DOE/EA-1970

Complete Appendix C
Of Agency Correspondence and Enclosures

DRAFT
ENVIRONMENTAL ASSESSMENT

FOR

FISHERMEN'S ATLANTIC CITY WINDFARM

OFFSHORE OF ATLANTIC CITY, NEW JERSEY

US Department of Energy
Office of Energy Efficiency and Renewable Energy
Golden Field Office

FEBRUARY 2015

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 9, 2015

John K. Bullard
Regional Administrator
Greater Atlantic Regional Fisheries Office
National Marine Fisheries Service
Northeast Region
55 Great Republic Drive
Gloucester, MA 01930-2276

SUBJECT: DOE and USACE Request for Re-Initiation of the Section 7 Endangered Species Act Informal Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Mr. Bullard:

The U.S. Department of Energy (DOE) is proposing to provide funding to Fishermen's Atlantic City Windfarm, LLC (project proponent) to support the development of an offshore wind renewable energy facility (proposed project) within New Jersey state waters, located approximately 2.8 miles off the New Jersey coast from Atlantic City. The U.S. Army Corps of Engineers, Philadelphia District (USACE) has regulatory and permitting authority for this proposed project under Section 404 of the *Clean Water Act* and Section 10 of the *Rivers and Harbors Act of 1899*. The USACE issued Department of the Army Permit CENAP-OP-R-2008-0777-39 for this proposed project on June 14, 2013. Since issuance of the USACE permit, the project plans have been refined and a permit modification package has been submitted to the USACE. The USACE is proposing to process a modification to that permit.

The proposed project would consist of the construction, operation, maintenance, and eventual decommissioning of up to six wind turbine generators that would generate a maximum of approximately 25 megawatts (MW) of electricity, a 33-kilovolt (kV) alternating current (AC) submarine cable interconnecting the turbines, a 33-kV AC submarine transmission cable (export cable), and a 33-kV AC underground cable (onshore interconnection cable) that would connect the proposed project with existing onshore infrastructure in Atlantic City, New Jersey.

The following Federally listed species could potentially be impacted by the proposed project: Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaengliae*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), blue whale (*Balaenopera musculus*), sperm whale (*Physter microcephalus*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretts caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtles (*Eretmochelys imbricate*), Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) and the Shortnose Sturgeon (*Acipenser brevirostrum*).

The USACE previously completed consultation pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), with your office for permitting of the proposed project and determined that the proposed project is not likely to adversely affect any species listed as threatened or endangered under your jurisdiction. This determination was based on a biological assessment submitted during the consultation process. On May 22, 2012 your office concurred with this determination. A copy of this concurrence is attached (Enclosure 1). Since this concurrence, the following changes have occurred:

- A permit modification package has been submitted to the USACE. The USACE plans to issue a Public Notice to solicit comments and recommendations from the public concerning modification of the Department of the Army permit. The USACE will include your office on the distribution list to be notified when the Public Notice is published.
- The New York Bight, Chesapeake Bay, Carolina and South Atlantic Distinct Population Segments (DPSs) of Atlantic sturgeon were listed as endangered, and the Gulf of Maine DPS was listed as threatened under the ESA on April 6, 2012.
- DOE is completing an Environmental Assessment (EA) for the proposed project under the National Environmental Policy Act (NEPA) and the USACE is a cooperating agency. DOE will include your office on the distribution list to be notified when the draft EA is posted for the public comment period.

To streamline the NEPA process and to avoid redundancy, DOE and USACE have decided to jointly re-initiate Section 7 consultation for the proposed project. A biological assessment prepared by DOE is attached (Enclosure 2). This assessment addresses the modifications to the proposed project that have occurred since the completion of the initial USACE led Section 7 consultation and it addresses the potential effects of the proposed project modifications on the listed species.

DOE, as the lead federal agency and USACE, as the permitting agency, have reviewed the proposed project changes and the biological assessment and determined that their respective actions of funding and modifying the permit for the proposed project *may affect but is not likely to adversely affect* the following listed species: Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaengliae*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), blue whale (*Balaenopera musculus*), sperm whale (*Physter microcephalus*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretts caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill sea turtles (*Eretmochelys imbricate*), Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) and the Shortnose Sturgeon (*Acipenser brevirostrum*) with the inclusion of the Department of the Army special permit conditions (Enclosure 3):

DOE and USACE respectfully request your concurrence with their determination. Please send any correspondence to:

U.S. Department of Energy
Golden Field Office
Attn: Ms. Lori Gray
NEPA Division Director
15013 Denver West Parkway
Golden, CO 80401

U.S. Army Corps of Engineers
Regulatory Branch, Philadelphia District
Attn: Mr. Lawrence M. Slavitter
Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107-3390

If you have any questions or require any additional information, please contact Lori Gray at (720)356-1568 or lori.gray@ee.doe.gov or Larry Slavitter, USACE at 215-655-6734 or Lawrence.M.Slavitter@usace.army.mil.

Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

Electronic cc:
Karen Greene, HCD Sandy Hook
Julie Crocker, PRD
Michael Hahn, DOE
Roak Parker, DOE
Lawrence M Slavitter, USACE

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

MAY 2 2 2012

Frank J. Cianfrani
Chief, Regulatory Branch
Department of the Army
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Wanamaker Building, 100 Penn Square East
Philadelphia, Pennsylvania 19107-3390

Received
In Regulatory Branch
MAY 2 4 2012
Philadelphia District
Corps of Engineers

RE: Fishermen's Energy Off-Shore Wind Project

Dear Mr. Cianfrani,

Your April 11, 2012, letter requests consultation pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), concerning your proposed authorization of the installation of a wind energy project in New Jersey State waters. The project is proposed by Fishermen's Energy of New Jersey, LLC. You are proposing to authorize this project under the authority of Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act. You have requested our concurrence with your determination that the proposed action is not likely to adversely affect any species listed as threatened or endangered under our jurisdiction. We concur with your determination; the justification for our determination is provided below.

PROPOSED ACTION

The project site is approximately 2.8 miles east of Atlantic City (see Figure 1 below). The proposed action consists of the installation of six turbines with scour protection and a submarine electric transmission cable. The six turbines will generate approximately 20 MW of electricity and will be placed in a row, approximately 1,080 meters apart from each other. Each turbine will be supported by a jacketed foundation consisting of three 52-inch diameter steel piles driven into the sea floor. Power output from the turbines will be transmitted via a 34.5 kilovolt (kV) submarine electric cable to access the shore will make landfall at a point in Atlantic City and continue underground to the existing Huron Substation located along Absecon Avenue. Water depth at the turbine site is approximately 26-40 feet at mean lower low water. The applicant plans to begin construction during the summer of 2012. Total construction time is approximately four months.

The primary wind turbine components are the nacelle, and the rotor works which include the hub and three turbine blades. Each turbine will have a rotor diameter of approximately 377 feet and a center hub height of approximately 306 feet above mean higher high water.

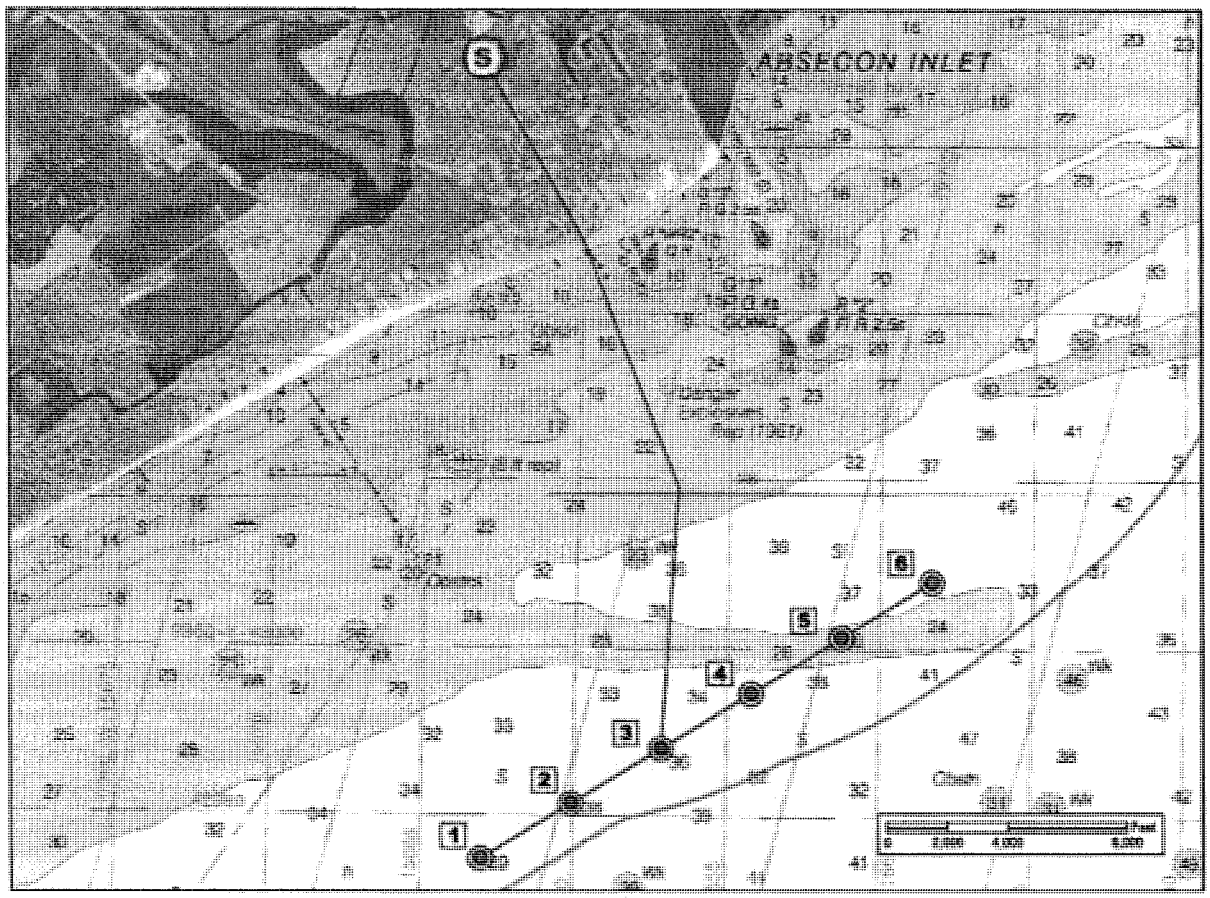


Figure 1. Project Site – dots illustrate the turbine location with the line illustrating the submarine cable.

Installation of the Foundation Structure and Turbines
Six wind turbines will be installed; each turbine will sit on a foundation consisting of three jacketed steel piles. Installation will occur from a jack-up barge. The barge will be tended by appropriate tugs and workboats as needed.

The foundation piles will be driven about 150 feet into the seafloor with a pneumatic pile driving hammer. Each piling will require between 600 and 900 blows using a hydraulic hammer over a period of 1 to 2 hours; pile driving will occur for a total of 12-15 hours over a period of 12-24 days.

Driving hollow steel piles with impact hammers produce intense, sharp spikes of sound, while vibratory hammers produce continuous sound of lower intensity. Impact hammers produce such short spikes of sound with little energy in the infrasound range (Carlson *et al.* 2001). The type and intensity of the sounds produced during pile driving depend on a variety of factors, including, but not limited to, the type and size of the pile, the firmness of the substrate into which the pile is being driven, the depth of water, and the type and size of the pile driving hammer. Sound pressure levels are positively correlated with the size of the pile, as more energy is

required to drive larger piles. Firmer substrates require more energy to drive piles, and produce more intense sound pressures. Sound attenuates more rapidly with distance from the source in shallow than in deep waters. According to information provided by the applicant, pile driving is expected to generate sound levels of 199 dB re 1μPa Peak at 10 meters.

The total in-water construction time of the foundation and turbines will be approximately six weeks. Once the foundation is installed, barges with cranes will be used to install the wind turbine components.

Scour Control Systems
Due to the high energy oceanic environment at the project site, a scour control system will be installed. The armor stones used in a rock armor scour protection would be sized so that that they are large enough not to be removed by the effects of the waves and currents, while being small enough to prevent the stone fill material placed underneath it from being removed. Rock armor and filter layer material would be placed on the seabed using a clamshell bucket operating from the barge. Stone will consist of 4-6 inch filter stone and 12-15 inch armor stone. The applicant estimates the rock armor would impact 0.7 acres at each tower; for a total impacted area of 4.2 acres of the seabed.

Tower Lighting
Aviation and navigation safety lighting would be installed and maintained on the structure in accordance with Federal Aviation Authority (FAA) and U.S. Coast Guard (USCG) requirements. The USCG lighting for navigation safety would consist of two amber lights (USCG Class C) mounted on the platform deck. In accordance with FAA guidelines, the tower would be equipped with a light system consisting of a low intensity flashing red light (FAA designated L-864) for night use. The applicant will also follow Private Aids to Navigation (PATON) requirements of the USCG.

Cable Installation
The cable will be arranged in a "single string" array and will be composed of three copper conductors, arranged within an insulated single wire armored submarine electric composite cable. An addition fiber-optic cable bundle will also be included within the composite cable. The overall diameter of the composite cable will be approximately 5 inches.

The cable will be installed via jet plow, except for the area within 1,800 feet of the shoreline which will be installed with horizontal directional-drilling (HDD). The jet plow device is hydraulically powered and is towed along the sea bottom by a specially designed cable laying vessel. As it is pulled forward, it fluidizes the sediment with pressurized seawater so the cable settles into the trench under its own weight to the planned depth of burial. The trench will be approximately 24 inches wide. The cable will be buried 9 feet below the sea bottom. An additional 15 foot x 15 foot area will be disturbed to allow the transition from jet plow to HDD (which is buried deeper under the sediment and will travel under the land).

Vessel Traffic
During construction activities, especially during pile driving activities, the applicant estimates four to six stationary or slow moving vessels would be present in the general vicinity of the pile

installation. Vessels delivering construction materials or crews to the site will also be present in the area between the mainland and the construction sites. The barges, tugs and vessels delivering construction materials generally will travel at speeds below 10 knots (18.5 km/h) and may range in size from 90 to 400 ft (27.4 to 122 m), while the vessels carrying construction crews will be traveling at a maximum speed of 21 knots (39 km/h) and will typically be 50 ft (15 m) in length. The tower sections would be raised using a barge mounted crane.

The structure will be accessed by boat for routine maintenance. Twice weekly vessel trips due to operation and maintenance are expected over the 25 year life of the project.

Decommissioning

Fishermen's Energy expects to operate the turbines for 25 years. Decommissioning activities for the turbines will begin with the removal of all components from the tower. A derrick barge will be transported to the offshore site and anchored adjacent to the structure. The mast will be removed from the deck and loading onto the transport barge. The deck will be cut from the foundation structure and loaded on the transport barge. It is estimated that the entire removal process for a tower will take one week or less.

Cutting and Removing Piles

The applicant will sever bottom-founded structures and their related components at least 4.6 m (15 feet) below the mudline to ensure that nothing will be exposed that could interfere with future activities in the area. It is not anticipated that explosives will be used to remove the structures.

Common nonexplosive severing tools that may be used consist of abrasive cutters (e.g., sand cutters and abrasive water jets), mechanical (carbide) cutters, diver cutting (e.g., underwater arc cutters and the oxyacetylene/oxyhydrogen torches), and diamond wire cutters. Of these, the most likely would be an internal cutting tool, such as a high pressure water jet-cutting tool. In order to cut a pile internally, the sand that had been forced into the hollow pile during installation will be removed by hydraulic dredging/pumping, and stored on a barge. Once cut, the steel pile will then be lifted on to a barge, and transported to shore. Following the removal of the cut pile and the adjacent scour control system, the sediments will be returned to the excavated pile site using a vacuum pump and diver assisted hoses. No excavation around the outside of the monopole or piles prior to the cutting is anticipated. Cutting and removing piles will take anywhere from several hours to one day per pile. After the foundation is severed, it will be lifted on the transport barge and towed to the decommissioning site.

Removal of Scour Control System

During decommissioning of the towers, the scour control system will also be removed. Armor stones will be removed using a clamshell dredge or similar equipment and placed on a barge. It is estimated that the removal of the scour control system will take less than two days for each tower.

Cable Removal
Power cables at each turbine location will be excavated to burial depth (9 feet), cut and removed. All cabling at or below the 9-foot depth will be left in place, undisturbed. The transition area at the HDD transition site will be removed and backfilled.

Disposal
All materials will be removed by barge and transported to shore. The steel will be recycled and remaining materials would be disposed of in existing landfills in accordance with applicable regulations.

SPECIAL PROJECT CONDITIONS
You will require several special permit conditions. These are detailed in Appendix I of this letter. These conditions are designed to minimize potential effects to listed species and include requirements for monitoring during pile installation.

LISTED SPECIES IN THE ACTION AREA
The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). For this activity, the action area includes the project site (see Figure 1) as well as waters between the project site and shore. This area is expected to encompass all effects of the proposed action.

Several ESA-listed species occur seasonally in the action area. Since the proposed activities could occur year-round, it can be assumed that these species could be present for all or some of the proposed activity. In the section below, we summarize the best available information on the use of the action area by listed species.

Six species of endangered large whales occur seasonally off the Atlantic coast of the U.S.; the North Atlantic right whale, fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), humpback whale (*Megaptera novaeangliae*), sperm whale (*Physeter macrocephalus*), and blue whale (*Balaenoptera musculus*). However, of these six species, only three – right, humpback, and fin whales – are likely to occur in the action area; sperm, blue and sei whales are typically found in waters further offshore. Right and humpback whales are most likely to occur in the action area between November and April and fin whales are most likely to occur in the action area between October and January. However, acoustic monitoring data indicates that individuals may occur in the action area throughout the year (NJDEP 2010).

Four species of listed sea turtles including endangered leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempi*) and green *(Chelonia mydas)* sea turtles and threatened loggerhead (*Caretta caretta*) sea turtles occur seasonally in the action area. Sea turtles arrive in the mid-Atlantic, including the action area, in May and typically begin migrating southward by mid-November. Satellite tracking studies of sea turtles in New York waters found that foraging turtles mainly occurred in areas where the water depth was between approximately 16 and 49 ft (Ruben and Morreale 1999). This depth was interpreted not to be as much an upper physiological depth limit for turtles, as a natural limiting depth where light and food are most suitable for foraging turtles (Morreale and Standora 1990). Depths at the project site range from

26-40 feet. We expect sea turtles in the action area between May and November, with the highest number of individuals present between June and October.

On February 6, 2012, we published notice in the *Federal Register* that we were listing the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs of Atlantic sturgeon as endangered, and the Gulf of Maine DPS as threatened under the ESA (77 FR 5880 and 77 FR 5914). The effective date of these listings was April 6, 2012. The range of Atlantic sturgeon from all five DPSs extends from Labrador Inlet, Labrador, Canada to Cape Canaveral, Florida. We have considered the best available information on the distribution of Atlantic sturgeon and have determined that Atlantic sturgeon from any of the five DPSs may be present in the action area. As a result, in this consultation, we consider effects of the proposed action on all five DPSs of Atlantic sturgeon.

After emigration from the natal estuary, subadult and adult Atlantic sturgeon forage within the marine environment, typically in waters less than 50 m in depth, using coastal bays, sounds, and ocean waters (Vladykov and Greeley, 1963; Murawski and Pacheco, 1977; Dovel and Berggren, 1983; Smith, 1985; Collins and Smith, 1997; Welsh *et al.*, 2002; Savoy and Pacileo, 2003; Stein *et al.*, 2004; USFWS, 2004; Laney *et al.*, 2007; Dunton *et al.*, 2010; Erickson *et al.*, 2011; Wirgin and King, 2011; D. Fox, pers. comm.; T. Savoy, pers. comm.). Atlantic sturgeon are likely to occur in the action area while making coastal migrations or while foraging. Atlantic sturgeon spawn in freshwater portions of large rivers and early life stages are not tolerant to salinity. As such, no eggs, larvae or juvenile Atlantic sturgeon are likely to occur in the action area. The only life stages present would be subadults and adults.

EFFECTS OF THE ACTION

In order to assess the potential effects of your proposed approval of the Fishermen's Energy project, we assessed the likelihood that listed species, if present in the action area would be affected by the proposed actions considered in this consultation, and if so, if those effects would be insignificant and discountable. Potential effects of the proposed action can be broadly categorized into the following categories: (1) acoustic effects, (2) effects to benthic habitat, (3) effects of an increase in vessel traffic, (4) effects of operation, (5) effects of non-routine and accidental events, and (6) decommissioning.

Acoustic Effects

When anthropogenic disturbances elicit responses from fish, sea turtles and marine mammals, it is not always clear whether they are responding to visual stimuli, the physical presence of humans or man-made structures, or acoustic stimuli. However, because sound travels well underwater, it is reasonable to assume that, in many conditions, marine organisms would be able to detect sounds from anthropogenic activities before receiving visual stimuli. As such, exploring the acoustic effects of the proposed project provides a reasonable and conservative estimate of the magnitude of disturbance caused by the general presence of a manmade, industrial structure in the marine environment, as well as the specific effects of sound on the behavior of listed species.

The level of a sound in water can be expressed in several different ways, but always in terms of dB relative to 1 micro-Pascal (μPa). Decibels are a log scale; each 10 dB increase is a ten-fold

increase in sound pressure. Accordingly, a 10 dB increase is a 10x increase in sound pressure, and a 20 dB increase is a 100x increase in sound pressure.

The following are commonly used measures of sound:

- Peak sound pressure level (SPL): the maximum sound pressure level (highest level of sound) in a signal measured in dB re 1 μPa.

- Sound exposure level (SEL): the integral of the squared sound pressure over the duration of the pulse (e.g., a full pile driving strike.) SEL is the integration over time of the square of the acoustic pressure in the signal and is thus an indication of the total acoustic energy received by an organism from a particular source (such as pile strikes). Measured in dB re $1\mu Pa^2$-s.

- Single Strike SEL: the amount of energy in one strike of a pile.

- Cumulative SEL (cSEL): the energy accumulated over multiple strikes. cSEL indicates the full energy to which an animal is exposed during any kind of signal. The rapidity with which the cSEL accumulates depends on the level of the single strike SEL. The actual level of accumulated energy (cSEL) is the logarithmic sum of the total number of single strike SELs. Thus, cSEL (dB) = Single-strike SEL + $10\log_{10}(N)$; where N is the number of strikes.

- Root Mean Square (RMS): the average level of a sound signal over a specific period of time.

Marine organisms rely on sound to communicate with conspecifics and derive information about their environment. There is growing concern about the effect of increasing ocean noise levels due to anthropogenic sources on marine organisms, particularly marine mammals. Effects of noise exposure on marine organisms can be characterized by the following range of physical and behavioral responses (Richardson *et al.* 1995):

1. Behavioral reactions – Range from brief startle responses, to changes or interruptions in feeding, diving, or respiratory patterns, to cessation of vocalizations, to temporary or permanent displacement from habitat.
2. Masking – Reduction in ability to detect communication or other relevant sound signals due to elevated levels of background noise.
3. Temporary threshold shift (TTS) – Temporary, fully recoverable reduction in hearing sensitivity caused by exposure to sound.
4. Permanent threshold shift (PTS) – Permanent, irreversible reduction in hearing sensitivity due to damage or injury to ear structures caused by prolonged exposure to sound or temporary exposure to very intense sound.
5. Non-auditory physiological effects – Effects of sound exposure on tissues in non-auditory systems either through direct exposure or as a consequence of changes in behavior, e.g., resonance of respiratory cavities or growth of gas bubbles in body fluids.

Right, Humpback, and Fin Whale Hearing

In order for right, humpback, and fin whales to be adversely affected by noise, they must be able to perceive the noises produced by the activities. If a species cannot hear a sound, or hears it poorly, then the sound is unlikely to have a significant effect (Ketten 1998). Baleen whale hearing has not been studied directly, and there are no specific data on sensitivity, frequency or intensity discrimination, or localization (Richardson *et al.*1995) for these whales. Thus, predictions about probable impact on baleen whales are based on assumptions about their hearing rather than actual studies of their hearing (Richardson *et al.*1995; Ketten 1998).

Ketten (1998) summarized that the vocalizations of most animals are tightly linked to their peak hearing sensitivity. Hence, it is generally assumed that baleen whales hear in the same range as their typical vocalizations, even though there are no direct data from hearing tests on any baleen whale. Most baleen whale sounds are concentrated at frequencies less than 1 kHz (Richardson *et al.*1995), although humpback whales can produce songs up to 8 kHz (Payne and Payne 1985). Based on indirect evidence, at least some baleen whales are quite sensitive to frequencies below 1 kHz but can hear sounds up to a considerably higher but unknown frequency. Most of the manmade sounds that elicited reactions by baleen whales were at frequencies below 1 kHz (Richardson *et al.*1995). Some or all baleen whales may hear infrasounds, sounds at frequencies well below those detectable by humans. Functional models indicate that the functional hearing of baleen whales extends to 20 Hz, with an upper range of 30 Hz. Even if the range of sensitive hearing does not extend below 20-50 Hz, whales may hear strong infrasounds at considerably lower frequencies. Based on work with other marine mammals, if hearing sensitivity is good at 50 Hz, strong infrasounds at 5 Hz might be detected (Richardson *et al.*1995). Fin whales are predicted to hear at frequencies as low as 10-15 Hz. The right whale uses tonal signals in the frequency range from roughly 20 to 1000 Hz, with broadband source levels ranging from 137 to 162 dB (RMS) re 1 μPa at 1 m (Parks & Tyack 2005). One of the more common sounds made by right whales is the "up call," a frequency-modulated upsweep in the 50–200 Hz range (Mellinger 2004). The following table summarizes the range of sounds produced by right, humpback, and fin whales (from Au *et al.*2000):

Table 1. Summary of known right, humpback, and fin whale vocalizations

Species	Signal type	Frequency Limits (Hz)	Dominant Frequencies (Hz)	Source Level (dB re 1μPa RMS)	References
North Atlantic Right	Moans	< 400	--	--	Watkins and Schevill (1972)
	Tonal	20-1000	100-2500	137-162	Parks and Tyack (2005)
	Gunshots		50-2000	174-192	Parks *et al.*(2005)
Humpback	Grunts	25-1900	25-1900	--	Thompson, Cummings, and Ha (1986)
	Pulses	25-89	25-80	176	
	Songs	30-8000	120-4000	144-174	Thompson, Cummings, and Ha

					(1986) Payne and Payne (1985)
Fin	FM moans Tonal Songs	14-118 34-150 17-25	20 34-150 17-25	160-186 186	Watkins (1981), Edds (1988), Cummings and Thompson (1994) Edds (1988) Watkins (1981)

Most species also have the ability to hear beyond their region of best sensitivity. This broader range of hearing probably is related to their need to detect other important environmental phenomena, such as the locations of predators or prey. Considerable variation exists among marine mammals in hearing sensitivity and absolute hearing range (Richardson *et al.* 1995; Ketten 1998); however, from what is known of right, humpback, and fin whale hearing and the source levels and dominant frequencies of the construction noise sources, it is evident that right, humpback, and fin whales are capable of perceiving construction noises, and have hearing ranges that are likely to have peak sensitivities in low frequency ranges that overlap the dominant frequencies of pile driving and vessel noise.

Sea Turtle Hearing

The hearing capabilities of sea turtles are poorly known. Few experimental data exist, and since sea turtles do not vocalize, inferences cannot be made from their vocalizations as is the case with baleen whales. Direct hearing measurements have been made in only a few species. An early experiment measured cochlear potential in three Pacific green turtles and suggested a best hearing sensitivity in air of 300–500 Hz and an effective hearing range of 60–1,000 Hz (Ridgway *et al.* 1969). Sea turtle underwater hearing is believed to be about 10 dB less sensitive than their in-air hearing (Lenhardt 1994). Lenhardt *et al.* (1996) used a behavioral "acoustic startle response" to measure the underwater hearing sensitivity of a juvenile Kemp's ridley and a juvenile loggerhead turtle to a 430-Hz tone. Their results suggest that those species have a hearing sensitivity at a frequency similar to those of the green turtles studied by Ridgway *et al.*(1969). Lenhardt (1994) was also able to induce startle responses in loggerhead turtles to low frequency (20–80 Hz) sounds projected into their tank. He suggested that sea turtles have a range of best hearing from 100–800 Hz, an upper limit of about 2,000 Hz, and serviceable hearing abilities below 80 Hz. More recently, the hearing abilities of loggerhead sea turtles were measured using auditory evoked potentials in 35 juvenile animals caught in tributaries of Chesapeake Bay (Bartol *et al.* 1999). Those experiments suggest that the effective hearing range of the loggerhead sea turtle is 250–750 Hz and that its most sensitive hearing is at 250 Hz. In general, however, these experiments indicate that sea turtles generally hear best at low frequencies and that the upper frequency limit of their hearing is likely about 1 kHz. As such, sea turtles are capable of hearing in low frequency ranges that overlap with the dominant frequencies of pile driving and vessel noise, and are therefore likely to be exposed to construction-related noise.

Atlantic Sturgeon Hearing

Sturgeon are hearing generalists and rely primarily on particle motion to detect sounds (Lovell *et*

*al.*2005). While there are no data both in terms of hearing sensitivity and structure of the auditory system for shortnose or Atlantic sturgeon, there are data for the closely related lake sturgeon (Lovell *et al.*2005; Meyer *et al.*2010), which for the purpose of considering acoustic impacts can be considered as a surrogate for shortnose and Atlantic sturgeon.

The available data suggest that lake sturgeon can hear sounds from below 100 Hz to 800 Hz (Lovell *et al.*2005; Meyer *et al.*2010). However, since these two studies examined responses of the ear and did not examine whether fish would behaviorally respond to sounds detected by the ear, it is hard to determine thresholds for hearing (that is, the lowest sound levels that an animal can hear at a particular frequency) using information from these studies.

The swim bladder of sturgeon is relatively small compared to other species (Beregi *et al.*2001). While there are no data that correlate effects of noise on fishes and swim bladder size, the potential for damage to body tissues from rapid expansion of the swim bladder likely is reduced in a fish where the structure occupies less of the body cavity, and, thus, is in contact with less body tissue. Although there are no experimental data that enable one to predict the potential effects of sound on sturgeon, the physiological effects of pile driving on sturgeon may actually be less than on other species due to the small size of their swim bladder.

Criteria for Assessing the Effects of Noise Exposure

Several components of the proposed action will produce sound that may affect listed sturgeon, sea turtles and whales. NMFS is in the process of developing a comprehensive acoustic policy that will provide guidance on managing sources of anthropogenic sound based on each species' sensitivity to different frequency ranges and intensities of sound. The available information on the hearing capabilities of cetaceans and the mechanisms they use for receiving and interpreting sounds remains limited due to the difficulties associated with conducting field studies on these animals. However, current thresholds for determining impacts to marine mammals typically center around root-mean-square (RMS) received levels of 180 dB re 1μPa for potential injury, 160 dB re 1μPa for behavioral disturbance/harassment from a non-continuous noise source, and 120 dB re 1μPa for behavioral disturbance/harassment from a continuous noise source. These thresholds are based on a limited number of experimental studies on captive odontocetes, a limited number of controlled field studies on wild marine mammals, observations of marine mammal behavior in the wild, and inferences from studies of hearing in terrestrial mammals. In addition, marine mammal responses to sound can be highly variable, depending on the individual hearing sensitivity of the animal, the behavioral or motivational state at the time of exposure, past exposure to the noise which may have caused habituation or sensitization, demographic factors, habitat characteristics, environmental factors that affect sound transmission, and non-acoustic characteristics of the sound source, such as whether it is stationary or moving (NRC 2003). Nonetheless, the threshold levels referred to above are considered conservative based on the best available scientific information at this time and will be used in the analysis of effects for whales and sea turtles in this consultation.

Popper *et al.*(2006) have proposed a set of criteria for injury to fish exposed to pile driving. Based on the best available scientific information, they determined that pile driving resulting in a cumulative sound exposure level (cSEL) of 187 dB re: 1 μPa2 •sec *and* a peak sound pressure level of 208 dB re: 1 μPa in any single strike has no potential to cause injury or mortality to fish.

These criteria are similar to those adopted by NMFS Northwest Regional Office, the US Fish and Wildlife Service, and the Federal Highway Administration, who determined that based on the best available scientific information, that pile driving resulting in a cSEL level of 187 dB re: 1 µPa2 •sec *and* a peak sound pressure level of 206 dB re: 1 µPa peak in any single strike has no potential to cause injury or mortality to fish weighing more than 2 grams. All sturgeon that may occur in the action area will likely weigh more than 2 grams.

The NMFS Northwest Region criteria noted above considered effects to green sturgeon which are biologically similar to Atlantic sturgeon. Because of this, it is reasonable to consider that these acoustic thresholds designed to be protective of green sturgeon would also be protective of Atlantic sturgeon. These thresholds will be used in the analysis of effects for Atlantic sturgeon in this consultation.

For purposes of assessing behavioral effects of pile driving at several West Coast projects, NMFS has employed a 150dB re 1 µPa RMS SPL criterion at several sites including the San Francisco-Oakland Bay Bridge and the Columbia River Crossings. For the purposes of this consultation we will use 150 dB re 1 µPa RMS as a conservative indicator of the noise level at which there is the potential for behavioral effects for Atlantic sturgeon. That is not to say that exposure to noise levels of 150 dB re 1 µPa RMS will always result in behavioral modifications or that any behavioral modifications will rise to the level of "take" (i.e., harm or harassment) but that there is the potential, upon exposure to noise at this level, to experience some behavioral response. Behavioral responses could range from a temporary startle to avoidance of an ensonified area.

As hearing generalists, sturgeon rely primarily on particle motion to detect sounds (Lovell *et al.*2005), which does not propagate as far from the sound source as does pressure. However, a clear threshold for particle motion was not provided in the Lovell study. In addition, flanking of the sounds through the substrate may result in higher levels of particle motion at greater distances than would be expected from the non-flanking sounds. Unfortunately, data on particle motion from pile driving is not available at this time, and we are forced to rely on sound pressure level criteria. Although we agree that more research is needed, the studies noted above support this as an indication for when behavioral effects could be expected. We are not aware of any studies that have considered the behavior of Atlantic sturgeon in response to pile driving noise. However, given the available information from studies on other fish species, we consider 150 dB re 1 µPa RMS to be a reasonable estimate of the noise level at which exposure may result in behavioral modifications.

Effects of Noise Exposure

Sources of construction noise associated with the proposed project include pile driving, construction and maintenance vessel transits, and operation of the wind turbines.

Noise Associated with Installation of the Wind Turbines and Foundations

Sound levels associated with the driving of piles have been presented by the applicant. Each of the six turbines will be supported on a tripod foundation, consisting of three 52-inch diameter piles. The applicant has determined that the maximum SPL at 10 meters from the source will be 199 dB re 1uPa or 185dB re 1uPa RMS. Noise will attenuate to 159 dB re 1uPa RMS at 500

meters from the source and 157 dB re 1uPa RMS at 1,000 meters from the source (see Fishermen's Energy 2012). Noise will attenuate to below 150 dB re 1uPa RMS at 3,800 meters from the pile being driven.

As noted in the special project conditions, an initial exclusion zone around the pile driving equipment of 1,200 meters will be established such that piles will not be driven if a whale or sea turtle is observed within 1,200 meters of the pile to be driven. Acoustic monitoring during the installation of the first pile will take place. Since multiple piles are being driven, the applicant can then either maintain the 1,200 km exclusion zone or reset it to a distance where underwater noise will be less than 160dB re 1uPa RMS outside the zone.

It is important to note that pile driving will only occur for 1-2 hours for each pile to be installed for a total of 12-15 hours over a period of 15-24 days. Thus, in order for a whale or sea turtle to have the potential to be exposed to pile driving noise that may result in injury (180dB) or harassment (160dB), a whale or sea turtle would have to be within 1,200 meters of the pile to be driven during the 4-5 hour period when pile driving will occur. Given the intermittent distribution of whales and sea turtles throughout the action area, any occurrence of a whale or sea turtle in such a small area of space and time is unlikely. As only 18 piles will be driven, the likelihood of co-occurrence remains small even when all pile driving events are considered. As explained in the special permit conditions, the 1,200 meter exclusion zone will be monitored by at least one trained endangered species observer for at least 60 minutes prior to the start of pile driving. It is expected that the observer will be able to detect the presence of any whales or sea turtle at the surface within the 1,200 meter exclusion zone and that additional observers will be utilized if one observer is not enough to effectively monitor this area. The normal duration of sea turtle dives ranges from 5-40 minutes depending on species, with a maximum duration of 45-66 minutes depending on species (Spotila 2004). As sea turtles can stay submerged for longer than 30 minutes, but typically surface at least every 60 minutes, it is reasonable to expect that monitoring for at least 60 minutes will allow the endangered species observer to detect any sea turtles that may be submerged in the exclusion zone.

Sound levels will have dissipated to below the 160 dB threshold within a distance of 500 meters. As no pile driving will occur if a whale or sea turtle is within 1,200 meters of the pile, no whales or sea turtles are likely to be exposed to potentially injurious or harassing levels of sound. Thus, whales or sea turtles are not likely to be exposed to levels of construction-related noise that will result in injury or harassment.

Based on the analysis presented herein, no whales or sea turtles are likely to be exposed to any noise greater than 160dB. Thus, listed species are not likely to be exposed to levels of underwater noise that will result in injury or disturbance and any acoustic effects of the proposed action will be insignificant and discountable.

Noise generated from the pile installation will be less than the values expected to result in injury or mortality of Atlantic sturgeon (i.e., it is less than 206dB re 1uPa Peak). As such, we do not expect any injury or mortality of Atlantic sturgeon. The area where noise levels will be above the level that could result in behavioral modifications will extend 3,800 meters from the pile being driven. We expect that Atlantic sturgeon in the action area may avoid this area by

swimming around it. However, because pile driving will only occur for 4-5 hours at a time and because the activity is in the open ocean where there are no other barriers to movements, any disturbance is likely to have an insignificant effect on the individual. Based on this analysis, we have determined that it is extremely unlikely that any minor changes in behavior resulting from exposure to increased underwater noise associated with pile installation will preclude any Atlantic sturgeon from completing any normal behaviors such as resting, foraging or migrating or that the fitness of any individuals will be affected. Additionally, there is not expected to be any increase in energy expenditure that has any detectable effect on the physiology of any individuals or any future effect on growth, reproduction, or general health. For these reasons, any effects of exposure to underwater noise associated with pile installation will be insignificant and discountable.

Vessel Noise

Support and vessel transits will occur regularly throughout the operational period. Vessels transmit noise through water and cumulatively are a significant contributor to increases in ambient noise levels in many areas. The dominant source of vessel noise from the proposed action is propeller cavitation, although other ancillary noises may be produced. The intensity of noise from service vessels is roughly related to ship size and speed. Large ships tend to be noisier than small ones, and ships underway with a full load (or towing or pushing a load) produce more noise than unladen vessels. Vessel traffic associated with the proposed action would produce levels of noise of 150 to 170 dB re 1 μPa-m at frequencies below 1,000 Hz. A tug pulling a barge generates 164 dB re 1 μPa-m when empty and 170 dB re 1 μPa-m loaded. A tug and barge underway at 18 km/h can generate broadband source levels of 171 dB re 1 μPa-m. A small crew boat produces 156 dB re 1 μPa-m at 90 Hz.

Vessel noises are within the range of frequencies that whales can detect. The noise produced by smaller crew support vessels is below the threshold of harassment from a non-continuous noise source (160 dB; while the vessel noise is continuous, whales will not be exposed continuously as the vessels will be transiting and only a small area will be esonified at a given time). As such, any effects from noise associated with crew support vessels will be discountable. Project related vessel traffic traveling between the construction staging areas and the project site will consist of tugs and barges. As noted above, the source level for these vessels is approximately 164-171 dB re 1 μPa-m. However, operational noise sources are expected to diminish to below the 160 dB re 1uPa threshold within short distances. Based on the operating procedures which limit vessels from approaching within 100 meters of any whale and 500 meters of a right whale, it is extremely unlikely that any project vessel would come close enough to a whale in a manner that would result in exposure to harassing levels of noise. As such, no whales are expected to be exposed to injurious or harassing levels of sound. As no avoidance behaviors are anticipated, the distribution, abundance and behavior of whales in the action area is not likely to be affected by noise associated with construction or maintenance vessels and any effects will be insignificant or discountable.

As noted previously in relation to construction noise, sea turtles are thought to be far less sensitive to sound than marine mammals. Although vessel noises are within the limited range of frequencies they can detect, evidence suggests that sound levels of 110-126 dB re 1μPa are required before sea turtles can detect a sound (Ridgway 1969; Streeter, in press). McCauley

(2000) noted that dB levels of 166 dB re 1μPa were required before any behavioral reaction was observed. As all operational noise sources are expected to diminish to below this threshold within very short distances, no sea turtles are expected to be exposed to injurious or harassing levels of sound. As no avoidance behaviors are anticipated, the distribution, abundance and behavior of sea turtles in the action area is not likely to be affected by noise associated with construction or maintenance vessels and any effects will be insignificant or discountable.

Similarly, we expect that Atlantic sturgeon may be able to hear the noise associated with vessels; however, as all operational noise sources are expected to diminish to levels that would not be bothersome within very short distances, no Atlantic sturgeon are expected to be exposed to injurious or harassing levels of sound. As no avoidance behaviors are anticipated, the distribution, abundance and behavior of Atlantic sturgeon in the action area is not likely to be affected by noise associated with construction or maintenance vessels and any effects will be insignificant or discountable.

Noise Associated with Turbine Operation
Once installed, the operation of the turbines is not expected to generate substantial sound levels above baseline sound in the area. Preliminary results from noise studies conducted in the United Kingdom suggest that in general, the level of noise created during the operation of offshore windfarms is very low and does not cause avoidance of the area by marine species (Nedwell, unpub. data, reported in BOEM 2008). Even in the area directly surrounding the wind turbines, noise was not generally found above the level of background noise, resulting in normal activity of marine animals (Nedwell, unpub. data, reported in BOEM 2008).

Acoustic modeling of underwater operational sound at the proposed Cape Wind facility was performed for the design wind condition and reported in the Cape Wind EIS (BOEM 2008). Baseline underwater sound levels under the design wind condition are 107.2 dB. The predicted sound level from operation of a WTG is 109.1 dB at 65.6 feet (20 m) from the tower (i.e., only 1.9 dB above the baseline sound level) and this total sound level falls off to 107.5 dB at 164 feet (50 m) and declines to the baseline level by 361 feet (110 m)). Since the WTGs will be spaced farther apart than 360 feet (110 m) (approximately 629 to 1,000 m or 0.34 to 0.54 nautical miles apart), no cumulative impacts from the operation of the 130 WTGs in the Wind Park are anticipated.

As whales, sea turtles and Atlantic sturgeon are distributed throughout the project area, these species are likely to be exposed to operational sound of the turbines. However, as the sound (109.1 dB at 65.6 feet) will be less than 2dB above the baseline underwater noise levels (107.5 dB) and well below noise levels that are expected to elicit any behavioral response, the operational noise of the turbines will not result in injury or disturbance of whales, sea turtles or sturgeon.

Effects to Benthic Habitat
Activities that disturb the sea floor will also affect benthic communities, and can cause effects to listed species by reducing the numbers or altering the composition of the species upon which these species prey. Activities that may affect the sea floor and result in the loss of foraging resources for listed species include pile installation, scour protection (rock armoring) and cable

installation. The proposed activities to be carried out will result in both the temporary disturbance and permanent loss of benthic habitat. Effects to benthic resources and habitat will be restricted to the area within the project footprint where sediment disturbing activities will occur.

The rock armor system will impact approximately 4.2 acres of the seabed. Although these impacts would result in permanent loss of this benthic habitat, loss of this habitat is not likely to have a measurable adverse impact on normal sea turtle or Atlantic sturgeon foraging activity or any other behaviors of listed species. As such, any effects to whales and sea turtles resulting from loss of benthic habitat resulting from the installation of piles and associated scour protection will be insignificant and discountable.

The jetting process will affect benthic resources and habitat in two ways: entrainment of microorganisms and displacement or burial of other benthic resources. This is likely to result in a temporary loss of forage items and a temporary reduction in the amount of benthic habitat available for foraging sea turtles and Atlantic sturgeon. Impacts associated with cable installation, barge positioning, anchoring, anchor line sweep, and the pontoon on the jet plow device would be temporary and localized. Impacts from anchor line sweep would primarily affect the sediments to a depth of between 3 and 6 inches. Anchoring locations would have disturbances to the sediment to a depth of 4 to 6 feet at each anchor deployment, leaving a temporary irregularity to the seafloor with localized mortality of infauna. Jet plow embedment would directly disturb sediments to a depth of approximately 9 feet.

Egg and larval stages of demersal species would experience some mortality due to burial. The temporary displacement of benthic habitats is also likely to result in the mortality and/or dispersal of other benthic organism in the footprint of the construction activities. As the jetting and cable laying occurs very slowly, most mobile organisms (i.e., crabs, finfish) are likely to be able to avoid the area where the jet plow is operating.

The species that whales forage on (copepods, krill, small schooling fish) are not expected to be affected by disturbances to the benthic environment, no foraging whales will be affected by the proposed action. The alteration of benthic habitat and the loss of benthic resources during construction could impact sea turtles and Atlantic sturgeon. However, most mobile organisms, including most sea turtle prey items, are likely to be able to avoid the jetting. While there is likely to be some loss of sea turtle and Atlantic sturgeon forage items, the amount of habitat affected represents a very small percentage of the available foraging habitat for these species. Any shift in foraging is likely to be only to undisturbed areas only a few feet away. Recolonization of temporarily disturbed areas is expected to be rapid, with colonization by mobile organisms beginning within days and complete recolonization occurring within 3-12 months. As cable laying will occur over several months and recovery of benthic communities will take another several months, foraging opportunities along the cable route may be reduced for one to two years. However, as only a small percentage of the potential foraging areas in the action area will be affected, any movements of sea turtles or Atlantic sturgeon to other foraging sites are likely to be localized and the benthic disturbance is not likely to cause sea turtles to leave the action area.

Increased Turbidity
Turbidity can interfere with the ability of individuals to forage effectively by obscuring visual detection of or dispersing potential prey. Increased turbidity and resuspension of sediments can be expected from cable installation, pile installation and vessel anchoring.

Of these activities, cable installation, including jetting and backfill, is expected to generate the most turbidity and disturbance of bottom sediments. Simulations of sediment transport and deposition from jet plow embedment of the submarine cable system and inner array cables have been reported for other similar projects (see BOEM 2008). These simulations used two models (HYDROMAP to calculate currents and SSFATE to calculate suspended sediments in the water column and bottom deposition from the jet plow operations) to estimate the suspended sediment concentrations and deposition that could result from jet plow embedment of the cables. The model results demonstrate that concentrations of suspended sediment in the water column resulting from the jet plow embedment operations are largely below 50mg/L. The modeling results indicate that the suspended sediment concentration levels are short lived due to the tides flushing the plume away from the jetting equipment and the sediments rapidly settling out of the water column. For example, the duration of time when suspended sediment levels would be greater than 10mg/L above background levels is less than three hours after the jet plow has passed a given point along the route. In places along and immediately adjacent to the cable route, suspended sediment concentrations are predicted to remain at 100mg/L for two to three hours.

Suspended sediment is most likely to affect listed species in the action area if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting prey. Any whales, sea turtles or sturgeon in the area of the cable laying operations would be exposed to an increase in suspended sediment for a short duration (2-48 hours). However, as these species are highly mobile and any suspended sediment plumes will be localized and temporary, it is not likely that these species would be exposed to a high suspended sediment load for a significant amount of time. Any alteration in movements is likely to be temporary and local and effects to individuals will be insignificant.

Vessel Traffic
The proposed action will result in an increase in vessel traffic in the action area. Tugs and barges will be used to transport materials from the staging areas and smaller vessels will also be used to deliver crew to the project site. These vessels will represent an increase in vessel traffic in the action area. The barges, tugs and vessels delivering the buoy and anchor generally will travel at speeds below 10 knots and may range in size from 90 to 150 feet. While on site, vessels will be slow moving or stationary. Crew vessels, typically less than 65 feet in length, may travel at higher speeds as they travel to and from the project sites.

Collision with vessels remains a source of anthropogenic mortality for both sea turtles and whales. The proposed project will lead to increased vessel traffic in the action area that would not exist but for the proposed action. This increase in vessel traffic will result in some increased risk of vessel strike of listed species. However, due to the limited information available regarding the incidence of ship strike and the factors contributing to ship strike events, it is difficult to determine how a particular number of vessel transits or a percentage increase in

vessel traffic will translate into a number of likely ship strike events or percentage increase in collision risk. In spite of being one of the primary known sources of direct anthropogenic mortality to whales, and to a lesser degree, sea turtles, ship strikes remain relatively rare, stochastic events, and an increase in vessel traffic in the action area would not necessarily translate into an increase in ship strike events. As outlined in the special permit conditions, several measures will be implemented to further reduce the likelihood of a project vessel interacting with a whale or sea turtle. These include mandatory adherence to any DMA associated speed restrictions, a requirement to post a dedicated lookout for marine mammals and sea turtles during all transits, and mandatory adherence to vessel speed restrictions for all vessels greater than 65 feet in length during the November 1 – April 30 time period even in those areas of the action area that do not overlap with the SMAs.

Although little is known about sea turtle and whale reactions to vessel traffic, these species are thought to be able to avoid injury from slower-moving vessels since the animal has more time to maneuver and avoid the vessel. Vessels will only travel between 0-4.5 knots while actually engaged in construction activities. At these speeds, vessel movements during construction are not likely to pose a vessel strike risk to whales or sea turtles.

The risk of collision is greatest when vessels are moving at higher speeds when transiting between the staging areas and the project site. As such, the 10 knot maximum speed of the construction vessels is likely to reduce the chance for collision. Lookouts will be posted on all vessel transits. All vessels would follow the vessel strike avoidance procedures discussed above. The presence of an experienced endangered species observer at the construction site who can advise the vessel operator to slow the vessel or maneuver safely when listed species are spotted will further reduce the potential for interaction with vessels.

Large whales, particularly right whales, are vulnerable to injury and mortality from ship strikes. Although the threat of vessel collision exists anywhere listed species and vessel activity overlap, ship strike is more likely to occur in areas where high vessel traffic coincides with high species density. In addition, ship strikes are more likely to occur and more likely to result in serious injury or mortality when vessels are traveling at speeds greater than ten knots. Based on the number of vessels involved, the project location outside of any whale or sea turtle concentration area, the slow speed at which vessels will be operating, and the implementation of measures designed to minimize the potential for vessel strikes, NMFS has determined that the increased risk of vessel collision posed by project vessel operation in the action area is insignificant.

As noted in the 2007 Status Review and the proposed rule, in certain geographic areas vessel strikes have been identified as a threat to Atlantic sturgeon. While the exact number of Atlantic sturgeon killed as a result of being struck by boat hulls or propellers is unknown, it is an area of concern in the Delaware and James rivers. Brown and Murphy (2010) examined twenty-eight dead Atlantic sturgeon observed in the Delaware River from 2005-2008. Fifty-percent of the mortalities resulted from apparent vessel strikes and 71% of these (10 of 14) had injuries consistent with being struck by a large vessel (Brown and Murphy 2010). Eight of the fourteen vessel struck sturgeon were adult-sized fish (Brown and Murphy 2010). Given the time of year in which the fish were observed (predominantly May through July; Brown and Murphy 2010), it is likely that many of the adults were migrating through the river to the spawning grounds.

The factors relevant to determining the risk to Atlantic sturgeon from vessel strikes are currently unknown, but they may be related to size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of Atlantic sturgeon in the area (e.g., foraging, migrating, etc.). It is important to note that vessel strikes have only been identified as a significant concern in the Delaware and James rivers and current thinking suggests that there may be unique geographic features in these areas (e.g., potentially narrow migration corridors combined with shallow/narrow river channels) that increase the risk of interactions between vessels and Atlantic sturgeon. These geographic features are not present in the open ocean generally or in the action area specifically.

We have considered the likelihood that an increase in vessel traffic associated with the proposed action would generally increase the risk of interactions between Atlantic sturgeon and vessels in the action area. As explained above, there will be a small, localized increase in vessel traffic. There is likely to be considerable variation in the amount of vessel traffic in the action area on a seasonal and daily basis. Given the large volume of traffic in the action area (fishing vessels, shipping, recreational boats) and the wide variability in traffic in any given day, the increase in traffic associated with the proposed action is extremely small.

Given the small and localized increase in vessel traffic that would result from the proposed action, it is unlikely that there would be any detectable increase in the risk of vessel strike. As such, effects to Atlantic sturgeon from the increase in vessel traffic are likely to be discountable.

