2011) *Standard for measurement and monitoring of underwater noise*. Results showed no lethal effects to sole larvae but they concluded that interspecific differences in vulnerability to sound may occur so their results cannot be extrapolated to fish larvae in general. This study provided no information on sub-lethal effects and behavioral impacts of anthropogenic sound on fish remain unknown. A study on juvenile chinook salmon reported sound thresholds for injury being exceeded by wind farm construction noise (Halvorsen *et al.*, 2012).

Some researchers expressed the need for a framework to do targeted sound pilot studies on fish and microinvertebrates in the Great Lakes. Dr. Winter (2012b) insisted on not limiting research of impacts of anthropogenic sound to OSW but all anthropogenic noise sources. He also suggested considering noise impacts for all OSW farm phases. Some of Great Lakes fish experts agreed that fine-scale pilot studies of behavioral impacts (e.g., aversion and acclimatization) may be needed.

A novel approach for underwater noise mitigation was presented by Dr. Preston (University of Texas), based on the sound absorption properties of bubbles. Underwater bubbles absorb sound but freely rising bubbles do not mask continuous sound. Larger bubbles are able to absorb continuous sound due to larger amounts of attenuation.

Freely rising bubbles are the current industry standard for masking noise by pile driving but they are not very effective at low frequency noise mitigation. Research has been conducted on tethered encapsulated bubbles at the University of Texas and commercialization has recently begun (Preston 2012). There are multiple advantages of tethered encapsulated bubbles: 1) they allow for large stable bubbles, 2) their

frequency and attenuation are adjustable, 3) continuous air supply is not required, and 4) they are not dispersed by currents (Preston 2012)[7].

Data Needs

Based on the presentations and discussions relating to the European case studies, there is less concern relating to continuous power production noise than was previously thought. Impacts from the potentially more harmful impulsive noise can be mitigated by the more efficient technologies discussed above.

Policy Recommendation

Dr. Winter explained that the U.S. noise criteria for deepwater construction are too conservative in his opinion based on the results of Bolle *et al.* (2012) on sole larvae and Halvorsen *et al.* (2012) on salmonids.

Mitigation Options

- Due to potential impacts to fish eggs, larvae and juveniles, developers and resource managers should work together to develop a construction schedule or mitigation strategies, which would minimize harmful impacts during biologically sensitive times/seasons.

- Due to potential impacts to migrating fish, major noise-generating construction activities should be minimized or mitigated in critical areas during migrating seasons.

- Sound attenuation devices should be used during OSW farm construction to minimize disruption and disturbance to aquatic life from sound, taking into account recent developments indicating large bubble sizes are necessary to attenuate low frequency noise and technology advances to enable their application (Preston 2012).

2) Electromagnetic Fields

Potential Impact

Submarine cables used for electric transmission create electromagnetic fields which can affect fishes, yet research on European eel in the Baltic Sea has only shown minor effects (Ohman *et al.*, 2007). The *State of Science Workshop* had identified that electromagnetic fields could impact fish by disorienting migration and prey and mate detection and that several Great Lakes species of conservation concern, including the American eel and the lake sturgeon, are particularly sensitive to electromagnetic fields. The following research priority had been identified: quantify thresholds for physiological or behavioral effects of noise and electromagnetic fields for representative Great Lakes fish taxa (GLC, 2011).

Discussion/Presentations

Transmission cables were buried at both the Egmond aan Zee and Lake Vanern wind farms, and measurements have shown very weak electromagnetic fields close to buried cables. There were no observable impacts on fish in the North Sea case study. A study of the orientation ability of eels along an AC cable in Kalmar Strait, Sweden, showed that electromagnetic fields were of small or no concern. Cables wrapped in woven steel also reduced electromagnetic fields.

[7] This technology has some uncertainties for the Great Lakes: 1) local environment plays large role, noise abatement systems will need to be designed for their specific location and reduction needs; 2) water-column noise abatement may not be sufficient, coupling into lake bottom may re-radiate back into water column; 3) bottom treatment may be necessary in some cases; and 4) developers would have to incur the added cost of mitigation.

Data Needs
There seemed to be less concern from impacts of electromagnetic fields after hearing about these mitigation measures used in both European case studies. There was a suggestion to study impacts of existing submarine transmission lines in the Great Lakes to address this research need.

Mitigation Options
- Transmission cables should be wrapped in woven steel and buried to reduce electromagnetic fields and minimize impacts to fish and other aquatic resources.

3) Turbidity

Potential Impact
High turbidity occurs when sediments and other materials are re-suspended in the water, by natural or human forces, blocking the sunlight and thus decreasing the oxygen production of plants and algae. The suspended sediments also absorb heat from the sunlight leading to warmer water and reduced dissolved oxygen. This is harmful to fish and other aquatic organisms: fish gills can become damaged or clogged, filter-feeding invertebrates can be negatively affected, and fish eggs and insect larvae can be smothered (e.g., NERRS, n.d.). In the Great Lakes, resuspension of sediments, increasing turbidity, occurs commonly in depths up to 30 meters and perhaps up to 50 meters on rare occasions, with high wind speeds (Hawley 2012).

Discussion/Presentations
Sediment disturbance was observed during construction at Egmond aan Zee, which led to changes in phytoplankton biomass although effects on zooplankton were negligible. Fish and marine mammals seemed to avoid the area during construction activities but returned once the activities had ended.

In the Lake Vanern wind farm experience, informal visual observations during construction showed limited turbidity impacts to fish due to local hydrodynamic conditions (i.e., strong currents) quickly diluting suspended particles. However, construction took place outside spawning seasons of vendace[8] and pikeperch, two important fish species, as a precautionary measure (Frykberg and Wizelius, 2012).

Mitigation Options
- The mortality of certain fish eggs can be avoided if construction work that causes high turbidity is conducted outside the spawning and migrating seasons of important fish species.
- The use of turbidity curtains can localize sediment suspension around foundation structures during construction.

Policy Recommendation
Regulators should work to develop construction schedules that are informed by biological priorities to minimize ecological impacts.

4) Fish Movement

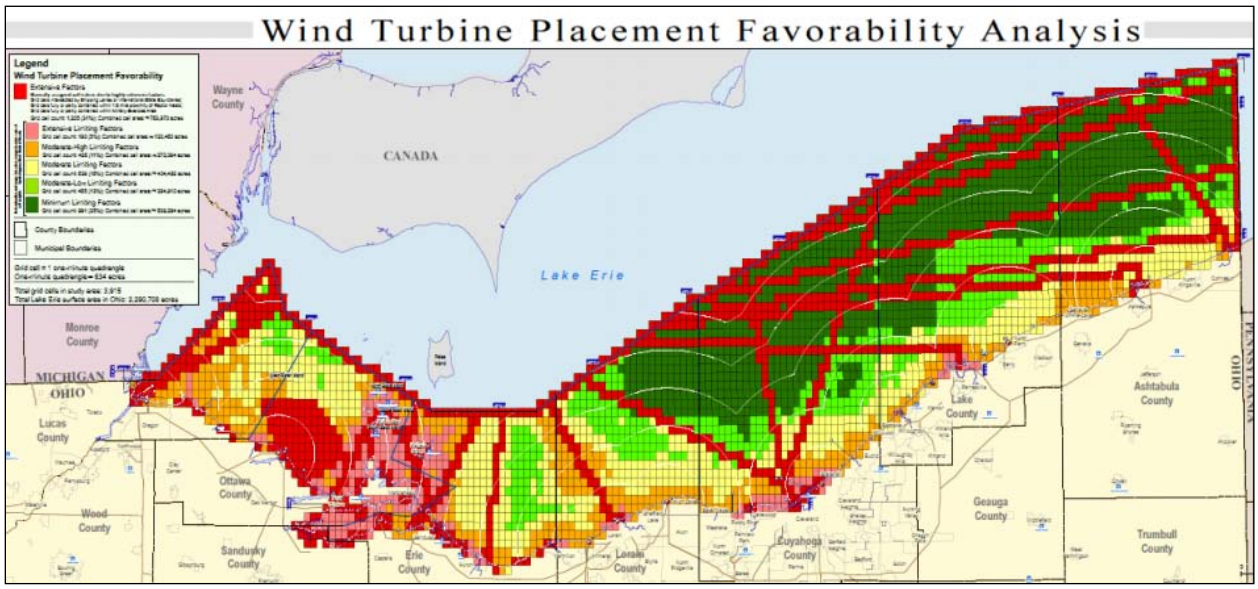
Potential Impact
There is a lot of uncertainty regarding the impacts of wind turbines on fish movement, and influences will likely be different for migratory and non-migratory fish species. It will take time to understand the long-term consequences of wind turbines. We have a limited knowledge of a few select species in a few lakes

[8] Vendace is a member of the coregonid family including lake whitefish and cisco.

and very little open-lake data (e.g., swimways). A review article looking at all fish movement studies in the Great Lakes between 1952 and 2000 found that the majority of studies were related to non-native salmonids and a few on trout, walleye and sturgeon. Most of these are mark-recapture estimates or use radio telemetry (Landsman *et al.*, 2011; VanderGroot, 2012).

Discussion/Presentations

The Lake Erie Walleye Tagging Program (in Ohio) estimates gross migration routes; the data is not designed to be fine. It was initiated in 1990 with 117,000 fish released to date looking at migration and survival. The center of Lake Erie has no tag returns most likely because fishermen are less active in these areas rather than because fish are not there. The most favorable areas for OSW development, as defined by the Ohio Wind Turbine Placement Favorability Analysis (See green squares on Map 1), are where there is less fishing effort.



Map 1 – Ohio Wind Turbine Placement Favorability Analysis (source: Ohio Department of Natural Resources[9]).

Data Needs

There's limited knowledge of a select species in a few lakes and very little open-lake data. Although some migratory fish may use areas that have been identified as favorable for wind turbine placement, it is unknown how the fish will behave if turbines are in place. It is not known how fish will adapt to turbines. Will they be displaced? Migrate around structures? Key in on structures as desirable? Or will species differ in their response? While additional data on fish distributions and migratory behavior in the presence of wind turbines is desirable, the potential location of fish migratory routes should not prevent siting of offshore wind turbines.

Policy Recommendation

A precautionary approach should be adopted when siting OSW in relation to threatened and endangered migratory fish species (e.g., lake sturgeon) because all the required information is not available. However, when considering impacts to migratory species with more robust populations an adaptive approach should be adopted where data is collected prior to and during operation, which can be incorporated into

[9] http://www.ohiodnr.com/tabid/21234/Default.aspx

future decisionmaking. For example, if migratory routes are disturbed by construction, it is advisable to ensure that active construction does not coincide with migration.

5) Lakebed Habitat

Potential Impact

The lakebed provides habitat to a range of aquatic species that contribute to the Great Lakes ecosystem. Long-term disruption to sensitive lakebed habitats may influence densities of benthic invertebrates as well as fish spawning or nursery habitats.