Interactions with Cable Laying Equipment

Both the inner-array cables (i.e., the cable running between the turbines) and the submarine cable will be installed with a jet plow and cable laying barge. Listed species in the path of the cable could theoretically collide with the vessel towing the plow. Cable laying operations proceed at speeds of <1 knot. At these speeds, any whale, sea turtle or sturgeon that is encountered on the bottom or in the path of the vessel is expected to be able to avoid collision or interaction with the cable laying operations. Additionally, as the cable will be taut as it is unrolled and laid in the trench, there is no risk of entanglement. Although listed species present in the vicinity of the cable laying may be displaced from the area, displacement would be temporary for the duration of the jet pass (i.e., several minutes). The cable trench will be no more than 24-inches wide. As such, any displacement would cause a whale, turtle or sturgeon to make a temporary shift in swimming direction for up to several minutes. This is not likely to affect the ability of the individual to complete any normal function (i.e., foraging, resting, and migrating) that may take place along the cable route. Based on this information, listed species colliding or directly interacting with cable laying and jetting equipment are extremely unlikely to occur and, therefore, discountable. The effects of suspended sediment and noise associated with the cable laying and impacts to benthic resources are discussed in detail above.

Operation of the Wind Turbine

Lighting

Per the USCG and the FAA, lighting will be required to operate on the towers at all times. Sea turtle hatchlings are known to be attracted to lights and adversely affected by artificial beach

lighting, which disrupts proper orientation towards the sea. However, given the distance of the towers from shore and that hatchlings are not known to be present in the action area, it is extremely unlikely that the lighting on the towers would affect sea turtles. If this lighting resulted in the attraction of sea turtles or marine mammals or their prey, no effects to sea turtles or marine mammals would occur as they are not likely to collide with the stationary tower. As such, any effects of project lighting on sea turtles or whales will be discountable. Because Atlantic sturgeon are benthic fish, it is extremely unlikely that they would be affected by lights on towers located well out of the water.

Habitat Shift

We have considered whether the presence of six 3-pile foundations in the action area and their associated scour control systems has the potential to shift the area immediately surrounding each tower from soft sediment, open water habitat to a structure-oriented system. This may create localized changes, namely the establishment of "fouling communities" within the immediate area surrounding each tower and an increased availability of shelter among the pile structure. The turbine foundations will represent a source of new substrate with vertical orientation in an area that has a limited amount of such habitat, and as such may attract finfish and benthic organisms, potentially affecting sea turtles by causing changes to prey distribution and/or abundance. While the aggregation of finfish around the piles will not attract sea turtles, some sea turtle species may be attracted to the tower foundations for the fouling community and epifauna that may colonize the underwater structure as an additional food source for certain sea turtle species, especially loggerhead and Kemp's ridley turtles. All four sea turtle species may be attracted to the underwater structure for shelter, especially loggerheads that have been reported to commonly occupy areas around oil platforms (NRC 1996) which also offer similar underwater vertical structure.

More specifically, loggerheads and Kemp's ridleys could be attracted to the piles to feed on attached organisms since they feed on mollusks and crustaceans. Loggerheads are frequently observed around wrecks, underwater structures and reefs where they forage on a variety of mollusks and crustaceans (USFWS 2005). Leatherback turtles and green turtles however are less likely to be attracted to the tower foundations for feeding since leatherbacks are strictly pelagic and feed from the water column primarily on jellyfish and green turtles are primarily herbivores feeding on seagrasses and algae. However, if either of these forage items occur in higher concentrations near the piles, these species of sea turtles could also be attracted to the piles.

As explained above, right whales feed on copepods while humpback and fin whales feed on schooling fish. If the tower foundations led to an increase in schooling fish around the piles, it is possible that individual whales could be attracted to the tower foundations. However, the small number and low density of turbine foundations (i.e., 6 in an area 2.8 miles off shore with no other vertical structure) makes it extremely unlikely that the distribution of forage species in the action area would be altered in a way that would affect the distribution of humpback or fin whales. As such, any effects to the distribution of fin or humpback whale forage species will be insignificant and discountable.

Although the tower foundations would create additional attachment sites for benthic organisms that require fixed (non-sand) substrates and additional structure that may attract certain finfish

species, the additional amount of surface area being introduced would be a minor addition to the hard substrate that is already present. Due to the small amount of additional surface area in relation to the total area of the proposed action and the mid-Atlantic as a whole and the spacing between towers, the new additional structure is not expected to alter the species composition in the action area. While the increase in structure and localized alteration of species distribution in the action area around the tower foundations may affect the localized movements of sea turtles in the action area and provide additional sheltering and foraging opportunities in the action area for these species, any effects will be beneficial or insignificant.

Unexpected Events

Vessel Collision with Turbine Tower or Damage Resulting from Natural Events
The extent of potential impacts that could result from a vessel collision with a tower largely depends on the extent of damage to the tower, its foundation and the vessel. Some smaller vessels would merely strike a glancing blow and possibly suffer some hull damage but not sink. Other vessels may suffer enough damage to sink, causing a small release of fuel and debris. A larger vessel may cause a collapse of the tower. Similarly, a large storm could cause damage to the tower and/or its foundation. Repair of a damaged or collapsed tower or its foundation would create short term and localized disturbances to the benthos, water column, and pelagic organisms similar to the construction and decommissioning of a single tower, albeit in reverse order and combined in a single event. The effects of a vessel collision or destructive natural event are difficult to predict. However, effects to listed species from such an event are more likely to be attributable to the debris that enters the water and effects of any repair activities. As any effects are likely to be on a small scale and temporary, any effects, if adverse, will be insignificant.

Fuel Spill
A fuel spill could result from a diesel generator and would be an unintended, unpredictable event. Marine animals, including whales and sea turtles, are known to be negatively impacted by exposure to oil and other petroleum products. Atlantic sturgeon could also be negatively impacted by a fuel spill. Without an estimate of the amount of fuel released it is difficult to predict the likely effects on listed species. As the effects of a spill are likely to be localized and temporary, sea turtles and whales are not likely to be exposed to fuel and any effects would be discountable. Additionally, should a response be required by the US EPA or the USCG, there would be an opportunity for NMFS to conduct a consultation with the lead Federal agency on the spill response.

Decommissioning
Removal activities are expected to have impacts similar to those discussed above in relation to construction activities, including temporary seafloor disturbance and turbidity. However, all impacts would be of less magnitude than those resulting from construction activities. As such, effects of decommissioning activities will be insignificant or discountable.

CONCLUSIONS OF ESA CONSULTATION

NMFS has reviewed the action being proposed by Fishermen's Energy that you are proposing to authorize and agrees that activities to be carried out as described herein are not likely to

adversely affect any species of listed whales, sea turtles or Atlantic sturgeon when implemented according to the special project conditions you have developed and will require. This concludes consultation pursuant to Section 7 of the ESA for this proposed action by BOEMRE. Re-initiation of consultation is required and shall be requested by BOEMRE or by NFMS where discretionary federal involvement or control over the action has been retained or is authorized by law and (a) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation, (b) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the consultation, or, (c) if a new species is listed or critical habitat designated that may be affected by the identified action. No take of any listed whale, sea turtle or Atlantic sturgeon is anticipated or exempted. take is defined in the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." If there is any incidental take of a listed species, reinitiation would be required.

ONGOING COORDINATION UNDER THE MARINE MAMMAL PROTECTION ACT (MMPA)

It is our understanding that Fishermen's Energy is working with NMFS' Office of Protected Resources to obtain authorization in the form of an Incidental Harassment Authorization for the take by Level B harassment of a small number of bottlenose dolphins, harbor porpoise and harbor seals. Notice of this application was published in the Federal Register on April 12, 2012 (77 FR 14736). Nothing in this consultation letter changes or alleviates any obligations of you or the applicant under the MMPA. Should you have any questions regarding the ongoing MMPA coordination, please contact Michelle Magliocca at (301) 427-8401.

We look forward to continuing to work cooperatively with you and your agency on the development of alternative energy in State waters. Should you have any questions regarding this consultation, please contact Julie Crocker of my staff at (978) 282-8480 or by e-mail (Julie.Crocker@noaa.gov).

Sincerely,

for Daniel A. Morris
Acting Regional Administrator

CC: Slavitter, ACOE
Boelke, Greene - F/NER4
Magliocca, F/PR

File Code: Sec 7 ACOE NAP Fishermen's Energy 6 towers NJ
PCTS: FNER 2012/01588

APPENDIX I.

Special Permit Conditions (as required by ACOE)

Part 1.

The following mitigation, monitoring and reporting requirements shall be implemented by the permittee during the conduct of the installation of the wind turbine's jacketed foundation. Additional detail on how these measures will be implemented is described in the MMS Gulf of Mexico NTL No. 2007-G02 (see http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g02.pdf), or superseding NTL. Although this NTL focuses on seismic surveying with air guns in the GOM, the methodologies described in the NTL for exclusion-zone monitoring, ramp up and shut down as the same as those that will be required under this proposed action.

1. Establishment of Exclusion Zone: A 1250 meter (4100 feet) radius exclusion zone for listed marine mammals and sea turtles will be established around the turbine being installed in order to reduce the potential for serious injury or mortality of these species.

2. Visual Monitoring of Exclusion Zone: The exclusion zone around the turbine support vessel must be monitored for the presence of listed marine mammals or sea turtles before, during and after any pile driving activity. The exclusion zone will be monitored for 60 minutes prior to the ramp up (if applicable) of the hydraulic hammer. If the exclusion zone is obscured by fog or poor lighting conditions, work will not be initiated until the entire exclusion zone is visible for the 60 minute period. If listed marine mammals or sea turtles are observed within the zone during the 60 minute period and before the ramp up begins, pile driving will be delayed until they move out of the area and until at least an additional 30 minutes have passed without a listed marine mammal or sea turtle sighting. Monitoring of the zone will continue for 30 minutes following completion of the pile driving.

3. Monitoring of the zones will be conducted by one qualified NMFS-approved observer. Observer qualifications will include direct field experience on a marine mammal/sea turtle observation vessel and/or aerial surveys in the Atlantic Ocean. All observers will receive NMFS-approved marine mammal observer training and be approved in advance by NMFS after a review of their qualifications. Visual observations will be made using binoculars or other suitable equipment during daylight hours. Data on all observations will be recorded based on standard marine mammal observer collection data. This will include: dates and locations of construction operations; time of observation, location and weather; details of marine mammal sightings (e.g., species, numbers, behavior); and details of any observed taking (behavioral disturbances or injury/mortality). Any significant observations concerning impacts on listed marine mammals or sea turtles will be transmitted to NMFS and MMS within 48 hours. Any observed takes of listed marine mammals or sea turtles resulting in injury or mortality will be immediately reported to NMFS and US Army Corps of Engineers.

4. Implementation of Ramp-Up: A "ramp-up" (if allowable depending on specific sound source) will be required at the beginning of each seismic survey in order to allow marine

mammals and sea turtles to vacate the area prior to the commencement of activities. Pile driving may not commence (i.e., ramp up) at night time or when the exclusion zone cannot be effectively monitored (i.e., reduced visibility).

5. Shut Down: Continuous (day and night) pile driving operations will be allowed. However, if a listed marine mammal or sea turtle is spotted within or transiting towards the exclusion zone surrounding the turbine and the survey vessel, an immediate shutdown of the equipment will be required. Subsequent restart of the pile driver will only be allowed following clearance of the exclusion zone and the implementation of ramp up procedures (if applicable).

6. Compliance with Equipment Noise Standards: All pile driving equipment will comply as much as possible with applicable equipment noise standards of the U.S. Environmental Protection Agency, and all equipment will have noise control devices no less effective than those provided on the original equipment.

7. The following reports must be submitted during the conduct of pile driving:

   a. A report will be provided to COE and NMFS within 90 days of the commencement of pile driving activities that includes a summary of the work and monitoring activities and an estimate of the number of listed marine mammals and sea turtles that were observed during pile driving activities. The report will include information such as: dates and locations of operations; details of listed marine mammal or sea turtle sightings (dates, times, locations, activities, associated work); and estimates of the amount and nature of listed marine mammal or sea turtle takings.

   b. Any observed injury or mortality to a listed marine mammal or sea turtle must be reported to NMFS and COE within 24 hours of observation. Any significant observations concerning impacts on listed marine mammals or sea turtles will be transmitted to NMFS and COE within 48 hours.

Part 2:

The permittee shall implement the following specific measures meant to reduce the potential for vessel harassments or collisions with ESA-listed marine mammals or sea turtles during all phases of the project.

1. All vessels and aircraft associated with the construction, operation, maintenance, and/or decommissioning of the project will be required to abide by the: (1) NOAA Fisheries Northeast Regional Viewing Guidelines, as updated through the life of the project (http://www.nmfs.noaa.gov/pr/pdfs/education/viewing_northeast.pdf); and (2) MMS Gulf of Mexico Region's NTL No. 2007-G04 (http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g04.pdf), or any superseding NTL.

2. All vessel and aircraft operators must undergo training to ensure they are familiar with the guidance in #1 above. These training requirements must be written into any contractor agreements.

3. All personnel and contractors will be advised that there are civil and criminal penalties for harming, harassing, or killing marine mammals and sea turtles, which are protected under MMPA and ESA.

4. All vessels associated with the project will operate at idle speed at all times while in shallow waters where the draft of the vessel provides less than a four foot clearance from the bottom.

5. Any collision with *any* marine mammal must be reported. More information can be found at http://www.nmfs.noaa.gov/pr/shipstrike/msr/.

    a. Vessels transiting MSR areas are required to report their course, speed, position, destination, and route to the U.S. Coast Guard upon entry into the reporting area. Vessels should report via INMARSAT C to one of the following addresses: Email: RightWhale.MSR@noaa.gov or Telex: 236737831. Vessels not equipped with INMARSAT C should report via alternate satellite communications equipment to one of the following addresses: Email: RightWhale.MSR@noaa.gov or Telex: 236737831. Vessels unable to use satellite communications equipment should contact the U.S. Coast Guard Communication Area Master Station, Chesapeake, Virginia via SITOR/NBDP on 8426.3 kHz, 12590.8 kHz, 16817.8 kHz twenty four hours per day, or 6314.3 kHz from 2300 GMT until 1100 GMT and 22387.8 kHz from 1100 GMT until 2300 GMT.

    b. Vessels unable to use satellite communications or SITOR/NBDP should contact the U.S. Coast Guard Communication Area Master Station, Chesapeake, Virginia via published voice frequencies.

    c. Mariners can learn more about steps to avoid collisions with whales at: http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/marinersweatherlog_shipstrike.pdf

BIOLOGICAL ASSESSMENT FOR FISHERMEN'S ATLANTIC CITY WINDFARM

PREPARED BY U.S. DEPARTMENT OF ENERGY

1.0 BACKGROUND/HISTORY

The purpose of this Biological Assessment is to address the effect of the Fishermen's Atlantic City Windfarm project on Endangered Species Act (ESA) listed species, listed as endangered or threatened under the ESA, or their designated critical habitat. The "action" under consideration is the development of an offshore wind renewable energy facility (**proposed project**) within New Jersey state waters, located approximately 2.8 miles off the New Jersey coast from Atlantic City.

The action involves the construction, operation, maintenance, and eventual decommissioning of up to six wind turbine generators that would generate a maximum of approximately 25 megawatts (MW) of electricity, a 33-kilovolt (kV) alternating current (AC) submarine cable interconnecting the turbines, a 33-kV AC submarine transmission cable (export cable), and a 33-kV AC underground cable (onshore interconnection cable) that would connect the proposed project with existing onshore infrastructure in Atlantic City, New Jersey.

The U.S. Department of Energy (DOE), the lead federal agency, is proposing to fund Fishermen's Atlantic City Windfarm, LLC (FACW) (**project proponent**) to support the development of the proposed project. The U.S. Army Corps of Engineers, Philadelphia District (USACE) has regulatory and permitting authority for this proposed project under Section 404 of the *Clean Water Act* and Section 10 of the *Rivers and Harbors Act of 1899*. The USACE issued Department of the Army Permit CENAP-OP-R-2008-0777-39 for this proposed project on June 14, 2013. The USACE is proposing to process a modification to that permit.

The USACE previously completed consultation pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), with your office for permitting of the proposed project and determined that the proposed project is not likely to adversely affect any species listed as threatened or endangered under your jurisdiction. This determination was based on a Biological Assessment (USACE Biological Assessment) submitted during the consultation process on April 11, 2012. On May 22, 2012 your office concurred with this determination.

In addition, on August 2, 2011, the project proponent supplied a document entitled "Revised Marine Mammal and Sea Turtle Risk Assessment" dated July 21, 2011 which summarized the findings of the 1 year site specific study performed by the project proponent, and the 2 year study performed by the New Jersey Department of Environmental Protection concerning the use of the project site by marine mammals and sea turtles.

Since the conclusion of the USACE led Section 7 consultation, the following changes have occurred:

- A permit modification package has been submitted to the USACE. The USACE plans to issue a Public Notice to solicit comments and recommendations from the public concerning modification of the Department of the Army permit. The USACE will include your office on the distribution list to be notified when the Public Notice is published.
- The New York Bight, Chesapeake Bay, Carolina and South Atlantic Distinct Population Segments (DPSs) of Atlantic sturgeon were listed as endangered, and the Gulf of Maine DPS was listed as threatened under the ESA on April 6, 2012.

- DOE is completing an Environmental Assessment (EA) for the proposed project under the National Environmental Policy Act (NEPA) and the USACE is a cooperating agency. DOE will include your office on the distribution list to be notified when the draft EA is posted for the public comment period.

This Biological Assessment, prepared by DOE, only addresses the modifications to the proposed project that have occurred since the completion of the initial USACE led Section 7 consultation and it addresses the potential effects of the proposed project modifications on the listed species.

The purpose of the proposed project is to provide support for regionally-diverse advanced technology offshore wind demonstration projects through collaborative partnerships in support of DOE's and the Department of the Interior's National Offshore Wind Strategy. In March 2012, DOE issued Funding Opportunity Announcement Number: DE-FOA-0000410 *US Offshore Wind: Advanced Technology Demonstration Projects* (the FOA) to provide this support. The purpose of the Advanced Technology Demonstration Projects is to verify innovative designs and technology developments and validate full performance and cost under real operating and market conditions. The proposed project would fulfill DOE's goals of installing innovative offshore wind systems in U.S. waters in the most rapid and responsible manner possible and expedite the development and deployment of innovative offshore wind energy systems with a credible potential for lowering the levelized cost of energy.

Offshore wind energy can help the nation reduce its greenhouse gas emissions, diversify its energy supply, provide cost-competitive electricity to key coastal regions, and stimulate economic revitalization of key sectors of the economy. However, if the nation is to realize these benefits, key challenges to the development and deployment of offshore wind technology must be overcome, including the relatively high current cost of energy, technical challenges surrounding installation and grid interconnection, and the untested permitting or approval processes. Accordingly, there is a need to reduce the cost of energy through technology development to ensure competitiveness with other electrical generation sources; and to reduce deployment timelines and uncertainties limiting US offshore wind project development.

2.0 DESCRIPTION OF THE ACTION AND ACTION AREA

Changes to the Project Description (PD) that were previously submitted during the USACE Section 7 consultation are highlighted in yellow and the change is explained in the accompanying footnote.

The Action Area has not changed from the description provided in the USACE Biological Assessment. A copy of this document is attached for your use.

The Proposed Project consists of the construction, operation, maintenance, and eventual decommissioning[1] of a nominal 25 MW[2] offshore wind renewable energy facility, consisting of up to six turbines[3], a 33-kiloVolt (kV)[4] alternating current (AC) submarine cable interconnecting the turbines (inter-array cable), a 33-kV[4] AC submarine transmission cable (export cable), and a 33-kV[4] AC underground cable (onshore interconnection cable) that would connect the Proposed Project with existing onshore infrastructure located in Atlantic City, New Jersey.

The offshore components of the Proposed Project, including the turbines and the inter-array cable, would be located in state waters approximately 2.8 nautical miles from Atlantic City, New Jersey. The export

[1] Previous PD did not include eventual decommissioning of the Proposed Project
[2] Previous PD stated "20 MW (net)"
[3] Previous PD stated "six offshore wind turbines"
[4] Previous PD stated "34.5 kv"

cable would traverse state waters to shore. The onshore components, including the onshore interconnection cable, fiber optic cable, and interconnection facilities would be located in Atlantic City, New Jersey. Construction would be supported by a construction staging area(s) and a construction port. Onshore support facilities would be located at existing waterfront industrial or commercial sites in the cities of Camden and Atlantic City, New Jersey.

All remaining aspects of the project, including staging sites, vessel traffic, color and labeling of the turbines, seasonal restriction and maintenance schedules remain the same and are not impacted by the proposed project changes.

Annual net electricity production for this Project is anticipated to be approximately 80,000 MW-hours[5] (MWh). The total ocean area considered as the project area is approximately 170 acres (calculated as the perimeter around the group of six turbines, approximately 200 feet in each direction) plus a 5 foot width along the length of the export cable route from the turbines to the shore); however the actual portion of the area that would be physically disturbed by the placement of the turbines and cables is approximately 2 acres. The cable and turbines would be located in water depths of 26 to 40 feet below mean lower low water (MLLW).

Wind Turbine and Foundation Design

The offshore turbine assemblies would each be composed of three primary elements, a foundation, tower, and three blade turbine. The nacelle houses the major mechanical components of each turbine. Each tower would be approximately 16.5 feet in diameter at the base and taper to a diameter of 12.5 feet at the top. Each turbine would have a name plate capacity of no more than 5 MW[6] and a blade rotor diameter of no more than 427 feet[7]. Each of the three (3) blades would be two hundred thirteen (213) feet long[8]. The blade at its lowest point would be located 80 feet above mean high water and 506.4 feet above mean high water at its highest point[9].

The turbine array would be oriented in one row parallel to the coastline running northeast to southwest. Spacing between the turbines would be approximately 3,543 feet. Each of the wind turbines would be supported by an Inward Battered Guide Structure (IBGS) jacket-type foundation[10] driven into the seabed (**Figure 1**). The IBGS jacket-type foundation consists of four legs, with each leg being a hollow steel pipe with an approximate outer diameter of 84 inches. The triangular structure has 90-inch diameter pile sleeves for each leg and bracing elements of the foundation will measure approximately 22 feet in length and 72 inches in diameter. At the mudline, each side of the foundation will measure approximately 53 feet from the center point of each leg. The IBGS extends upward from below the seabed, through the water column to exposure at the surface, then tapers to approximately 50 feet above mean lower low water. The structural braces for the towers would be seventy two (72) inches in diameter and would be located laterally along the entire foundation[11].

[5] Previous PD stated "75,000 MWh"

[6] Previous PD stated "3.6 MW"
[7] Previous PD stated "394 feet"
[8] Previous PD stated "approximately 192 foot long"
[9] Previous PD stated "blade at its lowest point would be located approximately 100 feet above the surface of the water and approximately 500 feet above the surface of the water at its highest point at mean high water"
[10] Previous PD referenced "monopole foundation"
[11] Previous PD did not reference these specifications since the tower was originally intended to be a monopole foundation

Engineering analyses have determined that the base of each foundation will no longer require a scour protection mat or rock scour protection around each foundation pile[12].

Installation of Turbines and Foundations

Fishermen's Atlantic City Windfarm, LLC (FACW) the project proponent, has thoroughly investigated vessel and port availability, and is currently in negotiations with multiple third parties to provide equipment and expertise in the installation of the turbine foundations and turbines. FACW has identified suitable existing US Jones Act-compliant vessels capable of installing the turbines in the 40 foot water depths at the project site. Specialty contractors would be required for delivery and installation of foundations, turbines and the subsea electrical cabling. Installing the array of turbines will require the ability to lift, place, and connect foundations, pilings nacelles, blades and heavy electrical equipment. These components can weigh well in excess of 200 tons each, and can only be lifted with specialized jack up barges or vessel-mounted cranes offering a stable, safe work platform.

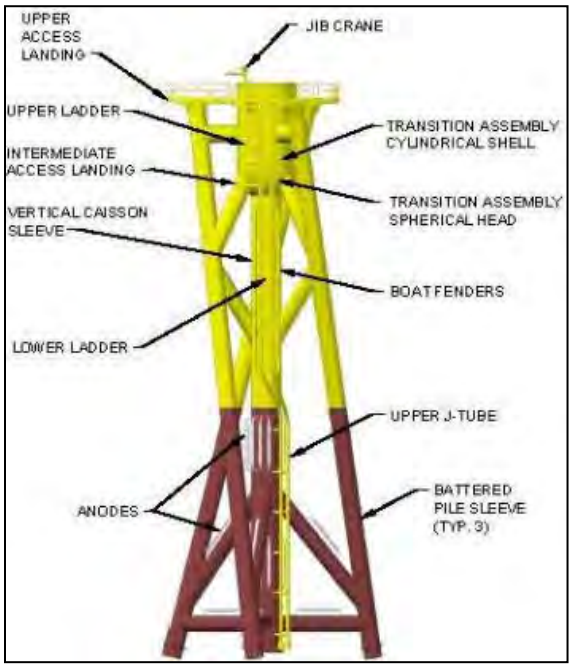


Figure 1. Foundation Design for the Proposed Project.

FACW currently has a Memorandum of Understanding with the South Jersey Port Corporation for materials staging and preparation. The turbines and associated major components are envisioned to be delivered to the Beckett Street Marine Terminal in Camden, New Jersey. Up to 6 months before the scheduled installation, the turbines would be transported from the manufacturer to the Beckett Street Marine Terminal via barge, rail, and/or truck depending upon their origin. Existing waterfront bulkheads, cranes and laydown areas at Beckett Street would be used to support the staging for this project. At the facility, final turbine assembly including generator mounting and electrical hookups would be performed to minimize work performed offshore. At that point, the turbine manufacturer would lead the final assembly and configuration for the wind turbine generator components to be delivered by vessel to the offshore array field.

[12] Previous PD stated "scour mats and/or rock protection will be installed to prevent ocean currents from eroding the seabed around the foundation base".

The steel turbine towers would be manufactured domestically and transported to the staging area at Beckett Street Marine Terminal via barge, rail, and/or truck. Each tower is approximately 250 feet in length (comprised of bolted segments) and is secured to the foundation by bolting to a transition piece (or flange) at the top of the foundation.

The foundations would be fabricated at a Gulf of Mexico facility and then transported by barge to the staging area at Beckett Street Marine Terminal. Once assembly is completed, the foundations would be loaded onto ABS class ocean deck barges that would carry three jackets per barge. It is anticipated that the two barges would be transported by two tugs directly to the project site. A floating crane barge or specialized jack-up barge or barge equipped with a high capacity crane pile handling frame and pile driving equipment would perform structure installations (**Figure 2**). The installation vessel would position itself near to each of the turbine installations. The vessel would then jack itself up out of the water to provide a stable platform in which to carry out the installation activities. Offshore experience has shown that it normally takes approximately 24 hours in fair weather conditions to position and anchor the installation vessel. Once the installation vessel is in the turbine array field, it would be moved as minimally as possible, but would, out of necessity, move from one turbine location to the next.



Figure 2. Typical heavy jackup vessel used for offshore wind turbine installations

To secure the foundation in place, steel pipe pilings 7 feet in diameter would be inserted down through the piling sleeves, and then driven to a depth of approximately 140 feet below the seabed using impact hammer methods. The jacket foundations would require the installation of four (4) eighty four (84) inch piles that would be driven inside, down and through the length of each of the ninety (90) inch diameter sleeves of the foundation for each turbine[13]. The anchoring piles would be driven to a depth of approximately 150 feet below the mudline. The maximum sound generation for each pile would be approximately 199 dB (re 1 uPa) at the source.

[13] Previous PD stated "pile driving of eighteen (18) forty eight (48) inch diameter pipes placed in the openings on the three ends of the foundation structure"

Each foundation would also be fitted with a ladder extending from the water surface up to a working deck to allow personnel access from vessels. Electrical power generated by the turbine would be cabled down through the structure to emerge from a J-Tube below the seabed.

The Proposed Project would be constructed using the following approach which has been successfully employed in Europe:

- All foundations are installed first;
- The submarine cable is installed next and energized to provide electricity from the grid to assist in turbine installation;
- Turbine towers are installed on the foundations;
- The turbines are installed on each tower; and
- Lastly the turbines are commissioned and made operational.

The complete wind turbine structure requires a series of main lifts for full assembly. The foundation center caisson (i.e., a watertight retaining structure) would be driven to the required depth using impact methods. The guide structure would then be lifted onto the caisson and secured. Each of the three pilings would then be lifted into the sleeves on the guide structure and hammered to the required depth below the seabed. The turbine tower would then be lifted and secured onto the foundation. Lastly the turbine components including the nacelle and turbine blades would be lifted to the tower top and installed.
Turbine system installations are anticipated to require four to seven fair weather days to complete. In order to minimize the complexity and duration of offshore operations, components of the turbines would be pre-assembled to the extent possible prior to transportation offshore.

Cable Route and Installation

Cables would be manufactured in Seymour, Connecticut and transported by rail to a staging pier in Port Elizabeth, New Jersey. The cable reels would be placed on a special cable laying barge and transported to the project site for installation.

Power output from the turbines would be transmitted via a 33 kV AC submarine cable (export cable) to access the shore. The inter-array transmission cable from each turbine structure would be linked to the export cable that would make landfall at a point in Atlantic City, at the base (southeast terminus) of Tennessee Avenue in Atlantic City. The cable would then continue northwest for 1.2 miles underground to the existing Huron Substation, located along Absecon Avenue. The path of this underground cable is roughly coincident with the line created by Tennessee Avenue. The submarine transmission cable route was selected after evaluations of alternative routes and landfall locations which included bringing the cable to shore through the Absecon Inlet. The route ultimately selected proved to present the least environmental impacts identified during the permitting process and was most acceptable to the USCG.

Offshore, the submarine export and inter-array cables would be arranged in a single string array. An additional fiber-optic cable bundle would also be included within the export cable for telecommunication purposes. At each turbine location, the power and telecommunication cables would extend down from the turbine within the tower structure, and then emerge through a J-tube just above the seabed where it would be connected to the adjacent turbine.

Jet plowing technology would be used to bury the export and inter-array cables to a target depth of 6 feet[14] below the seabed. The export cable would originate at Turbine #3. During this process the installation vessel slowly travels along the planned cable route while towing a weighted sled fitted with a

[14] Previous PD stated “9 feet”

trenching device (plow) and a nozzle which jets water into the bottom to create a narrow trench. The cable is simultaneously fed out from the vessel and laid into the trench. Blades at the back of the sled scrape bottom material over the trench to backfill. The cable would be buried in this manner to approximately 1,800 feet from the shoreline. The depth of the cable below the project along the Atlantic City Beach will be 20 feet. The cable that would run from the turbines to the shore would be five (5) inches in diameter[15].

Beginning at a distance approximately 1,800 feet from the shoreline, the cable would be routed through a lined conduit installed using Horizontal Directional Drilling (HDD) methods.[16] The installation of this HDD conduit would be performed from the landside. At the base of Tennessee Avenue (approximately 500 feet inland of the high water line), a concrete vault approximately 8 feet by 8 feet by 7 feet would be installed below roadway grade using typical upland excavation equipment. HDD equipment would then drill a 6-inch diameter cable-way 25 feet below the street level, underneath the boardwalk and beach, and emerge at the jet plow end point 1,800 feet from shore. While drilling, the cable-way would be lined with polyvinyl chloride (PVC) conduit to prevent collapse and to protect the cable after it has been installed. Soil material removed from the bored hole (approximately 13 cubic yards) would be removed from the site. All construction-related soil and debris would be appropriately disposed of depending upon the characteristics of the material, in accordance with relevant New Jersey Department of Environmental Protection (NJDEP) regulations. Once HDD is completed, the cable would be pulled from the offshore vessel through the conduit to emerge at the shore end vault, where the offshore cable would be connected.

A similar cable to that used offshore, but designed specifically for land applications would be used for the remaining 1.2 mile run below the Tennessee Avenue street level to the Huron substation. Again HDD methods would be used to route the cable 25 feet below street level. This burial depth was selected after a review of existing below grade infrastructure along this route. At 25 feet, the cable would be below all existing infrastructure. Soil material removed from the bored hole (approximately 46 cubic yards) would be removed from the site and properly disposed as described above. At the Huron substation facility, a breaker system, and other minor electrical components specific to the Proposed Project would need to be installed for connection of the export cable and to the power grid.

Operations and Maintenance

Upon completion of the construction activities, FAWC would conduct several weeks of commissioning activities that would entail the testing of the turbines as well as the offshore and onshore transmission systems. The project would begin operations approximately in October 2017 and continue until the end of the 25-year expected operational life of the facility.

Operation of the turbines would require continuous remote (shore-based) monitoring and control, scheduled onsite maintenance, and unscheduled responses to faults or damage. Additionally, the management of the maintenance program and reporting requirements would be addressed by the operations team. This work includes, but is not limited to:

- Remote monitoring and supervision of the wind turbines and associated equipment 24 hours a day, 7 days a week using the wind power supervisory control and data acquisition system;
- Initiation of any required corrective action;

[15] Previous PD stated “8 inches in diameter”

- Operation of the Turbine Condition Monitoring (TCM) system;
- Performing diagnostic assessment of data from the TCM;
- Managing the inventory of spare parts, including performing any maintenance of these spare parts;
- Scheduling and logistics planning of maintenance activities; and
- Performing daily communication with the facility operator.

Each turbine would undergo scheduled maintenance and inspection as well as a full annual maintenance program as prescribed by the turbine manufacturer. This work would be performed by personnel qualified by the manufacturer. Additionally, inspections of the underwater structures and seabed would be performed at a minimum of once per year.

As access to the turbines can only be achieved by vessel, sea conditions would dictate when service may be performed. Heavy annual work would be scheduled to occur during summer months when conditions for accessing the turbines are typically suitable (waves less than 3 feet). During winter months, accessibility may be limited for extended periods of time.

Service crews would board a dedicated service vessel based in Atlantic City, New Jersey. Personnel would gain access to the turbines via the ladder system incorporated into each foundation. Tools and light parts would be lifted onto the structure using a small crane system provided on the structure working deck. Annual maintenance for each turbine is expected to require 5 to 8 days of onsite work. Turbines would be returned to normal operation at the end of each service day.

No oils or other waste would be discharged during service events. Appropriate measures would be implemented to provide for containment and collection of hazardous material spills should they occur. It is not expected that any painting would be necessary during the life of the turbines, other than to repair damage. The original coating system on the towers is designed to last the lifetime of the structure.

The following section was not part of the original project description.

Decommissioning

While the project is presently planned for a 25 year operational period, the potential for equipment upgrades and continued operation would be evaluated throughout the project life. When it is determined that the project is to be decommissioned, all physical elements of the project would be removed and the site would be restored to its original condition. A financial instrument to fund decommissioning activities would be set in place at the start of the project to ensure that sufficient funds are available for removal of the turbines and support infrastructure.

A comprehensive Decommissioning Plan which addresses the engineering, environmental, regulatory, and economic elements of the decommissioning task. The plan addresses state requirements presently in place as well as those established by the Bureau of Ocean Energy Management (BOEM) guidelines described in 30 CFR Parts 250.1700 – 1754. An overview of the Decommissioning Plan is provided below.

Decommissioning of the project would involve the removal of equipment both offshore and onshore and would be performed utilizing similar equipment to that used during the construction process. This equipment may include barges, lift boats, tugs and crew vessels. Deep draft vessels would port at the Beckett Street Terminal in Camden, New Jersey, while smaller crew vessels would operate from Atlantic

City. Onshore, trucks, trailers, and cable handing equipment would be used to recover the cable and substation equipment. Removed materials would be refurbished, recycled, or disposed of, as appropriate.

Offshore Equipment Removal

Removal of the offshore equipment would consist of the following tasks:

- Removal of the wind turbines;
- Removal of towers and foundations;
- Removal of inter-array and export cables; and
- Site clearance survey.

The removal processes would be performed with full consideration of environmental and safety compliance. Federal and state permits would be in place as required prior to initiating decommissioning. During decommissioning, safety exclusion zones would be established and marked with buoys and navigational aids to protect the workforce and vessel traffic. FACW would ensure that any subsea obstacles would be adequately marked until they are made safe or removed.

Removal of the turbine equipment would essentially be the reverse of the installation. Using a barge supported heavy lift crane, each rotor and nacelle would be lowered to a transport barge and secured for transit to port. Power cables would be removed from the tower and at the sea bed. The steel turbine tower would be removed as one unit above the transition joint at water level.
Each tower foundation is comprised of three driven pilings, a center caisson and a guide structure. The guide structure would first be removed and loaded onto a barge for recycling. Each of the pilings and the caisson would be cut 15 feet below the seabed and removed. The remaining piling structures (below -15 feet) would be left in place.

Because full removal off all buried cable would cause disturbance to the established sea bed, power cables at each turbine location would be excavated to the 6 foot burial depth, cut and removed. All cabling at or below the 6-foot depth would be left in place undisturbed.

Upon completion of structural decommissioning, a site clearance survey would be performed to ensure that no debris remains within the project area, and to document the physical condition of the seabed. Similar to the geophysical survey performed pre-construction, the clearance survey would employ side scan sonar for imaging the seabed, a magnetometer to detect ferrous materials, and depth mapping systems. Any objects detected would be investigated and removed as appropriate. Demonstration of clearance would be provided to the appropriate agencies.

Onshore Equipment Removal

Removal of the onshore equipment would consist of the following tasks:

- Removal of sea-to-shore transition cable;
- Abandonment of sea-to-shore directionally drilled conduit;
- Abandonment of the onshore cable vault;
- Removal of land cable; and
- Removal of substation equipment.

After removal of the offshore equipment, the remaining power transmission cable would be pulled back through its HDD conduit to the vault at the base of Tennessee Avenue from where it would be removed for recycling. The 6-inch conduit would be left in place, 25 feet below the boardwalk and beach, and extending offshore to the former transition point.

All equipment would be removed and the vault would be abandoned in accordance with Atlantic City, New Jersey regulations or, at the discretion of the city, the vault would be removed and the excavated site backfilled.

The land based cable extending from the vault to the Huron substation would be removed from its conduit by pulling from the substation end. The cable would be trucked from the location and recycled. The 6-inch buried conduit (approximately 25 feet below grade) would be capped and left in place for future use by the city or other projects.

Switchboxes and other electrical equipment at the substation will be removed in accordance with requirements set by Atlantic County Electric. Any other ancillary equipment would either be removed or left in place as preferred by Atlantic County Electric.

3.0 LISTED SPECIES AND CRITICAL HABITAT IN THE ACTION AREA

In a letter dated 20 October 2010, the National Marine Fisheries Service (NMFS) indicated that the following Federally listed species could be potentially impacted by the project: Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaengliae*), fin whale (*Balaenoptera physalus*), sei whale (*Balaenoptera borealis*), blue whale (*Balaenopera musculus*), sperm whale (*Physter microcephalus*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretts caretta*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*) and hawksbill sea turtles (*Eretmochelys imbricate*). Since this date the Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) was listed as a threatened species on February 6, 2012. While not specifically identified by the NMFS, the Shortnose Sturgeon (*Acipenser brevirostrum*) is found within the action area. Both the Atlantic Sturgeon and Shortnose Sturgeon were considered by the USACE Biological Assessment.

Information on the species' life history and its habitat and distribution are included in the "Revised Marine Mammal and Sea Turtle Risk Assessment" dated July 21, 2011 which was previously submitted to NMFS and in the NMFS Section 7 concurrence letter dated May 22, 2012.

4.0 EFFECTS OF THE ACTION

This effects analysis only pertains to the proposed action modifications that have occurred since the completion of the initial USACE led Section 7 consultation and their effect on the listed species. There will be no increase in vessel size or in the number of vessels to be used in association with the change in foundation type. The impacts from vessels associated with the project remain the same as the impacts described in the USACE Biological Assessment.

The change in foundation type will result in an increase in number and diameter of the piles from eighteen (18) forty eight (48) inch diameter piles to twenty-four (24) eighty four inch piles per turbine foundation.

Sound pressure levels generated during marine pile driving are affected by a number of variables including hammer force, piling diameter, piling wall thickness, bottom composition, water depth and temperature. Documented observations indicate that the source SPLs generally fall into three categories described by the range of piling diameters.

Piling Diameter Range (inches)	Source SPL (dB re 1 uPa)
12 to 40	170 - 195
41 to 96	195 - 204
Above 96	204 - 207

In order to estimate the distance from the pile driving at which the SPLs fall below the 160dB threshold, FISHERMEN's estimates that while driving an 84-inch diameter piling, SPLs at a 10-meter distance from the source will be in the range of 199 dB re 1 µPa for frequencies ranging between 10 Hz and 2 kHz. Given these baseline values, the SPL at various distances from the source was calculated using the Practical Spreading Loss model which provides an accepted method for determining sound transmission loss over distance from the source.

Anticipated SPLs at various distances from pile driving in each turbine location are given in the following table:

Distance from Source (m)	SPL (dB re 1 uPa)
10	199
100	183
250	173
500	169
1000	164

Therefore, the impacts associated with the number and size of the pilings would be expected to remain the same as the impacts described in the USACE Biological Assessment. It is estimated that sound levels would drop to below the point considered harmful to whales or sea turtles (greater than 160 dB) at a point roughly 1000 meters from the pile driving source.

Due to the change in foundation type, scour mats and/or rock protection installation are no longer required. The impacts associated with installation of scour mats and/or rock protection will no longer be realized. No direct impacts to a listed marine mammal or sea turtle nor to the feeding habitat would be expected as a result of this project modification.

The target burial depth for the export and inter-array cables has been changed from 9 feet to 6 feet and the diameter of the cable has been changed from eight inches to five inches in diameter. The impacts associated with the change in target burial depth and cable diameter would be expected to remain the same as the impacts described in the USACE Biological Assessment.

The turbine size has changed from 3.6 MW to no more than 5 MW and there was an increase in blade length and rotor diameter. The impacts associated with turbine operation would remain the same as the impacts described in the USACE Biological Assessment.

Upon completion of the wind farm's useful life, the turbine towers and cables would be removed. The decommissioning would begin with the disconnection of the submarine cables from the turbine switchgear. Each turbine would then be broken down and taken apart using equipment similar to that used in construction and in a similar sequence. It is anticipated that the foundations may need to be cut off as low as 15 feet below the mud line. The cut off to 15 feet below the mudline is the current federal regulation (30 CFR Part 285) for decommissioning renewable energy projects in federal waters.

Per federal regulations (30 CFR Parts 250, 1750-1754), associated cables of the project that are at or above the three-foot depth or constitute a hazard would to the extent possible be removed using barges and/or jet plow equipment, similar to the equipment used to install the cables. Only marine mammals and sea turtles in the immediate vicinity of the site (i.e., those that had not moved away from the area upon arrival of decommissioning vessels) would be expected to be affected during tower removal and transport and pile cutting.

It is expected that the impacts to the marine mammals and sea turtles in the vicinity of the project related to decommissioning would be minimal. Temporary avoidance behavior would be expected during deconstruction activity. These behavior changes would be short-term and would likely be similar to the avoidance behaviors observed during heavy pleasure boat use, ferry traffic, or heavy fishing activity in the areas used by these species. Accidental discharge of waste materials or fuels is expected to be negligible during decommissioning activities. Similar to construction-related impacts, underwater noise associated with decommissioning activities would be limited, and would be minor and short term.

6.0 CONCLUSIONS

Conservation measures in the form of Special Conditions as described in the USACE Biological Assessment have been added to the Department of the Army permit to ensure the project is not likely to adversely affect listed species of concern in the action area. In addition, DOE will add these measures to the FACW financial assistance contract terms and conditions upon completion of Section 7 consultation.

Based on the information received from the project proponent and from the USACE led Section 7 consultation, the DOE, as the lead federal agency has determined that the effects on the listed species are as follows with the inclusion of the previously identified Department of the Army permit conditions (see Appendix C):

Atlantic right whale (*Eubalaena glacialis*) – may affect, but not likely to adversely affect

Humpback whale *(Megaptera novaengliae)* - may affect, but not likely to adversely affect

Fin whale *(Balaenoptera physalus)* – may affect, but not likely to adversely affect

Sei whale (*Balaenoptera borealis*) - may affect, but not likely to adversely affect

Blue whale *(Balaenopera musculus)* – may affect, but not likely to adversely affect

Sperm whale *(Physter microcephalus)* – may affect, but not likely to adversely affect

Kemp's ridley sea turtle *(Lepidochelys kempii)* – may affect, but not likely to adversely affect

Loggerhead sea turtle *(Caretts caretta)* – may affect, but not likely to adversely affect

Green sea turtle *(Chelonia mydas)* – may affect, but not likely to adversely affect

Leatherback sea turtle *(Dermochelys coriacea)* – may affect, but not likely to adversely affect

Hawksbill sea turtles *(Eretmochelys imbricate)* – may affect, but not likely to adversely affect

Atlantic Sturgeon *(Acipenser oxyrinchus oxyrinchus)* - may affect, but not likely to adversely affect

Shortnose Sturgeon *(Acipenser brevirostrum)* - may affect, but not likely to adversely affect

Permit Special Conditions

Special Conditions 15 through 27 of the USACE Individual Permit outline requirements for the protection of marine mammals and sea turtles. These conditions are as follows:

15. Mitigation, monitoring and reporting requirements shall be implemented by the permittee during the conduct of the installation of the wind turbine jacketed foundation. Additional detail on how these measures will be implemented is described in the MMS Gulf of Mexico (GOM) NTL No. 2007-G02 (see http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g02.pdf), or superseding NTL. Although this NTL focuses on seismic surveying with air guns in the GOM, the methodologies described in the NTL for exclusion-zone monitoring, ramp up and shut down as the same as those that will be required under this proposed action. All reports generated shall be submitted to this office once completed.

16. A 1250 meter (4100 feet) radius exclusion zone for listed marine mammals and sea turtles will be established around the pile of the jacketed foundation being installed in order to reduce the potential for serious injury or mortality of these species. The exclusion zone around the turbine support vessels must be monitored for the presence of listed marine mammals or sea turtles before, during and after any pile driving activity. The exclusion zone will be monitored for 60 minutes prior to the ramp up of the hydraulic hammer. If the exclusion zone is obscured by fog or poor lighting conditions, work will not be initiated until the entire exclusion zone is visible for the 60 minute period. If listed marine mammals or sea turtles are observed within the zone during the 60 minute period and before the ramp up begins, pile driving will be delayed until they move out of the area and until at least an additional 60 minutes have passed without a listed marine mammal or sea turtle sighting. Monitoring of the zone will continue for 60 minutes following completion of the pile driving.

17. To allow any unobserved marine mammals and sea turtles to leave the project area, a "soft start", which involves having the hammer commencing work at half power, shall be employed, for a minimum of 15 minutes. After this time period, the hammer can be used at full power unless a marine mammal or sea turtle is seen within the exclusion zone.

18. If a listed marine mammal or sea turtle is spotted within or transiting towards the exclusion zone surrounding the turbines and the work vessels, an immediate shutdown of the equipment will be required. Subsequent restart of the hydraulic hammer will be allowed following clearance of the exclusion zone and the implementation of the start-up procedures as noted above.

19. All pile driving equipment will comply with applicable equipment noise standards of the US Environmental Protection Agency, and all equipment will have noise control devices no less effective than those provided on the original equipment.

20. Monitoring of the exclusion zones will be conducted by qualified NMFS-approved observer(s). Observer qualifications will include direct field experience on a marine mammal/sea turtle observation vessel and/or aerial surveys in the Atlantic Ocean. All observers will receive NMFS-approved marine mammal observer training and be approved in advance by NMFS after a review of their qualifications. Visual observations will be made using binoculars or other suitable equipment during daylight hours. Data on all observations will be recorded based on standard marine mammal observer collection data. This will include: dates and locations of construction operations; time of observation, location and weather; details of marine mammal sightings (e.g., species, numbers, behavior); and details of any observed taking (behavioral disturbances or injury/mortality). Any significant observations concerning impacts on listed marine mammals or sea turtles will be transmitted to NMFS and the Corps within 48

hours. Any observed takes of listed marine mammals or sea turtles resulting in injury or mortality will be immediately reported to NMFS and US Army Corps of Engineers.

21. The following reports must be submitted during pile driving activities:

a. A report will be provided to the NMFS and the Corps within 90 days of the commencement of pile driving activities that includes a summary of the work and monitoring activities and an estimate of the number of listed marine mammals and sea turtles that were observed during pile driving activities. The report will include information, suc as : dates and locations of operations, details of listed marine mammal or sea turtle sightings (dates, times, locations, activities, associated work), and estimates of the amount and nature of listed marine mammal or sea turtle takings.

b. Any observed injury or mortality to a listed marine mammal or sea turtle must be reported to the NMFS and the Corps within 24 hours of observation. Any significant observations concerning impacts on listed marine mammals or sea turtles will be transmitted to NMFS and the Corps within 48 hours.

22. The permittee shall develop, within 180 days of the date of the estimated commence of work at the site, a draft protocol to be followed by all vessel captains and aircraft pilots to ensure that marine mammals and sea turtles will not be harassed during project implementation. The following references: (1) NOAA Fisheries Northeast Regional Viewing Guidelines, as updated through the life of the project http://www.nmfs.noaa.gov/pr/pdfs/education/viewing_northeast.pdf); and (2) MMS Gulf of Mexico Region's NTL No. 2007-G04 (http://www.gomr.mms.gov/homepg/regulate/regs/ntls/2007NTLs/07-g04.pdf), or any superseding NTL are supplied for your use in developing this document. The draft protocol will submitted to the Corps and the NMFS for review and approval prior to regulated work being initiated.

23. All vessel and aircraft operators shall undergo training to ensure they are familiar with the guidance above. These training requirements must be written into any contractor agreements. The permittee shall supply this office with written verification that all vessel captains and aircraft pilots have undergone the training.

24. All personnel and contractors will be advised that there are civil and criminal penalties for harming, harassing, or killing marine mammals and sea turtles, which are protected under the Endangered Species Act.

25. All vessels associated with the project will operate at idle speed at all times while in shallow waters where the draft of the vessel provides less than a four foot clearance form the bottom.

26. Any collision with any marine mammal or sea turtle must be reported to both this office and the National Marine Fisheries Service. More information can be found at http://www.nmfs.noaa.gov/pr/shipstrike/msr/.

a. Vessels transiting MSR areas are required to report their course, speed, position, destination, and route to the US Coast Guard upon entry into the reporting area. Vessels should report via INMARSAT C to one of the following addresses:
e-mail RightWhale.MSR@noaa.gov or Telex: 236737831. Vessels not equipped with INMARSAT C should report via alternate satellite communications equipment to one of the following addresses:
e-mail RightWhale.MSR@moaa.gov or Telex:236737831. Vessels unable to use satellite communications equipment should contact the US Coast Guard Communication Area Master Station, Chesapeake, Virginia via SITOR/NBDP on 8426.3 kHz, 16817.8 kHz twenty four hours per day, or 6314.3 kHz from 2300 GMT until 1100 GMT and 22387.8 kHz from 1100 GMT until 2300 GMT.

b. Vessels unable to use satellite communications or SITOR/NBDP shall contact the US Coast Guard Communication Area Master Station, Chesapeake, Virginia via published voice frequencies.

c. Mariners can learn more about steps to avoid collisions with whales at: http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/marinersweatherlog_shipstrike.pdf.

27. All monitoring protocols as outlined in the document entitled "Post-Construction Avian, Bat, and Marine Mammals Studies Fishermen's Energy State Waters Wind Power Project", dated March 23, 2012, shall be followed in full, including submittal of reports to both the Corps and the NMFS.

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 9, 2015

Karen Greene
United States Department of Commerce
National Oceanic and Atmospheric Administration
Fisheries Service, Habitat Conservation Division
NEFSC James J. Howard
Marine Sciences Laboratory
74 Magruder Road, Sandy Hook
Highlands, NJ 07732

SUBJECT: DOE and USACE Request for Re-Initiation of the Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Ms. Greene:

The U.S. Department of Energy (DOE) is proposing to provide funding to Fishermen's Atlantic City Windfarm, LLC (project proponent) to support the development of an offshore wind renewable energy facility (proposed project) within New Jersey state waters, located approximately 2.8 miles off the New Jersey coast from Atlantic City. The U.S. Army Corps of Engineers, Philadelphia District (USACE) has regulatory and permitting authority for this proposed project under Section 404 of the *Clean Water Act* and Section 10 of the *Rivers and Harbors Act of 1899*. The USACE issued Department of the Army Permit CENAP-OP-R-2008-0777-39 for this proposed project on June 14, 2013. Since issuance of the USACE permit, the project plans have been refined and a permit modification package has been submitted to the USACE. The USACE is proposing to process a modification to that permit.

The proposed project would consist of the construction, operation, maintenance, and eventual decommissioning of up to six wind turbine generators that would generate a maximum of approximately 25 megawatts (MW) of electricity, a 33-kilovolt (kV) alternating current (AC) submarine cable interconnecting the turbines, a 33-kV AC submarine transmission cable (export cable), and a 33-kV AC underground cable (onshore interconnection cable) that would connect the proposed project with existing onshore infrastructure in Atlantic City, New Jersey.

The project area has been designated as Essential Fish Habitat (EFH) for a wide variety of federally managed species. The USACE previously completed an EFH consultation with your office for permitting of the proposed project and determined that the installation of the proposed project would have limited adverse effects on EFH, and the species of concern. This

determination was based on a 2011 EFH assessment, completed by Normandeau Associates Inc. which was submitted to your office during the consultation process. On June 27, 2011 your office concurred with this determination. A copy of this concurrence is attached (Enclosure 1). Since this concurrence, the following changes have occurred:

- A permit modification package has been submitted to the USACE. The USACE plans to issue a Public Notice to solicit comments and recommendations from the public concerning modification of the Department of the Army permit. The USACE will include your office on the distribution list to be notified when the Public Notice is published.
- The New York Bight, Chesapeake Bay, Carolina and South Atlantic Distinct Population Segments (DPSs) of Atlantic sturgeon were listed as endangered, and the Gulf of Maine DPS was listed as threatened under the ESA on April 6, 2012.
- DOE is completing an Environmental Assessment (EA) for the proposed project under the National Environmental Policy Act (NEPA) and the USACE is a cooperating agency. DOE will include your office on the distribution list to be notified when the draft EA is posted for the public comment period.