Discussion/Presentations

Different construction techniques have varying degrees of impact on lakebed habitat, and basal scouring may be an attractive nuisance. For example, invasive dreissenid mussel populations could increase in those areas as they prefer hard substrates (Janssen 2012; Jones and Ricciardi, 2005). Impacts to lakebed fauna and vegetation were observed during the construction of the Egmond aan Zee wind farm but not afterward. Study results showed some fish species (e.g., cod and crabs) were attracted to scour bed habitats created by currents swirling around the foundations while demersal fish avoided such areas (Winter, 2012a).

Blasting can be particularly harmful to lakebed habitat and, as a mitigation measure, it was not used during the Lake Vanern wind farm construction. Rather, their rock adaptor foundations were attached using vertical wires that were drilled into the bedrock, which greatly minimized impacts to lakebed habitats (Frykberg and Wizelius, 2012). If using the foundation technology from Lake Vanern, hard substrates – either bedrock outcroppings, limestone reefs or hard compacted clays – are likely favorable for wind farm siting in the Great Lakes. However, hard substrates are also the favored substrates for spawning by some native Great Lakes fishes and interactions will need to be examined.

Dr. Janssen, University of Wisconsin at Milwaukee, and his team have been using a highly modified, tethered Remotely Operated Vehicle (ROV) to collect lake trout eggs and sac fry around deep reefs. The ROV can be tracked along a bathymetry map in real time and eggs and sac fry have been found in cobble at and adjacent to drop-offs and at ridges (Janssen *et al.,* 2006). Lake trout reefs also concentrate fish prey such as microzooplankton and mesozooplankton (Houghton *et al.,* 2009). Monitoring data will help to determine and evaluate specific fish habitat localization and protection issues (Janssen, 2012).

Data Needs

1) Substrate and bathymetric data for the Great Lakes is coarse and – especially in the case of the substrate data – outdated, but would allow for general fish habitat identification with tools such as the Lakebed Alteration Tool. More detailed site assessments of lakebed habitat would be necessary prior to any project.
2) More recent and comprehensive substrate data would greatly assist with the accuracy of tools such as the Great Lakes Lakebed Alteration Decision Support Tool, which can support the siting of OSW farms.

Policy Recommendation

Local bathymetry data, site-specific (geophysical, biological and archaeological) and surficial mapping could help to avoid the destruction of prime fish habitat. For example, very detailed mapping of reef areas is required when working to avoid preferred lake trout, lake herring or lake whitefish spawning habitats, which can be quite small. Sediment transport will also need to be taken into consideration.

Mitigation Options

- Lakebed disturbance can be minimized during construction of OSW foundations and installation of underwater cables. For example, building foundation structures in hard substrate types that are not biologically significant for spawning can greatly minimize impacts to fish and aquatic habitats as was learned from the Lake Vanern case study. It is also feasible to increase reef habitat by encouraging suitable rock substrate and structural designs if pilings are required.
- The timing and duration of OSW farm construction can be modified to reduce the period of disturbance to fish and other aquatic species. For example, a modular approach to installation where all underwater construction is completed prior to tower installation could reduce the period of underwater construction.

6) Fishing

Potential Impact

Both commercial and recreational fisheries are active in the Great Lakes. Wind turbine structures could act as aggregating devices in attracting a variety of fish species. Anglers and fishers may key in on these structures as desired fishing locations.

Alternatively, in some situations the area surrounding OSW foundations and buried cables may require restrictions on fishing or fishing methods (e.g., trawling). In situations such as this it may be desirable to place a buffer around OSW farms to limit negative impacts and avoid conflict fisheries.

Discussion/Presentations

The Lake Vanern case study provided a positive example of collaboration among the fishing community and developers to find compromise in the use of the shared resource. The developer reduced the restricted area greatly by altering the layout of the transmission cables. In the Great Lakes, OSW farms could serve to enhance fishing opportunities by aggregating fish populations. When restrictions are required, anglers and developers should work together to establish desirable outcomes.

Policy Recommendations

Developers should work with stakeholders to develop consensus on the use of OSW farms to protect the interests of both parties.

7) Artificial Reefs

Potential Impact

The underwater hard surfaces of wind turbine foundations can attract fish and act as artificial reefs providing new habitat for aquatic invertebrate species (Langhamer, 2012). Some studies have found that these artificial reefs increase fish biodiversity (e.g. Ambrose and Anderson, 1990) while other studies have found no significant difference as compared to surrounding areas (e.g. McGlennon and Branden, 1994). One potential negative impact might be the increased colonization of invasive species such as dreissenid mussels and round gobies or alewives, which may also benefit from additional hard substrate or structures to aggregate around (Bulleri and L. Airoldi, 2005; GLC, 2011). The *State of the Science Workshop* identified that native species such as lake trout could also benefit from reef-like habitats created by wind turbine foundations (GLC, 2011).

Discussion/Presentation
In the freshwater case study of the Lake Vanern wind farm, many small fish have been observed around the operating foundations including certain species of sculpin (European bullhead). Furthermore, plankton is congregating in whirls near the foundations and algae have grown on the upper parts of the foundations providing food for fish and marine fauna (Frykberg and Wizelius, 2012). In regard to the North Sea case study, the newly created hard-substrate habitats around monopoles had higher abundance of some fish, but lower abundance of sand-dwelling species. Habituation may play a role in the potential fish congregating effect around the foundations, yet there is currently no data on the behavior of migratory fish species when they encounter an OSW farm (Winter, 2012a).

Data Needs
It is not known if there could be a congregating or avoidance effect of fish around monopiles in the Great Lakes. Pilot projects would provide beneficial information on aggregation patterns and fish behaviors throughout the water column around turbine structures in the Great Lakes.

c. Potential Impacts on Other Aquatic Resources

During the workshop there were several other topics that were discussed. These presentations increased the group's awareness of the current state of understanding about these important physical processes; however, no major concerns rose to the top. The following section provides a brief overview of information covered and table 1 details the anticipated impacts of OSW on these resources overall and at a local scale.

8) Ice

Potential Impact
The Great Lakes ice cover has large interannual variability which affects regional economy, ecosystems and water balance (see Box 3). There is an increased potential for ice formation around OSW foundations, creating islands of piled up ice at a very local scale which may impact the structures as well as local ice patterns. However, ice has put extreme pressure on the Lake Vanern foundations and there have been no observed structural impacts (Frykberg and Wizleius, 2012; Wang, 2012).

Data Needs
More research must be conducted on potential ice formation and depth around OSW foundations, as well as resulting changes to the ecosystem.

Policy Recommendation
There can be ice scour up to 20 meters in the Great Lakes, which means cables in the nearshore would likely need to be buried, especially in Lake Erie (Hawley, 2012).

9) Bathymetry

Potential Impact
The Great Lakes are deep, with average depths being greater than 50 meters except for Lake Erie, yet most of them have several distinct basins separated by shallower areas. The construction of OSW farms would cause local scour and deposition but nothing substantial, meaning that there could be very minor

Box 3 – Great Lakes Ice Cover

Great Lakes ice cover has large interannual variability which affects regional economy, ecosystems and water balance; however, there has been a warming since the early 1970s. Ice reduction decreased at a rate of -2.05%/year on average from 1970-2008. The El Niño/La Niña–Southern Oscillation (ENSO) and Arctic/North Atlantic Oscillations (NAO/AO) have impacts on year-to-year Great Lakes ice cover. Since 1973, there have been 11 ice minimum winters of which five can be attributed to strong El Nino events, and four can be explained by the joint strong +NAO and La Nina events. Two of the minimum winters occurred for unexplained reasons (Wang *et al.*, 2012).

Low ice cover leads to greater exposure to atmospheric/weather patterns, resulting in greater evaporation and reduced lake levels (predicted). There was an ice cover record low in the 2011-12 winter with approximately 5 percent coverage due to lack of sustained cold (Bai *et al.*, submitted). This led to early harmful algal blooms and early disturbed sediment in Lake Erie.

A decreasing trend of ice coverage may lead to more lake-effect snow or rain, and more evaporation may bring about lower water levels and warmer water temperatures. There may be a disruption of quagga mussels that will have to filter for a longer period of time. Furthermore, more storm stirring and mixing could lead to more suspended sediments, lessening the light intensity and plankton blooms. Longer periods with wave action will enhance coastal erosion (Wang, 2012).

changes in bathymetry at a local scale (Hawley, 2012). The *State of the Science Workshop* identified coastal morphology as being potentially altered by the presence of OSW farms (GLC, 2011).

10) Wind Climate

Potential Impact

There is a high level of uncertainty surrounding the impacts of OSW on wind climate or wind patterns. It is not anticipated that an overall change to wind climate would be observed, but it is less certain what might occur at the local level (Hawley, 2012).

Data Needs

Precise wind stress reduction patterns are unknown and should be predicted accurately in each OSW project (Hawley, 2012) to advance understanding of these processes as well as to increase efficiency of siting.

11) Waves

Potential Impact

Impacts of OSW farms on wave patterns would be very localized (Hawley, 2012); however, it is unclear how OSW installations may impact wave patterns or how waves may impact the installations.

12) Sediment Transport

Potential Impact

Bathymetry, wind climate, waves and the type of bottom sediments drive sediment transport, which can lead to different sediment transport potentials within and among the lakes. However, since good substrate data is lacking it may be hard to predict how an area may act. Fortunately, as OSW foundation construction will be very localized and relatively brief, impacts to sediment transport, which may be relatively great, should be short-lived and impact small geographic areas (Hawley, 2012).

13) Circulation Patterns

Potential Impact

Since there are no tides in the Great Lakes, the four main factors that affect circulation are wind stress, bottom topography, temperature gradients and the Earth's rotation (Beletsky, 2012). Wind has the potential to alter horizontal and vertical circulation due to the Ekman transport mechanism: cyclonic and anticyclonic winds can create upwellings and downwellings (Colling, 2001). While there is uncertainty, it is possible that an OSW farm could create a wind stress deficit and disturb the upper water layer due to wind farm-induced Ekman pumping (Broström, 2008).

Discussion/Presentations

Potential risks of OSW farms on Great Lake currents are 1) changes in circulation patterns, 2) creation of localized upwelling and downwelling patterns, and 3) change in thermocline position.

Data Needs

Studies conducted on existing structures in the lakes may be useful, and there are many opportunities to look at these localized shifts at initial OSW farms.

Table 1 Possible effects of wind farms on Great Lakes physical properties (adapted from Hawley, 2012)

Parameter	Overall impact	Local impact
Bathymetry	None	Small
Wind	None	Unknown
Waves	None	Small
Sediment transport	Small	Unknown
Circulation patterns	Unknown	Unknown

5) Research Needs

Throughout the workshop, several areas for future Great Lakes fishery research were identified but three rose to the top: 1) detailed knowledge of substrate types and the location of spawning areas for valuable species; 2) potential impacts to migratory fishes(e.g., lake sturgeon); and 3) recommended best practices to avoid or mitigate impacts to spawning areas and migratory fish species.