To streamline the NEPA process and to avoid redundancy, DOE and USACE have decided to jointly re-initiate EFH consultation for the proposed project. A summary of proposed changes to the project description are attached (Enclosure 2). A revised EFH Assessment is attached (Enclosure 3) which addresses the proposed changes to the turbine foundations and the undersea cables, and how those changes could potentially impact the findings of the 2011 EFH Assessment.

DOE, as the funding agency, and USACE, as the permitting agency, have reviewed the proposed project changes and the revised EFH Assessment and determined that their respective actions of funding and modifying the permit for the proposed project would have limited adverse effects on EFH, and the species of concern due to the installation and eventual decommissioning of the project.

DOE and USACE respectfully request your concurrence with their determination. Please send any correspondence to:

U.S. Department of Energy
Golden Field Office
Attn: Ms. Lori Gray
NEPA Division Director
15013 Denver West Parkway
Golden, CO 80401

U.S. Army Corps of Engineers
Regulatory Branch, Philadelphia District
Attn: Mr. Lawrence M. Slavitter
Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107-3390

For your information, the project proponent will coordinate with the National Marine Fisheries Services, Office of Protected Resources to obtain necessary authorizations under the Marine Mammal Protection Act if needed.

If you have any questions or require any additional information, please contact Lori Gray at (720)356-1568 or lori.gray@ee.doe.gov or Larry Slavitter, USACE at 215-655-6734 or Lawrence.M.Slavitter@usace.army.mil.

Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

Electronic cc:
Julie Crocker, PRD
Michael Hahn, DOE
Lori Gray, DOE
Roak Parker, DOE
Lawrence M Slavitter, USACE

Enclosure 1

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat Conservation Division
James J. Howard Marine
Sciences Laboratory
74 Magruder Road
Highlands, NJ 07732

June 22, 2011

Frank Cianfrani, Chief
Regulatory Branch
Philadelphia District
U.S. Army Corps of Engineers
Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107-3390

Received
JUN 27 2011
U.S. Army Corps of Engineers

ATTN: Larry Slavitter, Regulatory Branch
RE: Fisherman's Energy of New Jersey, LLC 2008-0777

Dear Mr. Cianfrani:

NOAA's National Marine Fisheries Service (NMFS), Northeast Region, Habitat Conservation Division has reviewed the essential fish habitat assessment prepared for Fisherman's Energy of New Jersey, LLC's proposal to install six nominal 4 MW wind turbines in the Atlantic Ocean approximately 2.8 nautical miles (nm) offshore of Atlantic City, Atlantic County, New Jersey. The proposed turbines would generate less than 25MW (net) of electricity. Each turbine would stand approximately 300 feet (ft) above the surface of the water and would be spaced approximately 0.667 miles (4,053 ft) apart in a single row orientation. The turbines would consist of a 16-ft diameter steel monopole with a wall thickness of more than two inches driven more than 100 feet into the ocean floor. The monopoles and other components of the turbines would be installed using a "jack-up" barge standing on the ocean floor with steel legs attached to the vessel. Each monopile would be stabilized by a static rock scour protection placed around each pile. The rock scour protection would be four to six inch "filter" stone and 12 to 15 inch armor stone placed around each monopile using a barge based crane fitted with a clamshell bucket. Each foundation scour pad would impact approximately 0.7 acres of the seafloor.

The turbines would be connected through a series of submarine electric cables which are called the "array cables." The array cables are approximately 4.5 inches in diameter and rated to 35kVAC and consist of steel armor layer around 3 polyethylene-coated copper conductors. The electrical energy produced by the turbines will be transmitted to shore via a submarine electric cable, called the "export cable," approximately 5.25 inches in diameter and of similar construction as the array cables. The array cables would be installed using a jet plow. The export cable would also be installed with a jet plow to an area approximately 1500 feet from the shoreline. Horizontal directional drilling would then be used to bring the cable onshore. The cables would be installed to a depth of nine feet below the existing sea floor.

Essential Fish Habitat
The project are has been designated as EFH for a wide variety of federally managed species including Atlantic cod (*Gadus morhua*), Atlantic butterfish (*Peprilus triacanthus*), Atlantic sea herring (*Clupea harengus*), bluefish (*Pomatomus saltatrix*), black sea bass (*Centropristis striata*), monkfish (*Lophius americanus*), red hake (*Urophycis chuss*), scup (*Stenotomus chrysops*), summer flounder (*Paralichthys*

dentatus), windowpane flounder (*Scophthalmus aquosus*), winter flounder (*Pseudopleuronectes americanus*), cobia (*Rachycentron canadum*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), winter skate (*Leucoraja ocellata*), little skate (*Leucoraja erinacea*), clearnose skate (*Raja eglanteria*), dusky shark (*Carcharhinus obscurus*), sandbar shark (*Carcharhinus plumbeus*) and tiger shark (*Galeocerdo cuvier*).

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires federal agencies such as the Army Corps of Engineers to consult with the Secretary of Commerce, through NMFS, regarding any action or proposed action authorized, funded, or undertaken by the agency that may adversely affect essential fish habitat (EFH) identified under the MSA. The EFH regulations, 50 CFR Section 600.920, outline that consultation procedure.

We have reviewed the EFH assessment for this project. Overall, the assessment appears to evaluate adequately the potential effects of the project on federally managed species and their prey based upon the information available currently. The applicant has collected site specific information on sediments, benthic invertebrates, marine mammals, sea turtles, Atlantic sturgeon and avian species. Fisherman's Energy has also committed to working with the appropriate state and federal agencies, including NMFS in the development of a post-construction monitoring plan to assess any effects to NOAA trust resources. Any additional baseline and ambient condition surveys will also be included in the monitoring plan.

Based upon our review of the information provided, it appears that the proposed project will have some adverse effects on EFH. However, at this time, we have no EFH conservation recommendations to offer pursuant to Section 305(b) (4) (A) of the MSA. We look forward to continuing to work with the Corps, Fisherman's Energy, the New Jersey Department of Environmental Protection and other appropriate agencies to develop a suitable comprehensive post-construction monitoring plan. We anticipate that there will be future opportunities to evaluate the effects of the project on NOAA trust resources and well as commercial and recreational fishing activities in the area as the results of the post-construction monitoring program becomes available. At that time, actions may be needed to avoid, minimize or mitigate for any adverse effects that are identified.

Endangered and Threatened Species and Marine Mammals

As discussed in our previous letters, several species of federally listed threatened or endangered species under the jurisdiction of the NMFS are known to occur in the vicinity of the proposed project area. Section 7 of the Endangered Species Act of 1973 (ESA), as amended requires federal agencies to consult with NMFS to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or adversely modify or destroy designated critical habitat. Should you have any questions regarding the information presented on listed species or about the ESA Section 7 process, please contact Julie Crocker of NMFS Protected Resources Division at (978)282-8480 or julie.crocker@noaa.gov.

While not protected under the ESA, several other species of marine mammals can be found in the coastal and offshore waters of New Jersey. All marine mammals receive protection under the Marine Mammal Protection Act of 1972. Under the Marine Mammal Protection Act (MMPA), it is generally illegal to "take" a marine mammal without prior authorization from NOAA. "Take" is defined as harassing, hunting, capturing, or killing, or attempting to harass, hunt, capture, or kill any marine mammal. "Harassment" is defined as any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal in the wild, or has the potential to disturb a marine mammal in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

Under the MMPA, the Secretary of Commerce, through NOAA, may authorize the take of small numbers of marine mammals incidental to otherwise lawful activities (except commercial fishing), provided that

the takings would have no more than a negligible impact on those marine mammal species and would not have an unmitigable adverse impact on the availability of those species for subsistence uses. An activity has a "negligible impact" on a species or stock when it is determined that total taking by the activity is not reasonably likely to reduce annual rates of survival or annual recruitment (i.e., offspring survival, birth rates). Most incidental take authorizations to date have involved the incidental harassment of marine mammals by sound. In the event that any aspect of the project will result in a "take" the Corps or the project applicant would be required to obtain an incidental take authorization in advance from NOAA. It is recommended that any project proponent discuss permitting needs with NMFS' Office of Protected Resources Permits, Conservation, & Education Division (301-713-2289). Information on the MMPA permitting process can also be found online at: https://apps.nmfs.noaa.gov/questionnaire/questionnaire.cfm.

Because aspects have the potential to affect federally listed species and marine mammals protected under ESA and the MMPA, the Corps should contact our Protected Resources Division to determine the appropriate procedure to for coordination. The appropriate coordination should be completed prior to the Corps' decision on this permit application. We look forward to continued coordination on this project as it moves forward. If you have any questions or need more information, please contact Karen Greene at 732 872-3023.

Sincerely,

Stanley W. Gorski
Field Offices Supervisor

cf: HCD Sandy Hook - K. Greene
PRD – J. Crocker
FWS- Pleasantville
MAFMC – T. Hoff
NEFMC

Description of the Proposed Project – Fishermen's Atlantic City Windfarm

Changes to the Project Description (PD) that were previously submitted during consultation are highlighted in yellow and the change is explained in the accompanying footnote.

The Proposed Project consists of the construction, operation, maintenance, and eventual decommissioning[1] of a nominal 25 MW[2] offshore wind renewable energy facility, consisting of up to six turbines[3], a 33-kiloVolt (kV)[4] alternating current (AC) submarine cable interconnecting the turbines (inter-array cable), a 33-kV[4] AC submarine transmission cable (export cable), and a 33-kV[4] AC underground cable (onshore interconnection cable) that would connect the Proposed Project with existing onshore infrastructure located in Atlantic City, New Jersey.

The offshore components of the Proposed Project, including the turbines and the inter-array cable, would be located in state waters approximately 2.8 nautical miles from Atlantic City, New Jersey. The export cable would traverse state waters to shore. The onshore components, including the onshore interconnection cable, fiber optic cable, and interconnection facilities would be located in Atlantic City, New Jersey. Construction would be supported by a construction staging area(s) and a construction port. Onshore support facilities would be located at existing waterfront industrial or commercial sites in the cities of Camden and Atlantic City, New Jersey.

All remaining aspects of the project, including staging sites, vessel traffic, color and labeling of the turbines, seasonal restriction and maintenance schedules remain the same and are not impacted by the proposed project changes.

Annual net electricity production for this Project is anticipated to be approximately 80,000 MW-hours[5] (MWh). The total ocean area considered as the project area is approximately 170 acres (calculated as the perimeter around the group of six turbines, approximately 200 feet in each direction) plus a 5 foot width along the length of the export cable route from the turbines to the shore); however the actual portion of the area that would be physically disturbed by the placement of the turbines and cables is approximately 2 acres. The cable and turbines would be located in water depths of 26 to 40 feet below mean lower low water (MLLW).

Wind Turbine and Foundation Design

The offshore turbine assemblies would each be composed of three primary elements, a foundation, tower, and three blade turbine. The nacelle houses the major mechanical components of each turbine. Each tower would be approximately 16.5 feet in diameter at the base and taper to a diameter of 12.5 feet at the top.

[1] Previous PD did not include operation, maintenance, and eventual decommissioning of the Proposed Project
[2] Previous PD stated "20 MW (net)"
[3] Previous PD stated "six offshore wind turbines"
[4] Previous PD stated "34.5 kv"
[5] Previous PD stated "75,000 MWh"

Each turbine would have a name plate capacity of no more than 5 MW[6] and a blade rotor diameter of no more than 427 feet[7]. Each of the three (3) blades would be two hundred thirteen (213) feet long[8]. The blade at its lowest point would be located 80 feet above mean high water and 506.4 feet above mean high water at its highest point[9].

The turbine array would be oriented in one row parallel to the coastline running northeast to southwest. Spacing between the turbines would be approximately 3,543 feet. Each of the wind turbines would be supported by an Inward Battered Guide Structure (IBGS) jacket-type foundation[10] driven into the seabed (**Figure 1**). The IBGS jacket-type foundation consists of four legs, with each leg being a hollow steel pipe with an approximate outer diameter of 84 inches. The triangular structure has 90-inch diameter pile sleeves for each leg and bracing elements of the foundation will measure approximately 22 feet in length and 72 inches in diameter. At the mudline, each side of the foundation will measure approximately 53 feet from the center point of each leg. The IBGS extends upward from below the seabed, through the water column to exposure at the surface, then tapers to approximately 50 feet above mean lower low water. The structural braces for the towers would be seventy two (72) inches in diameter and would be located laterally along the entire foundation[11].

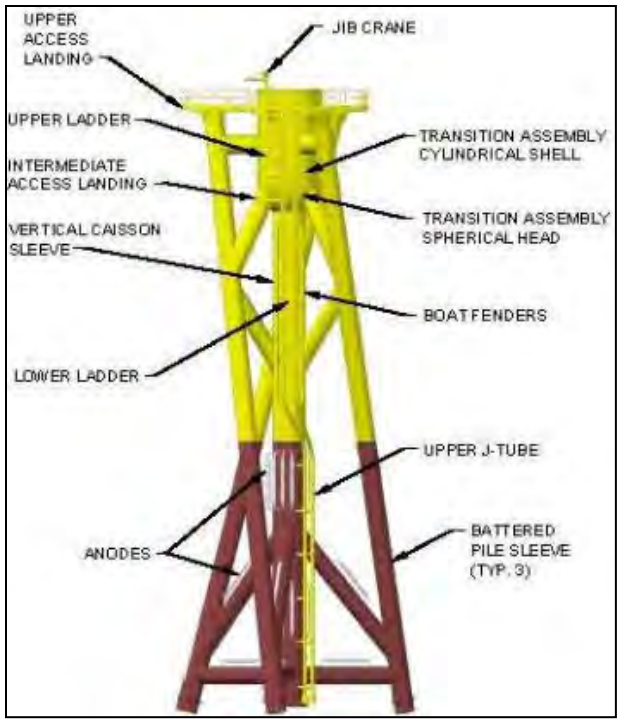


Figure 1. Foundation Design for the Proposed Project.

[6] Previous PD stated "3.6 MW"
[7] Previous PD stated "394 feet"
[8] Previous PD stated "approximately 192 foot long"
[9] Previous PD stated "blade at its lowest point would be located approximately 100 feet above the surface of the water and approximately 500 feet above the surface of the water at its highest point at mean high water"
[10] Previous PD referenced "monopole foundation"
[11] Previous PD did not reference these specifications since the tower was originally intended to be a monopole foundation

Engineering analyses have determined that the base of each foundation will no longer require a scour protection mat or rock scour protection around each foundation pile[12].

Installation of Turbines and Foundations

Fishermen's Atlantic City Windfarm, LLC (FACW) the project proponent, has thoroughly investigated vessel and port availability, and is currently in negotiations with multiple third parties to provide equipment and expertise in the installation of the turbine foundations and turbines. FACW has identified suitable existing US Jones Act-compliant vessels capable of installing the turbines in the 40 foot water depths at the project site. Specialty contractors would be required for delivery and installation of foundations, turbines and the subsea electrical cabling. Installing the array of turbines will require the ability to lift, place, and connect foundations, pilings nacelles, blades and heavy electrical equipment. These components can weigh well in excess of 200 tons each, and can only be lifted with specialized jack up barges or vessel-mounted cranes offering a stable, safe work platform.

FACW currently has a Memorandum of Understanding with the South Jersey Port Corporation for materials staging and preparation. The turbines and associated major components are envisioned to be delivered to the Beckett Street Marine Terminal in Camden, New Jersey. Up to 6 months before the scheduled installation, the turbines would be transported from the manufacturer to the Beckett Street Marine Terminal via barge, rail, and/or truck depending upon their origin. Existing waterfront bulkheads, cranes and laydown areas at Beckett Street would be used to support the staging for this project. At the facility, final turbine assembly including generator mounting and electrical hookups would be performed to minimize work performed offshore. At that point, the turbine manufacturer would lead the final assembly and configuration for the wind turbine generator components to be delivered by vessel to the offshore array field.

The steel turbine towers would be manufactured domestically and transported to the staging area at Beckett Street Marine Terminal via barge, rail, and/or truck. Each tower is approximately 250 feet in length (comprised of bolted segments) and is secured to the foundation by bolting to a transition piece (or flange) at the top of the foundation.

The foundations would be fabricated at a Gulf of Mexico facility and then transported by barge to the staging area at Beckett Street Marine Terminal. Once assembly is completed, the foundations would be loaded onto ABS class ocean deck barges that would carry three jackets per barge. It is anticipated that the two barges would be transported by two tugs directly to the project site. A floating crane barge or specialized jack-up barge or barge equipped with a high capacity crane pile handling frame and pile driving equipment would perform structure installations (**Figure 2**). The installation vessel would position itself near to each of the turbine installations. The vessel would then jack itself up out of the water to provide a stable platform in which to carry out the installation activities. Offshore experience has shown that it normally takes approximately 24 hours in fair weather conditions to position and anchor the

[12] Previous PD stated "scour mats and/or rock protection will be installed to prevent ocean currents from eroding the seabed around the foundation base".

installation vessel. Once the installation vessel is in the turbine array field, it would be moved as minimally as possible, but would, out of necessity, move from one turbine location to the next.



Figure 2. Typical heavy jackup vessel used for offshore wind turbine installations

To secure the foundation in place, steel pipe pilings 7 feet in diameter would be inserted down through the piling sleeves, and then driven to a depth of approximately 140 feet below the seabed using impact hammer methods. The jacket foundations would require the installation of four (4) eighty four (84) inch piles that would be driven inside, down and through the length of each of the ninety (90) inch diameter sleeves of the foundation for each turbine[13]. The anchoring piles would be driven to a depth of approximately 150 feet below the mudline. The maximum sound generation for each pile would be approximately 199 dB (re 1 uPa) at the source.

Each foundation would also be fitted with a ladder extending from the water surface up to a working deck to allow personnel access from vessels. Electrical power generated by the turbine would be cabled down through the structure to emerge from a J-Tube below the seabed.

The Proposed Project would be constructed using the following approach which has been successfully employed in Europe:

- All foundations are installed first;
- The submarine cable is installed next and energized to provide electricity from the grid to assist in turbine installation;
- Turbine towers are installed on the foundations;

[13] Previous PD stated "pile driving of eighteen (18) forty eight (48) inch diameter pipes placed in the openings on the three ends of the foundation structure"

- The turbines are installed on each tower; and
- Lastly the turbines are commissioned and made operational.

The complete wind turbine structure requires a series of main lifts for full assembly. The foundation center caisson (i.e., a watertight retaining structure) would be driven to the required depth using impact methods. The guide structure would then be lifted onto the caisson and secured. Each of the three pilings would then be lifted into the sleeves on the guide structure and hammered to the required depth below the seabed. The turbine tower would then be lifted and secured onto the foundation. Lastly the turbine components including the nacelle and turbine blades would be lifted to the tower top and installed.

Turbine system installations are anticipated to require four to seven fair weather days to complete. In order to minimize the complexity and duration of offshore operations, components of the turbines would be pre-assembled to the extent possible prior to transportation offshore.

Cable Route and Installation

Cables would be manufactured in Seymour, Connecticut and transported by rail to a staging pier in Port Elizabeth, New Jersey. The cable reels would be placed on a special cable laying barge and transported to the project site for installation.

Power output from the turbines would be transmitted via a 33 kV AC submarine cable (export cable) to access the shore. The inter-array transmission cable from each turbine structure would be linked to the export cable that would make landfall at a point in Atlantic City, at the base (southeast terminus) of Tennessee Avenue in Atlantic City. The cable would then continue northwest for 1.2 miles underground to the existing Huron Substation, located along Absecon Avenue. The path of this underground cable is roughly coincident with the line created by Tennessee Avenue. The submarine transmission cable route was selected after evaluations of alternative routes and landfall locations which included bringing the cable to shore through the Absecon Inlet. The route ultimately selected proved to present the least environmental impacts identified during the permitting process and was most acceptable to the USCG.

Offshore, the submarine export and inter-array cables would be arranged in a single string array. An additional fiber-optic cable bundle would also be included within the export cable for telecommunication purposes. At each turbine location, the power and telecommunication cables would extend down from the turbine within the tower structure, and then emerge through a J-tube just above the seabed where it would be connected to the adjacent turbine.

Jet plowing technology would be used to bury the export and inter-array cables to a target depth of 6 feet[14] below the seabed. The export cable would originate at Turbine #3. During this process the installation vessel slowly travels along the planned cable route while towing a weighted sled fitted with a trenching device (plow) and a nozzle which jets water into the bottom to create a narrow trench. The cable is simultaneously fed out from the vessel and laid into the trench. Blades at the back of the sled scrape bottom material over the trench to backfill. The cable would be buried in this manner to

[14] Previous PD stated “9 feet”

approximately 1,800 feet from the shoreline. The depth of the cable below the project along the Atlantic City Beach will be 20 feet. The cable that would run from the turbines to the shore would be five (5) inches in diameter[15].

Beginning at a distance approximately 1,800 feet from the shoreline, the cable would be routed through a lined conduit installed using Horizontal Directional Drilling (HDD) methods.[16] The installation of this HDD conduit would be performed from the landside. At the base of Tennessee Avenue (approximately 500 feet inland of the high water line), a concrete vault approximately 8 feet by 8 feet by 7 feet would be installed below roadway grade using typical upland excavation equipment. HDD equipment would then drill a 6-inch diameter cable-way 25 feet below the street level, underneath the boardwalk and beach, and emerge at the jet plow end point 1,800 feet from shore. While drilling, the cable-way would be lined with polyvinyl chloride (PVC) conduit to prevent collapse and to protect the cable after it has been installed. Soil material removed from the bored hole (approximately 13 cubic yards) would be removed from the site. All construction-related soil and debris would be appropriately disposed of depending upon the characteristics of the material, in accordance with relevant New Jersey Department of Environmental Protection (NJDEP) regulations. Once HDD is completed, the cable would be pulled from the offshore vessel through the conduit to emerge at the shore end vault, where the offshore cable would be connected.

A similar cable to that used offshore, but designed specifically for land applications would be used for the remaining 1.2 mile run below the Tennessee Avenue street level to the Huron substation. Again HDD methods would be used to route the cable 25 feet below street level. This burial depth was selected after a review of existing below grade infrastructure along this route. At 25 feet, the cable would be below all existing infrastructure. Soil material removed from the bored hole (approximately 46 cubic yards) would be removed from the site and properly disposed as described above. At the Huron substation facility, a breaker system, and other minor electrical components specific to the Proposed Project would need to be installed for connection of the export cable and to the power grid.

The following sections were not part of the original project description.

Operations and Maintenance

Upon completion of the construction activities, FAWC would conduct several weeks of commissioning activities that would entail the testing of the turbines as well as the offshore and onshore transmission systems. The project would begin operations approximately in October 2017 and continue until the end of the 25-year expected operational life of the facility.

Operation of the turbines would require continuous remote (shore-based) monitoring and control, scheduled onsite maintenance, and unscheduled responses to faults or damage. Additionally, the

[15] Previous PD stated “8 inches in diameter”

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

- Remote monitoring and supervision of the wind turbines and associated equipment 24 hours a day, 7 days a week using the wind power supervisory control and data acquisition system;
- Initiation of any required corrective action;
- Operation of the Turbine Condition Monitoring (TCM) system;
- Performing diagnostic assessment of data from the TCM;
- Managing the inventory of spare parts, including performing any maintenance of these spare parts;
- Scheduling and logistics planning of maintenance activities; and
- Performing daily communication with the facility operator.

Each turbine would undergo scheduled maintenance and inspection as well as a full annual maintenance program as prescribed by the turbine manufacturer. This work would be performed by personnel qualified by the manufacturer. Additionally, inspections of the underwater structures and seabed would be performed at a minimum of once per year.

As access to the turbines can only be achieved by vessel, sea conditions would dictate when service may be performed. Heavy annual work would be scheduled to occur during summer months when conditions for accessing the turbines are typically suitable (waves less than 3 feet). During winter months, accessibility may be limited for extended periods of time.

Service crews would board a dedicated service vessel based in Atlantic City, New Jersey. Personnel would gain access to the turbines via the ladder system incorporated into each foundation. Tools and light parts would be lifted onto the structure using a small crane system provided on the structure working deck. Annual maintenance for each turbine is expected to require 5 to 8 days of onsite work. Turbines would be returned to normal operation at the end of each service day.

No oils or other waste would be discharged during service events. Appropriate measures would be implemented to provide for containment and collection of hazardous material spills should they occur. It is not expected that any painting would be necessary during the life of the turbines, other than to repair damage. The original coating system on the towers is designed to last the lifetime of the structure.

Decommissioning

While the project is presently planned for a 25 year operational period, the potential for equipment upgrades and continued operation would be evaluated throughout the project life. When it is determined that the project is to be decommissioned, all physical elements of the project would be removed and the site would be restored to its original condition. A financial instrument to fund decommissioning activities would be set in place at the start of the project to ensure that sufficient funds are available for removal of the turbines and support infrastructure.

A comprehensive Decommissioning Plan which addresses the engineering, environmental, regulatory, and economic elements of the decommissioning task. The plan addresses state requirements presently in place as well as those established by the Bureau of Ocean Energy Management (BOEM) guidelines described in 30 CFR Parts 250.1700 – 1754. An overview of the Decommissioning Plan is provided below.

Decommissioning of the project would involve the removal of equipment both offshore and onshore and would be performed utilizing similar equipment to that used during the construction process. This equipment may include barges, lift boats, tugs and crew vessels. Deep draft vessels would port at the Beckett Street Terminal in Camden, New Jersey, while smaller crew vessels would operate from Atlantic City. Onshore, trucks, trailers, and cable handing equipment would be used to recover the cable and substation equipment. Removed materials would be refurbished, recycled, or disposed of, as appropriate.

Offshore Equipment Removal

Removal of the offshore equipment would consist of the following tasks:

- Removal of the wind turbines;
- Removal of towers and foundations;
- Removal of inter-array and export cables; and
- Site clearance survey.

The removal processes would be performed with full consideration of environmental and safety compliance. Federal and state permits would be in place as required prior to initiating decommissioning. During decommissioning, safety exclusion zones would be established and marked with buoys and navigational aids to protect the workforce and vessel traffic. FACW would ensure that any subsea obstacles would be adequately marked until they are made safe or removed.

Removal of the turbine equipment would essentially be the reverse of the installation. Using a barge supported heavy lift crane, each rotor and nacelle would be lowered to a transport barge and secured for transit to port. Power cables would be removed from the tower and at the sea bed. The steel turbine tower would be removed as one unit above the transition joint at water level.

Each tower foundation is comprised of three driven pilings, a center caisson and a guide structure. The guide structure would first be removed and loaded onto a barge for recycling. Each of the pilings and the caisson would be cut 15 feet below the seabed and removed. The remaining piling structures (below -15 feet) would be left in place.

Because full removal off all buried cable would cause disturbance to the established sea bed, power cables at each turbine location would be excavated to the 6 foot burial depth, cut and removed. All cabling at or below the 6-foot depth would be left in place undisturbed.

Upon completion of structural decommissioning, a site clearance survey would be performed to ensure that no debris remains within the project area, and to document the physical condition of the seabed. Similar to the geophysical survey performed pre-construction, the clearance survey would employ side

scan sonar for imaging the seabed, a magnetometer to detect ferrous materials, and depth mapping systems. Any objects detected would be investigated and removed as appropriate. Demonstration of clearance would be provided to the appropriate agencies.

Onshore Equipment Removal

Removal of the onshore equipment would consist of the following tasks:

- Removal of sea-to-shore transition cable;
- Abandonment of sea-to-shore directionally drilled conduit;
- Abandonment of the onshore cable vault;
- Removal of land cable; and
- Removal of substation equipment.

After removal of the offshore equipment, the remaining power transmission cable would be pulled back through its HDD conduit to the vault at the base of Tennessee Avenue from where it would be removed for recycling. The 6-inch conduit would be left in place, 25 feet below the boardwalk and beach, and extending offshore to the former transition point.

All equipment would be removed and the vault would be abandoned in accordance with Atlantic City, New Jersey regulations or, at the discretion of the city, the vault would be removed and the excavated site backfilled.

The land based cable extending from the vault to the Huron substation would be removed from its conduit by pulling from the substation end. The cable would be trucked from the location and recycled. The 6-inch buried conduit (approximately 25 feet below grade) would be capped and left in place for future use by the city or other projects.

Switchboxes and other electrical equipment at the substation will be removed in accordance with requirements set by Atlantic County Electric. Any other ancillary equipment would either be removed or left in place as preferred by Atlantic County Electric.

ESSENTIAL FISH HABITAT ASSESSMENT
FOR THE
FISHERMEN'S ATLANTIC CITY OFFSHORE WINDFARM, LLC
PROPOSED SIX TURBINE NJ STATE WATERS OFFSHORE WIND PROJECT
2.8 MILES OFF OF ATLANTIC CITY, NEW JERSEY

Revised January 2015

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R-22700.002

Revised January 2015

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Glossary and Acronyms

Adverse effect: Any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (16 U.S.C. 1802(10)).

Atlantic States Marine Fisheries Commission (ASMFC): The Atlantic States Marine Fisheries Commission consists of 15 Atlantic coast states (Maine, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, North Carolina, South Carolina, Georgia, and Florida) and serves as a deliberative body, coordinating the conservation and management of shared near-shore fishery resources for sustainable use.

Benthic: Habitats or organisms associated with or occurring on the bottom of a body of water.

Bycatch: Species other than the primary target species caught incidentally through the harvest of the primary species.

Catch: The total number (or weight) of fish caught by fishing activities including all fish landed, discarded, and killed by the act of fishing.

Catch per Unit of Effort (CPUE): Number or biomass of fish captured per standardized unit of fishing effort.

Essential Fish Habitat (EFH): Waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Fecundity: The potential reproductive capacity of an organism or population measured by the number of eggs (or gametes or offspring) produced during each reproductive cycle.

Fish: Finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds (16 U.S.C. 1802(10)).

Fishery Management Plan: Plan containing fishery resources management and conservation measures, and other provisions required by the Magnuson-Stevens Fishery Conservation and Management Act, developed by the Fishery Management Councils or the Secretary of Commerce.

Fishing mortality (F): The fishing mortality rate for a specific stock is the proportion of the fishable stock that is caught in a year.

Habitat Areas of Particular Concern (HAPC): Essential fish habitat that has been judged to be particularly important to the long-term productivity of populations of one or more managed species, or to be particularly vulnerable to degradation.

Landings: The number or poundage of fish selected and kept (unloaded) by commercial fishermen or brought to shore by recreational fishermen. Landings are reported at the locations at which fish are brought to shore.

Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act): The Magnuson-Stevens Fishery Conservation and Management Act is the primary federal law governing marine fisheries management in United States federal waters.

Maximum Sustainable Yield (MSY): The largest average yield of fish stock to a fishery that can be sustained indefinitely under the existing environmental conditions.

Mid-Atlantic Fishery Management Council: The Mid-Atlantic Fishery Management Council is responsible for the management of fisheries in federal waters primarily off the mid-Atlantic coast (New York, New Jersey, Pennsylvania, Delaware, Maryland, Virginia, and North Carolina).

National Marine Fisheries Service (NMFS): The federal agency responsible for the conservation, protection, and management of living marine resources and ecosystems.

Necessary: The habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem (16 U.S.C. 1802(10)).

Neonate: A newborn.

New England Fishery Management Council: The New England Fishery Management Council is responsible for the management of fisheries in federal waters off the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut.

New Jersey Inland Bays system: The New Jersey Inland Bays system includes Little Egg Harbor, Great Bay (Mullica River), Little Bay, Grassy Bay, Reed Bay, Absecon Bay, Lakes Bay, Shelter Island Bay, Scull Bay, Great Egg Harbor, Peck Bay, Ludlam Bay, Townsend Sound, Stites Sound, Great Sound, Jenkins Sound, Grassy Sound, Richardson Sound, Jarvis Sound, and Cape May Harbor.

Overfished: A fish stock is considered overfished when the population size is below the minimum stock size threshold or sustainable target. The abundance is considered too low to ensure safe reproduction. The sustainable target is currently set by the National Marine Fisheries Service. The term is used in many fisheries when biomass has been estimated to be below a limit biological reference point.

Overfishing: When a fish stock is subjected to a fishing mortality rate that jeopardizes the capacity of the stock to produce maximum sustainable yield; exceeding the maximum fishing mortality threshold set by the National Marine Fisheries Service by 1 or more years.

Pelagic: Habitats or organisms occurring in the open sea or ocean water column anywhere from the surface to 1,000 meters; all areas not associated with the coast or sea floor.

Project area: The area calculated as the perimeter around the six turbines (approximately 200 ft in each direction) plus a five foot width along the cable route length from the turbines to the shore.

Recruitment: 1) The number or proportion of biomass added to a fish population due to growth or reproduction. 2) The moment when a young fish enters a fishery.

Spawning Stock Biomass (SSB): The total weight of all fish that contribute to reproduction in a population.

Stock: The part of a fish population with a specific migration pattern, spawning grounds, and subject to a distinct fishery.

Substrate: Sediment, hard bottom, structures underlying the waters, and associated biological communities (16 U.S.C. 1802(10)).

Young–of-the-year (**YOY):** Age-0 fish or fish born within the past year that have completed the transformation from the larval to the juvenile stage but have not yet reached one year of age.

Waters: Aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate (16 U.S.C. 1802(10)).

1.0 Introduction

The Sustainable Fisheries Act (SFA) was enacted by the U.S. Congress in 1996 amending the 1976 Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). The SFA recognized that many fisheries depend on marine, nearshore, and estuarine habitats for at least part of their lifecycles and introduced requirements to protect estuarine and marine ecosystems through identification and conservation of Essential Fish Habitat (EFH) for those species regulated under a federal fisheries management plan. Essential fish habitat (EFH) is defined as waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (NMFS 2007, 16 U.S.C. 1802(10)). Fish are defined as finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds (NMFS 2007, 50 CFR 600.10). The National Marine Fisheries Service (NMFS) is mandated by the SFA to coordinate with other federal agencies to avoid, minimize, mitigate, or offset adverse effects on EFH that could result from proposed activities.

This report presents an Essential Fish Habitat Assessment conducted for the proposed construction, operation, and decommissioning of a 25 MW offshore wind project located offshore of Atlantic City, New Jersey. This assessment is required under the Magnuson-Stevens Act of 1976, amended through 2007. The contents of this EFHA are intended to meet the requirements described by the National Marine Fisheries Service to comply with the Magnuson-Stevens Act, including: (1) a description of the proposed action; (2) an analysis of potential adverse effects of the action on EFH and managed species.

Atlantic sturgeons from the New York Bight Distinct Population Segment, listed as endangered in 2012, are known to occur off the New Jersey coast. This report contains an assessment of the potential effects of the proposed 25 MW offshore wind project located offshore of Atlantic City, New Jersey on this species and designated critical habitats that are listed under the Endangered Species Act (ESA).

2.0 Project Description

Fishermen's Energy of New Jersey, LLC proposes to install six nominal 4MW wind turbines in the Atlantic Ocean located between about 2.8 nautical miles offshore of Atlantic City, New Jersey in order to generate 25 MW (net) of electricity (Figure 1). Each turbine would stand approximately 300 feet (ft) above the water surface at mean high water and be spaced approximately 0.667 nautical miles (4,053 ft) apart in a single row orientation. The turbines will be connected through a series of submarine electrical cables which are called the "array cables". The array cables are will be up to 8" in diameter rated to 35kVAC and consist of a composite cables sheathed in high density polyethylene. The array cables will connect all six turbines and form an interconnection electric grid. The electrical energy produced by the 6 turbines will be transmitted to shore with a submarine electric cable called the "export cable". The export cable will be up to 8" in diameter rated to 35kVAC and consists of the same construction as the array cables. The export cable will be installed from a beach vault located approximately 10 feet below street level at the end of Tennessee Avenue near the boardwalk. From the beach vault, the export cable will be run approximately 2,600' seaward via an HDD duct to a seabed breakout point located approximately 2,000' from the low water mark at Steele Pier. From this HDD breakout point on the seabed the export cable will continue on to turbine #3 where it will connect the turbine array to the shore substation. For cable protection purposes, the target depth for burial of both the inter-array and export cables will be 6 ft below the existing seabed. The export cable will make landfall at the Tennessee Ave. beach vault, and then continue underground to the 69 kV Huron Substation which is part of the

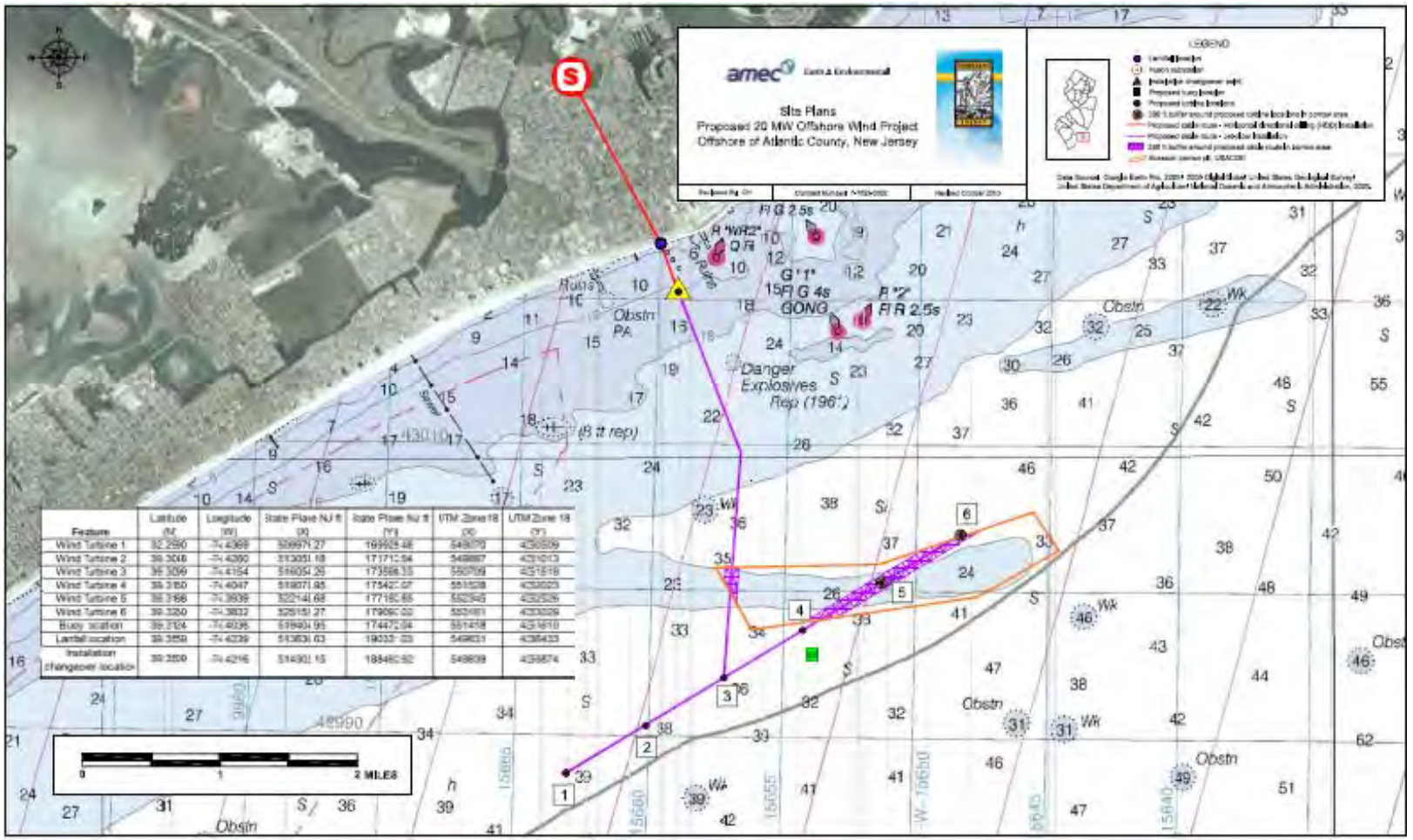


Figure 1. Site map, Fishermen's Energy proposed 25 MW offshore wind project.

PJM electric system. The submarine export cable will be spliced to a terrestrial export cable inside the beach vault. This terrestrial export cable will connect the offshore wind farm to the Huron Substation and will run through a pre-installed HDD duct. It is anticipated the terrestrial export cable will consist of 3 individual polyethylene coated copper conductors.

The project area calculated as the perimeter around the six turbines (approximately 200 ft in each direction) plus a five-foot width along the centerline of the cable route from the turbines to the shore is approximately 170 acres; however, the actual portion of the area that will be covered by turbine foundations is approximately 0.02 acres (923 ft^2), with an additional 3.66 acres that would be temporarily disturbed during cable installation. National Oceanic and Atmospheric Administration (NOAA) nautical charts indicate that the proposed project area is located in water depths of 26 to 40 ft below mean low water. Sediment data collected during the benthic survey in November 2010 indicate that the predominant grain size is fine-medium sand, with silt-clay composing less than 5% by weight.

Each wind turbine will be supported by a jacket-type foundation anchored to the seabed by four hollow steel pilings, each 84" (7 feet) in diameter, and driven about 150 feet into the ocean floor. These foundations will not require scour protection mats based on engineering analyses. The turbine tower is about 247 feet tall from the transition point (50 feet above mean high water, MHW) to the center of the hub achieving an 80-foot blade clearance above MHW, with the overall height of the hub at approximately 297 ft. A boat landing ladder for service access, as well as an access door to the structure interior spaces and ladder will be located just above water level. Together the foundation interior will be used as the conduit for the submarine cables as they run from the switchgear interface unit at the base of the turbine tower to the seabed where it emerges from a "J-tube" and transits to the next turbine tower for interconnection as part of the cable network. Lastly, the wind turbine assembly is composed of the nacelle, which houses the generator, and the rotor works, which include the hub and three turbine blades. Each turbine will have a rotor diameter of approximately 426 feet and a minimum center hub height of 297 feet above mean lower low water. The turbines will be installed on the transition piece top and will automatically rotate to orient the blades to maximize capture of wind energy.

Installation and commissioning of each of the turbines is expected to require four to seven fair weather days to complete. To minimize the complexity and duration of offshore operations, components of the turbines will be pre-assembled to the extent possible prior to transportation offshore. A jack-up vessel equipped with a high capacity crane with pile handling frame and hydraulic pile driving equipment will perform foundation and transition piece installations and remain at the project area for the duration of the installation. On site, turbine sections and materials will be transported to the jack-up vessel at the project site by barge and support handling vessels. The jack-up vessel will position itself locally to each of the turbine installations and lower its legs until they are sufficiently stable on the sea bed. The vessel will then jack itself up out of the water to provide a stable platform from which to carry out the installation activities. It will be moved between turbine locations to perform installations in the turbine array field.

The array and export cables connecting the substation and turbines will be installed and buried in the seabed using a jet plow. The export cable will run from an area approximately 1,500 ft from the shoreline via a pre-installed HDPE duct using horizontal directional drilling techniques. The pre-installed HDD duct will break out of the seabed at the 15 foot depth contour and is called the "transition point". The pre-installed HDD duct will then be used to bring the export cable onshore to the beach vault. The target depth of burial of the export cable from the turbine field to the transition point will be approximately nine feet. At the transition point, the HDPE duct will angle down to approximately 30

feet below the beach, then rise to approximately 10 feet in depth to terminate at the beach vault on Tennessee Ave for the terrestrial run of an upland cable.

The project will be decommissioned at the end of its operational life. The turbines are expected to last a minimum of 20 years and may be replaced with minimal disturbance to EFH habitat. The structural elements are likely to last 40 years based on maintenance. This would be subject to infrastructure integrity such as cable performance, foundation fatigue and structural integrity. Any environmental review associated with proposed upgrades for replacement would be completed prior to work being implemented. If the project is not re-powered after its operational life (currently modeled at 20 years, but expected to be longer), the project will be decommissioned. During decommissioning, turbine towers will be removed and transported from the project site. These activities will be undertaken at a time that is least disturbing to marine living resources. Facility operation will be assessed continually to ensure productive use while the installation is in place.

If decommissioning is required, it is expected that the EFH impacts to the marine resources in the vicinity of the project would be minimal. The decommissioning would begin with the disconnection of the submarine cables from the turbine switchgear. Each turbine would then be broken down and taken apart using equipment similar to that used in construction and in a similar sequence. It is anticipated that the jacket foundations may need to be cut off as low as 15' below the mud line. The cut off to 15' below the mudline is the current federal regulation (30 CFR, Part 285) for decommissioning renewable energy projects in federal waters. Per federal regulations (30 CFR 250.1750-1754), associated cables of the project that are at or above the three-foot depth or constitute a hazard would to the extent possible be pulled up using barges and/or jet plow equipment, similar to the equipment used to install the cables. It is our opinion that recovering cables that have been buried to 6' or greater may result in a greater disturbance to the surrounding marine environment than leaving them in place.

The above-water portions of jacket foundation and transition would have to be removed to prevent them from becoming a hazard to navigation, but the jacket foundation below the surface would be left in place after cutting up to 15' below the mud surface level. Removal of the cables would be more disruptive to the habitat than simply leaving them in place. A decision to leave cables buried deeper than a specific depth, would be determined through discussion with NJDEP Historical Bureau of Land Management prior to decommissioning.

3.0 EFH Designations

The National Marine Fisheries Service, New England Fishery Management Council, Mid-Atlantic Fishery Management Council, and South Atlantic Fishery Management Council have defined EFH for key species in the Northeastern United States coastal waters. EFH designations have been described based on 10' x 10' squares of latitude and longitude along the coast. The proposed Fishermen's Energy 6 Turbine offshore wind project is located within two of the 10' x 10' squares, which are identified below (Figure 2). By converting the decimal coordinates to minutes/seconds, it was determined that the majority of the project is located in the first identified square, and landfall will be located in the second identified square.

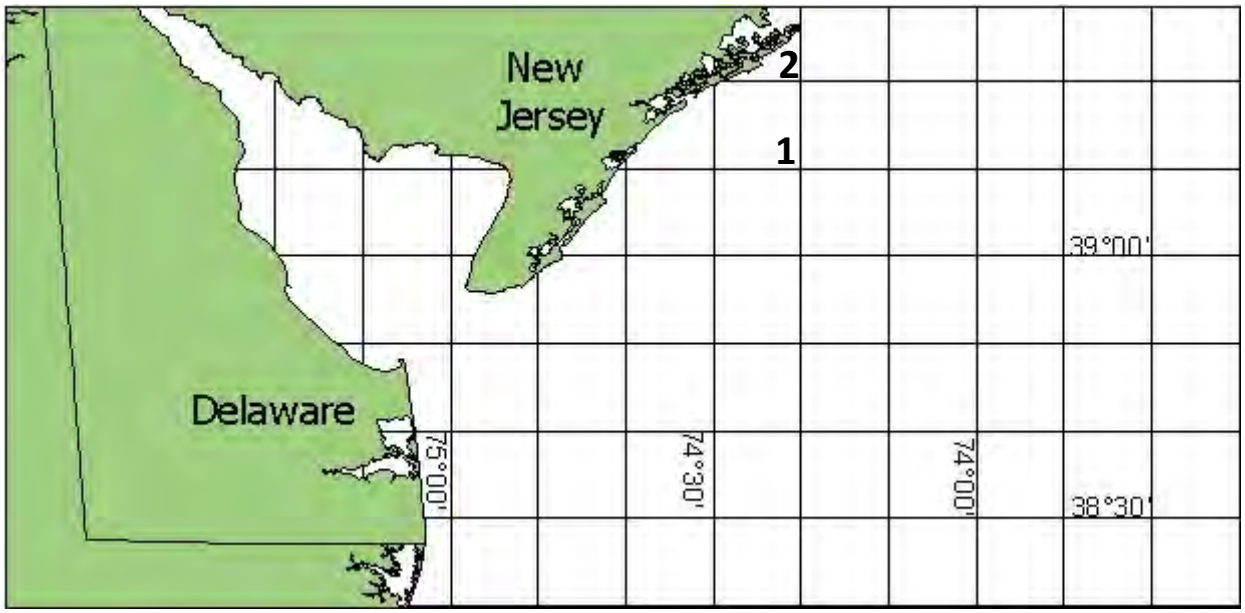


Figure 2. NOAA Fisheries 10 x10 minute squares for EFH designation.

Square 1

10' x 10' Square Coordinates:

Boundary	North	East	South	West
Coordinate	39° 20.0' N	74° 20.0' W	39° 10.0' N	74° 30.0' W

Square Description: The waters within the square within the Atlantic Ocean south and east of Ventnor City, N.J. The waters within this square just touch the coastline between Ventnor City, N.J. and Margate City, N.J.

Square 2

10' x 10' Square Coordinates:

Boundary	North	East	South	West
Coordinate	39° 30.0' N	74° 20.0' W	39° 20.0' N	74° 30.0' W

Square Description: Atlantic Ocean waters within the square within the New Jersey Inland Bays estuary affecting the following: Great Bay, Little Bay, Reed Bay, Absecon Bay, and the Atlantic Ocean. These waters affect Brigantine, N.J., Atlantic City, N.J., Absecon Inlet, Egg I., Great Thorofare, Main Marsh Thorofare, Hammock Cove, Doughty Creek, Perch Cove, Simkins Thorofare, Little Mud Thorofare, Mud Thorofare, Brigantine Channel, Black Pt., Grass Bay, Turtle Cove, Somers Cove, Obes Thorofare, Wading Thorofare, Broad Cove, Newfound Thororfare, Beach Thorofare, Great I., Inside Thorofare, Ventnor City, N.J., Smithville, N.J., Leeds Pt., Conovertown, N.J., Oceanville, N.J., Absecon Creek, and surrounding marsh.

3.1 Species with EFH Designations

A list of the 26 species which have designated EFH or commercial importance in the two identified 10' x 10' squares containing the proposed project area follows (Table 1). New Jersey Marine Fisheries Administration (NJMFA) trawl data collected from 1988 through 2010 in the three sampling blocks

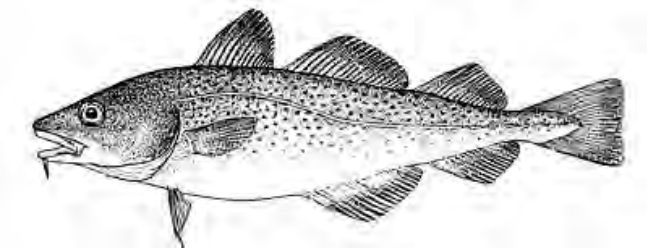
closest to the project area were used to describe the fisheries resources in the project area. Catch per unit of effort (CPUE) was derived from the NJMFA data as standardized number of fish per nautical mile (nm) towed and biomass (kg) of fish per nautical mile towed. These CPUE data were then averaged across time for each of the fish species with either juvenile or adult EFH in the project area to represent the fisheries resources that might reasonably be expected to occur in the project area (Table 2).

3.2 Life History Characteristic of Species with EFH Designation

The life history habitat requirements of the 26 designated EFH species within the project area are discussed below.

3.2.1 Demersal Species

3.2.1.1 Atlantic Cod *(Gadus morhua)*



General: Atlantic cod are a commercially important groundfish ranging from Greenland to North Carolina in North America. The project area is designated EFH for the cod adult life-stage (Table 1).

Adult: Adult cod prefer habitat with rocky, pebbly, or gravelly substrate at depths of 40-150 meters (m) with water temperatures <10° C, and salinities between 29-34 parts per thousand (‰; Lough 2004). Adult cod have not been documented in the New Jersey Inland Bays system (Stone et al. 1994), but have been reported rarely offshore Atlantic County (Fowler 1952, Fowler 1920). Atlantic cod in the Great South Channel area exhibit seasonal movement, moving southwesterly during autumn to overwinter in southern New England and the Mid-Atlantic coast, and returning in the spring (Lough 2004). Cod are visual feeders and require a minimum light intensity to actively feed (Ellertsen et al. 1980) on a variety of benthic and pelagic organisms including fish (silver hake, shad, mackerel, silversides, and herring), squid, decapods, and other crustaceans (amphipods and mysids; Bigelow and Schroeder 1953, Bowman et al.2000). Developmental shifts in diet have been reported, as cod, mature fish become a more important and predominant food source (Link and Garrison 2002, Bowman et al.2000). Adult cod predators include large sharks and spiny dogfish (Lough 2004).

Table 1. EFH species in the listed 10' x 10' squares of latitude and longitude as designated by the New England Fishery Management Council, Mid-Atlantic Fishery Management Council, South Atlantic Fishery Management Council, and the National Marine Fisheries Service in the Northeastern United States pursuant to the Magnuson-Stevens Fishery Conservation and Management Act.