Additionally, the need for integrated assessments was mentioned on numerous occasions. The idea of a pilot turbine foundation study was embraced by both physical and biological experts to gain comprehensive knowledge of potential physical and biological impacts. It would provide an instrumented footprint that could be moved to different locations in the five lakes. More physical research, mostly modeling, is needed to better understand wind stress and changes in circulation and ice patterns brought on by OSW farms, as well as resulting changes to the ecosystem. Indeed, there was a general consensus at the end of the workshop that the participation of physical scientists will be crucial in future discussions.

OSW power generation within the Great Lakes has the potential to be implemented with minimal impacts on the aquatic ecosystem if adequate mitigation options are adopted (GLC, 2011). Numerous

mitigation practices were discussed during the workshop. However, these must be further investigated to develop best practices that can be communicated to regulators and resource managers in order to minimize impacts to fish and aquatic resources.

6) Summary and Conclusions

In spite of relatively extensive OSW development in some parts of the world, including northern Europe, the cumulative effects of OSW are not well understood, yet are crucial to minimize potential impacts on Great Lakes fish and other aquatic resources, as well as other ecosystem components such as birds and bats, from future OSW developments. Renewable forms of energy such as OSW are not without negative impacts but, cradle to grave, renewable energy, including wind, has several inherent environmental advantages over non-renewable energy resources. One prominent Great Lakes fishery biologist commented at the workshop: "If we don't address climate change, we may not have any fish to worry about." However simplistic, this reflects a sentiment among many at the workshop of the need for a comprehensive and integrated approach to evaluating energy choices that considers the full range of impacts and enables policymakers to make comparisons among them. Although the Great Lakes states and provinces have a suite of environmental management laws, none currently has a framework (e.g., legislation or regulations) designed to evaluate offshore wind projects for their potential impacts on the environment or the economy. States and provinces can address this through a combination of regulatory and administrative rulemaking, legislation, guidance documents and decision support tools. Whatever the approach, state and provincial legislation and associated regulatory programs for offshore wind should consider the full range of impacts, both positive and negative, of OSW energy projects on quality of life and the environment in comparison to equivalent power generation from fossil fuel sources over the life of the project.

This Workshop Summary begins to delve into information needs required by regulators and resource managers to determine whether a proposed wind farm site will have a significant or unacceptable impact on fish and other aquatic resources. It also presents crucial mitigation measures as well as strategies to coordinate research needs into the future. The physical and biological experts at the workshop agreed that there is a need to continue the dialogue around fish and OSW energy. Some initial priorities were identified but there was a general sense that more discussion could have refined the findings. There are many forums looking at Great Lakes fish from many perspectives such as the Great Lakes Fishery Commission Lake Committees, but not specifically evaluating the potential impacts of OSW. Participants agreed that a longer workshop would have been helpful to allow more time to discuss and refine research priorities. Nonetheless, three main options were identified during the workshop to coordinate research needs into the future:

1) Since there has been a resurgence of OSW interest in the Great Lakes with LEEDCo's award, it would be timely to organize a second workshop that would bring together fishery experts. This would refine priorities identified at the November 2012 workshop and develop research and management roadmaps for use by fishery researchers, funders and managers to fill key knowledge gaps and support informed decisions about OSW while managing the Great Lakes ecosystem for sustainable production of valuable species. It would also allow full scoping of the specific research needs for the priorities identified.

2) The European presenters agreed that it is also important to have timely sharing of research results. Dr. Winter advocated for sharing among researchers and developers within and among countries. The

fruitful workshop discussions and conclusions can attest to this. For example, participants learned that research in Lake Vanern is of even greater value for informing Great Lakes research because Lake Vanern and the Great Lakes share several congeneric fish species.

3) It was suggested that an advisory committee be put together with physical and biological scientists to advise regulators and resource managers that will potentially be involved with OSW siting decisions and processes. As of now, more discussion is needed on how to incorporate priority research needs into regulatory programs and processes (e.g., pre- and post-construction monitoring could be part of the regulatory requirements).

7) Appendix A - Workshop Agenda

Offshore Wind Energy – Understanding Impacts on Great Lakes Fishery and other Aquatic Resources

Agenda

November 28-29, 2012
Great Lakes Environmental Research Laboratory
4840 S. State Rd., Ann Arbor, MI 48108-9719
(734) 741-2235

Wednesday, November 28

12:00 p.m.	Registration
12:30	Welcome and introductions, review agenda and workshop objectives –John Gannon, Ph.D., International Joint Commission (*retired*)
1:00	Case Study 1: Lake Vanern, the only operational offshore wind farm in a freshwater environment – Tore Wizelius and Åke Pettersson Frykberg, ReWind Offshore AB, Sweden
2:00	Case Study 2: The Dutch demonstration of the Egmond aan Zee offshore wind farm – Erwin Winter, Ph.D., Institute for Marine Sciences and Ecosystem Studies, Wageningen University and Research Center
3:00	Break
3:15	Facilitated Discussion of Case Studies and Their Relevance to Great Lakes Ecosystem – Michael Murray, National Wildlife Federation (*moderator*)
4:45	Day 1 wrap-up and overview of Day 2 – Amanda Sweetman, Great Lakes Commission
5:30 - 7:00	Happy Hour at Sava's Restaurant (upstairs), 216 S. State, Ann Arbor, Michigan