Species	Eggs	Larvae	Juveniles	Adults
Atlantic cod *(Gadus morhua)*				X
Atlantic butterfish *(Peprilus triacanthus)*			X	
Atlantic sea herring *(Clupea harengus)*			X	X
Black sea bass *(Centropristus striata)*	n/a		X	X
Bluefin tuna *(Thunnus thynnus)*			X	
Bluefish *(Pomatomus saltatrix)*	X		X	X
Clearnose skate (*Raja eglanteria*)			X	X
Cobia *(Rachycentron canadum)*	X	X	X	X
Dusky shark *(Charcharinus obscurus)*		X		
King mackerel *(Scomberomorus cavalla)*	X	X	X	X
Little skate (*Raja erinacea*)			X	X
Monkfish *(Lophius americanus)*	X	X		X
Red hake *(Urophycis chuss)*	X	X	X	X
Sandbar shark *(Charcharinus plumbeus)*		X/HAPC	X/HAPC	X/HAPC
Scup *(Stenotomus chrysops)*	n/a	n/a	X	X
Shortfin mako shark *(Isurus oxyrhyncus)*			X	
Spanish mackerel *(Scomberomorus maculatus)*	X	X	X	X
Spiny dogfish *(Squalus acanthias)*	n/a	n/a		X
Summer flounder *(Paralicthys dentatus)*	X	X	X	X
Surf clam *(Spisula solidissima)*	n/a	n/a	X	X
Tiger shark *(Galeocerdo cuvieri)*		X	X	
Windowpane flounder *(Scopthalmus aquosus)*	X	X	X	X
Winter flounder *(Pseudopleuronectes americanus)*	X	X	X	X
Winter skate			X	X
Witch flounder *(Glyptocephalus cynoglossus)*	X			
Yellowtail flounder *(Limanda ferruginea)*	X	X		

Notes: The notation "X" indicates that EFH has been designated within the square for a given species and life stage. The notation "n/a" indicates some of the species either have no data available on the designated lifestages, or those lifestages are not present in the species' reproductive cycle. These species are: surf clam which are referred to as pre-recruits and recruits (this corresponds with juveniles and adults in the tables); spiny dogfish which have no eggs or larvae (juveniles born live); and scup and black sea bass, for which there are insufficient data for the life stages listed and no EFH designation has been made as of yet (some estuary data are available for all the life stages of these species, and some of the estuary squares will reflect this). The notation "HAPC" indicates habitat areas of particular concern, EFH that has been judged to be particularly important to the long-term productivity of populations of one or more managed species, or to be particularly vulnerable to degradation. Important nursery and pupping grounds have been identified for sandbar shark in the shallow areas of and the mouth of Great Bay, NJ, and the lower and middle Delaware Bay.

Source: National Marine Fisheries Service, "Guide to Essential Fish Habitat Designations in the Northeastern United States for Marine Waters" posted on the internet at: http://www.nero.noaa.gov/States4/DelaNJ.htm

Table 2. Catch per Unit of Effort (number of fish per nautical mile and biomass per nautical mile) of Fish with Designated Juvenile and Adult Essential Fish Habitat in the Proposed 6 Turbine Offshore Wind Project Offshore of Atlantic City, NJ. (Source: New Jersey Division of Fish and Wildlife Marine Fisheries Administration. Data collected during New Jersey's Ocean Trawl program represent average CPUE for trawls collected from 1988-2010 from Stratum 18, average of Blocks 26, 27 and 28).

Species	Catch (number/nm)	Biomass (kg/nm)
Atlantic cod	0.0	0.0
Atlantic herring	57.2	10.2
Black sea bass	3.3	0.1
Bluefin tuna	0.0	0.0
Bluefish	20.4	1.4
Butterfish	130.0	3.8
Clearnose skate	3.8	5.2
Cobia	0.0	0.0
Dusky shark	0.0	0.0
King mackerel	0.0	0.0
Little skate	178.7	90.1
Monkfish	0.0	0.0
Red hake	18.8	0.2
Sandbar shark	0.0	0.0
Scup	14.0	0.4
Shortfin mako shark	0.0	0.0
Spanish mackerel	0.0	0.0
Spiny dogfish	10.9	21.5
Surf clam	7.5	1.1
Summer flounder	10.1	3.2
Tiger shark	0.0	0.0
Windowpane	52.8	10.1
Winter flounder	10.4	1.3
Winter skate	10.7	8.9

Atlantic cod spawn mostly in winter on shoal areas (Grosslein and Azarovitz 1982) from late October to April (Bigelow and Schroeder 1953), beginning along the southern flank of Georges Bank and progressing north and west (Lough 2004). Spawning areas include the Gulf of Maine, Georges Bank, and southern New England. Cod spawn transparent, buoyant, pelagic eggs 1.2-1.7 millimeters (mm) in diameter (Lough 2004).

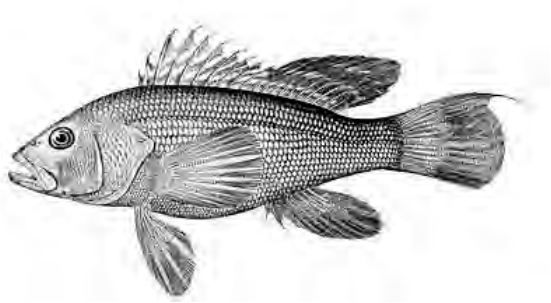
Atlantic cod are managed by the New England Fishery Management Council under the Northeast Multispecies Fishery Management Plan as two stocks, the Gulf of Maine and the Georges Bank and Southward. These Atlantic cod stocks support important year round commercial and recreational fisheries (Mayo and O'Brien 2006). The Georges Bank and Southward Atlantic cod stock is considered overfished (NEFSC 2008). The Georges Bank and Southward cod spawning stock biomass declined from approximately 91,000 metric ton (mt) in 1980 to 18,500 mt in 1995, increased to approximately 25,000

mt in 2001, and has since declined to 17,672 mt in 2007, approximately 12% of spawning stock biomass maximum sustainable yield (SSB_{MSY}; 148,084 mt). Recruiting year classes have been below the long term average of 14 million age 1 fish since 1991. The 2000 and 2001 year classes were the lowest in the 1978-2007 time series. The 2003 year class (10.8 million age 1 fish) was near average and fully recruited to the fishery during 2008. The 2007 fishing mortality (F; ages 5-8 unweighted) was estimated to be approximately 0.30, the second lowest F in the 1978-2007 time series (NEFSC 2008).

New Jersey commercial Atlantic cod landings peaked in 1960 at 1,612 mt, declined steadily to 7 mt in 1966, increased slightly to 153 mt in 1974, and then declined remaining low with an annual average of 13 mt from 1976 to 1996. New Jersey commercial Atlantic cod landings have been below 1 mt since 1995, and no Atlantic cod landings have been reported since 2006 (NMFS 2010). No juvenile or adult cod were collected by New Jersey Marine Fisheries Administration (NJMFA) near the project area from 1988 through 2010 (Table 2).

Adult Atlantic cod are unlikely to occur in the project area since this life-stage prefers cobble habitats at depths greater than 25 m (82 ft) and not the sand substrate at 7.9 to 12 m (26 to 40 ft) depths found in the project area. Additionally, Atlantic cod are uncommon along the southern New Jersey coast since it is near the southern end of their range in the western North Atlantic (Lough 2004).

3.2.1.2 Black Sea Bass (*Centropristis striata*)



General: Black sea bass is warm temperate species that occurs in the western Atlantic from southern Nova Scotia and the Bay of Fundy to southern Florida (Drohan et al. 2007). Their inshore-offshore range extends from near shore in depths of only a few feet of water out to about the 70-fathom contour line. North of Cape Hatteras black sea bass migrate inshore and northward in spring and offshore and southward in autumn (Nichols and Breder 1927). Black sea bass are usually found in complex habitats such as reefs on the continental shelf, but young-of-the-year regularly occur in estuarine habitats with structural complexity. The project area is designated EFH for black sea bass juvenile and adult life-stages (Table 1).

Juveniles/Adults: Juvenile and adult black sea bass occur in demersal waters over the continental shelf and in estuaries at salinities greater than 18 ‰ and temperatures above 6° C (Steimle et al. 1999a). They are often associated with structured habitats including rough bottoms, shellfish beds, man-made structures, and eelgrass. Juvenile black sea bass typically occur in estuarine nursery areas soon after settlement in coastal areas during the summer months. Older juveniles and adults migrate seasonally, spending spring through fall in nearshore habitats, and overwintering in outer coastal areas at depths of 30 to 70 fathoms (Nichols and Breder 1927). Migration is triggered by declining water temperatures and may allow juveniles in the Mid-Atlantic Bight to avoid temperatures below the lower lethal limit of 2-3° C (Hales and Able 2001). Juvenile black sea bass are abundant in the New Jersey Inland Bays system from May through September although they occur from April through December. Adult black sea bass

occur from May through December in the New Jersey Inland Bays system, but are most abundant from June through September (Stone et al. 1994). CPUE of black sea bass from NJMFA trawl data near the project area from 1998 through 2010 was 3.3/nm and biomass was 0.1 kg/tow (Table 2). Juveniles feed on benthic and epibenthic invertebrates (amphipod, isopods, and small crabs), and small fish (Drohan et al. 2007, Bowman et al. 2000). Adult black sea bass feed on a wide variety of benthic invertebrates and small fish, becoming increasingly piscivorous as they grow (Steimle et al. 1999a). Crustaceans (*Cancer irroratus* and *Meganyctiphanes norvegica*) and small fish dominate the diets of black sea bass in the Mid-Atlantic (Bowman et al. 2000).

Black sea bass mature between one and four years of age (Grosslein and Azarovitch 1982). Northern populations spawn during summer primarily between Chesapeake Bay and Montauk, New York in waters 18-44 m (Musick and Mercer 1977). Spawning off Virginia and Maryland peaks in July, but is progressively later to the north (Perlmutter 1939). Spawning has not been documented in the New Jersey Inland Bays system (Stone et al. 1994).

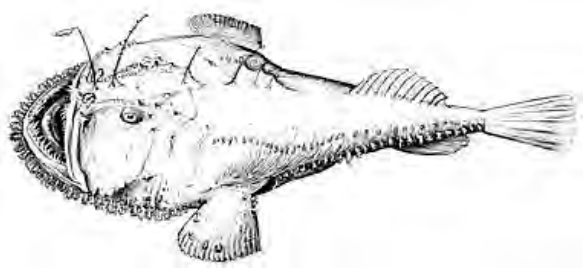
Black sea bass is a valuable food and game fish in southern waters. The black sea bass stock is managed as a single unit jointly by the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fishery Management Council under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan. Northeast Fisheries Science Center surveys in the late 1980s showed a slight rise in abundance that was followed by a decade of fluctuations near low abundance levels. A noticeable increase began in 1999, peaked in 2003, and was followed by a steady decline through 2006 (NEFSC 2006). The 2009 black sea bass stock assessment showed that the 2008 spawning stock biomass was 12,882 mt, and above the SSB_{MSY} (12,537 mt). The 2008 total catch was 2,039 mt, the estimated average fishing mortality was 0.28 and below the F_{MSY} (0.42). The National Marine Fisheries Service determined that the Atlantic black sea bass stock has been rebuilt (Shepherd 2009).

Commercial black sea bass landings north of Cape Hatteras have averaged approximately 1,280 mt from 1997-2007 (Shepherd 2009). The commercial fisheries occur in two distinct seasons. The spring through fall inshore fishery primarily executed with hook and line and pot gear has accounted for 11% of total commercial landings since 2000. The winter offshore fishery has accounted for 37% of total commercial landings since 2000. The 2008 black sea bass commercial landings were 850 mt (Shepherd 2009).

Recreational landings north of Cape Hatteras available since 1982 averaged approximately 1,600 mt annually. The 2008 black sea bass recreational landings were 742 mt. Recreational fisheries have accounted for 50% of the total landings by weight over the past decade and generally occurred in coastal areas from May until November (Shepherd 2006). Recreational fishery discards are substantial with annual average of 506 mt from 2000-2007, and 426 mt in 2008. However, only 15% of the discards are expected to be lost due to mortality (NEFSC 2006). New Jersey commercial black sea bass landings have averaged 260 mt from 2000 through 2008. New Jersey commercial black sea bass landings were 93 mt in 2009 (NMFS 2010).

Juvenile and adult black sea bass are not common in the project area since this species prefers structurally complex habitats and not the sandy substrate habitat that is found in the project area.

3.2.1.3 Monkfish (*Lophius americanus*)



General: Monkfish, also known as goosefish, occur along the eastern coast of North America from Newfoundland to North Carolina and along the Gulf of Mexico and coast of Brazil (Collette and Klein-MacPhee 2002). The project area is designated EFH for monkfish egg, larval, and adult life-stages (Table 1).

Eggs: Monkfish spawn from early spring through early fall with a peak May through June. Spawning occurs in the Carolinas in early spring and in the Gulf of Maine from May through June (Steimle et al. 1999b). Eggs are released within buoyant, ribbon-like mucus veils that can reach up to 12 m in length and 1.5 m in width (Martin and Dewry 1978) that float close to the surface. Individual eggs are 1.6-1.8 mm in diameter. Eggs occur in surface waters at depths between 15-1,000 m with water temperatures <18° C. Incubation time is temperature dependent, ranging from approximately 7 days at 15° C to 100 days at 5° C. Larvae hatch at 2.5-4.5 mm total length (TL) and remain within the egg veil for 2-3 days after hatching (Steimle et al. 1999b).

Larvae: Larvae are pelagic after they are released from the veil. They occur in pelagic waters at depths between 15-1,000 m with water temperatures between 6-20° C. Larvae prey on zooplankton, including copepods, crustacean larvae and chaetognaths (Steimle et al. 1999b). Monkfish larvae metamorphosis into juveniles and bottom dwellers at 5-10 cm TL (Bigelow and Schroeder 1953, Steimle et al. 1999b).The areas and habitats where this transition occurs are poorly known (Steimle et al. 1999b). NEFSC MARMAP ichthyoplankton surveys from 1977-1987 have collected larval monkfish along the New Jersey coast near the project area in May at densities of 10-41 larvae per $10m^2$ of water (Steimle et al. 1999b). Larvae appeared in the New York Bight area in April and June-September, averaging 0.28 per 100 cubic meters (Appendix Table 1).

Adults: Adult monkfish are found in bottom habitats with hard sand, sand and shell mix, pebbly gravel, and algae covered rocks at depths of 1-800 m with salinities of 29.9-36.7 ‰ and temperatures between 0-24° C (Steimle et al. 1999b, Richards et al. 2008). Monkfish have been reported offshore near Atlantic City (Fowler 1952). Adult monkfish are opportunistic ambush feeders and have a diverse diet of benthic and pelagic fish including skates, eels, dogfish, sand lance, herring, mackerel, cod, flounders, and hake. They have also feed on invertebrates (crabs and squid) and even sea birds (Steimle et al. 1999b, Bigelow and Schroeder 1953, Johnson et al. 2008). Monkfish make seasonal onshore-offshore migrations in response to changes in water temperatures (Steimle et al. 1999b). Seasonal distribution patterns in the southern Mid-Atlantic Bight suggest a northward or deep water departure from the southern Mid-Atlantic Bight in mid-spring (Richards et al. 2008). Mid-Atlantic Bight monkfish less than < 20 cm TL move or stay inshore in the winter and offshore in the summer (Steimle et al. 1999b). NMFS spring bottom trawl surveys from 1968 to 1997 have collected adult (≥ 43 cm) monkfish along the New Jersey coast near the project area at densities of 1 to < 2 fish per tow (Steimle et al. 1999b). No monkfish were collected in NJMFA trawls (Table 2).

Monkfish is a valuable commercial fish supporting one of the most lucrative fisheries in U.S. Northwest Atlantic Ocean waters. Due to differences in how fisheries are implemented in the two regions monkfish are managed by the New England and Mid-Atlantic Fishery Management Councils under the Monkfish Fishery Management Plan as two stocks: the northern stock consisting of the Gulf of Maine and northern Georges Bank areas, and the southern stock consisting of southern Georges Bank and the Mid-Atlantic Bight (Richards 2006). The estimated 2009 southern stock total biomass was 131,218 mt and above the biomass target of 120,292 mt. The 2009 southern stock fishing morality was 0.07 and below the estimated of F_{max} of 0.46 per year. The southern monkfish stock is not considered overfished and overfishing is not occurring (NEFSC 2010a).

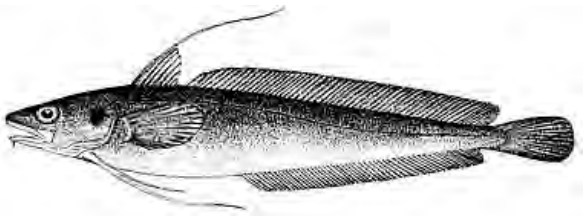
Surveys conducted in the southern area show consistent stock size trends. Biomass indices have remained at low levels after showing a slight increase in 2002. Size-based abundance indices indicate variable but stable recruitment in the southern stock. The median monkfish size in survey catches has remained relatively constant since the early 1990s, following a slow length distribution truncation from the 1960s to1990 (NEFSC 2010a).

Commercial monkfish fisheries occur year-round using gillnets, trawls and scallop dredges, peak fishing activity occurs during November through June. Reported total landings (both stocks) have declined since 2003 due to management regulations, and have averaged 11,600 mt from 2006-2009. Total landings in the southern stock were 5,302 mt in 2009 (NEFSC 2010a). Monkfish are also bycatch in the scallop and groundfish fisheries (Armstrong et al. 1992). Monkfish are discarded due to regulation and market sizes, discard rates differ between the directed monkfish fisheries and bycatch fisheries. Total monkfish discards during 1989-2009 have ranged between an estimated 1,600 mt (1992) and 7,500 mt (2001) per year. There is no significant recreational fishery (NEFSC 2010a).

New Jersey commercial monkfish landings averaged 1,774 mt from 2005 through 2008. New Jersey commercial monkfish landings were 1,676 mt in 2008, no commercial landings were reported in 2009 (NMFS 2010).

Monkfish eggs and larvae could occur in the project area during the spring when water temperatures are below 18 and 20° C, respectively. Adult monkfish could occur in the project area from late fall through spring when water temperatures are below 24° C since they are found in sandy habitats.

3.2.1.4 Red Hake (*Urophycis chuss*)



General: Red hake range from southern Nova Scotia to North Carolina (Bigelow and Schroeder 1953). Historically hake were found in the Great South Channel and on the northwestern slope of Georges Bank with heaviest concentrations from the southwestern area of Georges Bank to Hudson Shelf Valley (Grosslein and Azarovitz 1982). Red hake are rare in the New Jersey Inland Bays system (Stone et al. 1994), but have been reported offshore near Atlantic City (Fowler 1952, Fowler 1920). The project area is designated EFH for red hake egg, larval, juvenile, and adult life-stages (Table 1).

Eggs: Red hake eggs are 0.6-1.0 mm in diameter, buoyant, float near the surface, and are found in surface waters of the inner continental shelf with temperatures < 10° C, and salinities < 25 ‰ (Steimle et al. 1999c). Red hake eggs have not been documented in the New Jersey Inland Bays system (Stone et al. 1994). NEFSC MARMAP ichthyoplankton surveys from 1978-1987 have collected red hake eggs along the New Jersey coast near the project area from May to July at densities ranging from 1 to < 10 to 10 to < 100 eggs per $10m^2$ of water and from October to November at densities of 1 to < 10 eggs per $10m^2$ of water (Steimle et al. 1999c). In the New York Bight, red hake larvae averaged 0.29 per 100 cubic meters, and occurred between August and November.

Larvae: Red hake larvae occur in surface waters with sea surface temperatures less than 19° C, depths less than 200 m, and salinities greater than 0.5 part per thousand (‰) (Steimle et al. 1999c). Larvae hatch at approximately 2.0 mm in length and spend their first two months drifting at or near the surface often associated with floating debris, sargassum, and jellyfish. There is no known association between substrate type and occurrence of red hake larvae. Red hake larvae have not been documented in the New Jersey Inland Bays system (Stone et al. 1994).

Juveniles: Red hake larvae begin to descend to the bottom at 35 to 40 mm in length and become groundfish for the remainder of their lives (Bigelow and Schroeder 1953, Steimle et al. 1999c). They settle to the bottom on fine, silty sand at depths less than 100 meters and use depressions in the substrate for shelter. The presence of shelter is an important habitat requirement for juveniles (Steimle et al. 1999c). Small hake (5-15 cm) are closely associated with eelgrass (*Zostera marina*) in inshore areas, and frequently hide in living sea scallops (*Pecten magellanicus*) shells in deeper offshore areas. Older juveniles are found in bottom habitats that are less than 100 m deep in association with structure, shell fragments, or as an inquiline in sea scallops. Water temperatures are typically below 16° C with salinities ranging from 31-33 ‰. The association with sea scallops lasts until the red hake are approximately 14 cm in length (Steimle et al. 1999c). Red hake juveniles occur rarely in the New Jersey Inland Bays system from January through April and September through December (Stone et al. 1994). NMFS bottom trawl surveys have collected juvenile (< 26 cm) red hake along the New Jersey coast near the project area at densities of 25-100 fish per tow in the autumn (1963-1996), and densities ranging from of 1-10 to 50-100 fish per tow in the spring (1968-1997; Steimle et al. 1999c). Juvenile red hake food items include euphausiids, amphipods, decapods, and mysids (Bowman et al. 2000).

Adults: Adults prefer bottom habitats with depressions in soft substrates (sand and mud), water at temperatures below 12° C, depths from 30-130 m (occur from 5-300+ m), and at salinities from 33-34 ‰ (Steimle et al. 1999c). Red hake move inshore or offshore to remain within their preferred temperature range. Adult red hake have not been documented in the New Jersey Inland Bays system (Stone et al. 1994), but have been reported waters offshore near Atlantic City (Fowler 1952, Fowler 1920). NMFS spring bottom trawl surveys from 1968-1997 have collected adult (≥ 26 cm) red hake along the New Jersey coast near the project area at densities of 1-25 fish per tow (Steimle et al. 1999c). This agrees well with the NJMFA data, where CPUE near the project area was 18.8 fish/nm and 0.2 kg/nm (Table 2). Red hake forage on shrimp, small crustaceans, and small fish (Bowman et al. 2000, Steimle et al. 1999c, Bigelow and Schroeder 1953). Red hake predators include striped bass, spiny dogfish, goosefish, white hake, silver hake, sea raven, and harbor porpoise (Steimle et al. 1999c, Bowman et al. 2000). Hake reach sexual maturity in about two years (Musick 1969). Peak spawning occurs off Long Island from the end of June through July (Perlmutter 1939) and in mid-July on Georges Bank. The New York Bight also appears to be an important spawning and nursery area for red hake (Grosslein and Azarovitz 1982). Ripe eggs

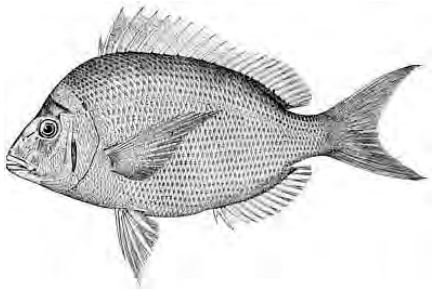
were observed in female red hakes in the Mid Atlantic Bight from late June through the end of July (Eklund and Targett 1990).

Red hake are managed as two stocks: the northern stock (Gulf of Maine-Northern Georges Bank) and the southern stock (Southern Georges Bank and Mid-Atlantic Bight) by the New England Fishery Management Council under the Northeast Multispecies Fishery Management Plan. Red hake stocks were last assessed in 1990 (Traver and Col 2006). The southern red hake stock NEFSC autumn survey biomass index fluctuated without trend from 1967 to 1983 and has since declined averaging 0.67 kg per tow from 1995 to 2004 despite very low landings since the early 1980s. The 2005 southern red hake stock biomass index was 0.78 kg per tow (Traver and Col 2006).

Southern red hake commercial averaged approximately 635 mt from 2000 through 2005. The 2005 southern red hake landings were a record low of 200 mt. Recreational landing from the southern stock have been negligible in recent years (Traver and Col 2006). New Jersey commercial red hake landings have remained low and have averaged 32 mt from 2002 through 2007. New Jersey commercial red hake landings were 52 mt in 2007, combined hake (red and white hake) landings were 0.2 mt (512 lbs) in 2009 (NMFS 2010).

Red hake eggs could occur in the project area from May through July, and in October and November. Red hake larvae may occur in the project area between August and November, since they are found near the surface in association with floating debris and organisms. Red hake juveniles less than 14 cm in length are unlikely to occur in the project area since they prefer structured habitats, shell fragment substrates or the shells of live sea scallops. Red hake juveniles greater than 14 cm in length could occur in the project area when water temperatures are between 3 and 22° C. The sandy bottom habitat in the project area has limited shelter and as a result is not the preferred offshore juvenile red hake habitat. Adult red hake are likely to occur in the project area when water temperature are below 12° C since they prefer soft substrate habitats including the sandy substrate present in the project area.

3.2.1.5 Scup (*Stenotomus chrysops*)



General: Scup occur from the Gulf of Maine to North Carolina and are most abundant south and west of Cape Cod (Bigelow and Schroeder 1953, Collette and Klein-MacPhee 2002). They make seasonal migrations from offshore winter grounds to inshore summer spawning and feeding grounds in April and May as waters warm to approximately 7° C (Grosslein and Azarovitz 1982, Morse 1978). Winter distribution is generally from approximately New Jersey to Cape Hatteras in waters 36-146 m deep. Summer distribution is along the southern New England and Mid-Atlantic coasts (Collette and Klein-MacPhee 2002, Grosslein and Azarovitz 1982). The project area is designated EFH for scup juvenile and adult life-stages (Table 1).

Juveniles: Juvenile scup (>18-19 mm TL) occur in schools in demersal waters over the continental shelf and inshore estuaries (0-38 m) with salinities greater than 15 ‰ and are associated with a variety of

substrates including mud, sand, mussel beds, and eelgrass (*Zostera marina*) (Steimle et al. 1999d). Juvenile scup are common in the New Jersey Inland Bays system from June through October (Stone et al. 1994). NMFS bottom trawl surveys have collected juvenile (≤ 15 cm) scup along the New Jersey coast near the project area at densities ranging from 1-10 to 101-1000 fish per tow in the autumn (1963-1996), and densities of 1-10 fish per tow in the spring (1968-1997; Steimle et al. 1999d). Data provided by NJMFA from the immediate project area averaged 14.0 fish/nm and 0.4 kg/nm (Table 2). Scup diets shift with size from small pelagic crustaceans (copepods) to a variety of benthic species (Steimle et al. 2000). Scup reach sexual maturity at age two and may reach a maximum age of 15 years (Bigelow and Schroeder 1953).

Adults: Adult scup occur in nearshore ocean waters and near the mouth of large bays during the summer, seldom being caught in waters shallower than 1.8 to 3.7 m (Bigelow and Schroeder 1953). They primarily occur in salinities greater than 15 ppt (Steimle et al. 1999d). Scup occur off New Jersey in early May (Grosslein and Azarovitz 1982). Adult scup occur rarely in the New Jersey Inland Bays system from June through October (Stone et al. 1994) but have been reported in waters offshore of Atlantic City (Fowler 1952, Fowler 1920). NMFS autumn bottom trawl surveys from 1963-1996 have collected adult (≥ 16 cm) scup along the New Jersey coast near the project area at densities ranging from 1-10 to 101-1000 fish per tow (Steimle et al. 1999d). They prefer smooth to rocky bottoms however; mixed sand and mud sediments that provide opportunity for preying on small benthic invertebrates are also important habitats. Scup are bottom feeders, adults prey on crustaceans, polychaetes, hydroids, sand dollars, squid and small fish (Bigelow and Schroeder 1953, Bowman et al. 2000). Adult scup cease feeding during spawning. Mid Atlantic Bight scup spawn along the inner continental shelf of southern New England from May to August, peaking from June through July (Steimle et al. 1999d, Grosslein and Azarovitz 1982). Spawning has not been documented south of Barnegat Bay, New Jersey or in the New Jersey Inland Bays system (Stone et al. 1994, Grosslein and Azarovitz 1982).

Scup are jointly managed as a single stock by the ASMFC and the Mid-Atlantic Fishery Management Council under the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (Terceiro 2006a). Scup spawning stock biomass declined from approximately 100,000 mt in 1963 to less than 5,000 mt in the mid-1990s. The scup population age structure became truncated with a low proportion of ages 3 and older fish as stock biomass declined during the 1980s and 1990s. Since 2000, the population age structure has expanded to resemble that observed in the late 1970s. Due to improved recruitment and low fishing mortality rates, spawning stock biomass has increased. The 2008 scup spawning stock biomass was approximately 188,000 mt and was above the SSB_{MSY} proxy of 92,044 mt (Terceiro 2009a, Terceiro 2006a).

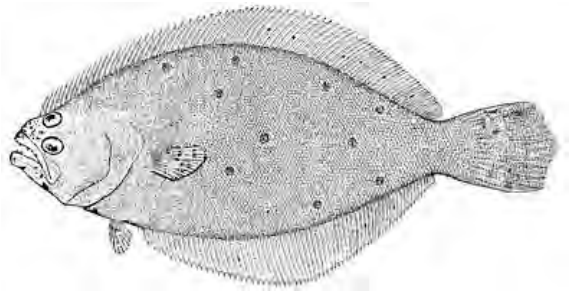
Recruitment averaged 68 million age 0 fish from 1985 to 1995. The 1999 and 2000 year classes were estimated to be the largest in the time series, at 218 and 267 million age 0 fish, respectively. Recruitment has averaged approximately 166 million age 0 fish from 2005 to 2008, and was 192 million age 0 fish in 2008 (Terceiro 2009a).

U.S. commercial scup landings averaged approximately 4,200 mt from 2003 to 2008. U.S. commercial scup landings were 2,343 mt in 2008 (Terceiro 2009a, Terceiro 2006a). Recreational landings represent a significant proportion of the total scup catch. Recreational landings d ranged between approximately 1,200 and 3,800 mt from 2000 to 2008. The 2008 recreational scup landings were about 1,800 mt (Terceiro 2009a, Terceiro 2006a).

New Jersey commercial scup landings have represented more than 18% of the total US commercial scup landings since 2000 (NMFS 2010, Terceiro 2009a). New Jersey commercial scup landings declined to a time series low (1950 to 2008) of 232 mt in 2000, and then increased to approximately 1,046 mt in 2003. New Jersey commercial scup landings were 351 mt in 2008 (NMFS 2010).

Scup juveniles are likely to occur in the project area from June through October. Adult scup could also occur in the project area from June through October since sandy habitats provide foraging opportunities for benthic invertebrate prey.

3.2.1.6 Summer Flounder (*Paralicthys dentatus*)



General: Summer flounder is a commercially valuable, left-sided benthic flatfish that ranges from the eastern portion of Georges Bank to South Carolina and Florida; it is most abundant in the Middle Atlantic Bight from Cape Cod to Cape Hatteras (Bigelow and Schroeder 1953, Collette and Klein-MacPhee 2002, Packer et al. 1999). Larger juveniles and adult summer flounder migrate seasonally in response to water temperature and photoperiod from inshore areas during spring through fall, to the outer continental shelf during winter. Summer flounder are common in the New Jersey Inland Bays system from May through September (Stone et al. 1994), and have been reported offshore near Atlantic City (Fowler 1952, Fowler 1920). The project area is designated EFH for summer flounder egg, larvae, juvenile, and adult life-stages (Table 1).

Eggs: Summer flounder eggs are transparent, spherical, and pelagic. Eggs are found in pelagic waters over depths ranging from 10-110 m with temperatures from 9-23° C (Packer et al. 1999). Egg development rate is temperature-dependent, development rates increase as temperatures increase. Summer flounder eggs have not been documented in the New Jersey Inland Bays system (Stone et al. 1994). NEFSC MARMAP ichthyoplankton surveys from 1978-1987 have collected summer flounder eggs along the New Jersey coast near the project area in October at densities of 10 to < 100 eggs per $10m^2$ of water (Packer et al. 1999).

Larvae: Larvae hatch in the water column at approximately 3.0 mm in length (Martin and Drewry 1978, Colton and Marak 1969) and remain pelagic for several weeks until settling on the bottom. Larvae 2-13 mm are found in pelagic waters at depths of 10-70 m with temperatures between 0-23° C, and salinities less than 35 ‰ (Packer et al. 1999). As larvae and post-larvae migrate back inshore to coastal and estuarine nursery grounds they can be found in shallower areas. Metamorphosis from the larval to juvenile stage occurs in inshore coastal and estuarine areas at a size range 8-18 mm standard length. During or shortly after transformation, juveniles settle onto the benthos where they typically bury themselves in mixed to sandy substrate (Keefe and Able 1994). Summer flounder larvae prey on zooplankton and small crustaceans (Packer et al. 1999). Larvae occur rarely in the New Jersey Inland Bays system from January to May and October to December (Stone et al. 1994). Larvae in the New York Bight were most abundant from October –December, and averaged 1.13 per 100 cubic meters (Appendix Table 1).

Juveniles: Juvenile summer flounder occur in inshore and estuarine soft-bottom habitats, and seem to prefer sandy sediments. Juvenile summer flounder utilize various estuarine habitats including marsh creeks, seagrass beds, mud flats, and open bays with water temperatures between greater than11° C, and a salinities between 10-30 ‰ (Packer et al. 1999, Deubler and White 1962). Juveniles occur year round in the New Jersey Inland Bays system, but are common from May through September (Stone et al. 1994). NMFS bottom trawl surveys have collected juvenile (≤ 28 cm) summer flounder along the New Jersey coast near the project area at densities of 11-50 fish per tow in the autumn (1963-1997), 1-10 fish per tow in the spring (1968-1997), and 1-10 fish per tow in the summer (1964-1995; Packer et al. 1999). Summer flounder are opportunistic feeders, smaller juveniles feed mostly on benthic invertebrates with fish becoming an increasingly important component in the summer flounder diet as they grow (Bowman et al. 2000, Packer et al. 1999).

Adults: Summer flounder north of Cape Hatteras, North Carolina are found in demersal waters over the continental shelf and inshore estuaries (0-25 m) on sandy or muddy bottoms in wide range of salinities during summer months. They are distributed during winter and early spring principally in offshore areas at depths ranging from 70-150 m (Packer et al. 1999, Grosslein and Azarovitz 1982). Adult summer flounder are common from May to September in the New Jersey Inland Bays system, although they occur from April through October (Stone et al. 1994). NMFS bottom trawl surveys have collected adult (> 28 cm) summer flounder along the New Jersey coast near the project area at densities of 51-100 fish per tow in the autumn (1963-1997), 1-10 fish per tow in the spring (1968-1997), and 11-50 fish per tow in the summer (1964-1995; Packer et al. 1999). CPUE of summer flounder from the NJMFA trawl data near the project area was 10.1 fish/nm and 1.3 kg/nm (Table 2). Summer flounder are opportunistic feeders consuming a variety of smaller fish, squids, crabs, shrimp, small mollusks, worms, and sand dollars. Fish prey items include windowpane, winter flounder, northern pipefish, Atlantic menhaden, bay anchovy, red hake, silver hake, scup, Atlantic silverside, American sand lance, bluefish, weakfish, and mummichog (Bowman et al. 2000, Packer et al. 1999). Predators of adult summer flounder are probably large sharks, rays, and goosefish (Bigelow and Schroeder 1953).

Migrating adults generally spawn offshore; however in Southern New England and the Mid-Atlantic spawning begins in September in inshore locations (Packer et al. 1999). Adults first spawn at the end of their third year at approximately 39 cm in length (Packer et al. 1999). Fecundity estimates ranged from 463,000 to 4,188,000 eggs per female for fish between 366 and 680 mm total length (Morse 1981, Packer et al. 1999). Tagging studies indicate that summer flounder migrating inshore return to particular estuaries in subsequent years (Sackett et al.2007, Packer et al. 1999).

Summer flounder are managed jointly by the Atlantic States Marine Fishery Commission and the Mid-Atlantic Fishery Management Council as a single stock from Maine to North Carolina under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (Terceiro 2006b). Summer flounder spawning stock biomass in 2008 was estimated to be 46,029 mt, approximately 77% of the SSB_{MSY} (60,074 mt). Recruitment averaged 42 million age 0 fish from 1982 to 2008. The 2008 year class was estimated to be about 58 million age 0 fish. The fishing mortality rate has been below 1.0 since 1997. The 2008 fishing mortality rate was estimated to be 0.250 and was below the threshold fishing mortality reference point F_{MSY} = F35% = 0.310 (Terceiro 2009b, Terceiro 2006b).

Total U.S. summer flounder commercial landings were restricted to 5,000 mt in 2000 (Terceiro 2001), and have averaged 6,000 mt from 2000 to 2008. Commercial summer flounder landings were 4,143 mt in 2008, approximately 3% over the final 2008 commercial quota. Since 1980, nearly 70% of the

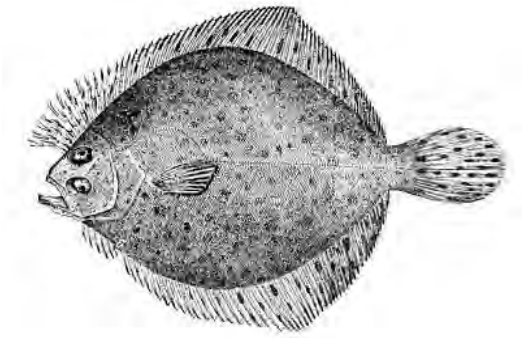
commercial summer flounder landings have come from the Exclusive Economic Zone (greater than 3 miles from shore; Terceiro 2009b).

Summer flounder recreational landings are a significant proportion of the total catch, and exceed commercial landings in some years (Terceiro 2006b). Estimated recreational landings have ranged between 3,800 and 7,100 mt from 1996 to 2005 and were 3,584 mt in 2008 (Terceiro 2009b, Terceiro 2006b).

New Jersey commercial summer flounder landings fluctuated during the 1990s and 2000s ranging between 599 and 1,302 mt with an average of 969 mt. New Jersey commercial summer flounder landings were 815 mt in 2009 (NMFS 2010).

Summer flounder eggs and larvae could occur in the project area in late summer. Juvenile and adult summer flounder are likely in the project area from April through October since they prefer sandy substrate habitats.

3.2.1.7 Windowpane Flounder (*Scopthalmus aquosus*)



General: Windowpane is a left-sided benthic flatfish, ranging from the Gulf of Saint Lawrence to Florida (Gutherz 1967). This species is very abundant in the New Jersey Inland Bays system and offshore waters near Atlantic City (Stone et al. 1994, Chang et al.1999). The project area is designated EFH for windowpane flounder egg, larval, juvenile, and adult life-stages (Table 1).

Eggs: Windowpane eggs are 1-1.4 mm in diameter, buoyant, and pelagic (Colton and Marak 1969). They are found in surface waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras at depths less than 70 m with sea surface water temperatures less than 20° C (Chang et al.1999). Windowpane eggs occur in the New Jersey Inland Bays system from April to September, and are highly abundant from May through August (Stone et al. 1994). NEFSC MARMAP ichthyoplankton surveys from 1978-1987 have collected windowpane eggs along the New Jersey coast near the project area from March through July at densities ranging from 1 to < 10 to 100 to < 1000 eggs per $10m^2$ of water and from September through November at densities ranging from 10 to < 100 to 100 to < 1000 eggs per $10m^2$ of water (Chang et al.1999). Eggs hatch in 8 days at water temperatures of approximately 12° C (Martin and Drewry 1978). Larvae are approximately 2 mm TL at hatching (Colton and Marak 1969, Chang et al.1999).

Larvae: Windowpane larvae habitat is pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras at depths less than 70 m with sea surface water temperatures less than 20° C. Larval distribution reflects egg spatial and temporal distributions (Chang et al.1999). Windowpane larvae are common in the New Jersey Inland Bays system from May through October (Stone et al. 1994). NEFSC MARMAP ichthyoplankton

surveys from 1977-1987 have collected windowpane larvae along the New Jersey coast near the project area from May to June at densities ranging from 1 to < 10 to 10 to 76 larvae per $10m^2$ of water and from October to November at densities of 10 to < 100 larvae per $10m^2$ of water (Chang et al.1999). In the New York Bight, larvae averaged 2.76 per 100 cubic meter and were present from May to December (Appendix Table 1). Larvae remain pelagic up to about 10 mm TL after which they settle on the bottom and develop into juveniles. Larvae are 13 mm TL at metamorphosis (Colton and Marak 1969).

Juveniles: Juvenile windowpane are found on muddy and fine sandy sediment at depths less than 100 m at water temperatures less than 25° C, and salinities between 5.5-36 ‰ (Chang et al.1999). Juvenile windowpane are highly abundant year-round in the New Jersey Inland Bays system (Stone et al. 1994). NMFS bottom trawl surveys have collected juvenile (< 22 cm) windowpane along the New Jersey coast near the project area at densities of 1-25 fish per tow in the autumn (1963-1996), and 1-10 to 10-25 fish per tow in the spring (1968-1997). Juvenile windowpane were present near the project area in the winter and summer trawl surveys (Chang et al. 1999). The primary food items for juvenile windowpane are amphipods, mysids, and decapod shrimp (Bowman et al. 2000, Chang et al. 1999). Predators of juvenile windowpane include Atlantic cod, black sea bass, monkfish, spiny dogfish, summer flounder, and weakfish (Chang et al. 1999).

Adults: Adults and spawning adults are found on mud or fine-grained sand bottom habitats at depths 1-75 m with water temperatures less than 26.8° C (adults) and 21° C (spawning adults), and salinities between 5.5-36 ‰ (Chang et al. 1999). Spawning takes place in two egg production peaks in the Middle Atlantic Bight, one in May-June, the other in September (Wilk et al. 1990, Morse and Able 1995, Smith et al. 1975). Adult windowpane are highly abundant year-round in the New Jersey Inland Bays system with abundant spawning documented from May through August (Stone et al. 1994). Windowpane have been reported offshore near Atlantic City (Fowler 1952, Fowler 1920). NMFS bottom trawl surveys have collected adult (≥ 22 cm) windowpane along the New Jersey coast near the project area at densities of 1-25 fish per tow in the autumn (1963-1996), and ranging from 50-100 to 500-1121 fish per tow in the spring (1968-1997). This is confirmed by NJMFA trawl data from the project area, which averaged 52.8 fish/nm and 10.1 kg/nm (Table 2). Adult windowpane were present near the project area in the winter and summer trawl surveys (Chang et al. 1999). Adult primary food items consist of small crustaceans, a variety of fish larvae, and polychaetes (Bowman et al. 2000, Chang et al. 1999). Windowpane diet in the Middle Atlantic Bight primary consists of mysids (especially *Neomysis)*, *Crangon*, small fish, and squid (Steimle et al. 2000, Bowman et al. 2000, Langton and Bowman 1981). A shift in prey consumption has been documented with windowpane growth. Small windowpane (less than 20 cm total length) consumed primarily *Neomysis*, larger windowpane consumed an increasing amount of *Crangon* and small fish (Steimle et al. 2000).

Windowpane are managed by the New England Fishery Management Council under the Multispecies Fishery Management Plan as two stocks: Gulf of Maine-Georges Bank and Southern New England-Mid-Atlantic Bight (Hendrickson 2006). Windowpane have limited commercial value due to its very thin body that does not grow particularly large. Southern New England-Mid-Atlantic Bight windowpane biomass indices have remained relatively stable from 1994 to 2007 at very low levels ranging from 0.1 to 0.33 kg per tow (Hendrickson 2006, Mayo and Terceiro 2005). The 2007 relative biomass index (0.19 kg per tow) was below the B_{MSY} proxy of 0.34 kg per tow (NEFSC 2008). Windowpane relative exploitation indices have been very low with an average of 0.63 from 1994 to 2004 (Hendrickson 2006). Relative fishing mortality rates gradually increased from 2002 to 2006 and were above the F_{MSY} proxy (1.47) in 2006 and 2007. The 2007 relative fishing mortality rate was 1.85 indicating that overfishing was

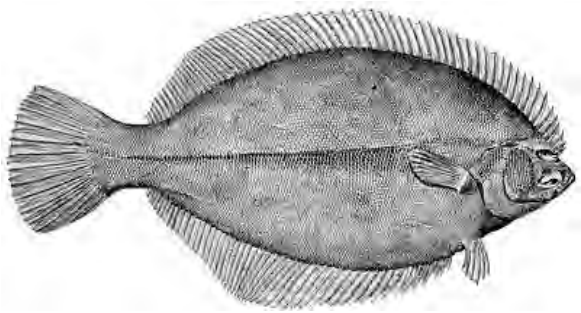
occurring in 2007. The Southern New England-Mid-Atlantic Bight windowpane stock has been unable to replace itself since 2003 as relative biomass indices have been at very low levels since 1989 (NEFSC 2008). Commercial landings of windowpane flounder were suspended effective May 1, 2010 (NOAA 2010).

Southern New England-Mid-Atlantic Bight windowpane commercial ranged from 100 and 200 mt during 1996 to 2001, and then declined remaining below 100 mt since 2002. A time series low 39 mt was reported in 2005. Southern New England-Mid-Atlantic Bight windowpane commercial landings were 81 mt in 2007 (Hendrickson 2006, NEFSC 2008). Southern New England-Mid-Atlantic Bight landings were predominately taken in Southern New England, south of Cape Cod from 1975 to 1994. After 1995, landings primarily occurred in the waters surrounding Long Island (NEFSC 2008). Recreational landings are negligible (Hendrickson 2006).

New Jersey commercial windowpane landings averaged 0.7 mt from 1971 through 1995, peaked at 51 mt in 2001, declined to 11.4 mt in 2003, and averaged approximately 17 mt from 2004 to 2008. The 2008 New Jersey commercial windowpane landings were 17 mt (NMFS 2010).

Windowpane eggs could occur in the project area from April through July, and September through November. Windowpane larvae could occur in the project area from May through June, and October through November. Juvenile and adult windowpane could occur year round in the project area since it contains their preferred sand bottom habitat.

3.2.1.8 Winter Flounder (*Pseudopleuronectes americanus*)



General: Winter flounder is an economically important flatfish that occurs in coastal waters from the Strait of Belle Isle, Newfoundland south to Georgia (, Collette and Klein-MacPhee 2002). Winter flounder are ubiquitous in inshore areas from Massachusetts to New Jersey and considered abundant in New Jersey waters (Stone et al. 1994). Wuenschell et al. (2009) found that in nearshore New Jersey waters, winter flounder were most abundant off Sandy Hook in the winter and spring, and were infrequently collected off southern New Jersey. The project area is designated EFH for winter flounder egg, larval, juvenile, and adult life-stages.

Eggs: Winter flounder eggs are demersal and adhesive, about 0.7 to 0.9 mm in diameter. They are deposited on sand, muddy sand, mud, and gravel bottom substrates, in depths less than 5 m (<16 ft), at water temperatures less than 10° C, and salinities from 10-30 ‰ (Pereira et al. 1999). Winter flounder eggs are common in the New Jersey Inland Bays system from January through March (Stone et al. 1994).

Larvae: Winter flounder larvae are pelagic and range from 2.3 to 3.5 mm TL at hatching (Sullivan 1915, Pearcy 1962). Larvae inhabit inshore areas with depths less than 6 m (<20 ft), sea surface temperatures less than 15° C, and salinities from 4-30 ‰ (Pereira et al. 1999). Winter flounder larvae do not disperse

far from egg habitat and remain in close association with the bottom (Pearcy 1962). Larvae transform into juveniles and assume a benthic habit, at 6.6 to 10 mm TL (Chambers and Leggett 1987). Winter flounder larvae are common in the New Jersey Inland Bays system from January through April (Stone et al. 1994). Larvae were collected in the New York Bight in March and April, with an annual average of 0.13 per 100 cubic meters (Appendix Table 1).

Juveniles: Juvenile winter flounder inhabit mud or fine-grained sand bottom habitats. Young-of-the-year (YOY) juveniles are found in water temperatures below 28° C, depths from 0.1-10 m, and salinities between 5-33 ‰. Age 1+ juveniles inhabit waters from 1-50 m, at temperatures below 25° C, and salinities between 10-30 ‰ (Pereira et al. 1999). Juvenile winter flounder are common year round in the New Jersey Inland Bays system (Stone et al. 1994). Juvenile winter flounder prey on a wide variety of invertebrate food items including polychaetes, amphipods and shrimp. Winter flounder usually mature at age 2 to 3 (Perlmutter 1947, O'Brien et al. 1993) however, in the northern areas of its range maturity may not occur until age 6 or 7 (Kennedy and Steele 1971). The complex stock structure of winter flounder complicates maturity comparisons as a result interpretations of winter flounder maturity data should be treated with caution (O'Brien et al. 1993).

Adults: Adult winter flounder inhabit mud or fine-grained sand bottom habitats at depths from 1-100 m with water temperatures less than 25° C, and salinity between 15-33 ‰ (Pereira et al. 1999). They occur in the New Jersey Inland Bays from January to May and October to December (Stone et al. 1994). NJMFA trawl data collected an average of 10.4 winter flounder per nm, weighing an average of 1.3 kg (Table 2).

Adult flounder eat primarily polychaete worms, amphipods, isopods, pelecypods, and plant material. Winter flounder generally migrate to deeper cooler water in summer and return to shallow nearshore areas in fall, in response to changes in water temperature (McCracken 1963). Howe and Coates (1975) showed that flounder south of Cape Cod dispersed in spring and summer in a southeasterly direction generally beyond the territorial limit; little mixing occurred between Georges Bank and the inshore areas.

Winter flounder spawn at night (Breder 1922, Stoner et al. 1999) in inshore waters from November to June depending on geographic location. In southern New England they typically spawn from January through April. Spawning adults prefer sand, muddy sand, mud, or gravel substrate at depths less than 6 m, with water temperatures less than 15° C, and salinities between 5.5-36 ‰ (Pereira et al. 1999). Fecundity estimates range from 99,000 to 2.6 million eggs (Saila 1962, Kennedy and Steele 1971) depending on size. Females produce one batch of eggs per year which is released over multiple spawning events (Stoner et al. 1999).

Winter flounder are managed as three stocks in U.S. waters: Gulf of Maine, southern New England-Middle Atlantic, and Georges Bank. U.S. commercial and recreational fisheries are managed in federal waters by the New England Fishery Management Council under the Multispecies Fishery Management Plan and in state waters by the Atlantic States Marine Fisheries Commission (ASMFC) under the Fishery Management Plan for Inshore Stocks of Winter Flounder (Hendrickson et al. 2006). The southern New England-Mid-Atlantic winter flounder stock occurs in the project area and is considered overfished (NEFSC 2008). Commercial fishing of this stock were suspended on May 1, 2010 (NOAA 2010). Spawning stock biomass was estimated to be 3,368 mt in 2007, approximately 9% of the SSB_{MSY} target reference point of 38,761 mt (NEFSC 2008), indicating gross overfishing. Recruitment at age 1 has ranged from 57 million fish in 1982 (age 1 in 1983) to 3.6 million fish in 2006 (age 1 in 2007). Over the 1982-2007 period, the geometric mean recruitment was approximately 18 million fish. The 2007 year

class (age 1 in 2008) was estimated to be 8.8 million fish (Hendrickson et al. 2006, NEFSC 2008). Average fishing mortality (ages 4-5 unweighted) ranged from 0.5 to 1.5 during the 1980s through the mid 1990s, and has declined since 1997 with a record low of 0.38 in 2004 (Hendrickson et al. 2006). The 2007 fishing mortality rate was estimated to be 0.649, over twice the F_{MSY} proxy (F40%) of 0.248.

Southern New England-Mid-Atlantic Bight recreational landings have remained below 1,000 mt since 1991. Recreational landings were estimated to be 116 mt in 2007, a 1981 to 2007 time series low. Most recreational landings occur during January to June with private and rental boats being the principal fishing mode (NEFSC 2008).

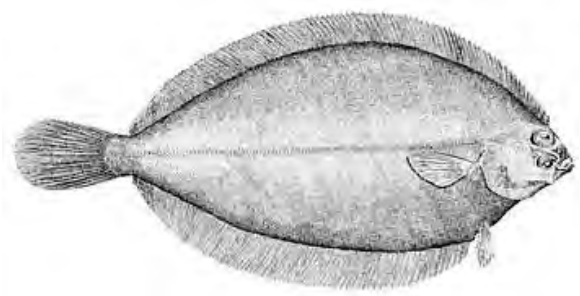
New Jersey commercial winter flounder landings averaged 135 mt from 2004 through 2008. New Jersey commercial winter flounder landings were 94 mt in 2008 (NMFS 2010).

The project area around the six turbines is 26-40 ft below mean low water. This is deeper than the identified EFH for winter flounder eggs of less than 16 ft (<5 m) and the EFH for larvae of less than 20 ft (<6 m). Therefore the project area around the turbines is not EFH for winter flounder eggs and larvae. The cable route will include nearshore areas with depths that are EFH for winter flounder eggs and larvae. As HDD will be used to install the cable from land to the 15-foot depth contour, winter flounder egg habitat will be disturbed by jet plowing between 15 ft. and 16 ft. depths. Similarly, winter flounder larvae habitat will be disturbed from cable installation between 15 ft. and 20 ft. depths. An estimated 6,000 square feet (0.14 acres) of winter flounder egg EFH, and an estimated 16,400 sq. ft (0.38 acres) of winter flounder larvae EFH will be temporarily disturbed during construction, but there will be no permanent loss of habitat. The HDD that starts at a depth of approximately 15 ft. (4 m) provides substantial mitigation for the loss of winter flounder egg and larval EFH.

The project area around the turbines and the cable route to shore are EFH for juvenile and adult winter flounder. Construction in these areas will result in the temporary disturbance of 3.66 acres during construction and the permanent loss of 0.02 acres (923 ft^2) due to the footprint of the turbine foundations.

Winter flounder eggs and larvae are likely to occur in the project area from January to April. Juvenile and adult winter flounder are likely to occur in the project area year round since it contains the fine-grained sandy substrate which is their preferred habitat.

3.2.1.9 Witch Flounder (*Glyptocephalus cynoglossus*)



General: Witch flounder is right-eyed, small-mouthed flounder that occurs in moderately deep water on both sides of the North Atlantic. They range from the Strait of Belle Isle, Newfoundland to Cape Hatteras, North Carolina in the western Atlantic (Cargnelli et al. 1999a, Collette and Klein-MacPhee 2002). The project area is designated EFH for the witch flounder egg life-stage (Table 1).

Eggs: Witch flounder spawn in the Middle Atlantic Bight at or near the bottom in dense aggregations at temperatures between 0-10° C from April to August with a peak in May or June (Cargnelli et al. 1999a, Smith et al. 1975). Witch flounder eggs are buoyant, 0.67-1.45 mm in diameter, and occur in surface waters from southwest Nova Scotia to Cape Hatteras at 10-170 m and temperatures between 4-17° C (Cargnelli et al. 1999a, Burnett et al. 1992, Bigelow and Schroeder 1953). Larvae hatch at 3.5 to 5.6 mm in length (Colton and Marak 1969) 7 to 8 days after spawning when water temperatures are 7.8 to 9.4° C (Bigelow and Schroeder 1953). NEFSC MARMAP ichthyoplankton surveys from 1978 – 1987 collected witch flounder eggs along the New Jersey coast near the project area in April at densities of 1 to <10 eggs per $10m^2$ (Cargnelli et al. 1999a).

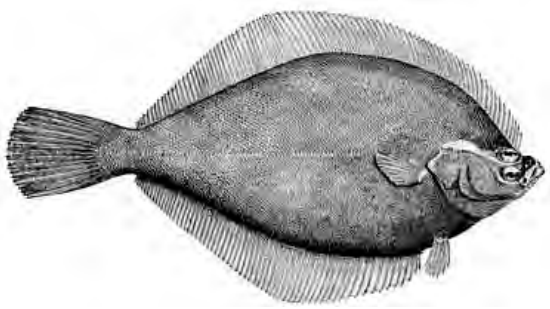
Adults: Witch flounder are managed as a single stock from the Gulf of Maine southward under the New England Fishery Management Council under the Northeast Multispecies Fishery Management Plan (Wigley and Col 2006, NEFSC 2008). The witch flounder stock is considered overfished (NEFSC 2008). Spawning stock biomass has declined to steadily 3,434 mt in 2007, 30% below the SSB_{MSY} of 11,447 mt. The spawning stock biomass age structure remained truncated in 2007 compared to MSY conditions. The 2007 fishing mortality was 0.29, 45% above F_{MSY} (F=0.20) but below the 1982-2007 time series average of 0.58 (NEFSC 2008).

The majority of U.S. commercial witch flounder landings are taken from the Georges Bank and Gulf of Maine regions with otter trawl gear. U.S. landings increased from 976 mt in 1962 to peak at 6,660 mt in 1984, then declined to 1,467 mt in 1990 and have since fluctuated at approximately 2,300 mt. The 2007 U.S. witch flounder landings were 1,075 mt (NEFSC 2008).

New Jersey commercial witch flounder landings peaked at approximately 41 mt in 1982 and have been variable since then. New Jersey commercial witch flounder landings were 9.4 mt in 2007 (NMFS 2010).

Witch flounder eggs could occur in the project area in April when water temperatures are between 4 to 17° C.

3.2.1.10 Yellowtail Flounder (*Limanda ferruginea*)



General: Yellowtail flounder range in the western Atlantic from Labrador to the Chesapeake Bay. They are most abundant on the western half of Georges Bank, the western Gulf of Maine, east of Cape Cod, and southern New England (Collette and Klein-MacPhee 2002). The project area is designated EFH for yellowtail flounder egg and larval life-stages (Table 1).

Eggs: Yellowtail flounder eggs are found in the surface waters of Georges Bank, Massachusetts Bay, Cape Cod Bay, and southern New England. Yellowtail flounder eggs are 0.79-1.01 mm in diameter (Colton and Marak 1969), pelagic, and occur in surface waters from 10-750 m at temperatures < 15° C with salinities of 32.4 – 33.5 ‰ (Johnson et al. 1999). Egg incubation times range from 4.5-14.5 days

(Walsh 1992, Miller et al. 1991), larvae hatch at 2.0-3.5 mm TL (Fahay 1983, Colton and Marak 1969). NEFSC MARMAP ichthyoplankton surveys from 1978 - 1987 collected yellowtail flounder eggs along the New Jersey coast near the project area in March and April at densities of 1 to <10 eggs per $10m^2$ (Johnson et al. 1999).

Larvae: Larvae occur primarily in waters 10-90 m deep, with surface temperatures between 5-17° C, and salinities of 32.4 – 33.5 ‰ (Johnson et al. 1999). The pelagic stage is brief and transformation occurs at 11.6-16.0 mm standard length (Fahay 1983). NEFSC MARMAP ichthyoplankton surveys from 1978 - 1987 collected yellowtail flounder larvae along the New Jersey coast near the project area from April to June at densities ranging from 1 to <10 to 10 to < 100 larvae per $10m^2$ (Johnson et al. 1999). In the New York Bight, larvae occurred from April to July, averaging 3.44 per 100 cubic meters.

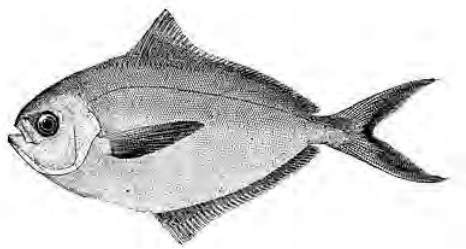
Adults: Yellowtail flounder are managed as three stocks: Georges Bank, Cape Cod-Gulf of Maine, and the Southern New England-Mid-Atlantic by the New England Fishery Management Council under Multispecies Fishery Management Plan (Legault and Cadrin 2006). The Southern New England-Mid-Atlantic yellowtail flounder stock is considered overfished and overfishing is occurring (NEFSC 2008). Northeast Fisheries Science Center (NEFSC) 1973-2008 winter, spring, and fall bottom trawl survey trends indicate stock biomass has remained low since the early 1990s. stock biomass has increased slightly in recent years, however the 2007 spawning stock biomass was 3,508 mt, 13% of SSBMSY (27,400 mt). Fishing mortality has declined since 2005 and is at the lowest levels reported in the 1973-2007 time series. The fishing mortality was 0.413 in 2007, 160% of FMSY (0.254; NEFSC 2008).

The yellowtail flounder U.S. commercial landings have been below 500 mt since 2003. Southern New England-Mid-Atlantic commercial yellowtail flounder landings were 209 mt in 2007 (NEFSC 2008). Recreational landings are considered negligible (Legault and Cadrin 2006).New Jersey commercial yellowtail flounder landings have been below 200 mt since 1984 and were 1.5 mt in 2004 (NMFS 2010).

Yellowtail flounder eggs could occur in the project area from March to April when water temperatures are below 15° C. Yellowtail flounder larvae could occur in the project area from April to June when water temperatures are between 5-17° C.

3.2.2 Coastal Pelagic Species

3.2.2.1 Atlantic Butterfish (*Peprilus triacanthus*)



General: Atlantic butterfish is a fast-growing, short-lived, schooling, pelagic species ranging from the Gulf of St. Lawrence south to Florida (Bigelow and Schroeder 1953). They are found over the entire Mid-Atlantic shelf in the summer and autumn, and aggregate along the edge of the continental shelf where water temperatures remain relatively warm in response to seasonal cooling (Grosslein and Azarovitz 1982). Butterfish are most abundant from the Gulf of Maine to Cape Hatteras (Bigelow and Schroeder 1953, Overholtz 2006a). The project area is EFH designated for the Atlantic butterfish juvenile life-stage (Table 1).

Juveniles: Small juvenile butterfish (less than30 mm) are pelagic and often form loose schools near the surface in association with flotsam and large jellyfish where they are protected from larger fish (Cross et al. 1999, Mansueti 1963, Bigelow and Schroeder 1953). Larger juveniles are found over sand and muddy substrate at depths between 10-365 m with water temperatures between 3-28° C (Cross et al. 1999). Juvenile butterfish are common in the New Jersey Inland Bays system from June through October (Stone et al. 1994). NEFSC fall bottom trawl surveys from 1963-1997 collected juvenile butterfish along the New Jersey coast near the project area at densities of 6 to 50 fish per tow (Cross et al. 1999). CPUE of butterfish from the NJMFA trawl data near the project area was 130.0 fish/nm and 3.8 kg/nm (Table 2).Butterfish begin to reach sexually maturity at age 1, all fish are mature by age 2 (DuPaul and McEachran 1973).

Butterfish consume primarily pelagic prey including thaliaceans, ctenophores, mollusks, small fish, squid, crustaceans, and polychaetes (Cross et al. 1999, Bowman et al. 2000). Butterfish predators include 30 species of fish (silver hake, bluefish, goosefish, weakfish, sharks, swordfish) and long-finned squid (Bowman et al. 2000, Rountree 1999).

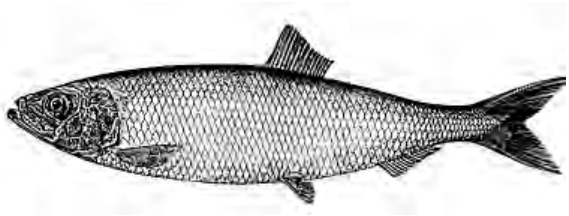
Adults: Atlantic butterfish are managed as a single stock by the Mid-Atlantic Fishery Management Council under the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (Overholtz 2006a). Atlantic butterfish spawning and recruit biomasses have been highly variable during the 1974 through 2008 time series and have declined since 1975. Total butterfish biomass averaged 102,200 mt from 2000 to 2008; spawning biomass averaged 67,600 mt and recruit biomass averaged 34,600 mt during the same time period. In 2008, total stock biomass was estimated to be 88,800 mt with a spawning biomass of 45,000 mt and a recruit biomass of 38,800 mt (NEFSC 2010b). Butterfish spawning biomass is strongly dependent on recruitment since this species is short-lived, matures early (A50 = 1 year), and has a high natural mortality rate (assumed M= 0.8). Spawning biomass and recruitment have continued to decline although fishing mortality has been very low relative to natural mortality for over 20 years. The cause of the poor recruitment is currently unknown (NEFSC 2010b).

Atlantic butterfish landings have declined since 1985 and have remained below 1,000 mt since 2002. Beginning in 2002, butterfish have been landed as bycatch primarily in the small-mesh bottom trawl fishery for squid. Butterfish discards in fisheries targeting other species comprised more than half the total landings over the last twenty years. Landings during 2002-2008 ranged from 400 and 900 mt. The 2008 landings were 451 mt (NEFSC 2010b).

U.S. commercial landings from 1965-2002 averaged 3,200 mt per year, and peaked at 11,972 mt in 1984 (Overholtz 2006a). Recreational landings are negligible (NEFSC 2010b, Overholtz 2006a). Fishing mortality has been below 0.05 since 2002 (NEFSC 2010b). New Jersey commercial butterfish landings averaged 71 mt from 2000 to 2008. New Jersey commercial butterfish landings were 15 mt in 2009, a 1950-2009 time series record low (NMFS 2010).

The butterfish juvenile life-stage could occur in the project area from June through October when water temperatures are between 10 and 28° C.

3.2.2.2 Atlantic Sea Herring (*Clupea harengus*)



General: Atlantic herring is a schooling, pelagic, commercially important coastal species ranging from northern Labrador to North Carolina in the western Atlantic (Collette and Klein-MacPhee 2002). In U.S. waters they are managed and assessed as a single stock complex with two spawning components: the Gulf of Maine and the Georges Bank-Nantucket Shoals. Atlantic herring undergo extensive north-south migrations associated with feeding, spawning, and overwintering. Atlantic herring occur year round in the New Jersey Inland Bay system (Stone et al. 1994) and have been documented in offshore New Jersey waters near Atlantic City (Fowler 1952, Stevenson and Scott 2005). The project area is designated EFH for Atlantic herring juvenile and adult life-stages (Table 1).

Juveniles: Juvenile Atlantic herring occur in pelagic and bottom waters ranging in depth from 15-135 m, with temperatures less than 10° C, and salinities from 26-32 ‰ (Reid et al. 1999). Atlantic herring larvae metamorphose into juveniles at 40-50 mm TL and begin schooling behavior. Juveniles occur year round in the New Jersey Inland Bays system, but are most abundant from April to June (Stone et al. 1994). NEFSC spring bottom trawl surveys from 1968-2003 collected juvenile (<25 cm) Atlantic herring near the project area at densities of 1-100 juveniles per tow (Stevenson and Scott 2005). Juvenile herring do not make seasonal north-south migrations but overwinter in deep bays or near the bottom in offshore areas. They move to overwintering habitats in southern New England and throughout the Middle Atlantic Bight during late summer and fall (Reid et al. 1999). Juvenile Atlantic herring prey on 15 different groups of zooplankton, the most predominate groups were copepods, decapod larvae, barnacle larvae, cladocerans, and pelecypod larvae (Sherman and Perkins 1971). Atlantic herring mature at 3 years of age and 23 cm (O'Brien et al. 1993).

Adults: Adult Atlantic herring occur in pelagic and bottom waters at depths ranging from 20-130 m with temperatures less than 10° C, and salinities greater than 28 ‰ (Reid et al. 1999). Adults occur year round in the New Jersey Inland Bays system, but are most abundant in January, November, and December (Stone et al. 1994). NEFSC spring bottom trawl survey from 1968-2003 collected adult (≥25 cm) Atlantic herring near the project area at densities ranging from 1-10 to 11-100 fish per tow (Stevenson and Scott 2005). CPUE of Atlantic herring from the NJMFA trawl data near the project area was 57.2 fish/nm and 10.2 kg/nm (Table 2).The adult diet includes copepods, euphausiids, decapods, and bivalve larvae (Sherman and Perkin 1971, Stevenson and Scott 2005). Herring predators include short-finned squid, a large variety of piscivorous fish (cod, monkfish, bluefish, silver hake, striped bass, mackerel, and tuna), elasmobranchs, marine mammals, and seabirds (Bigelow and Schroeder 1953, Bowman et al. 2000, Stevenson and Scott 2005). Adult herring undergo extensive migrations associate with feeding, spawning, and overwintering. Atlantic herring spawn in the Gulf of Maine- Georges Bank region over rocky or gravel bottoms from July to December, occurring progressively later with decreasing latitude (Overholtz et al.2004, Stevenson and Scott 2005). Females can produce 44,000 to 250,000 demersal eggs depending on their age and size (Morse and Morris 1981, Kelly and Stevenson 1985).

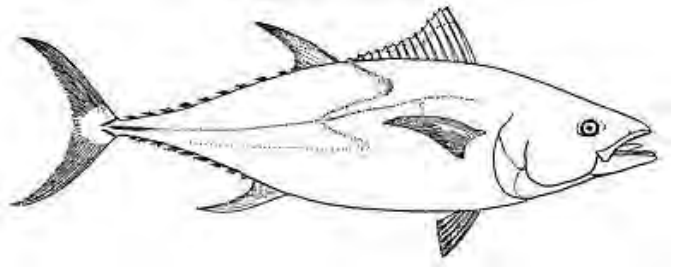
Atlantic herring is a highly valued commercial fish harvested by both domestic and foreign fishing fleets. The species is managed as a single stock complex for the Gulf of Maine and Georges Bank by the Atlantic States Marine Fishery Commission and the New England Fishery Management Council under the Interstate Fishery Management Plan for Atlantic herring (ASMFC 2009a). The Georges Bank spawning stock reached a peak of 1.4 million mt in 1967 (Grosslein and Azarovitz 1982), decreased by 1973 to about one-tenth of the 1967 level due to heavy fishing and only average or poor recruitment to the stock, and by 1977 the stock collapsed. The 2009 comprehensive Atlantic sea herring stock complex assessment showed that total biomass (age 2+, January 1st) fluctuated without trend after a steady increase from 1982 (111,600 mt) through 1997 (830,000 mt). Total biomass (652,000 mt) was below B_{MSY} (670,600 mt) in the beginning of 2008. Recruitment from the 1999-2000, 2003, 2004, and 2006 year classes were weaker than the long-term (1967-2005) average of 2.3 billion fish. The 2005 year class abundance estimate (3.3 billion fish) appears to be above average (ASMFC 2009a).Total landings averaged 109,000 mt during 2002-2005 (Overholtz 2006b, ASMFC 2009a). In 2008, total landings were 90,000 mt. Fishing mortality rates have remained below F_{MSY} (0.27) since 1990 and have been stable at approximately 0.16 since 2002. The 2008 fishing mortality rate was 0.14 (ASMFC 2009a).

U.S. landings averaged 95,000 mt during 2002-2005 and 89,000 mt from 2005-2008 (Overholtz 2006b, ASMFC 2009a). The 2008 U.S. Atlantic herring landings were 83,600 mt. New Jersey commercial Atlantic herring landings were 3.8% of the coastwide U.S. landings in 2008 (ASMFC 2009a). New Jersey commercial Atlantic herring landings have fluctuated since 1990, then declined to a 1950-2007 time series low of 0.6 mt in 2005. New Jersey commercial Atlantic herring landings were 2,740 mt in 2007 (NMFS 2010).

Juvenile and adult Atlantic herring could occur year-round in the project area; however they are mostly likely to occur in the project area during winter and spring (November to May) when water temperatures are below 10° C.

3.2.3 Coastal Migratory Species

3.2.3.1 Bluefin Tuna (*Thunnus thynnus*)



General: Atlantic bluefin tuna is a large, epipelagic, highly migratory, piscivorous species. They inhabit the warmer parts of the Atlantic, north regularly to Hamilton Inlet, Labrador, and the west, south, and southeast coasts of Newfoundland in the western Atlantic (Collette and Klein-MacPhee 2002). Bluefin tuna are annual visitors to the Gulf of Maine. They generally appear in southern New England and coastal New Jersey waters by the middle to end of June and July (Collette and Klein-MacPhee 2002, Fowler 1952). The project area is designated EFH for Atlantic bluefin tuna juvenile life-stage (Table 1).

Juveniles and adults: Juveniles and subadults (<145 cm TL) inhabit all inshore and pelagic surface waters at depth between 25-200 m with temperatures > 12° C in the Gulf of Maine from Cape Ann, MA (approximately 42.75° N) east to 69.75° W continuing south to and including Nantucket Shoals at 70.5°

W to Cape Hatteras, NC (approximately 35.5° N) (Collette and Klein-MacPhee 2002). No bluefin tuna were collected by NJMFA near the project area from 1998 through 2010 (Table 2).

Bluefin tuna consume mainly fishes, squids, crustacean, salps, and other invertebrates. The size cohorts 52-102 cm and 160-267 cm feed primarily on fishes (Scombridae, Bramidae and Myctophidae) and squids (Dragovich 1970, Eggleston and Bochenek 1989, Chase 2002). Tuna predators include white shark, longfin and shortfin mako sharks, and bluefish (Bigelow and Schroeder 1953, Bowman et al. 2000).

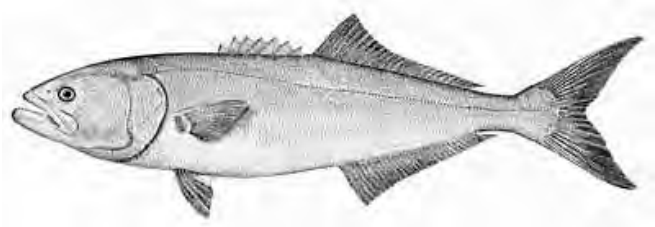
Atlantic bluefin tuna are managed domestically by the NOAA Fisheries Service Highly Migratory Species Management Division under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan and internationally by the International Commission for the Conservation of Atlantic Tunas (ICCAT). The ICCAT manages Atlantic bluefin tuna as two stocks: the western Atlantic and the eastern Atlantic-Mediterranean. The western Atlantic bluefin tuna stock is considered overfished and overfishing is occurring (NMFS 2010, HMSMD 2009). Atlantic bluefin tuna in U.S. waters have been designated an Endangered Species Act candidate (NOAA 2010). Western Atlantic bluefin tuna spawning stock biomass declined from 1970 to 1992 and has since fluctuated between 21% and 29% of the 1970 level (approximately 50,000 mt). Spawning stock biomass increased from the low of 21% in 2003 (10,500 mt) to an estimated 29% in 2009 (14,500 mt). Recruitment estimates have been without trend since 1977. A strong year-class was observed in 2003, the largest estimated since 1974. Fishing mortality has varied over time depending on the size of fish targeted by the various fishing fleets. Fishing mortality on tuna ages 9 and older (spawners) declined after 2003. Assuming a low recruitment scenario current fishing mortality (2006-2008) was estimated to be 0.73, 70% of the MSY level (2,585 mt), and the SSB_{2009} is about 10% higher than the MSY level. If a high recruitment scenario is considered, stock status estimates are more negative ($F_{2006\text{-}2008}/F_{MSY}$=1.9, B_{2009}/B_{MSY}=0.15; ICCAT 2010).

The reported western Atlantic total catch of Atlantic bluefin tuna increased from approximately 2,600 mt in 1998 to 3,300 mt in 2002, decreased to 1,638 mt in 2007, and increased to 2,000 mt in 2008. The western Atlantic total catch of Atlantic bluefin tuna was 1,935 mt in 2009 (ICCAT 2010).

New Jersey commercial Atlantic bluefin tuna landings averaged approximately 39 mt from 1976 to 2000, and 6.5 mt from 2000 to 2007. New Jersey commercial Atlantic bluefin tuna landings were 7.1 mt in 2007 (NMFS 2010).

Juvenile Atlantic bluefin tuna could occur in the project area during late spring and summer when water temperatures are greater than 12° C.

3.2.3.2 Bluefish (*Pomatomus saltatrix*)



General: Bluefish are an oceanic migratory pelagic species, inhabiting both inshore and offshore temperate and warm temperate continental shelf waters of the world (Bigelow and Schroeder 1953, Briggs 1960). In North America, bluefish range from Nova Scotia to Florida and also occur in the Gulf of Mexico from Florida to Texas. Seasonal distribution and spawning area information indicate northwest Atlantic and Gulf of Mexico stocks are separated, although some intermingling may occur (MAFMC

1998). They travel in large schools of like-size fish (Grosslein and Azarovitz 1982) generally moving north in spring and summer, south in autumn and winter, influenced by water temperature and photoperiod (Olla and Studholme 1971). They migrate into Mid-Atlantic waters in mid-to-late May and return to deeper offshore waters along the southeastern coast of Florida in November (Stone et al. 1994). The project area is designated EFH for bluefish eggs, juvenile and adult life-stages (Table 1).

Eggs: Bluefish eggs are 0.8-1.20 mm in diameter (Hardy 1978), pelagic, and occur in southern New England to Cape Hatteras mid-shelf waters from 30-70 m at temperatures between 18-22° C with salinities of > 31.0 ‰ (Fahay et al. 1999). Egg incubation times vary with temperature, at 18.0-22.2° C hatching occurs in 46 to 48 hours (Deuel et al. 1966, Hardy 1978). Bluefish eggs do not occur in estuarine waters and have not been documented in the New Jersey Inland Bays system (Stone et al. 1994). NEFSC MARMAP ichthyoplankton surveys from 1978 - 1987 have collected bluefish eggs along the New Jersey coast near the project area in July at densities of 1 to 24 eggs per $10m^2$ (Fahay et al. 1999).

Juveniles: Juvenile bluefish are found in pelagic water, nearshore areas, and estuaries with water temperatures between 19-24° C and salinities between 23-36 ‰. In estuaries, they are known to be associated with sand, mud, clay, *Ulva* and *Zostera* beds, and *Fucus* bottom habitats (Fahay et al. 1999). They are occur in the New Jersey Inland Bays system from May through November, but are most abundant from June through October (Stone et al. 1994). Bluefish reach sexual maturity during their second year of life. Juvenile bluefish are opportunistic and prey on available items ranging from crustaceans and polychaetes to fish. Juvenile bluefish aggressively feed on a variety of macroinvertebrates (including *Neomysis* spp*., Crangon* spp., *Nereis spp*., and squid) and fish (including bay anchovy, round herring, Atlantic silverside, and butterfish) that are locally abundant (Friedland et al. 1988, Buckel et al.1999a, Bowman et al. 2000, Shepherd and Packer 2006).

Adults: Adult bluefish occur in oceanic, nearshore, and continental shelf waters with temperatures greater than 14 and 16° C and salinities greater than 25 ‰ (Fahay et al. 1999). Bluefish are not known to be associated with any particular substrate. Adult bluefish are common in the New Jersey Inland Bays system from May through October (Stone et al. 1994). CPUE of bluefish from the NJMFA trawl data near the project area was 20.4 fish/nm and 1.4 kg/nm (Table 2). Adults spawn in two major spawning areas located on the east coast of the United States (Wilk 1982): one offshore near the inner edge of the Gulf Stream from southern Florida to North Carolina during the spring and the other in the Middle Atlantic Bight in summer. The adult diet is dominated by schooling species including bay anchovy, butterfish, round herring, and squid (Buckel et al. 1999a, Bowman et al. 2000). The only predators to adult bluefish are tuna, billfish, and sharks (Fahay et al. 1999, Chase 2002). Bluefish are a major component in the shortfin mako shark diet, composing 92.6% of the diet by weight in 2001-2002 (Stillwell and Kohler 1982, Wood et al. 2009).

Bluefish are managed in U.S. waters as a single stock by the Mid-Atlantic Fishery Management Council and the Atlantic States Marine Fisheries Commission under the Management Plan for the Bluefish Fishery. Bluefish abundance estimates peaked in 1982 at 163 million fish, declined in the mid 1990s to 58 million fish, increased to approximately 98 million in 2007, and then declined to 78 million in 2009. Biomass has shown an increasing trend since 2004, and was above the B_{MSY} (147,052 mt) in 2009 at 155,991 mt. Bluefish recruitment estimates have remained relatively constant since 2000 at approximately 22.5 million age-0 fish, however the 2009 recruitment estimate was below average at 8.0 million bluefish. Fishing mortality declined from 0.31 in 1987 to 0.12 in 2002. Estimated fishing mortality was 0.10 in 2009. The bluefish stock is considered rebuilt, bluefish are not overfished and overfishing is not occurring (ASMFC 2009b, Shepherd and Nieland 2010).

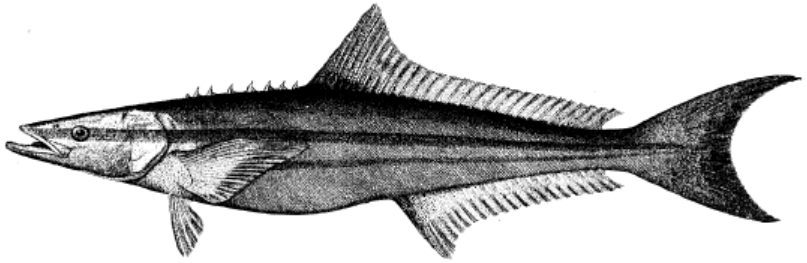
Total bluefish landings from Maine to Florida averaged 10,217 mt from 2000-2009. Total bluefish landings were estimated to be 9,312 mt in 2009 (Shepherd and Nieland 2010). Commercial landings have been regulated by quota since in 2000 and have averaged 3,283 mt annually. Atlantic coast commercial landings in 2009 were estimated to be 3,151 mt (ASMFC 2009b, Shepherd and Nieland 2010).

New Jersey commercial bluefish landings have since remained relatively steady since 1998, with an average of 539 mt from 2000-2008 (NMFS 2010). New Jersey commercial bluefish landings were approximately 464 mt in 2008 (ASMFC 2009b, NMFS 2010).

Bluefish are one of the most important recreational species and are caught by fishermen in bays and sounds, on ocean beaches, and over the continental shelf by trolling, live-baiting, casting, jigging, or chumming (Wilk 1982). The recreational component of the fishery constitutes 80-90% of the total catch, most of which is taken in waters from New York to Virginia (Shepherd 2000). Since 1981, annual coastwide recreational bluefish catch has averaged 8437 mt and landings have averaged 5126 mt (ASMFC 2009b). Recreational bluefish landings were estimated to be 6.9 million pounds in 2008 (ASMFC 2009b). New Jersey and New York had the greatest recreational harvests along the Atlantic coast in the late 1980s and 1990s, each accounting for approximately 21% of the average annual catch between 1987 and 1996 (MAFMC 1998).

Bluefish eggs could occur in the project area in July when water temperatures are between 18 and 22° C. Juvenile and adult bluefish could occur in the project area from May through November when water temperatures are between 15 and 30° C.

3.2.3.3 Cobia (*Rachycentron canadum*)



General: Cobia are a highly migratory, coastal pelagic species that occur nearly worldwide in tropical, subtropical, and warm temperate waters. They occur in the western Atlantic from Massachusetts to Argentina (Hardy 1978, Shaffer and Nakamura 1989). Cobia begin their northern spring migration from wintering grounds in the Florida Keys typically arriving in estuarine and coastal areas of Virginia and the Carolinas in late spring and early summer (Williams 2001). Cobia are relatively uncommon and rarely appear in large numbers. Adults tend to travel alone or in small schools frequently residing in the shadow of near-surface objects such as buoys, boats, and platforms (Shaffer and Nakamura 1989, Williams 2001). Cobia are uncommon but regular seasonal migrates to New Jersey waters and have been reported in Absecon Inlet and offshore Atlantic City (Milstein and Thomas 1976, Fowler 1952). The project area is designated EFH for cobia egg, larvae, juvenile, and adult life-stages (Table 1).

Eggs: Cobia eggs are 1.1-1.4 mm in diameter and transparent with one large oil globule. They are primarily found in offshore waters within the top meter of the water column at temperatures between 26-30° C and salinities of 23-35 ‰ (Hardy 1978, Shaffer and Nakamura 1989, SEFSC 2006a). Larvae hatch at about 3 mm in length (Shaffer and Nakamura 1989).

Larvae: Larvae are primarily found in offshore waters (surface to 300 m), although they can occur in estuarine waters, at temperatures between 24 to 32° C with salinities ranging from 19 to 37 ‰ (Shaffer and Nakamura 1989, SEFSC 2006a). No larvae were collected in New York Bight samples (Appendix Table 1).

Juveniles: Cobia juveniles are found in coastal and offshore shelf waters from the surface to 300 m at 17 to 25° C with salinities of 22 to 36 ‰ (SEFSC 2006a). Juveniles move to inshore coastal habitats including beaches, bays, and relatively high salinity (greater than 25 ppt) regions of estuaries as they grow from 13-15 mm to 45-140 mm (Shaffer and Nakamura 1989). Juveniles prey on fish, crustaceans, and squid (Shaffer and Nakamura 1989). No cobia were collected by NJMFA near the project area between 1998 and 2010 (Table 2).

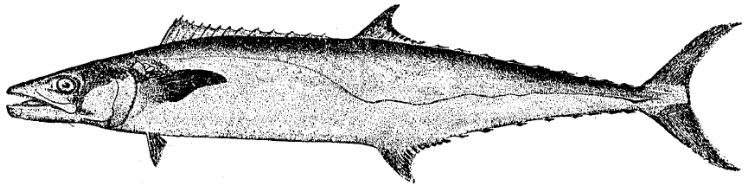
Adults: Adult are found in coastal and offshore shelf waters from 1-70 m at 19-28° C and salinities of 22-36 ‰ (SEFSC 2006a, Shaffer and Nakamura 1989). They have been found over a variety of habitats including rock, gravel, sand, and mud substrates, coral reefs, and pilings. Cobia occur in the Mid-Atlantic from late May until late October (Joseph et al.1964, Richards 1967). Spawning occurs from mid-June to mid-August near the Chesapeake Bay and in the Mid-Atlantic (Joseph et al.1964, Richards 1967). Cobia are voracious predators, often consuming prey whole. Adults prey on crustaceans, other benthic invertebrates, and fish, (Shaffer and Nakamura 1989, Bowman et al. 2000).

Cobia is a highly prized recreational species that is incidentally caught in several commercial fisheries. The majority of U.S. commercial and recreational cobia landings occur in the Gulf of Mexico (Shaffer and Nakamura 1989). Cobia are managed by the Gulf of Mexico and South Atlantic Fishery Management Councils under the Coastal Migratory Pelagic Fishery Management Plan as two stocks: the South Atlantic and the Gulf of Mexico. Current stock abundance data does not exist for the South Atlantic stock of cobia. The last Atlantic cobia stock assessment was conducted in 1996 (Hammond 2006).

Commercial Atlantic cobia landings averaged approximately 44 mt annually during 2000-2004, declined to 30 mt in 2005, and have since remained stable at approximately 41 mt. The 2008 commercial Atlantic cobia landings were 40 mt (NMFS 2010). The 1987 to 2008 Mid-Atlantic commercial landings averaged 0.6 mt (1,316 pounds). New Jersey commercial cobia landings from 1988 to 2007 averaged 0.6 mt (,330 pounds), with 0.7 mt (1,650 lbs) landed in 2007 (NMFS 2010).

Cobia eggs and larvae might occur in the project area from June through August when water temperatures are between 24 and 32° C since they are found in offshore waters; however, it is unlikely since spawning has only been documented in the western North Atlantic from Chesapeake Bay and areas to the south. Juveniles and adults could occur in the project area during from late May to October when water temperatures are above 17° C.

3.2.3.4 King Mackerel (*Scomberomorus cavalla*)



General: King mackerel is a highly migratory, pelagic, schooling species found in the western Atlantic from North Carolina to Brazil(Collette and Klein-MacPhee 2002, Godcharles and Murphy 1986). Strays have been collected as far north as the southern Gulf of Maine, however this species is considered to

occasionally occur in New Jersey waters (Collette and Klein-MacPhee 2002). The project area is designated EFH for king mackerel egg, larvae, juvenile, and adult life-stages (Table 1).

Eggs: King mackerel spawn in coastal waters of the northern Gulf of Mexico and off the south Atlantic coast. All lifestages of this species are pelagic and independent from benthic habitats (Godcharles and Murphy, 1986). They have a prolonged spawning season, spawning peaks from May through September in coastal Carolina waters. Fecundity ranges from 69,000 to 12.2 million eggs and is strongly correlated with length, age and total weight (Finucane et al. 1986). King mackerel eggs are 0.9-0.98 mm in diameter, spherical with a single oil globule, and are found in pelagic waters over depths of 35-118 m. Larvae hatch at approximately 2.98 mm in length (Fritzsche 1978).

Larvae: Larvae are found in pelagic waters at temperatures of 22-31° C and salinities of 27-37 ‰ at depths of 35-180 m (Godcharles and Murphy 1986, SEFSC 2006b). King mackerel larvae prey on other larval fish including carangids, clupeids, and engraulids (SEFSC 2006b). No larvae were collected in New York Bight samples (Appendix Table 1).

Juveniles: Juveniles are found in inshore waters with temperatures greater than 20° C and with salinities of 32-36 ‰ (SEFSC 2006b). King mackerel juveniles prey predominately on fish although they also consume some squid (SEFSC 2006b).

Adults: Adults are found in pelagic waters from the shore to the continental shelf edge at depths less than 80 m at temperatures greater than 20° C and with salinities of 32-36 ‰ (SEFSC 2006b). Adults migrate north during the spring and return south during the fall (SEFSC 2006b). No king mackerel were collected by NJMFA near the project area between 1998 and 2010 (Table 2). Adults prey on fish, penaeid shrimps, and squid (Collette and Klein-MacPhee 2002, Bowman et al. 2000, SEFSC 2006b).

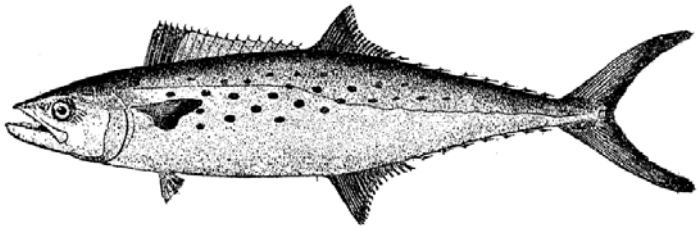
King mackerel are managed as a single stock under the Fishery Management Plan for the Coastal Migratory Pelagic Resources in the Gulf of Mexico and South Atlantic regions as two independent migratory groups: the Gulf migratory group and the South Atlantic migratory group. Total king mackerel Age 1+ abundance has declined in the South Atlantic region from a high of 12.8 million fish in 1981 to a low of 5.9 million fish in 2001. The estimated total Age 1+ stock abundance in 2006 was 7.2 million fish. Estimated South Atlantic recruitment at age-0 varied without trend, ranging from 2.2 million fish in 2000 to 8.6 million fish in 1989. The estimated 2006 recruitment was 4.7 million age-0 fish. Spawning stock biomass has decreased by approximately 45% since 1981 in the South Atlantic (SEDAR 2009).

Total landings of South Atlantic migratory group king mackerel averaged 3,092 mt from 2000 to 2006. Commercial landings averaged 1,415 mt from 2000 to 2006. Recreational landings from 2000 to 2006 averaged 1,678 mt (SEDAR 2009).

New Jersey commercial king mackerel landings are low averaging less than 0.08% of the South Atlantic Migratory Group landings from 1981 through 2009 (SEDAR 2009, NMFS 2010). Landings averaged 1.1 mt (2,471 pounds) from 2000 through 2007, and were 3.2 mt (6,969 pounds) in 2007 (NMFS 2010).

Early king mackerel life-stages are unlikely to occur in the project area since spawning has been documented off the Carolina coasts and areas to the south in the western North Atlantic. Juvenile and adult king mackerel could occur in the project area during summer months when water temperatures are above 20° C.

3.2.3.5 Spanish Mackerel (*Scomberomorus maculatus*)



General: Spanish mackerel is a highly migratory, schooling, epipelagic, neritic species found in the western Atlantic from the Gulf of Maine to the Yucatan Peninsula (Collette and Klein-MacPhee 2002, Godcharles and Murphy 1986). It most commonly occurs south of Chesapeake Bay with strays having been collected as far north as Nova Scotia. This species sometimes occurs in New Jersey waters during summertime migrations (Fowler 1952, Briggs and Waldman 2002). The project area is designated EFH for Spanish mackerel egg, larvae, juvenile, and adult life-stages (Table 1).

Eggs: Spanish mackerel eggs are approximately 1 mm in diameter, spherical, transparent with a single oil droplet and are found in pelagic waters over depths less than 50 m. Eggs hatch in about 25 hrs at 26° C and in 15.5 hrs at 29° C (Godcharles and Murphy 1986, Fritzsche 1978, SEFSC 2006c). Larvae hatch at approximately 2.6 mm TL (Fritzsche 1978).

Larvae: Larvae occur in pelagic waters at depths less than 50 m with temperatures between 20-32° C and salinities of 28-37 ‰. Spanish mackerel larvae prey on other larval fish including carangids, clupeids, and engraulids, and crustaceans (SEFSC 2006c).

Juveniles: Juvenile Spanish mackerel are found in coastal and estuarine waters at temperature greater than 25° C with salinities ranging from 11-34 ‰. Juveniles prey on other larval fish including clupeids and engraulids, crustaceans, and squid (SEFSC 2006c, Bowman et al. 2000). Engraulids were the predominant prey item of juvenile Spanish mackerel in the coastal waters of the Carolinas (Saloman and Naughton 1983).

Adults: Adults are found in estuarine and coastal waters from the shore to depths of 75 m with temperatures greater than 20° C and oceanic salinities (SEFSC 2006c). Adults migrate north during the spring and south during the fall (Godcharles and Murphy 1986). No Spanish mackerel were collected by NJMFA near the project area between 1998 and 2010 (Table 2). Adults prey on fish (especially Clupeoids), pandalid and penaeid shrimps, and squid (Bowman et al. 2000, Collette and Klein-MacPhee 2002, Saloman and Naughton 1983). Spanish mackerel spawn in batches over the continental shelf. Spawning progresses from south to north as water temperatures increase beginning in April in the Carolinas and late August to September off Sandy Hook, New Jersey (Godcharles and Murphy 1986).

Spanish mackerel is an important commercial and recreational species in the South Atlantic and is becoming more important in the Mid-Atlantic. The Spanish mackerel South Atlantic migratory group is managed by the South Atlantic Fishery Management Council under the Interstate Fishery Management Plan for Spanish mackerel. Atlantic coast commercial landings from 2000 to 2008 averaged 1,478 mt. The 2008 Atlantic coast commercial landings were approximately 1,289 mt (ASMFC 2006, NFMS 2010).

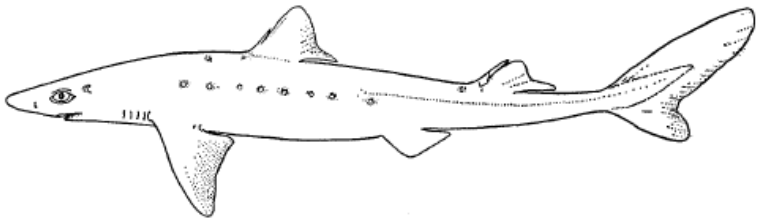
Recreational fishing for Spanish mackerel occurs throughout states in the South and Mid-Atlantic regions; however, recreational landings primarily occur in North Carolina and Florida. Coastwide recreational landings averaged 1.2 million pounds from 2000 to 2007 and were approximately 1.1 million pounds in 2007 (ASMFC 2006, SEDAR 2008).

New Jersey commercial Spanish mackerel landings generally contribute less than 1% to the total Atlantic coast Spanish mackerel commercial landings, and have been below 0.5% since 2001. New Jersey commercial Spanish mackerel landings have been steadily declining since 1996 to approximately 0.7 mt (1,456 lbs) in 2006. New Jersey commercial Spanish mackerel landings were 0.9 mt (2,075 lbs) in 2007 (NMFS 2010).

Early Spanish mackerel life-stages could occur in the project area from late August to late September when water temperatures are above 20° C. Juvenile and adult Spanish mackerel could occur in the project area during summer months when water temperatures are above 20° C.

3.2.4 SHARKS

3.2.4.1 Spiny Dogfish (*Squalus acanthias*)



General: Spiny dogfish populations occur on the continental shelves of northern and southern temperate zones throughout the world. They are distributed throughout the North Atlantic from Greenland to northeastern Florida, but are most abundant from Nova Scotia to Cape Hatteras (Compagno 1984a, Cohen 1982). Spiny dogfish are the most abundant shark in the western north Atlantic (Compagno 1984a, Collette and Klein-MacPhee 2002). They migrate up to at least 1,600 km along the east coast in response to changes in water temperature (Compagno 1984a, Jensen 1965). The project area is designated EFH for the spiny dogfish adult life-stage (Table 1).

Adults: Spiny dogfish are primarily epibenthic, however, they can move throughout the water column to surface waters. They occur in inshore and offshore shelf waters from nearshore shallows to 900 m. Spiny dogfish prefer water temperatures of 6-8° C, and seldom occur at temperatures >15° C (Collette and Klein-MacPhee 2002, Jensen 1965). Spiny dogfish is a spring and autumn transient; appearing along the New Jersey coast in March (Bigelow and Schroeder 1953). NEFSC spring bottom trawl surveys from 1968-2003 have collected adult (female ≥ 83 cm, male ≥ 60 cm) spiny dogfish near the project area at densities of 1 to 250 fish per tow (Stehlik 2007). This was confirmed by trawl data provided by NJMFA, where CPUE of spiny dogfish in the project area averaged 10.9 fish/nm and 21.5 kg/nm (Table 2). Individuals travel in schools by size until maturity (male at 6 years and females at 12 years) and then in segregated schools by size and sex (Collette and Klein-MacPhee 2002, Nammack et al. 1985, Bigelow and Schroeder 1953). Males and mature females are most common inshore. Spiny dogfish spawn offshore in winter (Bigelow and Schroeder 1953) and bear live young (1-15 pups) after 18-22 months of gestation (Jensen 1965). At birth pups are approximately 25.4 cm long (Jensen 1965). Spiny dogfish are voracious opportunistic predators, preying on most species of fish smaller than themselves (mackerel, herring, scup, flatfish, and cod), shrimp, crabs, squid, siphonophores and sipunculid worms (Bigelow and Schroeder 1953, Jensen 1965, Bowman et al. 2000). They have few natural enemies except for larger sharks and whales (Bowman et al. 2000, Stehlik 2007).

Spiny dogfish are managed domestically as a single stock along the United States Atlantic coast by the Mid-Atlantic Fishery Management Council under the Spiny Dogfish Fishery Management Plan. Spiny

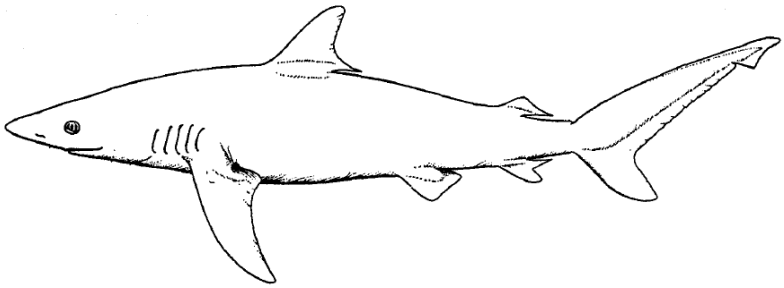
dogfish are vulnerable to population collapse if their numbers become depleted since they cannot quickly rebuild due to their late maturation, a long gestation period, low fecundity and long life (35-40 years; Nammack et al. 1985, Stehlik 2007). Total biomass increased from 337,686 mt in 2002 to 586,413 mt in 2008. The 2009 total biomass was 505,116 mt. Recruitment was highly variable from 1968-1996 and at a record low from 1997-2004. Recruitment has improved in recent years; the 2009 recruitment was the fifth highest in the 1968-2009 NEFSC time series at approximately 6,700 mt. U.S. spiny dogfish are considered rebuilt, they are not overfished and overfishing is not occurring (Rago and Sosebee 2010).

U.S. commercial landings averaged 2,200 mt from 2001-2008. Recreational landings are low with annual average of 200 mt from 1981-2008 (TRAC 2010, Rago and Sosebee 2010).

New Jersey commercial spiny dogfish landings sharply declined after 2000, and were 5.7 mt in 2007 (NMFS 2010).

Adult spiny dogfish could occur in the project area in the spring and autumn when water temperatures are between 5 and 15° C.

3.2.4.2 Dusky Shark (*Charcharinus obscurus*)



General: Dusky sharks have a worldwide distribution in warm temperate and tropical waters from the surf zone to offshore at depths from 0 to 1,300 ft (400 m; Compagno 1984b). They occur in the western Atlantic from southern Massachusetts and Georges Bank to the Caribbean, and the northern Gulf of Mexico to southern Brazil (Collette and Klein-MacPhee 2002, Compagno 1984b). These sharks avoid low salinity waters so they are not commonly found in estuaries (Compagno 1984b). They undergo seasonal temperature-related migrations northward in the summer and southward in the fall. The project area is designated EFH for dusky shark larvae (neonate – young-of-the-year (YOY), <121 cm TL) life-stage (Table 1). Dusky sharks have been repeatedly reported off the New Jersey coast (Bigelow and Schroeder 1953). No dusky shark were collected by NJMFA near the project area between 1998 and 2010 (Table 2).

Neonate/Young of the Year: Dusky sharks are viviparous, pups are born at 85 to 100 cm in litters of 3 to 14 (Compagno 1984b, NMFS 2009a). Reproduction occurs every 3 years either between June and July or December and January (NMFS 2009a). Dusky shark neonate – YOY habitat has been designated as shallow coastal waters including inlets and estuaries to the 200 m isobaths from southern Cape Cod to South Carolina with areas out to the 2000 m isobaths; and shallow coastal waters including inlets and estuaries to approximately the 200 m isobaths from the mid-coast of Georgia to Florida with area out to the EEZ along the southern coast of Florida (NMFS 2009b). Juvenile dusky sharks occur in coastal nursery grounds from New Jersey to South Carolina for several months (Cortés et al.2006) when water temperatures are above 19° C (Musick and Colvocoresses 1986). No dusky shark were collected by NJMFA near the project area between 1998 and 2010 (Table 2). The neonate and juvenile dusky shark (<61-110 cm) diet consists of a variety of bony fish, squid and crabs (Bowman et al. 2000, Gelsleichter et

al. 1999). Predators of neonate - early juvenile dusky sharks are other large sharks including great white, bull, and tiger sharks (Compagno 1984b, Bowman et al. 2000).

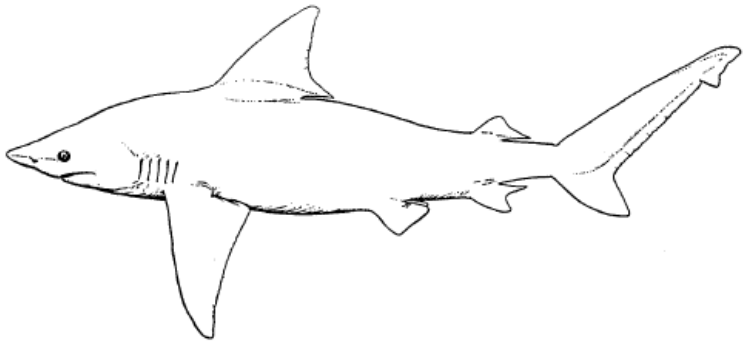
Adults: Dusky sharks are managed in U.S. waters in the western Atlantic in the large coastal shark management unit under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan. Dusky sharks are vulnerable to overfishing and population collapse due to very low population growth rates (<3% per year) and long generation times (30 years) resulting from the biological characteristics of late age at first reproduction (approximately 20 years), high longevity (> 40 years), and limited reproductive potential (Cortés et al. 2006). The abundance of many shark species in the large coastal shark assemblage by 1986 had declined by 50 to 75% from 1970s levels. The NMFS designated the dusky shark in the South Atlantic and Gulf of Mexico as a species of concern in 1997 (NMFS 2009a). Commercial and recreational fishing were prohibited in 1998 under the Atlantic Tunas, Swordfish, and Sharks Fishery Management Plan, however over 2,000 were recreationally caught in 2003. In 2004, the U.S. dusky shark population in the Northwestern Atlantic and Gulf of Mexico was designated on the IUCN Red List of Threatened Species as vulnerable (NMFS 2009a, Cortés et al. 2006). Currently the western Atlantic dusky shark population is at 15 to 20% of its virgin biomass (NMFS 2009a, Cortés et al. 2006). The dusky shark is considered overfished and overfishing is occurring (NMFS 2010b).

The current principal threat to the dusky shark is the recreational shark fisheries that are estimated to catch 18 to 28% of dusky shark neonates in their first year. Dusky sharks are also caught as bycatch in the directed tuna, swordfish, and shark longline fisheries and the tuna and swordfish gill net fisheries. Dusky shark size has decreased between 1961 and 2005 off New Jersey as a result of high fishing pressure (NMFS 2009a).

Dusky sharks were landed in commercial and recreational fisheries along the U.S. east coast prior to prohibition in 1998. Total dusky shark catch was 6,576 lbs dw (dressed weight) in 2009 (Cortés and Baremore 2010). Total commercial landings peaked in 1995 and 1996 at 357,920 and 290,820 lbs dressed weight respectively. Total dusky shark commercial landings were 486 lbs dw in 2009. There were no Mid-Atlantic dusky shark commercial landings in 2009. Total recreational landings declined over the time series (1981-2009) from 518,858 lbs dw in 1981 to 343 lbs dw in 2004, except for the landings in 2005 (43,064 lbs dw) and 2008 (33,750 lbs dw). Total dusky shark recreational landings were 6,090 lbs dw in 2009 (Cortés and Baremore 2010).

The entire project area has been declared EFH for neonate dusky shark, but descriptions of the specific habitat preferred by neonates is not available. Therefore, it is conservative to estimate that the entire project area is EFH for neonate dusky shark. Neonate dusky sharks could occur in the project area when water temperatures are above 19° C.

3.2.4.3 Sandbar Shark (*Charcharinus plumbeus*)



General: The sandbar shark is a slow-growing, bottom-dwelling, coastal species that ranges in warm-temperate coastal waters on both sides of the Atlantic, southern Indian Ocean, Indo-west Pacific from Australia to Japan, and Hawaii (Collette and Klein-MacPhee 2002, Compagno 1984b). They range in the western Atlantic from southern New England to the Florida Keys and the Florida Panhandle in the Gulf of Mexico (NMFS 2009b, Compagno 1984b). Sandbar sharks have been reported in New Jersey waters off Atlantic County (Fowler 1920). The project area is designated EFH and Habitat Areas of Particular Concern (HAPC) for sandbar shark larval (neonate – YOY; ≤ 78 cm TL), juvenile (79-190 cm TL) and adult (≥ 191 cm TL) life-stages (Table 1). HAPC is designated for the project area due to the important sandbar shark nursery and pupping grounds that have been identified in the shallow areas of and the mouth of Great Bay, New Jersey, and the lower and middle Delaware Bay.