Thursday, November 29

7:30 a.m.	Continental breakfast
8:00	Summary of Day 1 outcomes and Day 2 overview – Amanda Sweetman
8:15	Turbines in the Great Lakes: Where Might They Be? – Ed Rutherford, Ph.D., NOAA Great Lakes Environmental Research Laboratory (GLERL) and Jason Break, University of Michigan
9:00	Physical/limnological effects of offshore wind power on the Great Lakes *Presentations & Discussion* – Jennifer Boehme, Ph.D., International Joint Commission (*moderator*) • Currents – Dmitry Beletsky, Ph.D., University of Michigan • Wind, waves, sediment transport & bathymetry – Nathan Hawley, Ph.D., GLERL • Ice formation and icing patterns – Jia Wang, Ph.D., GLERL
10:15	Break
10:30	Biological effects of offshore wind on fisheries in the Great Lakes *Presentations & Discussion* – Jory Jonas, Michigan Dept. of Natural Resources (*moderator*) • Impacts of anthropogenic sound on aquatic organisms – Erwin Winters • Fish & habitat: offshore deep reefs – John Janssen, Ph.D., University of Wisconsin, Milwaukee • Impacts to fish movement in the Great Lakes—Chris Vandergoot, Ph.D., Ohio DNR • Identifying mitigation activities – Preston Wilson, Ph.D., University of Texas at Austin
Noon	Workshop wrap up & research priorities – Victoria Pebbles, Great Lakes Commission
12:30	Adjourn

8) Attendee list

Jonathon Beard
Grant Manager
Great Lakes Fishery Trust

Dmitry Beletsky
Associate Research Scientist
University of Michigan
CILER - School of Natural Resources and the Environment

James Boase
Fish Biologist
U.S. Fish and Wildlife Service

Jennifer Boehme
Physical Scientist
International Joint Commission

Jason Breck
Computer Specialist
University of Michigan

Charles Bronte
Fishery Biologist
U.S. Fish and Wildlife Service

Mark Clevey
Manager
Michigan Energy Office

Margaret Dochoda
Proxy
Big Sandy Bay Management Committee

Carlos Fetterolf
Great Lakes Fishery Commission (Retired)

John Gannon
International Joint Commission (Retired)

Tom Graf
MI Dept. of Environmental Quality
Water Resources Division

Christina Haska
Fishery Management Associate
Great Lakes Fishery Commission

Nathan Hawley
Oceanographer
NOAA GLERL

Dr. John Janssen
University of Wisconsin-Milwaukee

Jory Jonas
Research Biologist
Michigan Department of Natural Resources

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Brian Klatt
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Michigan Natural Features Inventory

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Great Lakes Commission

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Sarah Mullkoff
Energy/Climate Policy Coord.
National Wildlife Federation

Michael Murray
Staff Scientist
National Wildlife Federation

Carlyn Osborn
The John Hopkins University

Becky Pearson
Project Manager
Great Lakes Commission

Victoria Pebbles
Program Director
Great Lakes Commission

Åke Pettersson Frykberg
ReWind Offshore AB

Stephen Porter
Co-Chair
NWPAGE

Catherine Riseng
Research Scientist
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Ed Rutherford
Research Fishery Biologist
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Amanda Sweetman
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Great Lakes Commission

Katie Trachsel
Michigan Public Service Commission

Christopher S. Vandergoot
Ohio Department of Natural Resources
Sandusky Fisheries Research Station

Matt Wagner
DTE Energy

Jia Wang
Research Ice Climatologist
NOAA GLERL

Preston Wilson
Associate Professor
University of Texas at Austin
Dept. of Machanical Engineering

Erwin Winter
Institute for Marine Sciences and Ecosystem Studies
Wageningen University and Research Center

Tore Wizelius
ReWind Offshore AB

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
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OCT 2 1 2016

REPLY TO THE ATTENTION OF:

E-19J

Mr. Roak Parker, NEPA Document Manager
Golden Field Office
U.S. Department of Energy
15013 Denver West Parkway
Golden, Colorado 80401

Re: Scoping for Project Icebreaker Offshore Wind Project Environmental Assessment, Cleveland, Ohio (DOE/EA-2045)

Dear Mr. Parker:

Thank you for the opportunity to provide environmental assessment (EA) scoping comments for the Project Icebreaker Offshore Wind Project (the project) in Cleveland, Ohio. Our comments are provided pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA implementing regulations (40 CFR Part 1500-1508), and Section 309 of the Clean Air Act.

The project, as described in the Department of Energy's (DOE) September 14, 2016 Notice of Scoping, would consist of the design, construction, operation, maintenance, and decommissioning of a demonstration-scale offshore wind facility approximately eight miles offshore in Lake Erie. This demonstration project would consist of:

- Six wind turbines, having a combined generating capacity of approximately 21 megawatts (MW);
- Five submarine cables, including a fiber optics communication cable, to interconnect the turbines, with an approximate total length of 2.8 miles;
- One 9-mile-long submarine cable, including a fiber optics communications cable, to connect the offshore wind facility with the existing Cleveland Public Power Lake Road Substation in Cleveland;
- Installation of equipment, including a project substation, at the Lake Road Substation to accept electrical power from the offshore wind facility; and
- Approximately 150 of new overhead transmission line and support poles to transmit electricity from the project substation to the existing Lake Road substation.

DOE's Notice of Scoping contains an extensive list of resource areas and topics to be considered in the analysis of impacts and potential mitigation measures in the EA. That list includes:

- Geology, sediments, and soils;
- Water resources, including water quality and water supply;

- Biological resources (lake and terrestrial flora and fauna, including avian, bat, fisheries, and protected species);
- Wetlands;
- Shore erosion and accretion:
- Flood and floodplain hazards;
- Health and safety, including waste management and hazardous waste;
- Air quality and climate change;
- Lake use (commercial and recreational fisheries, commercial shipping and recreational boating);
- Traffic and transportation (including navigation risk and ice floes);
- Land use and infrastructure;
- Cultural resources;
- Aesthetics and visual resources;
- Noise;
- Economics and socio-economics (including energy needs, mineral needs, food and fiber production, and property ownership); and
- Environmental justice.