Neonate/Young of Year: Sandbar sharks are placentally viviparous, pups are born at 50-60 cm TL in litters of 1 to 14 pups after a 8 to 12 month gestation period (Collette and Klein-MacPhee 2002, Springer 1960). Sandbar shark neonate – YOY habitat has been designated as Atlantic coastal areas from Long Island, New York to Cape Lookout and localized coastal areas along South Carolina and Georgia; and localized coastal area of on the Florida Panhandle (NMFS 2009b). The primary nursery grounds in the Atlantic occur in the mid-Atlantic region especially Chesapeake Bay (Collette and Klein-MacPhee 2002). Gravid females release their young on nursery grounds from June to August (Compagno 1984b). Sandbar shark diets consist of benthic and demersal vertebrates and invertebrates from 40 different prey types (Stillwell and Kohler 1993). The juvenile diet on nursery grounds consists of blue crabs, mantis shrimp and other crustaceans, and a variety of small fish (menhaden, black sea bass, and flatfish; Medved and Marshall 1981).

Juveniles: Sandbar shark juvenile habitat has been designated as Atlantic coastal areas from southern New England to Cape Lookout, and localized areas along the Atlantic coast of southern North Carolina, South Carolina, and Florida (NMFS 2009b). Data from tagging studies suggests that juveniles return to their natal estuaries in summer for at least the first 3 years and return to adjacent coastal waters for up to 9 years. Wintering areas appear to be concentrated off North Carolina in nearshore waters less than 20 m deep. Older juveniles (>7 years) were recaptured as far as 60 km from shore. The tagging studies suggest that sandbar shark juveniles occur in these wintering areas from late October through late May for at least the first 7 years and up to 10 years (HMSMD 2006). The juvenile diet on the continental shelf consists of variety of fish (hakes, mackerels, monkfish, and flatfish), squids, and crabs (Stillwell and Kohler 1993).

Adults: Adult sandbar sharks are found along the Atlantic coast in shallow coastal areas from the shore to a depth of 280 m from southern New England (Nantucket, MA) to the Florida Keys (NMFS 2009b). No sandbar shark were collected by NJMFA near the project area between 1998 and 2010 (Table 2).

Seasonal migration occurs along the western Atlantic coast, they move north as water temperatures increase during the summer, and south as temperatures decrease during the fall (Collette and Klein-MacPhee 2002). Males and females remain in sexually segregated schools except during the mating season in June (Springer 1960). Males occur in deeper water than females. Adult sandbar shark diet includes fish (cod, bluefish, monkfish, skates, spiny dogfish, and flatfish), squid, and crabs (Collette and Klein-MacPhee 2002, Bowman et al. 2000, Stillwell and Kohler 1993).

Sandbar sharks are managed as a single stock in the western Atlantic in the large coastal shark management unit under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan. Sandbar sharks are vulnerable to overfishing and population collapse due to their slow maturation. Sandbar shark was an important commercial and recreational species along the Atlantic coast. This species became the primary target of the directed commercial fishery from Virginia to Florida in 1990s due to large fin size and high fin market value (Collette and Klein-MacPhee 2002). The increased fishing pressure had a negative impact on sandbar shark abundance, the estimated 2006 stock size had been reduced to less than 35% of it virgin size (HMSMD 2006). A time/area closure off North Carolina during the winter fishery (January to July) was implemented in 2005 to reduce bycatch of sandbar and dusky shark neonates and juveniles. The only direct fishing currently authorized on sandbar sharks is the shark research fishery. Recreational fishing for sandbar sharks was prohibited in 2008. Sandbar sharks are considered overfished and overfishing is occurring (NMFS 2010b, NMFS 2009b).

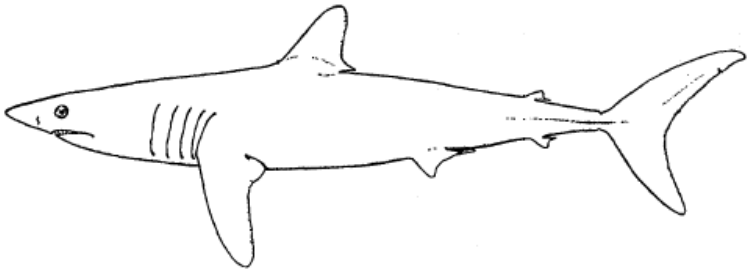
Total sandbar sharks landings increased from 52,800 sharks in 1982 to peak at 434,900 sharks in 1983. Landings declined to 91,200 sharks in 1997, increased to 104,900 sharks in 1998, and then declined. Total sandbar sharks landings were 15,900 sharks in 2009 (Cortés and Baremore 2010).

U.S. commercial sandbar sharks landings increased from 6,600 sharks in 1981 to a peak of 126,300 sharks in 1994, and then fluctuated between 33,400 to 62,700 sharks from 1998 to 2006. U.S. commercial sandbar sharks landings were 4,000 sharks in 2009. Mid-Atlantic sandbar shark commercial landings represented 0.3% of the 2009 U.S. commercial landings (Cortés and Baremore 2010).

U.S. recreational sandbar sharks landings increased from 33,600 sharks in 1982 to peak at 415,900 sharks in 1983, and then declined. U.S. recreational sandbar sharks landings were 4,500 in 2004 (Cortés and Baremore 2010).

The sandbar shark neonate – YOY life-stage is likely to occur in the project area from June to August. The project area is designated as HAPC and may be suitable habitat for a sandbar shark summer nursery area. The sandy substrate habitat present in the project area may provide neonate – YOY sandbar sharks with a foraging environment for benthic and demersal prey species. Juvenile and adult sandbar shark life-stages are likely to occur in the project area during summer months, since the project area is adjacent to Delaware Bay which is a principal pupping and nursery ground.

3.2.4.4 Shortfin Mako Shark (*Isurus oxyrhyncus*)



General: The project area is designated EFH for the shortfin mako shark juvenile (141-297 cm TL) life-stage (Table 1). Shortfin mako sharks are an extremely active, coastal and oceanic species found in warm-temperate and tropical waters (greater than 16° C) throughout the world from the surface to at least 500 m. They occur in the western Atlantic from Nova Scotia (the Gulf of Maine) to southern Brazil and southern Argentina (Collette and Klein-MacPhee 2002, Compagno 2001). Shortfin mako sharks occur in southern New Jersey waters in early June to October (Casey and Kohler 1992) and have been reported off the New Jersey coast near Atlantic City (Fowler 1952, Kohler et al. 1998). No shortfin mako shark were collected by NJMFA near the project area between 1998 and 2010 (Table 2).

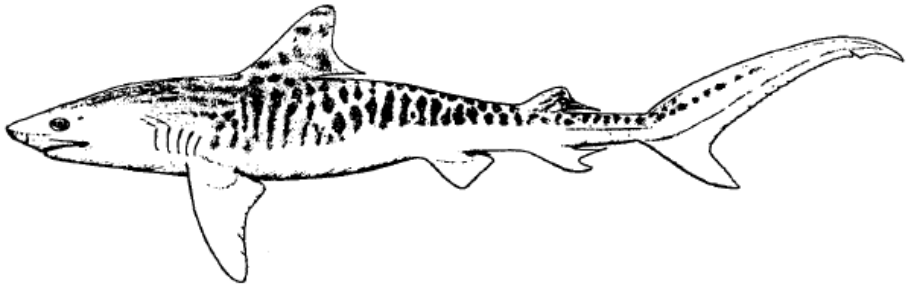
Shortfin mako sharks are among the fastest swimming sharks and are known for leaping several times their length from the water. They are prized game fish and when provoked have occasionally bitten swimmers, divers, and boats (Collette and Klein-MacPhee 2002, Compagno 2001). Long-range shortfin mako shark movements are not well known (Compagno 2001). In the most northern and southern parts of their range they follow the movements of warm water masses poleward in the summer (Compagno 1984a). Shortfin mako sharks have vascular heat exchangers that enable them to maintain their body temperature and metabolic rate 7–10 °C above the ambient water temperature (Carey and Teal 1969, Lowe and Goldman 2001).

Juveniles: Shortfin mako shark juvenile habitat has been designated in the Atlantic from southern New England through Cape Lookout, and localized areas off Maine, South Carolina, and Florida (NMFS 2009b). Juvenile diets consist of primarily of wide variety of fast swimming fish including bluefish, mackerels, tuna, herrings, menhaden, cod, and other elasmobranches, but other prey items include squid and crustaceans (Bowman et al. 2000, Maia et al. 2007, Wood et al. 2009). Shortfin mako grow is rapid (approximately 3.2 cm per month) during the first year it then declines to a slower rate (Bishop et al. 2006). Male and female growth rates are similar until approximately 2.0 m fork length (FL) between 10-13 years of age (Campana et al.2005, Bishop et al. 2006, Natanson et al. 2006). Males mature at approximately 1.8-2.0 m TL (7-9 years) and females at 2.8-3.0 m TL (18-21 years; Stevens 1983, Mollet et al. 2000, Bishop et al. 2006, Natanson et al. 2006).

Shortfin mako sharks are managed in the western Atlantic in U.S. waters in the pelagic shark management unit under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS 2009b). Shortfin mako sharks are vulnerable to overfishing and population collapse due to low reproductive productivity and a midrange intrinsic rebound potential. The IUCN Shark Specialist group has classified this species as a Lower Risk/Near Threatened species (Compagno 2001). The 2008 ICCAT stock assessment estimated Atlantic shortfin mako biomass to range from 95 to 165% of target levels, with the North Atlantic population experiencing some stock depletion. North Atlantic shortfin mako population biomass may be below the maximum sustainable yield (ICCAT 2008). Shortfin mako are considered overfished but overfishing is not occurring (NMFS 2010b).

Shortfin mako juveniles could occur in the project area when water temperatures are above 16° C.

3.2.4.5 Tiger Shark (*Galeocerdo cuvieri*)



General: The project area has been designated EFH for tiger shark larvae (neonate – YOY; ≤ 204 cm TL) and juvenile (205-319 cm TL) life-stages (Table 1), although more recent information indicates the project area is not EFH for neonate/YOY (NMFS 2009b) . Tiger sharks are cosmopolitan coastal-pelagic species found in most warm-temperate and tropical waters (greater than 18° C) from the surface and intertidal to approximately 140 m. They occur in the western North Atlantic from 40° to 0° N, and rarely occur north of the Mid-Atlantic Bight. Tiger sharks seem to prefer turbid areas in continental waters and often occur in river estuaries (Compagno 1984b, NMFS 2009b). Tiger sharks have been reported off the New Jersey coast near Atlantic City (Fowler 1952, Kohler et al. 1998). No tiger sharks were collected by NJMFA near the project area between 1998 and 2010 (Table 2).

Neonate/Young of Year: Tiger shark neonate - YOY habitat is currently designated in the Atlantic from Virginia to the mid-east coast of Florida (NMFS 2009b). Tiger sharks are ovoviviparous and usually give birth to an average litter of 40 pups approximately 70 cm TL (Collette and Klein-MacPhee 2002). There are no defined nursery grounds as young are found throughout the continental shelf. Tiger shark pupping and nursery areas in the western North Atlantic have been reported from approximately 35° N and from 33°45' to 29°20' N (Natanson et al. 1998) to 27° to 35° N (Driggers et al. 2008, NMFS 2009b). The project area would not be considered tiger shark neonate - YOY habitat.

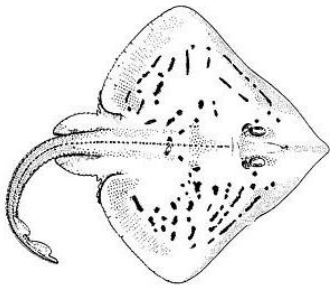
Juveniles/Adults: Tiger shark juvenile habitat has been designated as the Atlantic east coast from New England to Florida (NMFS 2009b). Tiger sharks are estimated to mature in approximately 7 years (Natanson et al. 1999) and live to be at least 12 years old (Compagno 1984b). Tiger sharks are opportunistic apex predators consuming a wide variety of prey items including bony fishes (monkfish and bluefish), elasmobranches (spiny dogfish and skates), squids, crabs, horseshoe crabs, gastropods, marine mammals, sea turtles , and birds (Randall 1992, Bowman et al. 2000, Compagno 1984b). Due to a wide variety of prey items and the numerous reports of attacks on divers, swimmers, and boats tiger sharks are considered to be among the most dangerous sharks (Compagno 1984b).

Tiger sharks are managed in U.S. waters in the western Atlantic in the large coastal shark management unit under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan. Tagging data, NMFS observer information, and fishing reports suggest that tiger sharks have been very abundant for approximately two decades (HMSMD 2006). Tiger shark landings are reported in the large coastal shark management unit landings, as a result species specific landings are unavailable. Large coastal shark landings have decreased substantially since 1999 and the most recent (2004) estimated landings are the lowest in the 1981-2004 time series (NMFS 2009). Tiger sharks have dominated the Atlantic large coastal shark commercial landings from 1995-2004 (HMSMD 2006). Tiger shark are not considered overfished and overfishing is not occurring (NMFS 2010b, HMSMD 2006); however, the data showed conflicting results in the most recent stock assessment (HMSMD 2006). The IUCN Shark Specialist group has classified this species as a Near Threatened species.

According to the most recent information (NMFS 2009b), the project area does not provide EFH habitat for neonate/young of the year tiger shark. Juvenile tiger sharks could occur in the project area when water temperatures are above 18° C.

3.2.5 SKATES

3.2.5.1 Clearnose Skate (*Raja eglanteria*)



General: The clearnose skate occurs along the eastern United States coast from the Nova Scotian Shelf to northeastern Florida (Bigelow and Schroeder 1953). The project area is designated EFH for clearnose skate juvenile and adult life-stages (Table 1).

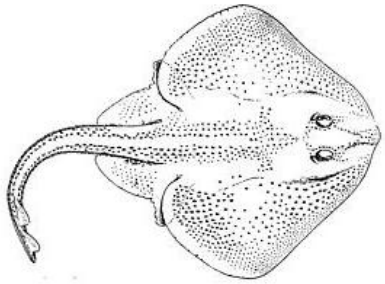
Juveniles/Adults: Clearnose skate are found on soft bottoms along the continental shelf, but also occur on rocky or gravelly bottoms (Packer et al. 2003). They have a wide depth preference and juvenile and adults have been found from 1-300 m. Juveniles were most common between 5 and 22 m with adults most common between 11 and 30 m. Clearnose skate are demersal feeders. Sources of prey include polychaetes, amphipods, shrimps, crabs, and small fish (Packer et al. 2003). Predators include the sand tiger shark (*Odontaspis taurus*).

Clearnose skate exhibit seasonal movements, moving north in spring/summer and south in fall and early winter (Packer et al. 2003). Off New Jersey, it was reported inshore between April and November (Bigelow and Schroeder 1953). Clearnose skate were collected in NEFCS spring trawl surveys at depths from 1-300 m but were most abundant between 1-30 m. Water temperatures ranged from 4-21^{o}C with most skates collected between 7-16 ^{o}C. NEFCS fall trawl surveys collected clearnose skates at depths from 1-80 m, with more than half collected at depths between 11-20 m. Temperatures ranged from 7-27 ^{o}C, with most collected between 18-22 ^{o}C. Clearnose skates have been reported inshore off New Jersey between April and November, and have been collected in Little Egg Harbor in April and May (Packer et al. 2003). No clearnose skates were collected during the NJMFA spring trawls near the project area, however they were collected in the NJMFA fall trawls near the project area at a CPUE of 3.8 fish/nm and 5.2 kg/nm (Table 2).

Clearnose skate are managed in the Northeast Region skate complex by the New England Fishery Management Council under the Skates Fishery Management Plan (Sosebee 2006). Total biomass for the aggregate skate complex was relatively stable from 1968 to 1980, peaked in the mid 1980s, steadily declined until 1994, increased until 2000, and has since declined. The large increase in skate biomass in the mid 1980s was dominated by winter and little skate when the species in the stock complex are divided into large (barndoor, winter, and thorny) and small sized skates (little, clearnose, rosette, and smooth). Clearnose skate spawning stock biomass has increased from 1975 to 2007. Clearnose skate are not overfished and overfishing is not occurring (NDPSWG 2009).

The project area is EFH for clearnose skate and they likely will occur in the project area at temperatures between 4-21^{o}C.

3.2.5.2 Little Skate (*Leucoraja erinacea*)



General: Little skate range from Nova Scotia to Cape Hatteras, and are most abundant from northern sections of the Mid Atlantic Bight and Georges Bank. Little skate are considered the most abundant skate in northern Mid-Atlantic waters. They exhibit seasonal movements, moving inshore in the spring and offshore during the winter(Packer et al. 2003a). The project area is designated EFH for little skate juvenile and adult life-stages (Table 1).

Juveniles/Adults: Juvenile little skate hatch fully developed at 93-102 mm TL (Collette and Klein-MacPhee 2002, Parker et al. 2003a). Juvenile and adult Little skate occur on sandy, gravel, and mud substrates from the shoreline to 400 m at temperatures between 2-21° C. Juveniles occur at salinities ranging between 26-36 ‰ and adults occur in salinities between 29-35 ‰ (Collette and Klein-MacPhee 2002, Parker et al. 2003a). They occur year round in the Mid-Atlantic (Parker et al. 2003a). NMFS bottom trawl surveys have collected juvenile (≤ 49 cm) little skates along the New Jersey coast near the project area at densities of 1-10 skates per tow in the autumn (1963-2001), and densities ranging from 11-100 to 101-1000 skates per tow in the spring (1968-2002). Adult (> 49 cm) little skates have been collected in NMFS spring bottom trawl surveys from 1968-2002 at densities of 1-10 skates per tow (Packer et al. 2003a). CPUE of little skate from the NJMFA trawl data near the project area was 178.7 fish/nm and 90.1 kg/nm (Table 2).

Little skates consume a variety of fish and invertebrates including: herring, silver hake, silversides, sand lance, winter flounder, amphipods, gastropods, bivalves, squid, and crabs. Little skate predators include spiny dogfish and other sharks, other skate species, cod, monkfish, sea raven, longhorn sculpin, bluefish, summer flounder, and gray seal (Bowman et al. 2000, Collette and Klein-MacPhee 2002, Parker et al. 2003a).

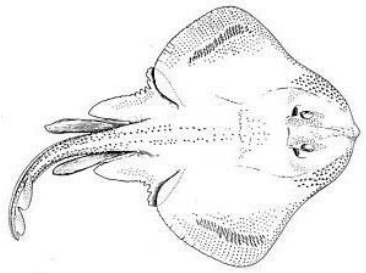
Little skate are managed in the Northeast Region skate complex by the New England Fishery Management Council under the Skates Fishery Management Plan (Sosebee 2006). Total biomass for the aggregate skate complex was relatively stable from 1968 to 1980, peaked in the mid 1980s, steadily declined until 1994, increased until 2000, and has since declined. The large increase in skate biomass in the mid 1980s was dominated by winter and little skate when the species in the stock complex are divided into large (barndoor, winter, and thorny) and small sized skates (little, clearnose, rosette, and smooth). The aggregate skate biomass increase from the mid-1990s to 2000 and the subsequent decline were due to an increase followed by a decline in little skate. Little skate spawning stock biomass was generally stable from 1982 through 2008 with slightly higher values estimated from 1999 through 2004. Little skate are not overfished and overfishing is not occurring (NDPSWG 2009, NMFS 2010b).

Little skate are primarily harvested by otter trawling, and are frequently bycatch in the groundfish and scallop fisheries. Skate landings are not reported by species, so species specific landings are unavailable.

Skate landings were 9,500 mt in 1969, they declined in during the 1970's, and in 1981 were only 800 mt. The landing increased in 1993 to 12,900 mt, declined slightly in 1995 to 7,200 mt, and reached a record high in 2007 at 19,000 mt. Landings increased beginning in the 1980's due to increase lobster bait demands and the skate wing export market. Skate wings are harvested for human consumption mainly from winter and thorny skates. Little skates are currently used for lobster bait. Recreational landings are considered insignificant (Sosebee 2006, NDPSWG 2009).

Juvenile and adult little skate could occur year round in the project area since water temperatures are generally between 2-21° C.

3.2.5.3 Winter Skate (*Leucoraja ocellata*)



General: Winter skates range from the south coast of Newfoundland to Cape Hatteras (Collette and Klein-MacPhee 2002). They are considered the second most abundant skate in northern Mid-Atlantic waters following little skate (Packer et al. 2003b). The project area has been designated EFH for winter skate juvenile and adult life-stages (Table 1).

Juveniles/Adults: Juvenile winter skate hatch fully developed at 112-127 mm TL and are often confused with juvenile little skates (Collette and Klein-MacPhee 2002, Parker et al. 2003b). Juvenile and adult winter skate occur on sand and gravel substrates at depths from the shoreline to 371 m at temperatures of -1.2-19° C and salinities of 28-35 ‰. Winter skate prey on polychaetes, amphipods, decapods, isopods, bivalves, hydroids and fish. As skates grow in size polychaetes and fish become a more important part of their diet, and crustacean decrease (Packer et al. 2003b). NMFS bottom trawl surveys have collected juvenile (≤ 84 cm) winter skates along the New Jersey coast near the project area at densities of 1-10 skates per tow in the autumn (1963-2001), and 11-100 skates per tow in the spring (1968-2002; Packer et al. 2003b). CPUE of winter skate from the NJMFA trawl data near the project area was 10.7 fish/nm and 8.9 kg/nm (Table 2).

Winter skate are managed in the Northeast Region skate complex by the New England Fishery Management Council under the Skates Fishery Management Plan (Sosebee 2006). Total biomass for the aggregate skate complex was relatively stable from 1968 to 1980, peaked in the mid 1980s, steadily declined until 1994, increased until 2000, and has since declined. The large increase in skate biomass in the mid 1980s was dominated by winter and little skate when the species in the stock complex are divided into large (barndoor, winter, and thorny) and small sized skates (little, clearnose, rosette, and smooth). The biomass of large sized skates steadily declined from the mid-1980s to the mid-1990s and has since been stable. Winter skate spawning stock biomass has followed the pattern of the autumn total biomass index with low values in the 1970s followed by a large increase in the size composition in the1980s, and a decline in the mid 1990s. The winter skate spawning stock biomass is currently at low values. Winter skate are not overfished and the species is rebuilding (NDPSWG 2009, NMFS 2010b).

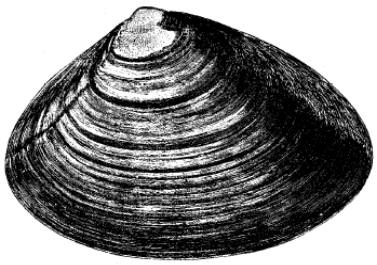
Winter skates are primarily harvested by otter trawling, and are frequently bycatch in the groundfish and scallop fisheries. Skate landings are not reported by species, so species specific landings are

unavailable. Skate landings were 9,500 mt in 1969, they declined in during the 1970's, and in 1981 were only 800 mt. The landing increased in 1993 to 12,900 mt, declined slightly in 1995 to 7,200 mt, and reached a record high in 2007 at 19,000 mt. Landings increased beginning in the 1980's due to increase lobster bait demands and the skate wing export market. Skate wings are harvested for human consumption mainly from winter and thorny skates. Little skates are currently used for lobster bait. Recreational landings are considered insignificant (Sosebee 2006, NDPSWG 2009).

Juvenile and adult winter skates could occur in the project area when water temperatures are between 1.2-19° C since the area contains the preferred sand substrate habitat.

3.2.6 Invertebrates

3.2.6.1 Surf Clam (*Spisula solidissima*)



The Atlantic surf clam is the largest bivalve mollusk in the western North Atlantic and inhabits sandy continental shelf habitats from the southern Gulf of St. Lawrence to Cape Hatteras, North Carolina (Merrill and Ropes 1969). Major concentrations of surf clams are found in the United States on Georges Bank, south of Cape Cod, off Long Island, southern New Jersey, and the Delmarva Peninsula (Merrill and Ropes 1969, Ropes 1980). The project area is not designated EFH for Atlantic surf clam juvenile and adult life-stages since the project area lies outside of federal waters and the U.S. Exclusive Economic Zone (EEZ; 3 mile to 200 nautical miles from shore). However, due to occurrence and the commercial importance of Atlantic surf clams in New Jersey territorial state waters (≤ 3 nautical miles from shore) the juvenile and adult life-stages of this species are discussed below (Table 1).

Atlantic surf clams are most abundant at depths of 8-66 m in turbulent areas deeper than the breaker zone at salinities from 14 to 52 ppt (Fay et al. 1983, Ropes 1980). Along New Jersey, the highest concentrations of surf clams occur at depths less than 18 m (Ropes 1980). The greatest concentrations of juveniles and adults are found in well-sorted, medium sand, but they may also occur in fine sand and silty-fine sand (Cargnelli et al. 1999b). They do not burrow into mud. Atlantic surf clams are planktivorous siphon feeders, their major diet components are diatoms and ciliates. Recently settled juvenile are consumed by the sevenspine bay shrimp (*Crangon septemspinosa*; Cargnelli et al. 1999b). Older juvenile and adult Atlantic surf clam predators are primarily moon snails, crabs, and sea stars. Atlantic cod and haddock are also known to prey on surf clams (Fay et al. 1983, Ropes 1980).

Size and age at sexual maturity is variable. *Spisula* may reach maturity as early as 3 months after settlement at lengths as small as 5 mm (off New Jersey; Chintala and Grassle 1995) to as long as 4 years at lengths of 80-95 mm (Prince Edward Island, Canada; Sephton and Bryan 1990). Growth is not uniform throughout the year as temperature significantly affects surf clam growth, physiology, and behavior (Ambrose et al. 1980, Davis et al. 1997). Surf clams may grow to a maximum size of 226 mm (Ropes 1980) and maximum age exceeds 30 years (Jones et al. 1978, Jacobson et al. 2006). Surf clams spawn in the summer and early fall. Egg fertilization occurs in the water column above the beds of spawning

clams (Ropes 1980). Surf clams along the New Jersey coast can exhibit two annual spawnings; the first spawning may begin as early as late May to early June closer inshore. Spawning is not associated with a particular temperature but usually occurs when temperatures are greater than 15º C, ranging from 19.5-30º C. The second minor spawning may be in October, caused by the breakdown of the thermocline (Tarnowski 1982, Ropes 1980, Sephton 1987). Little is known about other biotic factors such as salinity and dissolved oxygen on Atlantic surf clam spawning (Cargnelli et al. 1999b).

Atlantic surf clams in New Jersey territorial state waters (≤ 3 nautical miles from shore) are managed by the New Jersey Division of Fish and Wildlife. Atlantic surf clams in the EEZ are managed as a single stock by the Mid-Atlantic Fishery Management Council under the Atlantic Surf Clam and Ocean Quahog Fishery Management Plan. Surf clam biomass varies with latitude, in the southern Delmarva and New Jersey regions biomass, growth rate, and recruitment have declined while on Georges Bank and in the Long Island regions biomass and recruitment have increased. The surf clam biomass declined in the southern Delmarva and New Jersey regions is most likely due to poor recruitment, slow growth, and fishing mortality. The estimated EEZ stock biomass (120+ mm shell length) in 2008 was 878,000 mt meats and above the biomass target (543,000 mt of meats) and biomass threshold (272,000 mt of meats). The estimated 2008 EEZ fishing mortality was F= 0.027 and below the overfishing threshold ($F_{Threshold}$ = 0.15). The U.S. EEZ Atlantic surf clam stock is not overfished and overfishing is not occurring (NEFCS 2010b).

Total EEZ landings increased from approximately 13,186 mt of meats in 1979 to 22,889 mt of meats in1984, slowly declined to 18,234 mt of meats in 1998, and then increased to peak at 25,017 mt of meats in 2003. The total EEZ landings were approximately 22,481 mt of meats in 2008. Fishing effort has increased considerably since 1999, especially in the southern Delmarva and New Jersey regions (NEFCS 2010b).

New Jersey commercial surf clam landings increased from approximately 1,950 mt of meats in 1950 to 19,584 mt of meats in 1966, declined to 4,371 mt of meats in 1980, increased to 17,782 mt of meats in 1984, and continued to gradually increase. Landings peaked at 26,330 mt of meats in 2000, and then declined to 17,676 mt of meats in 2005. New Jersey commercial surf clam landings were approximately 20,317 mt of meats in 2007(NMFS 2010). New Jersey landings in 2008 accounted for 74% of the total 2008 EEZ landings (NEFCS 2010b).

The New Jersey State surfclam survey is conducted annually by the New Jersey Department of Environmental Protection. Figure 3 shows standing stock from 1994-2010 around Absecon Inlet, the survey area closest to the proposed project (NJ DEP 2010). Surfclam standing stock has declined from peaks in the late 1990s and early 2000s, with further declines in 2009-2010. A similar decline was noted from data collected during the NJ inshore surfclam surveys from the project area (Abescon to Little Egg inlet, up to 3 miles from shore; Figure 4; data provided by Jeff Normant NJ Division of Fish and Wildlife Marine Fisheries Administration Bureau of Shellfisheries). A spatial analysis of surfclam survey data in the Absecon Shoal borrow site revealed that adult surfclam density was highly variable and included both "hot spots" of high density as well as areas where surfclams are largely absent. Juvenile (<10mm) surfclam density from grab samples indicates that recruitment from the plankton is occurring. In fact, the 2009 density was the second highest recorded since 1994 (NEFSC 2010). Two studies near the project area estimated juvenile surfclam densities from benthic grab sampling ranging from 5-37 per square meter (Byrnes and Hammer 2001 , Versar 2010). However, length frequency data confirm that small clams are not recruiting into the population and replenishing the harvestable clams (NEFSC 2010). This implies that the benthic habitat is more vulnerable to impacts than the water column. Although the

NJMFA trawl program is not designed to census surf clams, they did occur in the catch at a density of 7.5 per nm, reinforcing the fact that they occur in the project area (Table 2).

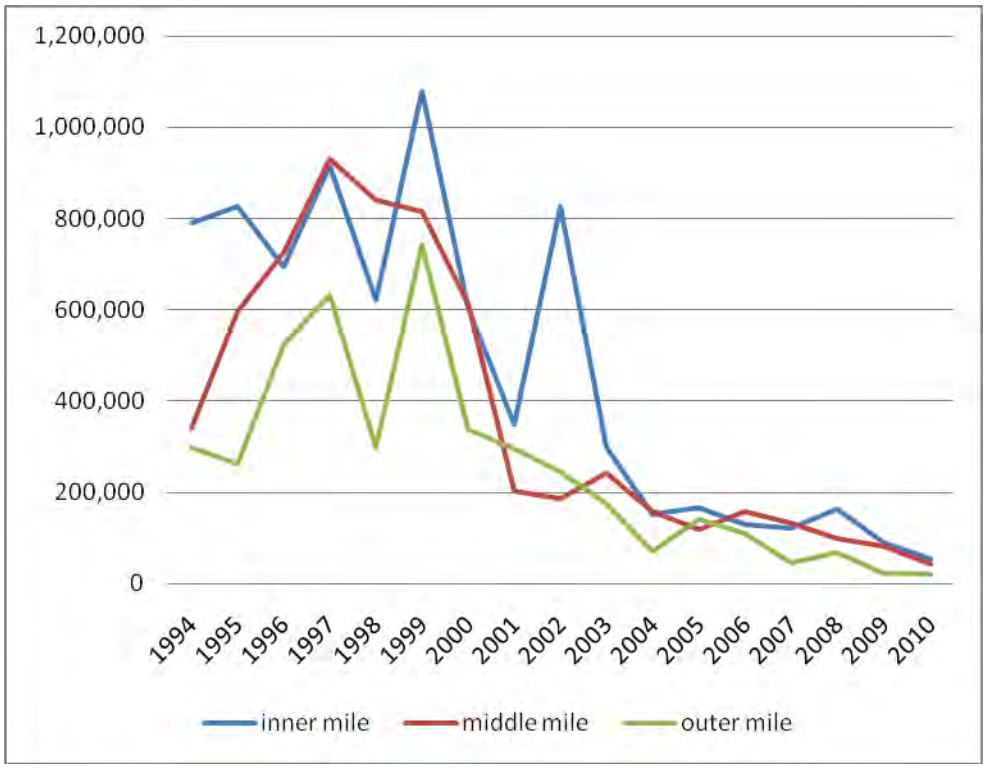


Figure 3. Annual surf clam standing stock (industry bushels) from Absecon Inlet, NJ from 1994-2010 in three-mile increments to shore. Source: NJDEP 2010.

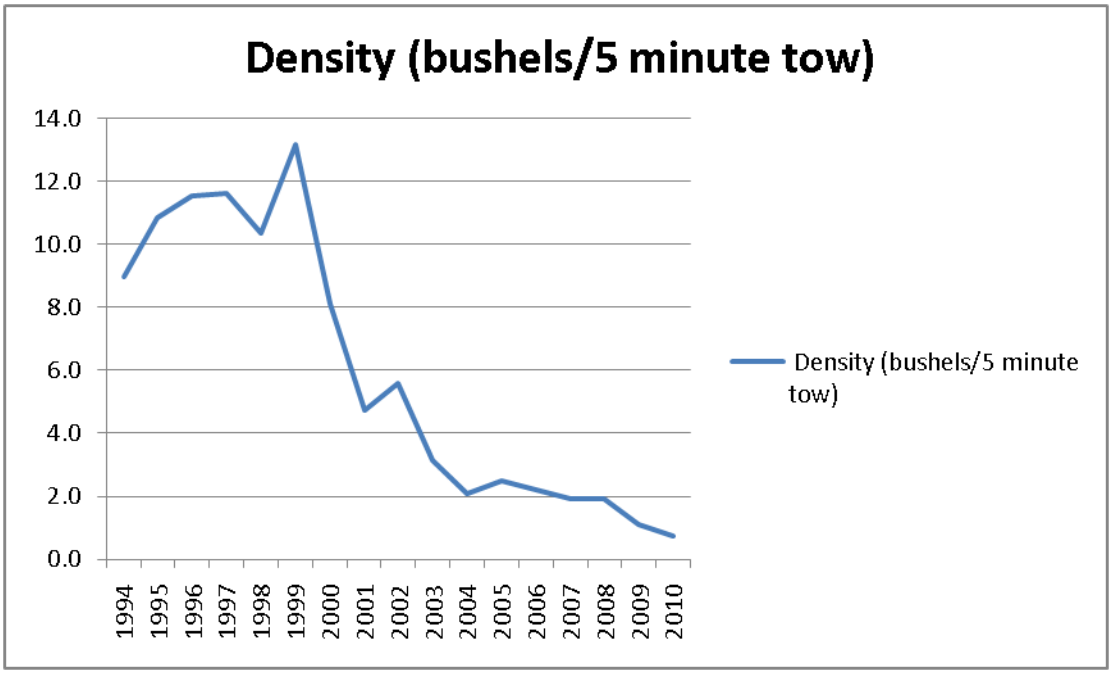


Figure 4. Annual surf clam density (bushels/5 minute tow) from Atlantic City, NJ area from 1994-2010. Source: Jeff Normant, NJ Division of Fish and Wildlife Marine Fisheries Administration Bureau of Shellfisheries.

3.2.6.2 Benthic macroinvertebrates

Benthic macroinvertebrates are important as a forage base for federally-managed species (Steimle et al. 2000). Crustaceans such as the shrimp *Crangon septemspinsa*, mysid *Neomysis americana,* and amphipod *Ampelisca* sp., and surfclam siphons, all found in the project area (Appendix B) are among the most important prey items for demersal fish. Benthic data studies off New Jersey (Boesch 1979) contained a station just north of the project area. Boesch (1979) categorized the benthic habitat at this station as inner shelf coarse substrate, characterized by dynamic, uniformly coarse sand containing a benthic community dominated by mollusks (*Tellina agilis*), crustaceans (*Tanaissus liljeborgi*), a variety of polychaetes, and the sand dollar *Echinarachnius parma.* Changes in dominant species were related to changes in subtle bottom topography, especially ridge and swale topography. Recently, the BOEMRE (formerly Minerals Management Service) and the Army Corps of Engineers have both conducted studies in the general area to evaluate the feasibility of sand borrowing since a portion of the project area contains a ridge or shoal area suitable for sand mining. Byrnes and Hammer (2001) conducted benthic surveys in May and September 1998 for six borrow areas off southern New Jersey including Area G1 just north of Absecon Inlet located 4.5 km northeast of Turbine 6 of the Fisherman's Energy project. Area G1 is a predominantly sandy habitat with a benthic community dominated by *Polygordius* sp., *Nucela proxima*, and *Capitella capitata* in May and the polychaetes *Polygordius* sp., *Apoprionospio pygmaea* and *Asabellides oculata* in September. Juvenile surf clam densities averaged 21 per m^2 and 37 per m^2 in May and September respectively. Versar, Inc. (2010) conducted a benthic survey in October 2009 for a proposed borrow area located on the finger shoal near Absecon Inlet that partially overlaps the Fisherman's Energy project area. Surface sand particle size and statistical analyses determined 3 sediment habitats: fine sand, coarse sand and mixed sand (fine to coarse) with distinct benthic

macroinvertebrates. Sediment type was identified as the major factor leading to habitat differences. The top of the shoal, where Fishermen's Energy Turbine 5 and a portion of the cable route are located, contained the least diverse and least abundant benthic community with a mix of coarse and fine sand dominated by Ascidiacea, *Polygordius jouinae*, and *Tanaissus psammophilus*. The juvenile surf clam density was 5 per m^2 (Versar 2010). A complete evaluation of benthic macroinvertebrates based on existing information is provided in NAI 2010. Site specific grain size and benthic data were collected in 2010; the results from this surveyare included as Appendix B of this document.

4.0 Analysis of Potential Adverse Impacts and Mitigation

The potential adverse impacts on EFH produced by the proposed project activities are discussed in the following sections. An adverse effect is defined as any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects are categorized as substantial or not substantial. Fishermen's Energy will work with federal and state regulatory agencies to develop and implement a post-construction monitoring plan that evaluates the project's impacts on the marine environment.

4.1 Permanent EHF Impacts

Installation of the jacket-type foundation would result in the loss of approximately 0.02 acres (923 ft^2) of benthic EFH habitat. Benthic invertebrates and shellfish, important as forage for federally-managed species, inhabiting the areas under the piles would be lost along with any fish species and lifestages unable to avoid construction activity. This habitat would be unavailable to support the 10 demersal EFH species described in Section 3.0. It would not be available as surf clam habitat. The addition of the foundations results in a loss of soft substrate but an increase in hard substrate, thus increasing habitat diversity. The actual surface area gained from the three-dimensional nature of the foundations would be substantially more than the surface area lost from the turbines. The steel pilings proposed for the jacket-type foundation will not be coated in the submerged zone (Keystone Engineering Inc. 2013), which will allow colonization and growth of fouling organisms (e.g. tube-dwelling amphipods and blue mussels) adapted to living on hard substrates. These organisms would provide a food source and refuge for a variety of fish species and function as artificial reef structures without covering adjacent soft bottom habitat. The proposed construction materials meet the 2004 AGSMFC Guidelines for Artificial Reef materials and 2007 NOAA National Artificial Reef Plan criteria for compatibility, durability, and stability for artificial reef habitat development (AGSMFC 2004, NOAA 2007). In New Jersey waters, conger eel (*Conger oceanicus*), radiated shanny (*Ulvaria subbifurcata)*, and ocean pout (*Macrozoarces americana)* used artificial reefs for cover and refuge; cunner and EFH-species black sea bass were found around the edges of the reefs (Figley 2003), and likely rely upon the reef-soft substrate-water column habitat complex , depending on the season and lifestage (Steimle and Zetlin 2000). Predatory fish that have been observed around mid-Atlantic artificial reefs include EFH species bluefish, mackerels and tunas (Scombridae); and summer flounder. These species may be preying on smaller species residing in or around the artificial reef, or may simply be attracted to the reef structure (Steimle and Zetlin 2000). Other EFH species that have been found on reef-like habitats in the Middle Atlantic Bight for feeding or shelter include Atlantic cod, red hake, striped bass, and scup (Steimle and Zetlin 2000).

A study of experimental artificial reefs deployed in New Jersey found that biomass i.e. organism weight was increased by a factor of from 24-123 times that in a surf-clam dominated habitat, and 771 to 2,195 times that of a polychaete-dominated soft substrate community (Figley 2003). These reef habitats provide increased surface area (an average of 47.5 times that of flat bottom), with complexity that provides habitat for hard substrate "fouling" organisms. Steimle et al. (2002) compared the annual production of epifauna on a concrete reef structure located at the mouth of Delaware Bay with that of the infauna of the surrounding sandy bottom over the 5-year period 1989-1994. On an equal footprint basis, the production of natural bottom infauna was 217-251 kcal/m²/yr as compared to 3,994-9,281 kcal/m²/yr of epifauna on the reef substrate.

Post-construction monitoring results from other offshore wind parks provide insights into the potential for EFH impacts. The Danish Horns Rev site in the North Sea, 14 km offshore, is in a highly dynamic shallow water habitat approximately 21-44 feet (6.4-13.4 m) deep (Leonhard and Pedersen 2006). The Horns Rev project, with 80 turbines, is much larger than the proposed Fishermen's Energy project. The investigators found that the most significant construction-related-effect was the loss of sand substrate habitat and its associated benthic infauna, combined with the creation of hard substrate (steel, gravel, stone) habitat, with its characteristic fauna. The rock scour protection community differed from the monopile community. Organisms such as the blue mussel (*Mytilus edulis)*, sea star (*Asterias rubens)*, and barnacles (*Balanus crenatus*) settled on the scour protection. A variety of fish species were observed foraging at the sites, including pouting and cod; other species such as rock gunnel and dragonet used the sites as habitat. These species were typical of wrecks in the North Sea. Leonard and Pedersen (2006) estimated that the amount of food available to predatory fish increased by a factor of 50 in comparison to soft substrate habitat.

The Danish Nysted wind farm, with 72 wind turbines, is approximately 6 miles offshore in the south Baltic Sea. It is located in waters approximately 19-31 feet (5.8-9.4 m) deep in mainly sand substrate (Elsam Engineering and ENERGI E2 2005). Two years after construction, there was some evidence of increased fish abundance near the turbines, but not as much as expected. This was attributed to the fact that the benthic community was composed mainly of large mussels, which are only moderately attractive to most of the resident fish species.

The North Hoyle Offshore Wind Farm in the Irish Sea has 30 2 MW turbines in 39 feet (12 m) of water (Cefas 2010). Post construction monitoring of the most abundant commercial fish assemblages showed catches that were comparable to pre-construction levels. Species composition of both benthic organisms and demersal fish post-construction was similar to pre-construction.

Installation of the turbine units may alter water circulation, which could alter the sediment composition in the immediate area. Six years of post-construction monitoring results from the Danish Horns Rev site showed that sediments around the turbines became coarser but paralleled changes at reference sites and thus were attributed to regional changes. No sediment disturbance was observed that could be related to changes in the hydrodynamic regime resulting from the presence of the wind turbines. Hydrodynamic regime changes are not expected to occur with the use of the jacket-type foundations or due to the presence of the Fishermen's Energy wind turbines.

EMF Effects

Transmission of electrical currents through buried cables cause emission of magnetic fields into the water column, the strength of which varies directly with the electrical voltage. Movement either of currents or swimming organisms through the magnetic field creates an induced electric field.

EMF intensity depends on a number of factors including the type of current (alternating current (AC) is less than direct current (DC)), the amount of current flow, cable orientation, distance from the cable, amount of substrate over the cable, and conductivity of sheathing material. The ability to detect EMF is species-specific, and effects would vary based on cable orientation, configuration, currents, swimming direction of the animal, etc. There is evidence from laboratory studies that elasmobranch fishes (sharks, skates, rays) have a well-developed electrosensory system and can detect both electric and magnetic fields. This group includes several of the EFH species in the project area- spiny dogfish; dusky, sandbar, shortfin mako and tiger sharks; and clearnose, little, and winter skates. Two species, spiny dogfish (Gill et al. 2009) and tiger shark (Yano et al. 2000) are not electro- or magneto-sensitive and have shown no behavioral responses to EMF. Five other EFH species, shortfin, mako and sandbar sharks; and little, winter, and clearnose skate all have shown some evidence of electrical or electromagnetic sensitivity. There is no information on dusky sharks. Behavioral studies have suggested the presence of electrosensitivity in Atlantic cod (Regnart 1931) and magnetosensitivity in two species related to species for which EFH has been designated in the project area (yellowfin tuna [Quinn and Ogden 1984] and the pleuronectid European plaice [Metcalfe et al. 1993]). Potential EMF effects include migration, prey detection, reproductive behavior, and habitat use.

The relatively low voltage proposed for the Fishermen's Energy project cable will result in a relatively low magnetic field strength, and, subsequently, a low induced electric field strength. Elasmobranchs have been found to be most sensitive to low frequency alternating electric fields (from 1-10Hz), although strong field intensities at frequencies up to 25 Hz can also elicit a response (New and Tricas, 1997; Bodznick et al. 2003). AC transmissions in the US are typically 60 Hz, which results in a field reversal 60 times per second, a rate at which it is unlikely that elasmobranchs could respond. Thus, exposure to a low voltage, 60 Hz AC cable is unlikely to affect elasmobranchs. Even if a shark or teleost fish detected the EMF from this cable, the response would be very localized and more likely in demersal species than pelagic species, particularly given the mobility of these species. EMF will be further reduced by using the proposed HDPE cable sheathing (CMACS 2003). Cable burial to at least 3.28 feet (1 m) will provide some mitigation, due the physical barrier, for the potential impacts of the strongest EMF exposure on sensitive species (CMACS 2003). As the strength of magnetic and electrical fields decreases with increasing distance (OSPAR 2009), EMF exposure will be further reduced by burying the cable six feet below the seabed (Normandeau et al.2011).

Sound Effects

Sound generated during wind farm operation has the potential to adversely affect EFH species. Components of sound include frequency (measured in Hertz), intensity (or pressure, measured in decibels), and duration. Decibels (db) are measured on a logarithmic scale in comparison to a reference sound (underwater sound is referenced to 1 µPa). The proposed project would generate additional noise related to both turbine operation as well as from vessels tending the project. The project area is in an area of active vessel use including shipping and commercial and recreational fishing. Incremental vessel operations related to the project are not expected to result in a substantial increase in noise levels.

Noise and vibration associated with operation of the turbines would be transmitted into the water column and sediment. The levels vary depending on the depth, substrate type, foundation type, turbine design, etc. Operational noise at four British wind projects ranged from 114- 130 dB re 1 µPa within the turbine arrays (Cefas 2010). The authors concluded that noise levels from wind farm operation were below thresholds that could cause avoidance behavior for several fish species, including two EFH

species, cod and herring. Operational sound levels were modeled for the Cape Wind project, and hearing-threshold calculated. The conclusion was that operational sounds would be marginally audible to finfish only at a distance of 20 m (66 ft). No injury or behavioral effects were anticipated from the project. Therefore, underwater sound emanating from the Fishermen's Energy wind project is unlikely to have deleterious effects on the noise environment of EFH species.

4.2 Temporary EHF Impacts

Habitat Disturbance.

The project would result in temporary disturbance of the demersal EFH habitat during placement of the jacket-type foundations and cables. Installation of the foundations would likely temporarily disturb adjacent areas as a result of anchoring of support vessels or placement of the jack-up barge. Installation of the jacket-type foundation will take approximately one day per foundation. Other than cable installation, this will be the total time period for in water construction of the turbines. All work of installing the other turbines components on top of the foundation will be above the water line and therefore will not impact EFH. Installation of the foundation would take approximately one day per turbine, or a total of 1-2 weeks.

Approximately 3.66 acres of temporary impact to demersal EFH habitat would result from cable installation. Cable installation would last approximately 1-2 weeks. Use of jet plowing for cable installation confines disturbance to a narrow trench, estimated to be approximately 5 feet wide. There would be additional disturbance and temporary loss of habitat around the borehole where the 12" diameter HDD conduit will breakout of the seabed. Anchor line sweep, anchoring, and skids on the jet plow would also temporarily disturb small additional areas of substrate. Jetting, and to a much lower degree, plowing, would result in temporary suspension of sediments, potentially causing additional benthic impacts from burial or smothering near the trench. All of these impacts would be localized and short term.

During construction, EFH functions and values for demersal species would be unavailable. That could include habitat, nursery/spawning, and benthic macroinvertebrate forage base, depending on the species and time of year. EFH species and shellfish with pelagic eggs and larvae would not be affected to the same degree. Cable installation would disturb approximately 0.14 acres of winter flounder egg EFH and 0.38 acres of winter flounder larvae EFH. Juvenile and adult EFH species could be displaced or killed during construction. Once the project has been constructed, the substrate would return to existing conditions. The Cape Wind project estimated seabed scar recovery from jet plow using sediment transport modeling (MMS 2009). The recovery time ranged from less than a day to 38 days, depending on the depth, current regime, and substrate type. Recolonization of the benthic macroinvertebrate forage base for demersal EFH species would begin immediately although the recovery time for benthic macrofaunal communities is variable and depends on the season and location. Disturbance involving a change in sediment structure or transport can affect the length of recovery time. Literature on benthic recolonization in the mid-Atlantic shelf has mostly been related to recovery after sand mining, a process that results in larger areas (and greater depths) of disturbance than that anticipated for this project. Recovery time is dependent on three factors: the composition and abundance of adjacent benthic communities; the likely composition of the new substrate; and the season of the disturbance (Diaz et al. 2004). The sediment composition following construction is likely to be similar to the existing conditions along the cable route, as sediment in this high-energy environment will be transported from surrounding areas. Therefore, macrofaunal species composition

will also ultimately be similar. Some of the typical dominant species such as annelids can readily recruit in any season from nearby populations. Those that are opportunistic such as *Streblospio* will appear in days to weeks. Other dominants such as amphipods, mollusks, and sand dollars (*Echinarachnius parma*) are less mobile and will rely on larval and juvenile recruitment. Larval and juvenile populations are able to repopulate the area more readily in the summer than during winter months. Diaz et al. (2004) estimated that benthic resources in an area disturbed by sand mining would be sufficient for demersal fish forage after a single spring/summer recruitment period. A study in a shoal area off northern New Jersey (Burlas et al. 2001) determined that in areas of high sediment movement and where sediment removal resulted in shallow pits, species abundance and richness recovered within 1 year; biomass, in particular sand dollar biomass, required 2.5 years to fully recover. Repopulation following sand mining in a borrow pit off Great Egg Harbor Inlet (NJ) recorded a two-year recovery period (Scott and Kelley 1998). Recovery after a hypoxic event on the inner shelf off Atlantic City was species dependent. Initial opportunistic colonizers repopulated the area within months, as did some species with late summer recruitment patterns such as surf clams and sand dollars. Crustaceans had not repopulated after one year of sampling (Boesch 1979). These recolonization studies represent a worst case, as the disturbed area was substantially larger, reducing the ability of organisms to migrate into the disturbed substrate from adjacent, undisturbed areas. Furthermore, studies show that recolonization after sand mining can be facilitated by leaving small areas undisturbed ("refuges"), similar to the areas between turbines, which allow organisms to migrate to disturbed areas (Byrnes et al. 2004 a, b).

Decommissioning would also result in temporary impacts to benthic EFH habitat. These impacts would be short term and localized, similar to construction impacts.

Construction Noise

Construction activities that will contribute to increased underwater noise in the proposed project area include ship and barge traffic related to delivery of workers and construction materials and the actual construction activity (including cable installation and pile driving). Of these, pile driving generates the highest levels of sound pressure waves. The type and intensity of sounds generated by pile driving depends on a number of factors including the type and size of the pile, substrate firmness, water depth, and the type and size of the pile-driving hammer. Sound pressure levels are positively correlated with pile size and substrate firmness; the larger the pile or the more firm the substrate, the more energy that is required to drive the pile into the substrate (NMFS 2005). Sound exposure intensity and duration are the most important factors in injury (Hastings and Popper 2005).

Fish could be impacted by underwater noise. Sublethal effects include behavioral effects such as feeding, schooling, and reproduction; soft tissue impacts; hearing loss; visual impairment, and other physiological conditions. The degree to which a fish is impacted by noise is dependent on several factors. These can include both the species and lifestage of fish as well as environmental factors such as water depth, hydrodynamic regime, and substrate type. The absence of a swimbladder (including all cartilaginous fish such as sharks, skates, and rays) reduces the vulnerability to sound and sound pressure effects. Smaller fish are more likely to be affected by underwater sound than larger fish. Eggs and larvae are unable to avoid sound effects, they are therefore potentially more vulnerable.