USEPA finds this is to be a robust list of relevant topics. However, we wish to elaborate on some of those topics to promote a thorough analysis of impacts and consideration of possible mitigation measures.

Alternatives

The Notice of Scoping (Section 2.0 Proposed Project Area) references that the proposed location for the Project Icebreaker pilot is the result of multiple earlier studies that considered a variety of environmental, geological, technical, and economic factors in site selection and project feasibility, undertaken by the Great Lakes Wind Energy Consortium, the Ohio Department of Natural Resources (ODNR), and others. Many of these studies were done in partnership with the local project sponsor, the Lake Erie Energy Development Corporation (LEEDCo). We recommend the EA summarize the range of alternative sites considered in project development and the rationale for selection of this proposed site and elimination of other sites. Relevant studies should be concisely summarized in the EA, but should also be available to the public as appendices to the EA and/or via web links on the project website. As a demonstration project, the EA ought to describe what design and operational factors of this project, once built, will be studied further to inform other possible future offshore wind projects in the Great Lakes.

Geology, sediments, and soils

USEPA recommends that the EA describe the quality of sediments and soils in the project's offshore and onshore footprints. How will the installation of the turbine foundations and associated cables avoid any areas of contamination? How will the project avoid, minimize, or mitigate for any suspension of sediment into the water column and associated impacts to water quality and fisheries? The EA should explain how dredged sediments will be tested for contamination and identify location of disposal for clean sediments.

Biological resources

The EA should summarize and document the studies done to date and the ongoing coordination with the US Fish and Wildlife Service (USFWS) and ODNR to protect fisheries, birds, and bats, including migratory birds, and federally and/or state-listed species. Strategies to minimize and mitigate for impacts to birds and bats, such as tower lighting and turbine operational parameters (e.g., cut-in speeds) ought to be analyzed and discussed. What monitoring measures will be employed to gauge the effectiveness of minimization and mitigation measures? Both USFWS and ODNR have developed bird and bat monitoring protocols for land-based wind projects. USEPA recommends that the EA discuss to what extent these tools can be adapted to the offshore environment. How will the submerged portions of the towers be maintained to minimize their use as habitat for aquatic nuisance species (e.g., zebra mussels, quagga mussels)?

Air quality and climate change

USEPA recommends the EA quantify air emissions, including greenhouse gases, associated with equipment (onshore and offshore) and lake vessels engaged in construction, operation, maintenance, and decommissioning of the project. Enclosed is USEPA's Construction Emission Control Checklist, which contains a variety of strategies that may be applicable in reducing emissions from this project.

The National Climate Assessment's section on the Midwest provides a useful starting place for analyzing changing climate conditions[1]. Describe ongoing and anticipated effects of climate change relevant to the project. For example, climate change may influence Lake Erie water level fluctuations. We recommend the EA discuss how the project may adapt to such fluctuations. We also recommend that the EA quantify the air pollution and greenhouse gases emissions that this renewable energy project will displace from existing electric power sources.

Traffic and transportation

In addition to navigation impacts and ice floes, please include in the EA a discussion of how the project will comply with applicable Federal Aviation Administration safety standards.

Environmental justice

USEPA's website hosts EJSCREEN, a free online tool that may help with screening for environmental justice concerns[2]. We also recommend the EA incorporate recommendations found in the Interagency Working Group for Environmental Justice NEPA Committee's *Promising Practices for Environmental Methodologies in NEPA Reviews*[3].

Permitting and Interagency Coordination

USEPA recommends that the EA summarize in a table all of the permits and approvals that will be needed by federal, state, and local governments for this project. Correspondence relevant to interagency coordination and permitting and approval processes should be included as appendices to the EA.

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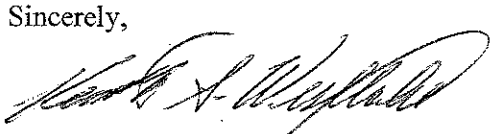
[1] U.S. Global Change Research Program, 2014 National Climate Assessment, available at: http://nca2014.globalchange/report

[2] https://www.epa.gov/ejscreen

[3] https://www.epa.gov/environmentaljustice/ej-iwg-promising-practices-ej-methodologies-nepa-reviews

USEPA supports the responsible development of clean energy technologies, including offshore wind. A rigorous environmental review under NEPA and the applicable permitting programs is an important part of such development. We appreciate the opportunity to engage this project during scoping. We are available to discuss our scoping comments, and look forward to reviewing the EA when it is released for public comment. If you have any questions on our scoping comments, feel free to contact me at 312-886-2910 and westlake.kenneth@epa.gov or Kathy Kowal of my staff at 312-353-5206 and kowal.kathleen@epa.gov.

Sincerely,



Kenneth A. Westlake, Chief
National Environmental Policy Act Implementation Section
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Enclosure – Construction Emission Control Checklist

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U.S. Environmental Protection Agency
Construction Emission Control Checklist

Diesel emissions and fugitive dust from project construction may pose environmental and human health risks and should be minimized. In 2002, EPA classified diesel emissions as a likely human carcinogen, and in 2012 the International Agency for Research on Cancer concluded that diesel exhaust is carcinogenic to humans. Acute exposures can lead to other health problems, such as eye and nose irritation, headaches, nausea, asthma, and other respiratory system issues. Longer term exposure may worsen heart and lung disease.[4] We recommend that the Department of Energy consider the following protective measures and commit to applicable measures in the Environmental Assessment.