Sound levels injurious to fish have been estimated in several ways. On the West Coast, the Fisheries Hydroacoustic Working Group composed of West Coast Departments Of Transportation, NMFS and USFWS established interim noise exposure criteria for pile driving based on absolute noise levels protective of most marine species. These are 206 dB re 1 µPa peak exposure and 187 dB re 1 µPa

accumulated sound exposure level (SEL) for fish > 2 grams (CalTrans 2009). Studies at five wind farm sites around England had an average unweighted peak construction noise level of 250 dB re 1 µPa at 1m (Nedwell et al. 2007), which exceeds the NMFS-defined peak noise criterion. The distance at which noise levels dropped below 200 dB re 1 µPa ranged from 1.9-12.8 km. In other words, pile driving generated adverse noise levels at distances up to 12.8 km away from the noise source. Nedwell et al. (2007) recommended use of a criterion geared to the species-specific hearing ability in units $dB_{ht.}$ A sound pressure level equivalent to 130 dB_{ht} re 1 µPa (130 db above the hearing threshold for that species) was defined as injurious and sound pressure level equivalent to 90 dB_{ht} re 1 µPa was defined as a behavioral threshold generating an avoidance response. The Cape Wind DEIS predicted perceived sound levels from pile driving for several finfish including one EFH species in the Fishermen's Energy project area (cod) as well as for seabass and tautog. Predicted underwater sounds would not be injurious to these species even at 30m from the sound source (MMS 2009). Behavioral effects (e.g. avoidance) would be likely at distances between 60-350 m from the source of the sound. Data collected at the five British offshore wind farms (Nedwell et al. 2007) suggests that pile driving generates sounds that affect behavior over large distances. The "Behavioral Impact Range" or distance where noise causes an avoidance reaction for cod and herring ranged from 1.6 km to 26 km from the construction activity. However, several studies on fish hearing and response (Popper and Clark, 1976; Enger, 1981; Denton and Gray, 1993; Cox et al., 1987; SEL, 2005) suggest that even intense sounds if intermittent should not produce permanent damage to fish sound receptors if the fish chose to remain in construction areas. That is likely to be the case for the Fishermen's Energy project because construction-related noise would be of short duration, no more than 1 to 2 weeks in total. Pile driving will begin with a soft start to allow fish to leave the area before maximum sound levels occur.

According to the Cape Wind DEIS, there are few studies of sound effects on fish eggs and larvae. Therefore, no predictions were made.

Sediment Contamination

The substrate in the project area is predominantly sand. Surface sediment samples show that the silt/clay component is less than 5% (FERN unpublished sediment data). Therefore, the ability of the sediments to retain organic carbon and associated contaminants is low. Furthermore, the project area is distant from potential sources of contaminants. Therefore, localized sediment disturbance is unlikely to release sediment-bound contaminants during construction. EFH species would not be exposed to increased levels of contaminants either through direct contact with the substrate or through ingestion of prey items.

Sediments could potentially be contaminated during cable installation using HDD. As a result of standard directional drilling techniques from shore to seaward, the drill bit will break out of the seabed at the 15' contour approximately 2,000' from shore. At the moment of breakout of the drill bit, a small amount of drilling fluid will be released into the water column. Drilling fluid consists of water (95%) with a small amount of bentonite clay (5%) along with small amounts of environmentally-safe additives. After the seabed breakout of the drill bit, a back reaming operation will take place and pullback of the 2,600' of HDPE conduit pipe will be performed from a barge moored offshore at the breakout location. The HDD activity in the EFH habitat is a 2 to 3 day operation, further reducing the risk of contamination.

Water Quality Effects

Construction activities, including installation of the jacket foundation and cables, and decommissioning activities will disturb the sea floor, with the potential to increase turbidity and total suspended solids

(TSS). Elevated turbidity and TSS can negatively affect EFH species by reducing visibility, interfering with the ability to detect prey and find suitable habitat. Demersal egg hatching and survival as well as some benthic invertebrate survival can be reduced if substantial amounts of sediment settle over eggs. These activities will be of short duration, several weeks at most. Sediment grain size in the project area is predominantly medium-coarse sand, with less than 5% silt/clay. Any sediments that are disturbed during construction or decommissioning will rapidly settle out. Furthermore, the currents regime in the project area is relatively dynamic so there are likely relatively high levels of TSS and turbidity at least episodically (i.e., during storms). EFH species and their prey species are probably accustomed to high levels of suspended sediments, so that the risk of adverse impacts from short term increases resulting from construction and decommissioning is low.

Sediment disturbance at the borehole during HDD will be minimized by using cofferdams. Minimal adverse effects on EFH species or their water column habitat could occur.

Entrainment/Impingement

Vessel operations require water withdrawal for engine cooling, and for jet plow operations. Most water withdrawals would be infrequent, during servicing and decommissioning. Servicing would include annual major service (4-6 days) and minor servicing (1-2 days, twice per year). Construction and decommissioning would take place over a period of 1-2 weeks. Therefore, water withdrawal from vessel operations would occur infrequently and over short periods of time. The incremental increase in water withdrawal from operations and decommissioning would be minor and have negligible effects on EFH species.

Jet plow operations would require additional water withdrawals. Jet plows generally withdraw surface water for use in operations. Ichthyoplankton eggs and larvae would be entrained during the operation. Jet plow operation can utilize anywhere from 1500-4200 gallons (5.7 -15.9 cubic meters) per minute, progressing at a 1,312 feet (400 meters) per hour (Kober et al. 2002). A rough estimate for this project could be 4 million gallons (15,142 cubic meters).

Ichthyoplankton larval data for the New York Bight area were secured from MARMAP sampling program (conducted from 1977 through 1987) and ECOMON program (2004 through 2005) for the proposed Safe Harbor project (Normandeau 2007). While not collected in the project area, these data, presented in Appendix Table 1, can be considered to qualitatively reflect the ichthyoplankton community in the project area. Entrainment was estimated by multiplying average density by the total water used in jet plow operation (Table 3).

Table 3. Estimates (lower-upper 95 percent confidence limits) of potential larval entrainment of the proposed Project. Based on annual average of monthly densities of fish larvae collected by MARMAP (1977-1987) in the New York Bight (source: Normandeau 2007).

Species	Larval Density (per 100 m^3) [1]	Estimated Jet Plow Entrainment of EFH Larval Species
Black sea bass	0.66	100 (0-212)
Bluefish	2.21	335 (0-911)
Cobia	0	0
King mackerel	0	0
Monkfish	0.28	42 (0-101)

Spanish mackerel	0	0
Summer flounder	1.13	171 (0-372)
Winter flounder	0.13	20 (0-48)
Red Hake	0.29	44 (0-103)
Windowpane flounder	2.76	418 (75-775)
Witch flounder	0.22	33 (0-74)
Yellowtail flounder	3.44	521 (0-1229)

[1] one cubic meter = 264 gallons

Based on this calculation, the estimated number of EFH ichthyoplankton entrained by jet plow could range from 0 (Spanish mackerel) to 521 for yellowtail flounder. This level of ichthyoplankton loss is minimal compared to the overall number of ichthyoplankton larvae dispersed into the project area. As a frame of reference, approximately 100 black sea bass larvae would be lost from entrainment; a female Black sea bass 2-5 years of age in the Mid-Atlantic Bight releases between 191,000 and 369,500 eggs annually (Drohan et al. 2007).

Cumulative Impacts

The impacts from the project must be considered in light of other adverse effects to EFH species. The loss of 0.02 acres of EFH is a loss of habitat for species, some of which have been overfished or are otherwise vulnerable. The creation of hard substrate habitat increases habitat diversity and could benefit some EFH species. The project area is in an area of active commercial and recreational fishing. In addition, sand mining occurs in adjacent areas. Sand mining is expected to occur within the next year. These activities disturb demersal EFH habitat. The project represents an incremental increase in EFH habitat disturbance. Construction activities will increase habitat disturbance in an area that is already disturbed by commercial fishing and sand mining. Approximately 3.66 acres of demersal EFH habitat will be disturbed over a period of several weeks. In addition, a small number of ichthyoplankton eggs and larvae will be entrained during jet plow operations. Construction noise will add to the ambient noise levels from other activities such as shipping and commercial fishing. Pile driving represents the most substantial noise increase, potential heard kilometers from the site for a short period of time.

5.0 Atlantic Sturgeon Assessment

Atlantic sturgeon listed under the Endangered Species Act (ESA) is of particular interest for this offshore wind project as this species has been documented in areas off the New Jersey coast. The proposed offshore wind project area overlaps habitat known to be used by sub-adult and adult Atlantic sturgeon that are part of the New York Bight Distinct Population Segment (DPS). This assessment evaluates the potential effects of the project on this species and designated critical habitats that are listed under the ESA.

5.1 New York Bight DPS of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus)*



General: Atlantic sturgeon is a long-lived, late maturing, estuarine dependent, anadromous fish that ranges from Hamilton River, Labrador, and George River, Ungava Bay, to Port Canaveral and Hutchinson Island, Florida (Collette & Klein-MacPhee 2002, ASSRT 2007). Thirty-five rivers have been confirmed to have had a historical spawning population; currently 32 rivers contain Atlantic sturgeon, with at least 20 having a spawning population. Many of these stocks are at historic lows (ASSRT 2007). On February 6, 2012, the NMFS listed five distinct population segments of Atlantic sturgeon under the Endangered Species Act; the Chesapeake Bay, New York Bight, Carolina, and South Atlantic populations were listed as endangered, while the Gulf of Maine population was listed as threatened (77 FR 5880). The New York Bight DPS of Atlantic sturgeon is defined as including all Atlantic sturgeons that are spawned in the watersheds that drain into coastal waters including Long Island Sound, the New York Bight, and Delaware Bay from Chatham, MA to the Delaware-Maryland border on Fenwick Island. The New York Bight DPS includes Atlantic sturgeon held in captivity and that are identified as fish belonging to the New York Bight DPS based on genetics analyses, previously applied tags or marks, or documentation that the fish originated from a river or is the progeny of any fish that originated from a river within the range of the New York Bight DPS. The marine range of New York Bight DPS Atlantic sturgeon extends from Hamilton Inlet, Labrador, Canada to Cape Canaveral, Florida (77 FR 5880). Atlantic sturgeon have been documented in the following New York Bight DPS rivers: Taunton, Connecticut, Hudson, and Delaware Rivers. The Hudson and Delaware Rivers are the only known Atlantic sturgeon spawning rivers in the New York Bight DPS (ASSRT 2007, Damon-Randall et al. 2013).

Eggs, Larvae, and Juveniles: Atlantic sturgeon utilize a wide variety of habitats. They require silt-free hard bottom substrates such as gradient boulder, bedrock, cobble-gravel, and coarse sand in freshwater rivers to spawn adhesive eggs (Collette & Klein-MacPhee 2002, Greene et al. 2009). Eggs hatch in 94 to 140 hours at water temperatures of 15.0 to 24.5° C. Larvae remain in deep river channels near spawning habitat upstream of the salt front and have been collected at depths of 9 to 20 m (29 to 66 ft). Juvenile sturgeon are found over sand, mud, cobble, rocks and transitional substrates and remain in their natal estuary for up to a year before migrating out to sea. Juveniles have been reported at depths of 2 to 37 m (6.5 to 121 ft), temperatures of 3 to 28° C, and salinities from 0 to 27.5 ppt (Greene et al. 2009).

Sub-adults and Adults: Large juvenile (sub-adult) Atlantic sturgeon emigrate out of their natal estuarine habitats and migrate long distances in the marine environment. Juvenile and adult Atlantic sturgeon frequently congregate in upper estuary habitats around the saltwater interface (Greene et al. 2009). Migrations to other nearby estuaries are common for sub-adult Atlantic sturgeon (Greene et al. 2009). Large juvenile and non-spawning adult Atlantic sturgeon have been documented in nearshore Atlantic coastal shelf areas with moderately shallow (7 m to 50 m) sand and gravel habitats (Stein et al. 2004a, Laney et al. 2007, Greene et al. 2009, Dunton et al. 2010). Studies have shown that Atlantic sturgeon aggregate in areas off southwest Long Island, along the New Jersey coast, off Delaware Bay, and off Chesapeake Bay (Stein et al. 2004b, Dunton et al. 2010, Erickson et al. 2011, Damon-Randall et al. 2013). Seasonal depth distribution patterns were observed in these studies, with sturgeon occupying the deepest waters during the winter and the shallowest waters during summer and early fall (Dunton et al. 2010, Erickson et al. 2011, Damon-Randall et al. 2013). The lowest numbers of Atlantic sturgeon caught in coastal shelf areas occurs during the summer (Dunton et al. 2010). Adult Atlantic sturgeon make seasonal migrations to and from freshwater spawning habitats. Spawning migrations to freshwater habitats occur in late winter to early summer (Stein et al. 2004a). Atlantic sturgeon appear to undergo large-scale southerly fall migrations and northerly spring migrations (Dovel and Berggren 1983, Dunton et al. 2010). Sturgeon use marine habitat for foraging before returning to natal rivers (in this case the

Hudson and Delaware Rivers) to spawn (Dunton et al. 2010). Diet prey items include polychaetes, amphipods, isopods, decapods, mollusks, and sand lance (*Ammodytes* spp.; Scott and Scott 1988, Johnson et al. 1997). Critical habitat has not been designated for the New York Bight DPS of Atlantic sturgeon.

Species Presence in New Jersey Waters and the Project Area: Atlantic sturgeon sub-adults and adults have been documented to aggregate off the coast of New Jersey in commercial fisheries bycatch, New Jersey Department of Environmental Protection (NJDEP) finfish surveys, and a variety of tagging studies (Stein et al. 2004a, Stein et al. 2004b, Johnson et al. 2005, Dunton et al. 2010,Erickson et al. 2011, Damon-Randall et al. 2013). The sturgeon captured in these studies ranged in size from 52 to 248 cm total length and in age from 5 to 26 years (Johnson et al. 2005, Dunton et al. 2010, Erickson et al. 2011). Atlantic sturgeon off the New Jersey coast were most often encountered on sand and gravel bottom types at depths of less than 25 m (Stein et al. 2004a, Dunton et al. 2010). Aggregation locations have been identified off Sandy Hook, the Barnegat Bay system, and the entrance of Delaware Bay (Stein et al. 2004a, Stein et al. 2004b, Dunton et al. 2010, Erickson et al. 2011, Damon-Randall et al. 2013). The NJDEP finfish surveys from 1988 through 2007 captured a total of 261 Atlantic sturgeon in 3,617 bottom trawls (0.072 fish per tow), with 95% of all captures occurring in depths of less than 20 m (Dunton et al. 2010). The highest catch per unit effort (CPUE) occurred during the winter months with 0.124 fish per tow, followed by the fall (0.096 fish per tow) and the spring (0.079 fish per tow; Dunton et al. 2010). Atlantic sturgeon were not captured during the summer months (July through September). The majority of sturgeon (91%) were captured off northern New Jersey during the winter, with 80% occurring within a small area of Sandy Hook. During the fall, 92% of captured sturgeon occurred north of Little Egg Inlet, with 64% occurring off northern New Jersey (Dunton et al. 2010). Sturgeon were collected along the entire coast during the spring months with 44% of the captures occurring off Sandy Hook. The shallow water area (< 20 m) between the New York Bight to Virginia is considered overwintering habitat for Atlantic sturgeon and functions as a migratory or dispersal corridor from the southern tip of Long Island, NY to Cape Hatteras, NC (Dunton et al. 2010, Erickson et al. 2011). Genetic analysis indicates that Atlantic sturgeon collected along the New Jersey coast are predominantly from the New York Bight DPS, although individuals may also be migrants from other DPSs including the Gulf of Maine, Chesapeake Bay, Carolina, and South Atlantic (Waldman et al. 1996, Wirgin et al. 2000, Waldman et al 2013, Damon-Randall et al. 2013). Sturgeon tend to aggregate within their spawning river geographic region so the majority of fish in the adjacent mixing area are from the nearest DPS with a small percentage of fish from other DPSs (Damon-Randall et al. 2013).

Atlantic sturgeon have been observed or collected near the project area (Dunton et al. 2010, Erickson et al. 2011, Damon-Randall et al. 2013). The two sturgeons observed near the project area in 2007-2008 by Erickson et al. (2011) using pop-up satellite archival tags were present during the third (July through September) and fourth (October through December) calendar quarters. NJDEP 1988 through 2007 finfish surveys collected a few Atlantic sturgeons near the project area during spring months (Dunton et al. 2010). The project area is within the New Jersey coastal region that is used as overwintering habitat and a migratory or dispersal corridor by sub-adult and adult Atlantic sturgeon (Dunton et al. 2010, Erickson et al. 2011). Based on the available information, sub-adult and adult Atlantic sturgeon could occur in the project area year round, although occurrence is expected to be rare.

5.2 Analysis of Potential Impacts and Risk Assessment for Atlantic Sturgeon

Potential impacts to Atlantic sturgeon include effects to prey resources and foraging habitats, habitat shift, jet plowing, water quality, exposure to electromagnetic field, vessel strike, and noise. As Atlantic sturgeon are demersal fish, light pollution is not expected to affect this species.

5.2.1 Effects to prey resources and foraging habitats

Construction in project areas will result in the temporary disturbance of 3.66 acres during construction and the permanent loss of 0.02 acres (923 ft^2) of Atlantic sturgeon foraging habitat due to turbine foundation installation. The hard substrate benthic community that is expected to develop on the turbine foundations is not expected to support Atlantic sturgeon foraging. The proposed project would result in the loss of a small amount of sub-adult and adult Atlantic sturgeon foraging habitat.

Temporary effects to prey resources and foraging habitats resulting from construction activities (e.g. turbine and cable installations) are also expected. Atlantic sturgeon may utilize the project area for foraging during their seasonal movements. Johnson et al. (1997) found that Atlantic sturgeon food preferences include polychaetes (*Lumbrinereis fragilis*, *Notocirrus spiniferus*, *Pherusa affinis*) and the isopod *Politolana concharum*. Two of these species (*N. spiniferus* and *P. concharum)* were collected at two stations in the site-specific benthic survey. Approximately 3.66 acres of benthic forage habitat will be temporarily disturb and unavailable for Atlantic sturgeon forage for a period of 1-2 weeks. Recolonization of the forage base is expected to begin almost immediately but could require as much as 1-2.5 years to fully recover (Burlas et al. 2001, Diaz et al. 2004). Additional forage habitat is available within the project area and in adjacent areas including the preferred aggregation locations to the north (Barnegat Bay) and south (entrance of Delaware Bay).

5.2.2 Habitat shift

Atlantic sturgeon might move around the project area during construction and operation. The project is relatively small and turbines are well spaced, so that Atlantic sturgeon would not have to exert a lot of energy to avoid the project and project activities. The proposed turbine foundations are not expected to affect Atlantic sturgeon migration along the New Jersey coast or the dispersal corridor from the southern tip of Long Island to Cape Hatteras.

5.2.3 Jet plow

Transmission lines associated with the project would require use of jet plowing, which would create a narrow (5 foot wide) trench with a six-foot depth. The cable is placed and subsequently covered, an operation that will take approximately 1-2 weeks. The primary effects from jet plowing to Atlantic sturgeon would be collision, habitat disturbance, and sediment suspension.

Jet plowing could affect sturgeon directly, causing injury and possible mortality, however it is expected that Atlantic sturgeon would move away from any construction activity, including jet plowing. Indirect effects from jet plow would include disturbance of benthic forage base and sediment suspension. Atlantic sturgeon may utilize the project area for foraging during their seasonal movements. The temporary effects to prey resources and foraging habitat as a result of construction activities is discussed above under Section 5.2.1 Effects to prey resources and foraging habitats.

Jet plow operations would re-suspend sediments, increasing turbidity and total suspended solids (TSS) in the water column. Sediment plume modeling was conducted for the Cape Wind Project, where

sediments are similar to this project but with deeper water depths (ASA 2006). Water column concentrations were generally less than 50 mg/L with some peaks of over 100 mg/L usually lasting less than 2 hours. There were some instances of concentrations of 500 mg/L for short periods of time in areas of with higher levels of silt and clay. Water quality monitoring of jet plows in Long Island Sound (OSI 2008) resulted in sediment plumes that were minimal, transient and localized. The average increase in TSS over background levels was 2.0 mg/L, and TSS never exceeded the 100 mg/L regulatory limit. There is no information on effects of turbidity and TSS on Atlantic sturgeon; however, Gilbert (1989) indicates that sturgeon prefer turbid waters for feeding and spawning. The increases in turbidity and TSS for the Fishermen's Energy project will be of short duration (1-2 weeks) and is expected to rapidly dissipate due to the open ocean conditions. Atlantic sturgeon are expected to avoid jet plow operations in response to disturbance and high TSS levels.

5.2.4 Water quality

Construction (e.g. foundation and cable installations) and decommissioning activities will disturb the sea floor, and have the potential to temporarily increase turbidity and TSS. The sediment grain size in the project area ranges from fine sand to gravel, with silt-clay content in most samples of less than 5%. The sediment has a low ability to retain organic carbon and associated contaminants. The project is distant from sources of contaminants, and therefore sediment disturbing activities are unlikely to release sediment-bound contaminants into the water column. Sediments dispersed into the water column are expected to rapidly settle to the ocean floor since the sand-gravel content of the sediments is high. Sediment disturbance will be of short duration (1 week for turbine installation; 1-2 weeks for jet plow). Therefore, any construction-related effects of water quality are expected to be localized and of short duration.

5.2.5 Exposure to electromagnetic field

Acipenseriformes (sturgeons) are known to be electroreceptive species, and may use their electrosense to detect prey and predators, as well as for orientation or navigation (Teeter et al. 1980, Basov 1999, Gill et al. 2005). Basov (1999) reported feeding responses to 50 Hz electric fields for several species of sturgeon. Two species of sturgeons (*Acipenser ruthenus* and *A. gueldenstaedtii)* responded to weak electric fields at low frequencies by changing their orientation and searching for the field source. As frequencies increased, sturgeons responded by exhibiting active foraging behavior, then changing their orientation and searching for the field source, and finally exhibiting an escape response (Basov 2007).

The transmission cables for the Fishermen's Energy project will be 35 kvAC, buried at a depth of 6 feet. Grounded sheathed AC cables are expected to generate a localized magnetic field that will induce an electric field close (millimeters) to the cable and within the range detectable by Atlantic sturgeons (CMACS 2003). Induced electric field intensity depends on a number of factors including type of current (alternating current (AC) generates lower magnetic fields than direct current (DC)), the amount of current flow, cable orientation, distance from cable, sheathing, and amount of substrate over the cable as well as size of the organism and speed of travel over the cable. Burial to at least 3.28 ft (1 m) is likely to mitigate the strongest potential magnetic field and induced electric fields impacts on sensitive fish species (CMACS 2003, Gill et al. 2005, Normandeau et al. 2011). In the United Kingdom, the Department of Energy and Climate Control recommends that cables for offshore wind projects be buried to a depth of at least 1.5 m (4.92 ft) below the seabed to mitigate electromagnetic field effects on electrosensitive species (DECC 2011). Although it is possible that Atlantic sturgeon could sense an electromagnetic field in the immediate area of the cable; the small load on the cable, relatively deep burial (approximately 2

m), and species' slow swimming speeds would be expected to minimize the strength of the induced electric field. Any electromagnetic field effects on Atlantic sturgeon would be very localized and are expected to be negligible.

5.2.6 Vessel strike

Vessel strikes are one of the factors affecting this species' continued existence and are most likely to occur in locations that support large ports and have relatively narrow waterways, such as the Delaware, James and Cape Fear Rivers (ASSRT 2007). The Fishermen's Energy project area is not constrained in this manner.

The Fishermen's Energy project will require vessel use during both during construction and operation activities. Construction activities will require vessels to tend the jet plow and jack up barges for a relatively short time period (1-2 weeks for the jet plow; 1 week for turbine installation). Atlantic sturgeon are expected to avoid the project area during construction. Operation activities will involve tending the project with vessels twice per week. This is a small increase in vessel traffic. Atlantic sturgeon are expected to avoid contact with these vessels as the turbines are waters 26 to 40 feet deep and the area has few physical constraints.

5.2.7 Noise

Sound and sound pressure will be generated during both construction and operation. Construction activities that will contribute to increased underwater noise include pile driving, jet plowing, and vessel traffic related to delivery of workers and construction materials. Of these, pile driving generates the highest levels of sound pressure waves. The type and intensity of sounds generated by pile driving depends on a number of factors including the type and size of the pile, substrate firmness, water depth, and the equipment used. Sound exposure intensity and duration are the most important factors in injury (Hastings and Popper 2005).

High levels of underwater noise have the potential to injure or kill Atlantic sturgeon. Sublethal effects include behavioral effects (e.g. avoidance) that alter feeding, schooling, and reproduction activities; soft tissue impacts; hearing loss; visual impairment; and other physiological conditions. The degree to which a fish is affected by noise is dependent on several factors. These can includeing both the species and lifestage of fish, as well as environmental factors such as water depth, hydrodynamic regime, and substrate type. The presence of a swimbladder in Atlantic sturgeon increases their vulnerability to sound and sound pressure effects.

According to Hastings and Popper (2005), hearing thresholds are not known for sturgeon species, although it is suspected that sturgeon can detect sounds from less than 100 Hz to more than1000 Hz (Popper 2005). Sturgeon are listed among highly mobile species able to avoid adverse sound effects (CalTrans 2009). One way of evaluating potential effects of sound on Atlantic sturgeon is to compare noise monitoring levels to noise exposure criteria deemed to be protective of marine species. On the West Coast, the Fisheries Hydroacoustic Working Group composed of West Coast Departments of Transportation, NMFS and USFWS established interim noise exposure criteria for pile driving based on absolute noise levels. These are 206 dB re 1 µPa peak exposure and 187 dB re 1 µPa accumulated sound exposure level (SEL) for fish > 2 grams (CalTrans 2009). Studies at five wind farm sites around England had an average unweighted peak construction noise level of 250 dB re 1 µPa at 1m (Nedwell et al. 2007), which exceeds the NMFS-defined peak noise criterion. The distance at which noise levels dropped below 200 dB re 1 µPa ranged from 1.9-12.8 km. Pile driving was expected to generate adverse noise

levels at distances up to 12.8 km away from the noise source. Another evaluation method is to model sound and compare the results to known fish hearing thresholds. The Cape Wind DEIS predicted perceived sound levels from pile driving for several finfish EFH species (cod, seabass, and tautog). Predicted underwater sounds would not be injurious to these species even at 30m from the sound source (MMS 2009). Behavioral effects would be likely at distances between 60-350 m from the source of the sound. However, several studies on fish hearing and response (Popper and Clark, 1976; Enger, 1981; Denton and Gray, 1993; Cox et al., 1987) suggest that even intense sounds if intermittent should not produce permanent damage to fish sound receptors if the fish chose to remain in construction areas. This is likely to be the case for the Fishermen's Energy project because construction-related noise would be of short duration, no more than 2 weeks in total, and occur during daylight hours. Pile driving could begin with a soft start to allow Atlantic sturgeon to leave the area before maximum sound levels occur.

5.3 Conclusion

Atlantic sturgeon is of particular interest for this project as this ESA listed species has been documented off the coast of New Jersey. Critical habitat has not been designated for Atlantic sturgeon. The project area due to it shallow depth, sediment type, and location along a migratory or dispersal corridor is suitable forage habitat for sub-adult and adult life-stages of Atlantic sturgeon. The occurrence of this species in the project area is expected to be rare, based on the NJDEP 1988-2007 finfish survey CPUE of 0.072 fish per tow and that the majority of sturgeon captures along the New Jersey coast in a variety of surveys have been north of Little Egg Inlet near Sandy Hook and Barnegat Bay. The proposed project in-water work could result in minimal temporary effects to Atlantic Sturgeon in the rare event that an individual entered the project area. The project is expected to result in the temporary disturbance of 3.66 acres during construction and the permanent loss of 0.02 acres of sub-adult and adult Atlantic sturgeon forage habitat. The jacket-type turbine foundations are not expected to affect Atlantic sturgeon migration along the New Jersey coast or the dispersal corridor from the southern tip of Long Island to Cape Hatteras. No impacts to spawning, egg, larvae, juvenile, and nursery habitat will occur due to this project as these habitats occur in large freshwater rivers and estuaries and are not found in or near the project area. The project in-water work is expected to have no to minimal impact on sub-adult and adult Atlantic sturgeon. The project is likely to have no more than minimal adverse effect on the New York Bight DPS of Atlantic Sturgeon habitat.

6.0 Summary

EFH species impacts are summarized in Table 4. The project will directly impact 0.02 acres (923 ft^2) of EFH habitat. This habitat supports demersal EFH species as well as their forage base (benthic invertebrates) and surf clams. Benthic invertebrates would be lost and demersal EFH species would be displaced or lost. EFH habitat will be replaced with hard substrate habitat created from the wind turbine foundations. The hard substrate habitat would be colonized by a different suite of benthic species and is expected to function as artificial reef structure, which would support a different type of fish community. The species typically associated with an artificial reef habitat, with the exception of black sea bass, are not EFH species. Hard substrate is uncommon off the New Jersey coast. The addition of hard substrate habitat would increase habitat diversity and is valued by some for improving recreational fishing. Project operations have the potential to increase noise levels, but other monitoring studies from other wind farm have found that operational noise levels were only marginally audible to finfish. Operational noise effects on EFH species are expected to be minimal. Operations would also

result in a small increase in vessel traffic, which has the potential to increase noise and disturb EFH species. The increased vessel activity would be minor and is not expected to adversely affect EFH species. Electrical transmission would generate a magnetic field, with the potential for an induced electrical field. EFH species such as shortfin mako and sandbar sharks, and little, winter and clearnose skate have shown some sensitivity to electro- or electromagnetic fields. The low transmission frequency in combination with cable armoring the depth at which the cable will be buried will minimize EMF effects to the point where they are unlikely to affect EFH species.

Table 4. EFH species, habitats, seasonal occurrences, and estimated EFH impacts.

Species	Eggs	Larvae	Juveniles	Adults	EFH Habitat Impacts
Atlantic cod *(Gadus morhua)*	n/a	n/a	n/a	No EFH provided, too shallow and substrate too fine	Adults- **No EFH provided; no adverse effect**
Atlantic butterfish *(Peprilus triacanthus)*	n/a	n/a	>30mm- Demersal	n/a	Juveniles- 0.02 acres permanent 3.66 acres temporary; **no more than minimal adverse effect**
Atlantic sea herring *(Clupea harengus)*	n/a	n/a	Pelagic- Winter/spring	Pelagic-winter/spring	Juveniles- **No more than minimal adverse effect** Adults- **No more than minimal adverse effect**
Black sea bass *(Centropristus striata)*	n/a	n/a	Prefer structured habitat; No EFH provided	Prefer structured habitat; No EFH provided	Juveniles/Adults- No EFH provided; **No adverse effect**; May benefit from addition of hard substrate habitat;
Bluefin tuna *(Thunnus thynnus)*	n/a	n/a	Pelagic-June/July	n/a	Juveniles-**No more than minimal adverse effect**
Bluefish *(Pomatomus saltatrix)*	Pelagic	n/a	Pelagic-June-Oct.	Pelagic-May-October	Eggs-entrainment loss; **No more than minimal adverse effects.** Juveniles-**No more than minimal adverse effect** Adults-**No more than minimal adverse effect**
Clearnose skate (*Raja eglanteria*)	n/a	n/a	Demersal-April-Nov.	Demersal-April-Nov.	Juveniles/Adults- 0.02 acres permanent,3.66 acres temporary; **no more than minimal adverse effect**
Cobia *(Rachycentron canadum)*	Offshore/pelagic; EFH unlikely in project area	Offshore/pelagic; EFH unlikely in project area	Pelagic- May-Oct.	Pelagic-May-Oct.	Eggs-no habitat; **No adverse effect** Larvae-no habitat; **No adverse effect** Juveniles-**No more than minimal adverse effect** Adults-**No more than minimal adverse effect**

(continued)

Table 4. (Continued)

Species	Eggs	Larvae	Juveniles	Adults	EFH Habitat Impacts
Dusky shark *(Charcharinus obscurus)*	n/a	Neonates	n/a	n/a	Neonates will avoid entrainment; **No more than minimal adverse effect**
Little skate (*Raja erinacea*)	n/a	n/a	Demersal-year-round	Demersal-year-round	Juveniles/Adults- 0.02 acres permanent . 3.66 acres temporary; **no more than minimal adverse effect**
Monkfish *(Lophius americanus)*	Pelagic-May-June	Pelagic-May-June	n/a	Demersal-late fall-spring	Eggs/Larvae- entrainment; **No more than minimal adverse effects.** Adults- 0.02 acres permanent 3.66 acres temporary; **no more than minimal adverse effect**
Red hake *(Urophycis chuss)*	Pelagic-May-July; Oct-Nov.	Pelagic-Aug. -Nov.	No EFH habitat, no appropriate substrate	Demersal-spring and fall;	Eggs/-Larvae-entrainment; **No more than minimal adverse effects.** Adults- 0.02 acres permanent, 3.66 acres temporary; **no more than minimal adverse effect**
Sandbar shark *(Charcharinus plumbeus)*		Demersal- HAPC; June-Aug.	Demersal-HAPC; June-Aug.	Demersal-HAPC; June-Aug;	Larvae/Juvenile/Adults-0.02 acres permanent ,3.66 acres temporary; **no more than minimal adverse effect**
Scup *(Stenotomus chrysops)*	n/a	n/a	Demersal-June-Oct.	Demersal-June-Oct.	Juveniles/Adults- 0.02 acres permanent ,3.66 acres temporary; **no more than minimal adverse effect**
Shortfin mako shark *(Isurus oxyrhyncus)*	n/a	n/a	Pelagic-June-Oct.	n/a	Juveniles-**No more than minimal adverse effect**
Spanish mackerel *(Scomberomorus maculatus)*	Pelagic-Aug-Sept.	P Pelagic-Aug-Sept.	Pelagic-summer	Pelagic-summer	Eggs/Larvae-entrainment; **No more than minimal adverse effects** Juveniles/Adults-**No more than minimal adverse effect**
Spiny dogfish *(Squalus acanthias)*	n/a	n/a	n/a	Pelagic-spring and fall	Adult-**No more than minimal adverse effect**

(continued)

Table 4. (Continued)

Species	Eggs	Larvae	Juveniles	Adults	EFH Habitat Impacts
Summer flounder *(Paralicthys dentatus)*	Pelagic-late summer	Pelagic-late summer	Demersal-April-Oct.	Demersal-April-Oct.	Eggs/Larvae-entrainment; **No more than minimal adverse effects.** Juveniles/Adults- 0.02 acres permanent ,3.66 acres temporary; **no more than minimal adverse effect**
Surf clam *(Spisula solidissima)*	n/a	n/a	Benthic-year round	Benthic-year-round	Juveniles/Adults- 0.02 acres permanent, 3.66 acres temporary; **no more than minimal adverse effect**
Tiger shark *(Galeocerdo cuvieri)*		EFH not provided according to latest sources	Occurs in temp-eratures > 18^{o}C	n/a	Larvae-**No EFH provided; no adverse effect** Juveniles-**No more than minimal adverse effect**
Windowpane flounder *(Scopthalmus aquosus)*	Pelagic-Mar-July; Sept.-Nov.	Pelagic-May-June; Oct-Nov.	Demersal-year-round	Demersal-year-round.	Eggs/Larvae-entrainment; **No more than minimal adverse effects** Juveniles/Adults- 0.02 acres permanent 3.66 acres temporary; **no more than minimal adverse effect**
Winter flounder *(Pseudopleuronectes americanus)*	Demersal; < 5m depth; Jan-April	Demersal; < 16m depth-Jan-April	Demersal-year-round	Demersal-year round.	Eggs-0.14 acres habitat temporary **No more than minimal adverse effects.** Larvae-0.38 acres habitat temporary; **No more than minimal adverse effects.** Juveniles/Adults- 0.02 acres permanent; 3.66 acres temporary; **no more than minimal adverse effect**
Winter skate	n/a	n/a	Demersal	Demersal	Juveniles/Adults- 0.02 acres permanent 3.66 acres temporary; **no more than minimal adverse effect**
Witch flounder *(Glyptocephalus cynoglossus)*	Pelagic-April	n/a	n/a	n/a	Eggs- entrainment; **No more than minimal adverse effects**

Species	Eggs	Larvae	Juveniles	Adults	EFH Habitat Impacts
Yellowtail flounder *(Limanda ferruginea)*	Pelagic-March-April	Pelagic-April-June	n/a	n/a	Eggs/Larvae-entrainment; **No more than minimal adverse effects**

Temporary impacts from the project would include construction activities such as installation of the cables and turbine foundation. Approximately 3.66 acres of EFH habitat would be disturbed during construction. Decommissioning activities would also temporarily disturb demersal EFH habitat. Jet plowing will disturb demersal EFH habitat, with subsequent loss or displacement of EFH species. Demersal eggs and larvae would be most vulnerable to construction-related effects, as they are unable to avoid the disturbance. Cable installation would result in disturbance of approximately 0.14 acres of winter flounder egg EFH and 0.38 acres of winter flounder larvae EFH. The risk of sediment contamination from HDD operation, specifically drilling fluid release, is negligible and will be minimized using standard drillbit breakout techniques. Construction and decommissioning activities would be localized and of short duration. The substrate would be rapidly recolonized by benthic macroinvertebrates, providing a forage base for EFH species. Restoration to original conditions may take up to two years. Use of HDD in nearshore areas will reduce demersal EFH impacts, specifically adverse effects on winter flounder eggs and larvae.

Construction and decommissioning activities also have the potential to increase turbidity and total suspended solids by disturbing the bottom substrate. Diminished water quality could negatively affect pelagic EFH. Increases in sedimentation could adversely affect demersal eggs and larvae. The project area is a high energy habitat, which would help to dissipate any suspended materials. This, in combination with the short duration of these activities will help minimize any adverse water quality effects.

Construction activities, specifically those associated with pile driving would increase noise pressure levels. These effects are species specific and vary with environmental factors such as water depth, hydrodynamic regime, and bottom substrate as well as the sound intensity, frequency and duration. The Cape Wind EIS concluded that sound generated by pile driving would not be injurious to EFH species. However, a field measurement of pile driving for a wind turbine was measured at 215 dB re 1µPa SEL, which exceeds the Fisheries Hydroacoustic Working Group standard of 187 dB SEL. EFH species that remain in the area during construction could experience adverse noise-related impacts. These will be minimized by the short construction period and by use of a soft start to move fish out of the project area. Jet plowing relies on water withdrawal to create a trench for the cable. Water withdrawal has the potential to entrain EFH eggs and larvae from the water column, with assumed 100% mortality. Entrainment estimates indicate the losses would be low and not injurious to the population.

Based on this assessment, we conclude that the Fishermen's Energy 6 turbine offshore wind project will have no adverse effect on those species and lifestages that have no EFH in the project area (Table 4). The project will have no more than minimal impacts to species and lifestages that have pelagic EFH habitat in the project area. The project will have no more than minimal adverse impacts on those species and lifestages with demersal EFH habitat in the project area.

The project area is suitable forage habitat for sub-adult and adult Atlantic sturgeon due to it shallow depth, sediment type, and location along a migratory corridor, however the occurrence of this species in project area is expected to be rare. The project is expected to result in the temporary disturbance of 3.66 acres during construction activities and the permanent loss of 0.02 acres of sub-adult and adult Atlantic sturgeon forage habitat. The temporarily disturbed habitat is expected to be rapidly recolonized with benthic macroinvertebrates, including the polychaetes and isopods preferred by Atlantic sturgeon. Atlantic sturgeon are expected to use adjacent areas in the project area and the preferred aggregation locations north and south of the project area during the recovery of the forage habitat. Project operations have the potential to increase noise levels, but monitoring studies from

other wind farm have found that operational noise levels were only marginally audible to finfish. Operational noise effects on effects on Atlantic Sturgeon are expected to be minimal. Operations will result in a small increase in vessel traffic, which has the potential to increase noise and the risk of vessel strikes. The increased vessel activity will be minor and Atlantic sturgeon are expected to avoid contact with these vessels due to the water depth and the lack of physical constraints in the area. Electrical transmission would generate a magnetic field, with the potential for an induced electrical field. Atlantic sturgeon have shown to be sensitive to electro- or electromagnetic fields. The low transmission frequency in combination with cable sheathing and the relatively deep 6 foot burial depth will minimize EMF effects to the point where they are unlikely to affect Atlantic sturgeon. The project is not expected to affect Atlantic sturgeon migration along the New Jersey coast.

Temporary impacts from the project would include construction activities, such as installation of the cables and turbine foundation, and decommissioning activities. Jet plowing will disturb Atlantic sturgeon forage habitat and could cause injury and possible mortality, although it is expected that Atlantic sturgeon would move away from jet plowing activity. Construction and decommissioning activities will be localized and of short duration, and the benthic habitat is expected to be rapidly recolonized with benthic macroinvertebrates, including the polychaetes and isopods preferred by Atlantic sturgeon. Construction and decommissioning activities also have the potential to increase turbidity and total suspended solids by disturbing the bottom substrate. Adverse water quality effects are expected to be minimal due the high energy open ocean project area which will dissipate suspended materials and the short duration of these project activities. Construction activities, specifically those associated with pile driving will increase noise pressure levels. These effects are species specific and vary with environmental factors such as water depth, hydrodynamic regime, and bottom substrate as well as the sound intensity, frequency and duration. The Cape Wind EIS concluded that sound generated by pile driving would not be injurious to finfish species. However, a field measurement of pile driving for a wind turbine was measured at 215 dB re 1µPa SEL, which exceeds the Fisheries Hydroacoustic Working Group standard of 187 dB SEL. An Atlantic sturgeon that enters and remains in the project area during construction could experience minimal adverse noise-related impacts. The short construction period and the use of a soft start to move sturgeon out of the project area will help minimize any impacts.

Based on this assessment, we conclude that the Fishermen's Energy six-turbine offshore wind project will have no to minimal impact on sub-adult and adult Atlantic sturgeon, and no more than minimal adverse effect on the New York Bight DPS of Atlantic Sturgeon habitat.

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APPENDIX A

Representative Ichthyoplankton Data

Appendix Table 1. Monthly average density (number per 100 m^3) of fish larvae in the New York Bight apex region[a] from MARMAP[b] (1977-1987) data. EFH species in Fishermen's Energy Project Area in bold

Species	Jan (N=3)	Feb (N=4)	Mar (N=8)	Apr (N=8)	May (N=9)	Jun (N=9)	Jul (N=9)	Aug (N=8)	Sep (N=5)	Oct (N=9)	Nov (N=6)	Dec (N=4)	LCL	Annual (N=12)	UCL
Ammodytes	53.1	130.2	109.1	48.58	10.26	0.01	0	0	0	0	0	5.56	0.33	29.74	59.15
Citharichthys arctifrons	0	0	0	0	0	0	0.4	50.3	34.03	4.95	0.46	0.3	0	7.54	18.08
Scomber scombrus	0	0	0	0	43.3	45.44	0	0.66	0	0	0	0	0	7.45	18.41
Engraulidae	0	0	0	0	0	0.37	29.23	20.76	3.81	1.87	0.32	0	-1.48	4.7	10.87
Hippoglossina oblonga	0	0	0	0	0	0.11	20.87	17.71	5.18	1.25	0.03	0	0	3.76	8.48
Urophycis	0	0	0	0	0	0.13	3.29	15.85	11.69	10.01	3.52	0.09	0.15	3.72	7.28
Limanda ferruginea	0	0	0	2.74	13	23.6	1.97	0	0	0	0	0	0	3.44	8.12
Etropus microstomus	0	0	0	0	0	0	3.18	6.38	15.89	11.35	0.03	0	0	3.07	6.49
Scophthalmus aquosus	0	0.06	0	0	3.25	1.69	5.88	0.45	2.29	12.04	6.66	0.76	0.39	2.76	5.12
Pomatomus saltatrix	0	0	0	0	0	0	20.46	6.04	0	0	0	0	0	2.21	6.02
Tautogolabrus adspersus	0	0	0	0	0.06	0.85	14.17	6.81	0	0	0	0	0	1.82	4.59
Unidentified larvae	0.51	0	0	0	17.36	0	0.34	0.49	0.27	0.1	0	0	0	1.59	4.75
Peprilus triacanthus	0	0	0	0	0	0.18	5.75	11.38	0.9	0.07	0.03	0	0	1.53	3.76
Prionotus carolinus	0	0	0	0	0	0	0.13	1.93	15.03	0.52	0.09	0	0	1.48	4.21
Paralichthys dentatus	0.41	0.05	0	0	0	0	0	0	0	3.27	6.4	3.39	0	1.13	2.46
Bothidae	0	0	0	0	0	0	0.27	3.59	6.81	0.26	0	0	0	0.91	2.26
Brevoortia tyrannus	0.12	0.1	0	0	0.01	0	0	0	0	0	8.93	0.72	0	0.82	2.45
Gadus morhua	0.44	0.73	2.12	0.85	0.45	0.18	0	0	0	0	0.03	4.29	0	0.76	1.56
Clupeidae	0	0	0	0	0	0.01	0	0	0.36	7.6	0.57	0.05	0	0.72	2.1
Ophidion marginatum	0	0	0	0	0	0	0.01	1.29	6.86	0.32	0	0	0	0.71	1.96
Centropristis striata	0	0	0	0	0	0	0.27	2.4	3.25	1.92	0.03	0	0	0.66	1.4
Enchelyopus cimbrius	0	0	0	0	1.15	4.07	0.79	0.29	0.07	0.02	0.32	0	0	0.56	1.3
Prionotus	0	0	0	0	0	0	0.14	1.89	1.99	2.03	0	0	0	0.5	1.07
Merluccius bilinearis	0.04	0.22	0	0.02	0.02	0.45	0.67	1.77	0.1	0.48	1.22	0.5	0.11	0.46	0.8
Urophycis chuss	0	0	0	0	0	0	0	2.11	0.36	0.19	0.8	0	0	0.29	0.68
Auxis	0	0	0	0	0	0	0	3.49	0	0	0	0	0	0.29	0.93
Lophius americanus	0	0	0	0.04	0	0.98	2.02	0.16	0.11	0	0	0	0	0.28	0.67

(Continued)

Appendix Table 1. Continued.

Species	Jan (N=3)	Feb (N=4)	Mar (N=8)	Apr (N=8)	May (N=9)	Jun (N=9)	Jul (N=9)	Aug (N=8)	Sep (N=5)	Oct (N=9)	Nov (N=6)	Dec (N=4)	LCL	Annual (N=12)	UCL
Urophycis regia	0.04	0	0	0	0	0	0	0	0	3.04	0	0	0	0.26	0.81
Ophidiidae	0	0	0	0	0	0	0.09	0.52	1.68	0.89	0	0	0	0.26	0.6
Pholis gunnellus	0	0.46	2.36	0.22	0	0	0	0	0	0	0	0	0	0.25	0.69
Glyptocephalus cynoglossus	0	0	0	0.01	1.14	1	0.49	0.02	0.04	0	0	0	0	0.22	0.49
Engraulis eurystole	0	0	0	0	0	0	2.21	0.04	0	0.08	0	0	0	0.2	0.6
Liparis	0	0	0	0.86	0.94	0.13	0	0	0	0	0	0	0	0.16	0.38
Myoxocephalus aenaeus	0	0	1.4	0.44	0	0	0	0	0	0	0	0	0	0.15	0.42
Cynoscion regalis	0	0	0	0	0	0	1.7	0	0	0	0	0	0	0.14	0.45
Pleuronectidae	0	0	0	0	1.61	0	0	0	0	0	0	0	0	0.13	0.43
Pseudopleuronectes americanus	0	0	0.77	0.77	0	0	0	0	0	0	0	0	0	0.13	0.32
Tautoga onitis	0	0	0	0	0	0	0.65	0.42	0	0.07	0	0	0	0.1	0.23
Hippoglossoides platessoides	0	0	0	1.1	0.02	0	0.02	0	0	0	0	0	0	0.1	0.3
Clupea harengus	0	0.05	0	0.01	0	0	0	0	0	0.62	0	0.32	0	0.08	0.21
Ulvaria subbifurcata	0	0	0	0	0.81	0.02	0	0	0	0	0	0	0	0.07	0.22
Lumpenus lumpretaeformis	0	0	0	0	0.83	0	0	0	0	0	0	0	0	0.07	0.22
Pollachius virens	0	0.42	0.12	0.01	0.04	0	0	0	0	0	0	0	0	0.05	0.13
Gadidae	0	0	0	0	0.32	0	0.13	0	0	0	0	0	0	0.04	0.1
Euthynnus alletteratus	0	0	0	0	0	0	0.52	0	0	0	0	0	0	0.04	0.14
Cyclopteridae	0	0	0	0.19	0.22	0.07	0.02	0	0	0	0	0	0	0.04	0.09
Cottidae	0	0	0.14	0.27	0.04	0	0	0	0	0	0	0	0	0.04	0.09
Stichaeidae	0	0	0.03	0	0.42	0	0	0	0	0	0	0	0	0.04	0.11
Anchoa	0	0	0	0	0	0	0	0.33	0	0	0	0	0	0.03	0.09
Tautogolabrus	0	0	0	0	0	0.37	0	0	0	0	0	0	0	0.03	0.1
Prionotus evolans	0	0	0	0	0	0	0.26	0.05	0	0	0	0	0	0.03	0.07
Myoxocephalus octodecemspinosus	0	0.06	0.22	0.14	0	0	0	0	0	0	0	0	0	0.03	0.08

(Continued)

Appendix Table 1. Continued.

Species	Jan (N=3)	Feb (N=4)	Mar (N=8)	Apr (N=8)	May (N=9)	Jun (N=9)	Jul (N=9)	Aug (N=8)	Sep (N=5)	Oct (N=9)	Nov (N=6)	Dec (N=4)	LCL	Annual (N=12)	UCL
Lumpenus	0	0	0	0	0.32	0	0	0	0	0	0	0	0	0.03	0.08
Etropus	0	0	0	0	0	0	0.05	0	0.07	0.24	0	0	0	0.03	0.08
Ceratoscopelus maderensis	0	0	0	0	0	0.25	0	0	0	0	0	0	0	0.02	0.07
Syngnathidae	0	0	0	0	0	0	0.06	0.14	0	0.05	0	0	0	0.02	0.05
Hippocampus erectus	0	0	0	0	0	0	0	0	0.18	0	0	0	0	0.02	0.05
Bothus	0	0	0	0	0	0	0	0.03	0.16	0	0	0	0	0.02	0.04
Etrumeus teres	0	0	0	0	0	0.09	0	0	0	0	0	0	0	0.01	0.02
Anchoa hepsetus	0	0	0	0	0	0	0	0	0	0.09	0	0	0	0.01	0.03
Melanogrammus aeglefinus	0	0	0	0.03	0.11	0	0	0	0	0	0	0	0	0.01	0.03
Syngnathus	0	0	0	0	0	0.01	0.13	0	0	0	0	0	0	0.01	0.04
Serranidae	0	0	0	0	0	0	0	0	0.07	0	0	0	0	0.01	0.02
Sciaenidae	0	0	0	0	0	0	0	0.16	0	0	0	0	0	0.01	0.04
Labridae	0	0	0	0	0	0	0	0.12	0	0.04	0	0	0	0.01	0.04
Sarda sarda	0	0	0	0	0	0	0.13	0	0	0	0	0	0	0.01	0.03
Anarhichas	0	0.06	0.03	0	0	0	0	0	0	0	0	0	0	0.01	0.02
Pleuronectiformes	0	0	0	0	0	0.12	0	0	0	0	0	0	0	0.01	0.03
Clupeiformes	0	0	0	0	0	0	0	0	0	0	0	0		0	
Sardinella aurita	0	0	0	0	0	0	0	0	0	0.02	0	0	0	0	0.01
Anchoa mitchilli	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0.01
Myctophidae	0	0	0	0.03	0	0	0	0	0	0	0	0	0	0	0.01
Diogenichthys atlanticus	0	0	0.01	0	0	0	0	0	0	0	0	0	0	0	0
Anguilla rostrata	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0.01
Congridae	0	0	0	0	0	0.05	0	0	0	0	0	0	0	0	0.01
Merluccius albidus	0	0	0	0	0.02	0.02	0	0	0	0	0	0	0	0	0.01
Gasterosteus aculeatus	0	0	0	0	0	0.02	0	0	0	0	0	0	0	0	0.01
Hippocampus	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0	0
Menticirrhus	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0

(Continued)

Appendix Table 1. Continued.

Species	Jan (N=3)	Feb (N=4)	Mar (N=8)	Apr (N=8)	May (N=9)	Jun (N=9)	Jul (N=9)	Aug (N=8)	Sep (N=5)	Oct (N=9)	Nov (N=6)	Dec (N=4)	LCL	Annual (N=12)	UCL
Micropogonias undulatus	0	0	0	0	0	0	0	0	0	0.02	0	0	0	0	0.01
Uranoscopidae	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0	0.01
Astroscopus guttatus	0	0	0	0	0	0	0.01	0	0	0	0	0	0	0	0
Blenniidae	0	0	0	0	0	0	0	0	0	0	0	0		0	
Macrozoarces americanus	0	0.04	0	0	0	0	0	0	0	0	0	0	0	0	0.01
Scombridae	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0.01
Gobiidae	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0
Sebastes	0	0	0	0	0	0	0	0	0	0	0	0		0	
Triglidae	0	0	0	0	0	0	0	0	0	0	0	0		0	
Liparis atlanticus	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0.01
Liparis inquilinus	0	0	0	0	0.04	0	0	0	0	0	0	0	0	0	0.01
Hemitripterus americanus	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0.01
Citharichthys	0	0	0	0	0	0	0	0	0	0	0	0		0	
Symphurus	0	0	0	0	0	0	0	0.02	0	0	0	0	0	0	0.01
Zoarcidae	0	0	0	0	0	0	0	0	0	0	0	0		0	

LCL = 95 percent lower confidence limit
UCL = 95 percent upper confidence limit

[a] Region in the New York Bight bounded by the coordinates 40°00' to 40°35' N and 73°00' to 73°55' ; Data from MARMAP program (conducted from 1977 through 1987 with monthly to bimonthly oblique tows ranging from Cape Hatteras, North Carolina to Cape Sable, Nova Scotia with a 61-cm bongo net fitted with 0.505-mm and 0.333-mm mesh netting) and ECOMON (30 stations within each of four ecosystem sub-regions (Middle Atlantic Bight, Southern New England, Georges Bank, and Gulf of Maine) six times per year, oblique tows using a 61-cm bongo net with 0.330 mm mesh, larvae only from 2004-2005). All available MARMAP and ECOMON data from the project area were pooled for each species and mean densities were calculated for each month that a species' early life stages appeared in the catch.