Mobile and Stationary Source Diesel Controls

Purchase or solicit bids that require the use of vehicles that are equipped with zero-emission technologies or the most advanced emission control systems available. Commit to the best available emissions control technologies for project equipment in order to meet the following standards.

- On-Highway Vehicles: On-highway vehicles should meet, or exceed, the EPA exhaust emissions standards for model year 2010 and newer heavy-duty, on-highway compression-ignition engines (e.g., long-haul trucks, refuse haulers, shuttle buses, etc.).5
- Non-road Vehicles and Equipment: Non-road vehicles and equipment should meet, or exceed, the EPA Tier 4 exhaust emissions standards for heavy-duty, non-road compression-ignition engines (e.g., construction equipment, non-road trucks, etc.).6
- Locomotives: Locomotives servicing infrastructure sites should meet, or exceed, the EPA Tier 4 exhaust emissions standards for line-haul and switch locomotive engines where possible.7
- Marine Vessels: Marine vessels servicing infrastructure sites should meet, or exceed, the latest EPA exhaust emissions standards for marine compression-ignition engines (e.g., Tier 4 for Category 1 & 2 vessels, and Tier 3 for Category 3 vessels).8
- Low Emission Equipment Exemptions: The equipment specifications outlined above should be met unless: 1) a piece of specialized equipment is not available for purchase or lease within the United States; or 2) the relevant project contractor has been awarded funds to retrofit existing equipment, or purchase/lease new equipment, but the funds are not yet available

Consider requiring the following best practices through the construction contracting or oversight process:

- Use onsite renewable electricity generation and/or grid-based electricity rather than diesel-powered generators or other equipment.

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[4] https://www3.epa.gov/region1/eco/diesel/health_effects.html
[5] http://www.epa.gov/otaq/standards/heavy-duty/hdci-exhaust.htm
[6] http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm
[7] http://www.epa.gov/otaq/standards/nonroad/locomotives.htm
[8] http://www.epa.gov/otaq/standards/nonroad/marineci.htm

- Use ultra-low sulfur diesel fuel (15 ppm maximum) in construction vehicles and equipment.
- Use catalytic converters to reduce carbon monoxide, aldehydes, and hydrocarbons in diesel fumes. These devices must be used with low sulfur fuels.
- Use electric starting aids such as block heaters with older vehicles to warm the engine.
- Regularly maintain diesel engines to keep exhaust emissions low. Follow the manufacturer's recommended maintenance schedule and procedures. Smoke color can signal the need for maintenance (e.g., blue/black smoke indicates that an engine requires servicing or tuning).
- Retrofit engines with an exhaust filtration device to capture diesel particulate matter before it enters the construction site.
- Repower older vehicles and/or equipment with diesel- or alternatively-fueled engines certified to meet newer, more stringent emissions standards (e.g., plug-in hybrid-electric vehicles, battery-electric vehicles, fuel cell electric vehicles, advanced technology locomotives, etc.).
- Retire older vehicles, given the significant contribution of vehicle emissions to the poor air quality conditions. Implement programs to encourage the voluntary removal from use and the marketplace of pre-2010 model year on-highway vehicles (e.g., scrappage rebates) and replace them with newer vehicles that meet or exceed the latest EPA exhaust emissions standards.

Fugitive Dust Source Controls

- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative, where appropriate. This applies to both inactive and active sites, during workdays, weekends, holidays, and windy conditions.
- Install wind fencing and phase grading operations where appropriate, and operate water trucks for stabilization of surfaces under windy conditions.
- When hauling material and operating non-earthmoving equipment, prevent spillage and limit speeds to 15 miles per hour (mph). Limit speed of earth-moving equipment to 10 mph.

Occupational Health

- Reduce exposure through work practices and training, such as turning off engines when vehicles are stopped for more than a few minutes, training diesel-equipment operators to perform routine inspection, and maintaining filtration devices.
- Position the exhaust pipe so that diesel fumes are directed away from the operator and nearby workers, reducing the fume concentration to which personnel are exposed.
- Use enclosed, climate-controlled cabs pressurized and equipped with high-efficiency particulate air (HEPA) filters to reduce the operators' exposure to diesel fumes. Pressurization ensures that air moves from inside to outside. HEPA filters ensure that any incoming air is filtered first.
- Use respirators, which are only an interim measure to control exposure to diesel emissions. In most cases, an N95 respirator is adequate. Workers must be trained and fit-tested before they wear respirators. Depending on the type of work being conducted, and if oil is present, concentrations of particulates present will determine the efficiency and

type of mask and respirator. Personnel familiar with the selection, care, and use of respirators must perform the fit testing. Respirators must bear a NIOSH approval number.

NEPA Documentation

- Per Executive Order 13045 on Children's Health[9], EPA recommends the lead agency and project proponent pay particular attention to worksite proximity to places where children live, learn, and play, such as homes, schools, and playgrounds. Construction emission reduction measures should be strictly implemented near these locations in order to be protective of children's health.
- Specify how impacts to sensitive receptors, such as children, elderly, and the infirm will be minimized. For example, locate construction equipment and staging zones away from sensitive receptors and fresh air intakes to buildings and air conditioners

[9] Children may be more highly exposed to contaminants because they generally eat more food, drink more water, and have higher inhalation rates relative to their size. Also, children's normal activities, such as putting their hands in their mouths or playing on the ground, can result in higher exposures to contaminants as compared with adults. Children may be more vulnerable to the toxic effects of contaminants because their bodies and systems are not fully developed and their growing organs are more easily harmed. EPA views childhood as a sequence of lifestages, from conception through fetal development, infancy, and adolescence.