APPENDIX B

Benthic Macroinvertebrate Report

Fisherman's Energy 20 MW Off-shore Wind Energy Project
Benthic Macroinvertebrate Report

Prepared for
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R-22039.003

January 2011

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1.0 Introduction

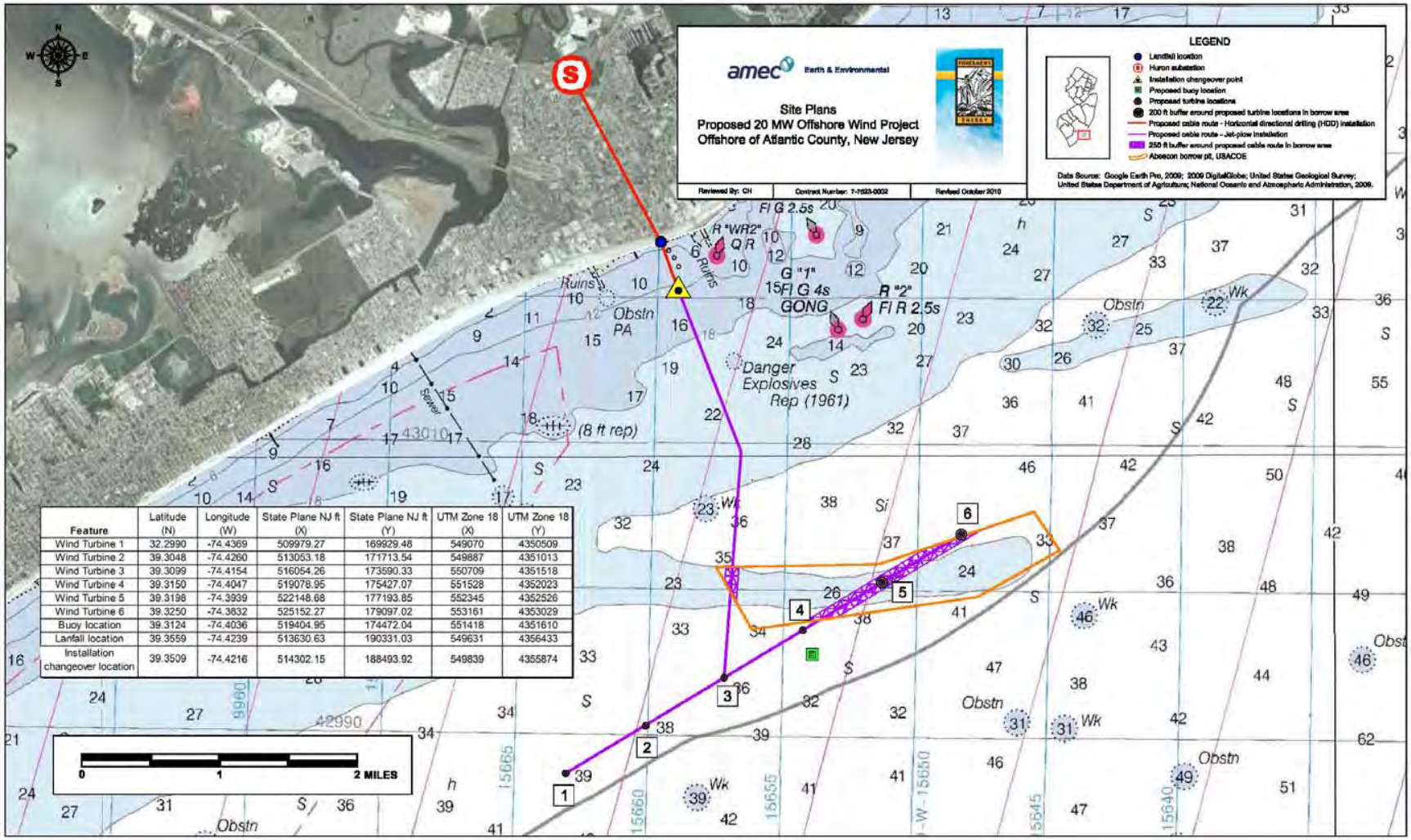
Fishermen's Atlantic City Windfarm, LLC (Fishermen's Energy) is an offshore wind-energy development company that is proposing the development of an offshore wind renewable energy facility within New Jersey State waters, comprised of up to six (6) electric generating windmills located approximately 2.8 miles off the New Jersey coast from Atlantic City (Figure 1). As part of the permitting process, Fishermen's Energy submitted a U.S. Army Corps of Engineers (Corps) 404 Permit Application on April 5, 2010. The Corps published a public notice (No. 2008-0777) on August 27, 2010. NOAA's National Marine Fisheries Service (NMFS), in its comment letter dated October 20, 2010, indicated that site specific benthic resource data were needed to assess the nature and extent of potential impacts to aquatic resources in the project area. This report provides information on benthic resources in the project area that has been derived from existing reports. Additional site specific benthic sampling at the 16 stations shown in Figure 1 was conducted in November 2010. Results from that study will be used to augment this report.

2.0 A Description of the Proposed Action

The proposed windmills are 3.6 MW Siemens turbines oriented in one row, generating a total of approximately 20 MW (net). Each of the wind turbines will be supported by a single monopile driven into the seabed. Power output from the turbines will be transmitted via a 34.5 kilovolt (kV) submarine cable to access the shore. The transmission cable from each turbine will be linked to a single main submarine transmission cable that will make landfall at a point in Atlantic City, and then continue underground to the existing Huron Substation, located along Absecon Avenue. The total ocean area considered as the Project area is approximately 170 acres (calculated as the perimeter around the group of six turbines (approximately 200 feet in each direction) plus a five foot width along the length of the cable route from the turbines to the shore); however, the actual portion of the area that will be physically disturbed by the placement of the turbines and cables is approximately 7.86 acres. A review of the National Oceanic and Atmospheric Administration (NOAA) nautical charts indicates that the proposed cable and turbines for the in-water portion of the Project would be located in water depths of 26 to 40 feet below mean lower low water (MLLW).

The six 3.6-MW Siemens turbines are each composed of three primary elements, a foundation, transition piece, and turbine assembly. The turbine foundation is the base of the structure and extends from below the seabed to approximately nine feet above the water surface. Based on geotechnical conditions, environmental loading and aesthetic considerations, monopile foundations have been selected for this project. A single steel pile, with a diameter of approximately 16 feet and wall thickness of more than two inches will be driven into the bottom to the required depth (approximately 150 ft). The foundation will extend 40 feet through the water column to exposure at the surface. Scour mats and/or rock will be installed to prevent ocean currents from eroding the seabed around the foundation base. The major components of the turbines and pile components will be pre-assembled at a port, currently planned for Becket Street Terminal in Camden, New Jersey and barged out to sea.

The transition section extends from the top of foundation to the turbine. The transition section



Feature	Latitude (N)	Longitude (W)	State Plane NJ ft (X)	State Plane NJ ft (Y)	UTM Zone 18 (X)	UTM Zone 18 (Y)
Wind Turbine 1	32.2990	-74.4369	509979.27	169929.48	549070	4350509
Wind Turbine 2	39.3048	-74.4260	513053.18	171713.54	549887	4351013
Wind Turbine 3	39.3099	-74.4154	516054.26	173590.33	550709	4351518
Wind Turbine 4	39.3150	-74.4047	519078.95	175427.07	551528	4352023
Wind Turbine 5	39.3198	-74.3939	522148.68	177193.85	552345	4352526
Wind Turbine 6	39.3250	-74.3832	525152.27	179097.02	553161	4353029
Buoy location	39.3124	-74.4036	519404.95	174472.04	551418	4351610
Lanfall location	39.3559	-74.4239	513630.63	190331.03	549631	4356433
Installation changeover location	39.3509	-74.4216	514302.15	188493.92	549839	4355874

Figure 1. Site map, Fishermen's Energy proposed 20 MW offshore wind project.

extends from the top of foundation (ending approximately 9 feet above sea level) to the turbine at approximately 295 feet. The transition pile tapers at the base from approximately 10 to 15 feet in diameter before extending up to full height. A boat landing for service access is located just above water level, as well as an access door to the structure interior spaces and ladder. The transition pile interior is also used as the conduit for the electrical cable as it runs from the turbine motor to the seabed where it emerges from a "Jtube" to its connection with the cabling network. The primary wind turbine components are the nacelle, which houses the gearbox and generator, and the rotor works which include the hub and three turbine blades. Each turbine will have a rotor diameter of approximately 350 feet and a center hub height of a minimum of 295 feet above sea level. The turbines are installed on the transition pile top and will automatically rotate to orient the blades into the wind to most effectively capture energy.

For the construction of the turbine foundations, monopiles will be delivered to the development site by barge and support handling vessels. On site, materials will be transferred from barges to the installation vessel. A specialized jack-up barge equipped with a high capacity crane with pile handling frame and hydraulic driving equipment will perform structure installations. The jack-up vessel will position itself locally to each of the turbine installations and lower its leg until they are sufficiently stable on the sea bed. The vessel will then jack itself up out of the water to provide a stable platform from which to carry out the installation activities. Once the jack-up barge is in the turbine array field, it will be moved between turbine locations to perform installations. Other barges and vessels will deliver components to the jack-up barge.

Installation of the six turbines is expected to require four to seven fair weather days to complete. In order to minimize the complexity and duration of offshore operations, components of the turbines will be pre-assembled to the extent possible prior to transportation offshore. Bridge height limitations in the Delaware Bay (between NJ and PA) will likely preclude the use of the jack-up barge to transport vertical turbine assemblies, therefore, turbine sections will be transported to the jack-up, which will remain on station for the duration of the installation, via delivery barge.

The Project will not require an offshore substation, but will rather utilize a 34.5 kV subsea cable to access the shore from the turbine array. At shore the power will be transmitted via a horizontally direction drilled (HDD) underground cable largely within an Atlantic City right of way to the 69 kV Huron Substation which is part of the PJM electric system.

The majority of the subsea cable installation will be conducted using either plow or jetting techniques. Jet plowing will take place in the areas spanning each turbine and from the wind farm, directly to the shore landing in Atlantic City. HDD will be employed from a distance of approximately 1,600 feet from the shore to the first vault. The burial depth of the subsea cable from the turbine field to the nine-foot contour (~15-foot water depth) will be approximately six feet; whereupon the cable will angle down to approximately 30 feet below the beach, then rise to approximately 10-foot in depth for the terrestrial run of an upland cable.

3.0 Historical Benthic Data

The macrobenthos of the mid-Atlantic shelf has been extensively studied (Wigley and Theroux 1981, Boesch 1979, Maurer et al. 1982, Burlas et al. 1981, Diaz et al. 2004). In their comprehensive survey of Atlantic shelf and slope benthos, Wigley and Theroux (1976) classified benthic macroinvertebrates according to latitude, depth and substrate. The continental shelf communities

throughout the New York Bight shelf region, from the New York Bight south to Cape Hatteras, were characterized as being similar. In general these communities were dominated by annelids, bivalve mollusks, crustaceans, and echinoderms, mainly sand dollars (*Echinarachnius parma*). The average macrofauna density was 1,254/m^2. BLM studies that were conducted off of the New Jersey shore for offshore oil and gas exploration (Boesch 1979) found the largest determinant of benthic community composition was sediment composition and depth; with secondary determinants being season and mesoscale (e.g. ridge and swale) topography. The benthic community from the inner shelf typically was a mix of suspension feeding annelid polychaetes (*Polygordius* sp., *Goniadella gracilis, Spiophanes bombyx*), bivalve mollusks (juvenile surf clams *Spisula solidissima, Tellina agilis*), small crustaceans (tanaid *Tanaissus liljeborgi)* and sand dollars (*Echinarachnius parma*) (Boesch 1979). These species are typical of linear shoals or ridges, and are adapted to the relatively mobile sandy sediment. Swale areas would include a different mix of species including suspension feeding annelids *Spiophanes bombyx, Lumbrineris impatiens*, and *Polygordius* sp.; bivalves *Nucula proxima* and *Tellina agilis*; and various small crustaceans (Boesch 1979; Byrnes et al. 2004 a, b).

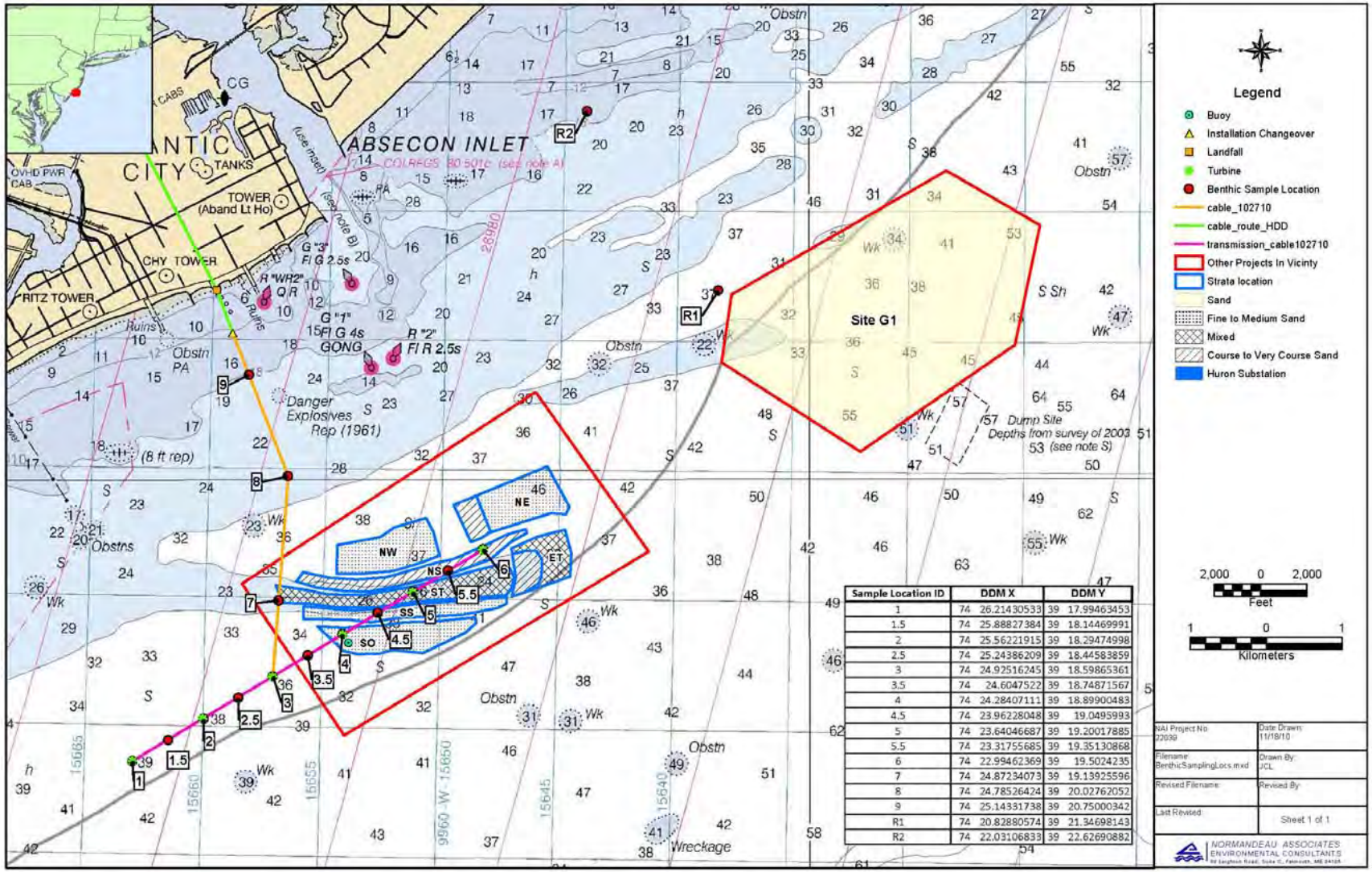
The BLM studies off New Jersey (Boesch 1979) included a station just north of the project area at a depth of 51 feet. Boesch categorized benthic habitat in the vicinity of the project area as inner shelf coarse substrate, characterized by dynamic, uniformly coarse sand. Density averaged 974/m^2, with an average number of species of 44 per 0.6m^2. Dominant species included mollusks such as *Tellina agilis*, crustaceans such as *Tanaissus liljeborgi,* a variety of polychaetes*,* and the sand dollar *Echinarachnius parma.* Changes in dominant species were related to changes in more subtle bottom topography, most notably ridge and swale topography.

Both Minerals Management Service and the Army Corps of Engineers have conducted studies in the general area to evaluate the feasibility of sand borrowing as a portion of the project area contains a ridge or shoal area suitable for sand mining. Byrnes and Hammer (2001) conducted benthic surveys for six borrow areas off southern New Jersey including Area G1 just north of Absecon Inlet located near Fisherman's Energy Reference Station 1 in May and September 1998 (Figure 2). Versar (2010) conducted a benthic survey for a proposed borrow area located on a finger shoal near Absecon Inlet that partially overlaps the Fisherman's Energy project area (Figure 2). The survey was conducted in October, 2009 and was based on the bathymetry of the finger shoal. Seven strata were identified and 5 sampling sites were randomly selected within each stratum.

As part of the site specific benthic sampling survey, Fishermen's Energy collected surface sediment samples in November 2010 in the wind project study area. The results were compared with grain size results from the historical benthic studies in order to estimate the likely benthic community structure and potential project impacts. Median grain size was fine sand with less than 6% silt clay round proposed turbines 1,2, 3 and 4; east of proposed Turbine 4, surface sediments ranged from medium to medium-coarse sand. Surface sediments along the proposed cable transmission route were predominantly fine sand. Depth around the proposed turbine area ranges from 26-40 feet; depth along the cable route ranges from intertidal to 36 feet.

North of Absecon Inlet (Byrnes and Hammer 2001)

Area G1 is a predominantly sandy habitat located near Fishermen's Energy Reference Station R1 (Figure 2). Total benthic infaunal density ranged from 5,647-6,438 individuals per m^2 and number of taxa ranged from 21-43 per station (Table 1). The mean number of taxa and the total abundance for Area G1 were higher in September than in May, an indication of the increase of benthic infauna



Sample Location ID	DDM X	DDM Y
1	74 26.21430533	39 17.99463453
1.5	74 25.88827384	39 18.14469991
2	74 25.56221915	39 18.29474998
2.5	74 25.24386209	39 18.44583859
3	74 24.92516245	39 18.59865361
3.5	74 24.6047522	39 18.74871567
4	74 24.28407111	39 18.89900483
4.5	74 23.96228048	39 19.0495993
5	74 23.64046687	39 19.20017885
5.5	74 23.31755685	39 19.35130868
6	74 22.99462369	39 19.5024235
7	74 24.87234073	39 19.13925596
8	74 24.78526424	39 20.02762052
9	74 25.14331738	39 20.75000342
R1	74 20.82880574	39 21.34698143
R2	74 22.03106833	39 22.62690882

Figure 2. Fisherman's Energy turbine and benthic station locations and two recent benthic surveys done south (Versar 2010) and north (Byrnes and Hammer 2001) of Absecon Inlet, NJ.

Table 1. Sediment and benthic community parameters from two recent assessments done near Absecon Inlet, NJ.

Assessment	Nearest F.E [a] Sample Location	Location, Date	Sediment[b]	% Coarse Sediment	Total Taxa[c]	Total Density (m^2) [d]	Juvenile *Spisula* Density (m^2)	Dominant Species	
								Taxon	Density (m^2)[d]
Byrnes and Hammer 2001	Near R1	G1,May, 1998	Sand	NA	21	5,647	21	*Polygordius* (LPIL) [e]	1,166
								Nucela proxima	92
								Capitella capitata	91
	Near R1	G1, Sep., 1998	Sand	NA	43	6,438	37	*Polygordius* (LPIL)[e]	1,081
								Apoprionospio pygmaea	631
								Asabellides oculata	412
Versar 2009	5 and 7	ST-Shoal Top, Oct. 2009	Mixed fine to coarse sand	24-63	8	418	5	Ascidiacea	664
								Polygordius jouinae	77
								Tanaissus psammophilus	77
	6	NS- North Side of Shoal, Oct. 2009	Coarse sand	74-95	13	4,832	9	Ascidiacea	2,714
								Polygordius jouinae	2,277
								Tanaissus psammophilus	759
	4.5	SS-South Side of Shoal, Oct. 2009	Medium to Fine sand	0.8-8	13	1,664	9	*Protohaustorius deichmannae*	596
								Acanthohaustorius similis	350
								Unciola serrata	118
	4	SO-South of Shoal, Oct. 2009	Medium to Fine sand	0.7-1	23	4,832	296	*Apoprionospio pygmaea*	1,873
								Protohaustorius deichmannae	591
								Tellina agilis	359
	Near Cable, Between 7 and 8	NW-NW of Shoal, Oct. 2009	Medium to Fine sand	0.5-4	18	4,000	127	*Polygordius jouinae*	1,155
								Unciola serrata	696
								Acanthohaustorius similis	614

[a] Fisherman's Energy Benthic Sample Location. Stations 4,5,6 and 7 are wind turbine locations (Figure 1).
[b] For Byrnes and Hammer 2001 sediment was categorized as gravel, sand and fine sediment. Versar 2010 reported grain size at each station.
[c] For Byrnes and Hammer 2001 Total Taxa is the mean number of taxa per station within Area G1. Versar 2010 results are reported as average per station.
[d] For Byrnes and Hammer 2001 Total Density/m^2 and Dominant Species Density/m^2 is a total count for Area G1. Versar 2010 results are reported as average per station. [e] LPIL=Lowest Practical Identification Level.

during the summer. The benthic community in September 1998 was dominated by the polychaetes *Polygordius* sp., *Apoprionospio pygmaea* and *Asabellides oculata.* Juvenile surf clam *Spisula solidissima* averaged 37/m^2 (Table 1). In the May survey, *Polygordius* sp. ranked first in abundance, and the bivalve *Nucela proxima* and the polychaete *Capitella capitata* were second and third, respectively. Juvenile surf clams averaged 21/m^2.

South of Absecon Inlet (Versar 2010)

Surface sediment and benthic community analysis results from the top of the finger shoal (ST), the sloping sides (north (NS), south (SS) and east of the shoal (ET)) and the deeper areas adjacent to the shoal north (NE and NW) and south (SO) show that clear differences in both sediment and benthic communities exist (Table 1). Surface sand particle size analysis revealed 3 sediment habitats: fine sand, coarse sand and mixed sand (fine to coarse). Statistical analyses (Multiple Dimensional Analysis, Simpler's Similarity Index, and ANOVA results) confirmed distinct benthic macrohabitats, with sediment type identified as the major factor leading to habitat differences.

The top of the shoal (ST), where Fishermen's Energy stations 5 and 7 are located, contained the least diverse and least abundant benthic community of the borrow study (Figure 2, Table 1). It had a mix of both coarse and fine sand as did 3 of the 5 stations sampled in the gradually sloping eastern toe of the shoal (ET). These sites shared the same benthic community characteristics in that diversity and infauna abundance was low in comparison to other strata within the study area and the community was generally dominated by the minute tunicates Ascidiacea (typically less than 1mm in diameter). The density of Atlantic surf clam juveniles (*Spisula solidissima*) was low compared to strata located off the finger shoal.

The steeply sloping north side of the finger shoal where Fishermen's Energy station 6 is located as well as two sites in the eastern toe of the shoal (ET) and one station in the Northeast flat area (NE) contained mostly coarse to very coarse sand with very little fine sand (Figure 2). The coarser sediments suggest that these regions are subjected to more hydrologic activity. The most abundant taxon on the stations with coarse sand was Ascidiacea, typically smaller in size that then the sand grains to which they attach. The second most abundant taxon was the polychaete *Polygordius jouinae*. These small polychaetes (about 5mm in length) prefer coarse sediments, living interstitially without tubes, and are common along the New Jersey coast (Ramey et al. 2006). The third ranking taxon at the coarse sand stations was the small tanaid crustacean *Tanaissus psammophilus*, also common to the New Jersey coastline (Byrnes and Hammer 2001). They are adapted to unstable sandy shoal sediments and have a life history strategy suitable to rapid recover after a major disturbance (Versar 2010). The density of *Spisula* juveniles was low compared to strata located off the finger shoal (Table 1).

The steeply sloping south side of the finger shoal (SS) where Fishermen's Energy Station 4.5 is located contained fine sand habitat dominated by amphipod crustaceans *Protohaustorius deichmannae*, *Acanthohaustorius similis*, and *Unciola serrata*. All 3 species have an affinity for fine sand and are common in New Jersey shoreline environments (Versar 2010). The density of *Spisula* juveniles was low compared to strata located off the finger shoal.

South of the finger shoal (SO) where Fishermen's Energy Station 4 is located is also fine sand habitat and had the lowest percentage of coarse sediments, and the highest number of taxa, total density, and Spisula density of all strata. The polychaete *Apoprionospio pygmaea* was most abundant, followed by the amphipod *Protohaustorius deichmannae* and the bivalve *Tellina agilis* (Table 1).

Northwest of the finger shoal (NW) is the closest area to the offshore portion of the proposed cable route located between Fishermen's Energy Stations 7 and 8. This fine sand habitat had a distinct benthic community with a high number of taxa, total density and *Spisula* density. *Polygordius jouinae* was most abundant and the amphipods *Unciola serrata* and *Acanthohaustorius similis* were also abundant (Versar 2010).

4.0 Analysis of Potential Adverse Impacts and Mitigation

4.1 Permanent Impacts

Installation of the turbine monopiles and scour protection would result in the loss of approximately 4.33 acres of benthic soft substrate habitat. Benthic invertebrates inhabiting the areas under the piles would be killed. Hard substrate habitat would be created around the turbines, offsetting soft substrate loss. The actual gain of habitat when the three-dimensional nature of scour protection is considered would be substantially more. This substrate would be colonized with fouling organisms adapted to living on hard substrates, providing a food source and refuge for certain species of fish.

The turbine units may alter water circulation, which could alter the sediment composition in the immediate area. The potential for scour will be reduced by the installation of a two-layer scour protection. A filter layer approximately one meter thick and 14 m radius will be overlain with one-meter thick rock armor layer approximately 11 meters in radius. The stones composing the armor layer will range from 600 mm to one meter in diameter. This will stabilize the structure and surrounding sediments.

The addition of scour protection results in a loss of soft substrate but an increase in hard substrate, thus increasing habitat diversity. A study of experimental artificial reefs deployed in New Jersey found that biomass was increased by a factor of from 24-123 times that found in a surf-clam dominated habitat, and 771 to 2,195 times that of a polychaete-dominated soft substrate community (Figley 2003). These habitats provide increased surface area (an average of 47.5 times that of flat bottom), with complexity that provides habitat for hard substrate "fouling" organisms such as blue mussels, barnacles, and macroalgae; refuges for cryptic species such as lobsters and crabs, and a food source for fish such as black sea bass (tautog), cunner and other species. Steimle et al. (2002) compared the annual production of epifauna on a concrete reef structure located at the mouth of Delaware Bay with that of the infauna of the surrounding sandy bottom over the 5-year period 1989-1994. On an equal footprint basis, the production of natural bottom infauna was 217-251 kcal/m²/yr as compared to 3,994-9,281 kcal/m²/yr of epifauna on the reef substrate.

Post-construction monitoring results from other offshore wind parks provide insights into benthic impacts and recovery. The Danish Horns Rev site in the North Sea , 14 km offshore, is in a highly dynamic shallow water habitat approximately 21-44 feet deep (Leonhard and Pedersen 2006). The Horns Rev project is much larger than the proposed Fishermen's Energy project, 80 turbines vs. six. Six years of post-installation monitoring data showed that sediments around the turbines became coarser but paralleled changes at reference sites and thus were attributed to regional changes. No sediment disturbance was observed that could be related to changes in the hydrodynamic regime resulting from the presence of the wind turbines. The benthic infaunal community near the turbines progressed from one initially very different to one with no statistically significant differences in abundance and biomass of dominant species from that at the reference locations. This transition

reflects the typical initial colonization by opportunistic species followed by community stabilization. The investigators found that the most significant construction-related-effect was the loss of sand substrate habitat and its associated benthic infauna, combined with the creation of hard substrate (steel, gravel, stone) habitat, with its characteristic fauna. The rock scour protection community differed from the monopile community. Organisms such as the blue mussel (*Mytilus edulis)*, sea star (*Asterias rubens)*, and barnacles (*Balanus crenatus*) settled on the scour protection. The hard substrate created a nursery for the crab *Cancer pagurus*, an edible crab, along with species such as the masked crab (*Cancer cassivelaunus)* and northern sea urchin (*Strongylocentrotus droebachiensis).* A variety of fish species were observed foraging at the sites, including pouting and cod; other species such as rock gunnel and dragonet use the sites as habitat. The vertical structure on the monopiles encouraged settlement by a variety of algae, along with blue mussels, barnacles, and the tube dwelling amphipod *Jassa marmorata,* an introduced species but common world-wide as a fouling organism. According to research presented in the monitoring report, it can take at least 5-6 years for the mature fouling community to develop, and longer if the community is decimated by strong storms. The authors estimate that the amount of food available to predators increased by a factor of 50 in comparison to soft substrate habitat. Changes in feeding patterns of some of the common predators (some of which avoided the wind farms, others that foraged within the wind farm), as well as cessation of commercial trawling in the study area may have indirectly contributed to changes in the dominance patterns of some common prey species.

The Danish Nysted wind farm, with 72 wind turbines, is approximately 6 miles offshore in the south Baltic Sea. It is located in waters approximately 19-31 feet deep in mainly sand substrate (Elsam Engineering and ENERGI E2 2005). Two years after construction, no changes in grain size around the turbines were noted, but dramatic changes in sediment along the cable route, a result of insufficient backfill following trenching. Finer grained sediments and drift algae have settled in the trench, with altered benthic species composition. Two years following construction, the benthic community, largely dominated by bivalve *Macoma balthica,* remained similar except in the vicinity of the cable trench. A dense community of blue mussels and barnacles developed around the turbine foundations and shafts. After two years, there was some evidence of increased fish abundance near the turbines, but not as much as expected.

4.2 Temporary Impacts

The project would result in temporary disturbance of the sea floor during placement of the monopiles and scour protection. Installation of the monopiles would likely temporarily disturb areas around the scour protection zone as a result of anchoring of support vessels or placement of the jack-up barge. Once each turbine has been fully installed, the benthic community in the anchoring footprint will begin to recover.

Approximately 3.66 acres of temporary impact to the benthic community would result from cable installation. Cable installation would last approximately 1-2 weeks. Construction activity would likely result in the loss of infauna in the construction zone. Use of jet plowing for cable installation confines disturbance to a narrow trench, estimated to be approximately 5 feet. Anchors and spuds would also disturb small areas of substrate. Jetting, and to a much lower degree, plowing, would result in temporary suspension of sediments, potentially causing additional benthic impacts from burial or smothering near the trench.

Once the project has been constructed, benthic macroinvertebrates would repopulate the disturbed areas over the cable and around the turbines. The recovery time for benthic macrofaunal communities is variable and depends on the season and location. Disturbance involving a change in sediment structure or transport can affect the length of recovery time. This is especially true if the disturbance creates a depositional area, resulting in an increase in fine sediments, with resultant change in benthic macrofauna. There has been a fair amount of literature on benthic recovery in the mid-Atlantic shelf, most related to repopulation following sand mining, a process that results in larger areas (and greater depths) of disturbance than that anticipated for this project. According to Diaz et al. (2004), the rapidity and degree of recolonization is dependent on three factors: the composition and abundance of adjacent benthic communities; the likely composition of the new substrate; and the season of the disturbance. The sediment composition is likely to be similar to the existing along the cable route, as sediment in this high-energy environment will be transported from surrounding areas. Therefore, species composition will also ultimately be similar. Some of the typical dominant species such as annelids can readily recruit in any season from nearby populations. Those that are opportunistic such as *Streblospio* will appear in days to weeks. Other dominants such as amphipods, mollusks, sand dollars (*Echinarachnius parma*) are less mobile and will rely on larval and juvenile recruitment. Larval and juvenile populations are able to repopulate the area more readily in the summer than during winter months. Diaz et al. (2004) estimate that benthic resources would be sufficient for demersal fish forage after a single spring/summer recruitment period. A study in a shoal area off northern New Jersey (Burlas et al. 2001) determined that in areas of high sediment movement and where sediment removal resulted in shallow pits, species abundance and richness recovered within 1 year; biomass, in particular sand dollar biomass, required 2.5 years to fully recover. Recolonization of a borrow pit off Great Egg Harbor Inlet (NJ) recorded a two-year recovery period (Scott and Kelley 1998). Recovery after a hypoxic event on the inner shelf off Atlantic City was species dependent. Initial opportunistic colonizers repopulated the area within months, as did some species with late summer recruitment patterns such as surf clams and sand dollars. Crustaceans had not repopulated after one year of sampling (Boesch 1979). These recolonization studies represent a worst case, as they are significantly larger in size level of disturbance. Furthermore, studies show that recolonization after sand mining can be facilitated by leaving small areas undisturbed ("refuges"), similar to the areas between turbines, which allow organisms to migrate to disturbed areas (Byrnes et al. 2004 a, b).

Construction-related impacts should be considered in the context of other activities that disturb the ocean bottom. When compared to commercial fishing for groundfish and surf clams as well as sand mining activities, the proposed project affects a substantially smaller area over a much shorter time frame.

5.0 Conclusions

Construction of the Fishermen's Energy 20 MW wind project would result in limited direct and indirect impacts to benthic macroinvertebrates. Approximately 4.2 acres of soft substrate habitat would be lost as the monopiles and scour protection are constructed. Hard substrate would replace the soft substrate habitat, which would increase habitat diversity and encourage settlement by hard substrate macrofauna. Typically, artificial reefs in New Jersey and elsewhere are productive and provide a forage base and refuge for a variety of larger invertebrates and fish.

During construction, approximately 3.66 acres of soft substrate habitat will be disturbed during installation of the cable as well as the turbines. The disturbance would be localized and short term. Some studies suggest recolonization occurs within a matter of weeks (depending on when the disturbance takes place), with full recovery in 1-2.5 years.

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February 9, 2015

Richard Ruvo, Director
Air Programs Branch
United States Environmental Protection Agency
Region 2
290 Broadway
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SUBJECT: General Conformity Analysis for Fishermen's Atlantic City Windfarm, LLC – Project Revisions

Dear Mr. Ruvo:

The U.S. Department of Energy (DOE) is proposing to provide funding to Fishermen's Atlantic City Windfarm, LLC (project proponent) to support the development of an offshore wind renewable energy facility (proposed project) within New Jersey state waters, located approximately 2.8 miles off the New Jersey coast from Atlantic City. The U.S. Army Corps of Engineers, Philadelphia District (USACE) has regulatory and permitting authority for this proposed project under Section 404 of the *Clean Water Act* and Section 10 of the *Rivers and Harbors Act of 1899*. The USACE issued Department of the Army Permit CENAP-OP-R-2008-0777-39 for this proposed project on June 14, 2013. Since issuance of the USACE permit, the project plans have been refined and a permit modification package has been submitted to the USACE. The USACE is proposing to process a modification to that permit.

The proposed project would consist of the construction, operation, maintenance, and eventual decommissioning of up to six wind turbine generators that would generate a maximum of approximately 25 megawatts (MW) of electricity, a 33-kilovolt (kV) alternating current (AC) submarine cable interconnecting the turbines, a 33-kV AC submarine transmission cable (export cable), and a 33-kV AC underground cable (onshore interconnection cable) that would connect the proposed project with existing onshore infrastructure in Atlantic City, New Jersey.

The project area is within the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE non-attainment area for the ozone National Ambient Air Quality Standards. The USACE previously coordinated a review of a General Conformity Applicability Analysis dated October 10, 2011 (Enclosure 1) for this project with your office. The determination was that the calculated emissions for the project are less than the General Conformity applicability thresholds for both construction and operations. Because the calculated emissions are less than the de minimis emission levels, the project is not subject to the General Conformity provision.

Since completion of your review, the following changes have occurred:

- A permit modification package has been submitted to the USACE. The USACE plans to issue a Public Notice to solicit comments and recommendations from the public concerning modification of the Department of the Army permit. The USACE will include your office on the distribution list to be notified when the Public Notice is published.
- DOE is completing an Environmental Assessment (EA) for the proposed project under the National Environmental Policy Act (NEPA) and the USACE is a cooperating agency. DOE will include your office on the distribution list to be notified when the draft EA is posted for the public comment period.

A summary of proposed changes to the project description is attached (Enclosure 2). A current project construction schedule is attached (Enclosure 3). DOE, as the funding agency, and USACE, as the permitting agency, have reviewed the proposed project changes and determined the changes do not impact the analysis since there will be no new types of vessels used, and no increase in vessel size or in the number of vessels to be used in association with the change in foundation type.

If you have any questions or require any additional information, please contact Lori Gray at (720)356-1568 or lori.gray@ee.doe.gov or Larry Slavitter, USACE at 215-655-6734 or Lawrence.M.Slavitter@usace.army.mil.

Please send any correspondence to:

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Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

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Lingard Knutson, USEPA
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Roak Parker, DOE
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Memo

Date: October 10, 2011

To: Charles Harman , AMEC

From: Lysa Modica, AMEC

Subject: **Revision 2: General Conformity Applicability Determination for a 25 MW Wind Farm Offshore Atlantic City, NJ based on EPA/NJDEP Comments**

This revised general conformity applicability analysis was prepared in response to a conference call held on September 28, 2011 between representatives of AMEC, the U.S. Army Corps of Engineers (USACOE), the U.S. Environmental Protection Agency Region II (USEPA), and the New Jersey Department of Environmental Protection (NJDEP). This revised general conformity applicability analysis addresses comments and questions raised during the referenced conference call. This revised analysis was conducted in conformance with Title 40 of the Code of Federal Regulations ("CFR") Part 51, Subpart W and Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans". The updated analysis for this revision includes a more detailed analysis of vessel transit routes for movement of construction materials to allow for tug/tow vessel load factor breakdown by water way (inland versus ocean) and also uses Tier 2 emission factors for the 4,000 hp construction tug on the "Offshore Marine" table (Table 7). Fishermen's Energy has committed to using at least one Tier 2 tug for construction of the wind farm. In addition, during the call, USEPA questioned the large decrease in CO emissions in the July update. The decrease was a result of the reduced construction schedule. This will be discussed in more detail in Section 2.1 – Construction Emissions.

The results of this revised analysis demonstrate that projected emissions from the construction and operation of the 25 MW wind farm will not exceed General Conformity applicability thresholds for NO_x, VOC, and $PM_{2.5}$ and a Record of Non-Applicability (RONA) can be issued by the ACOE for the project.

1.0 GENERAL CONFORMITY BACKGROUND AND PROJECT SUMMARY

The Fishermen's Atlantic City Windfarm (Fishermen's) is considered a Federal Action because of the involvement of the United States Army Corps of Engineers (USACOE), which is a federal agency. The Fishermen's Energy Project is a nominal 25 MW offshore pilot wind electric power generating and transmission facility to be constructed off the coast of Atlantic City, New Jersey. The project includes six (6) wind turbines, an underwater transmission cable system, transmission vaults, and AC interconnections to the Huron Substation located in Atlantic City, NJ. Fishermen's will supply power to New Jersey via a dedicated transmission cable located in the waters of New Jersey.

The Fishermen's Project is located in the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Interstate Air Quality Control Region (AQCR) which is designated as moderate nonattainment for ozone and nonattainment for $PM_{2.5.}$ In addition, the Project is also located in the Northeast Ozone Transport Region (OTR). Therefore, the Project must evaluate air emissions of ozone precursors (VOC and NO_x) as well as $PM_{2.5}$ from construction and operation of the Project and demonstrate compliance with the ozone State Implementation Plan (SIP) for New Jersey.

The wind turbines and transmission cable will be located in the waters of the State of New Jersey off of Atlantic City. The New Jersey transmission landfall transition and substation are located in Atlantic County, New Jersey. Under the Energy Policy Act of 2005 (EPAct 2005), air quality impacts from marine vessels and non-road equipment operating at offshore wind projects located in state waters are regulated under the General Conformity requirements. Projects located in federal waters are regulated by EPA and subject to regulations promulgated to address projects on the Outer Continental Shelf (OCS, 40 CFR 55).

The 1990 Clean Air Act Amendments include the provision of General Conformity, which is intended to ensure that Federal Actions (financing, permits, facilities, etc.) conform to a nonattainment area's SIP; thus not adversely impacting the area's progress toward attaining the National Ambient Air Quality Standards (NAAQS). The General Conformity Rule is codified in 40 CFR Part 51, Subpart W and Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" ("General Conformity Rule"). The General Conformity Rule regulates air pollutant emissions associated with actions that are federally funded, licensed, permitted, or approved, and ensures emissions do not contribute to air quality degradation or prevent the achievement of state and federal air quality goals. In short, General Conformity, if applicable, refers to the process to evaluate plans, programs, and projects to determine and demonstrate that they satisfy the requirements of the Clean Air Act (CAA) and applicable SIP. Under General Conformity, construction of the wind turbines and transmission cable are considered part of the Fishermen's project.

The process to determine conformity for a proposed action involves two steps: applicability and determination. Applicability is an assessment of whether a proposed action is subject to the General Conformity Rule. If the emissions associated with the Project exceed the applicability thresholds for New Jersey (set by the New Jersey Department of Environmental Protection (NJDEP)) under the General Conformity Rule, a General Conformity Determination would be required for the Project. Both construction and operational emissions from sources which do not require air permitting must be evaluated. If the emissions associated with the Project are less than the applicability thresholds, the project is said to conform to the New Jersey SIP.

2.0 APPLICABILITY DETERMINATION

As required under General Conformity, an applicability evaluation was conducted for the Fishermen's Energy Project to determine if the total direct and indirect emissions for non-attainment pollutants in the Project area exceed the annual ***de minimis*** levels specified in Title 40 CFR 58.853(b)(1) and (2). The general conformity applicability threshold for ozone precursors for an area in either moderate or basic ozone nonattainment within an ozone transport region ("OTR") or in a maintenance area is 50 tons per year (TPY) of volatile organic compounds (VOCs) and 100 TPY of nitrogen oxides (NO_x). For $PM_{2.5}$, the applicability threshold under general conformity is 100 TPY.

Applicability is based on both direct and indirect emissions from the proposed Project and includes the marine vessel transport of equipment to the construction site from Elizabeth and Camden, N.J. and back, construction of the wind turbines (including foundations), construction of the upland and marine transmission cable segments, and all marine vessels used to transport construction equipment and perform construction activities. In addition, vessel emissions during operations are also evaluated for applicability to conformity requirements.

2.1 Construction Emissions

Construction emissions were calculated for the following segments of construction:

- Marine emissions for construction of the upland transmission cable connection;
- Emissions from non-road combustion equipment for construction of the upland transmission cable connection and underground transmission cable;
- Mobile source (on-road) emissions from construction of the upland transmission cable;
- Emissions from non-road combustion equipment for construction of the wind turbine foundations and wind turbines;
- Offshore marine emissions for construction of the wind turbine foundations, wind turbines, and underwater cable; and
- Vessel emissions due to travel along the following marine routes:
    - Jacket foundation: One 4,000 hp tug for heavy lift crane barge from Elizabeth, N.J. to Atlantic City worksite and a return voyage to Elizabeth, N.J. A 0.68 load factor was used for this transit (206 miles roundtrip).
    - Turbine Installation: Two 3,000 hp tug/barge materials transport units mobilized from Elizabeth, N.J. to Camden, .NJ. A 0.68 load factor was used for the ocean portion of this transit (182 miles) and a factor of 0.31 was used for travel up the Delaware River (66 miles).

- Turbine Installation: 3 round trips (two 3,000 hp tugs) for transport of 6 turbines from Camden to the Atlantic City offshore worksite. A 0.68 load factor was used for the ocean portion of this transit (158 miles per roundtrip) and a factor of 0.31 was used for travel up the Delaware River (132 miles per roundtrip).
- Demobilize of two 3,000 hp tug/barge units back to Elizabeth NJ. A 0.68 load factor was used for this transit (103 miles).
- Turbine Installation: One 4,000 hp tug to transport one heavy lift crane vessel from Elizabeth, N.J. to Atlantic City worksite and a return voyage to Elizabeth NJ. A 0.68 load factor was used for this transit (206 miles roundtrip)
- Cable Installation: One 4,000 hp large tug to transit cable barge from Elizabeth, N.J. to Atlantic City worksite. A 0.68 load factor was used for this transit (103 miles).
- Cable Installation: One 4,000 hp large tug to transit from Atlantic City, N.J. to Camden to offload cable spares. A 0.68 load factor was used for the ocean portion of this transit (79 miles) and a factor of 0.31 was used for travel up the Delaware River (66 miles).
- Cable Installation: One 4,000 hp large tug to transit from Camden, N.J. back to Elizabeth, N.J. for demobilization after offloading cable spares for demobilization. A 0.68 load factor was used for the ocean portion of this transit (182 miles) and a factor of 0.31 was used for travel up the Delaware River (66 miles).

Table 1 provides a summary the calculated Project construction emissions compared to the General Conformity ***de minimis*** emission levels for the project area. The emissions include offshore emissions from construction of the wind turbines, vessel transit to/from the site, and land based emissions from the upland cable connection. A detailed breakdown of emissions from each source of construction emissions is provided in Tables 1 through 8 of Attachment 1.

Construction emissions have decreased substantially since the initial conformity analysis was submitted in April 2011. The reason for the decrease is due to three factors: (1) a change from monopole to jacket foundations; (2) a refinement of the construction schedule; and (3) the commitment to use a Tier 2 tug boat for the 4,000 hp constriction tug (Table 7). The original submitted conformity analysis was prepared based on a construction schedule that had a much longer construction period. However, the second submission document was based on a revised construction schedule that was developed between Fishermen's Energy and Weeks Marine and included more realistic construction scenarios. The emissions decrease is most apparent for CO and less so for NO_x because in addition to the decrease in schedule, more conservative emission factors were used for all tugs, with the exception of the 4,000 hp construction tug (Tier 0 in the July and this current revision versus Tier 2 for the April analysis) to calculate NO_x emissions from the marine vessels. In addition, in this most recent update, NO_x emissions are lower than the July submittal because by breaking out the vessel transit legs in more detail, it

was discovered that the roundtrip mobilization/demobilization to/from Elizabeth/Camden was included in a calculation that accounted for three roundtrips to deliver the turbines to the site.

Table 1. Comparison of Construction Emissions to Conformity Applicability Levels.

Pollutant	*de minimis* Emission Levels (tons/year)	Total Construction Emissions (tons)
NO_X	100	61.3
VOC	50	1.75
CO	NA	26.7
PM_{10}	NA	1.9
$PM_{2.5}$	100	1.9
SO_2	NA	6.1

NA – Not applicable as Atlantic County is attainment for those pollutants

Because construction of the project is expected to be completed within a 9-month period, total project emissions are conservatively assumed to occur within one calendar year. A review of the total construction emissions in Table 1 shows that both VOC and $PM_{2.5}$ are well below the General Conformity ***de minimis*** emission levels. In addition, even using the Tier 0 NO_x emissions factors for all but one vessel and higher vessel transit load factors, NO_x emissions are also below the General Conformity ***de minimis*** emission levels. Therefore, the Project does not require a formal General Conformity determination and would result in no significant air quality impact for emissions from construction.

2.2 Operational Emissions

During operation of the wind farm, there will be emissions from marine vessels that will provide maintenance to the wind turbines. Emissions during operations were also calculated for comparison to General Conformity applicability thresholds using Tier 0 emission factors. A summary of operational emissions is provided in Table 2. The detailed emissions calculation is provided in Attachment 2, Table 9.

A review of the total operational emissions in Table 2 below shows that VOC, NO_x, and $PM_{2.5}$ are well below the General Conformity ***de minimis*** emission levels. Therefore, the Project does

not require a formal General Conformity determination and would result in no significant air quality impact for emissions from operation.

Table 2. Comparison of Operational Emissions to Conformity Applicability Levels.

Pollutant	*de minimis* Emission Levels (tons/year)	Total Construction Emissions (tons)
NO_X	100	7.35
VOC	50	0.2
CO	NA	3.7
PM_{10}	NA	0.2
$PM_{2.5}$	100	0.2
SO_2	NA	1.0

NA – Not applicable as Atlantic County is attainment for those pollutants

The following sections identify the direct and indirect emission sources associated with the Project, and the corresponding emission estimates for those sources.

3.0 Emissions Calculation Methodology

Sources evaluated for the Project can be classified into four types of emission sources: marine vessels, non-road sources (e.g., most construction equipment), stationary generators, and on-road trucks. Marine vessels (3,000 and 4,000 hp) will be used to transport equipment, assist in preparing the upland cable connection and for construction and operation of the wind farm. Non-road sources include equipment such as excavators, backhoes, winches, compressors, and cranes. Construction of the upland cable connection will include one stationary source, a 38 hp generator. Mobile sources for the upland cable connection include six support trucks, a tractor trailer and a tandem dump truck. Following is a discussion of the sources of emissions factors, activity levels, and load data used to calculate emissions for this analysis. A project construction schedule is provided in Attachment 3.

3.1 Marine Vessels

Marine vessel emission factors were obtained from USEPA's ***Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories*** (April 2009) ***Table 3-8 Harbor Craft Emission Factors (g/kWh)***, Tier 0 engines for most of the vessels. Fishermen's has agreed

to use at least one Tier 2 tug for the construction of the wind farm. Therefore, this revised analysis used Tier 2 emission factors for the 4,000 hp tug in Table 7. In addition, load factors for the various types of vessels were obtained from Table 3-4 ***Load factors for Harbor Craft***. The types, numbers, and size of the vessels are summarized in Attachment 1 (see Tables 3, 7, and 8 of Attachment 1) for construction and Attachment 2 for operations. A load factor of 0.31 was used for the all of the tug boats during construction as the tug boats will only operate at a higher load factors while towing the barges to the offshore construction site. For transporting equipment, load factors of 0.31 were used for the tugs traveling though inland waterway segments and a load factor of 0.68 was used for tugs traveling ocean routes. Based on the construction schedule, it was conservatively assumed that the vessels will be operating with their engines running for 24 hours per day from June 14th 2012 to August 14th 2012 for a total of 61 days of offshore construction. For vessel transport, the travel time was calculated based on the distance and a travel speed of 8 knots. For operational emissions, it was assumed that wind turbine maintenance will occur 213 days out of the year for 10 hours per day. The emissions do not account for shut down of any engines when not in use.

3.2 Non-Road Equipment

Emission factors for the non-road construction equipment used for both the upland and marine construction were calculated using USEPA's NONROAD2008 model (USEPA, 2005, 2009, 2010). The New Jersey Department of Environmental Protection (NJDEP) Division of Land Use issued a draft permit for the project requiring the use of either Tier 4 engines or engines that meet Tier 2 non-road emissions standards plus the best available emissions control or technology technically feasible for the operation. To allow for the use of a combination of Tier 2 and Tier 4 engines, emissions for non-road engines were based on Tier 3 emission factors. Load factors for each piece of equipment were also obtained from NONROAD2008. Annual emissions were based on the construction schedule for the upland and marine segments.

For the upland transmission schedule, HDD construction was assumed to occur for 10 hours per day for 55 days, except for the two excavators, which will only operate for 30 days.

For construction of the wind turbine foundations, installation activities will occur for 24 hours per day and 37 days to complete. For construction of the wind turbines, construction will occur for 24 hours per day and 25 days. Construction of the underwater cable (i.e., the deck barge cable plow pump and deck barge cable engine) is anticipated to take 27 days at 24 hours per day to complete. These assumptions assume that the non-road engines are running for the entire time, which is a conservative assumption since N.J.A.C. 7:27-14 and 15 (and the NJDEP. Division of Land Use Draft Permit Condition 28) requires that all non-road construction equipment for the Project comply with the 3 minute idling limit.

3.3 On-Road Trucks

Emission factors for the trucks were calculated using USEPA's MOBILE6.2 model (USEPA, 2004). MOBILE6.2 provides emission factors for NO_X, CO, VOC, PM_{10} and $PM_{2.5}$ in grams per vehicle mile travelled for various vehicle types. Emission factors are further broken down by vehicle classes and travel speeds. For this analysis, the maximum emission factors for heavy duty diesel vehicles class 8A (HDDV8A) were applied. HDDV8A factors are representative of trucks between 33,001 and 60,000 tons gross vehicle weight. In addition, the emission factors are broken down by speeds. For this analysis, truck speeds of 55 miles per hour were used to conservatively reflect truck emissions. Other assumptions, including the trip length and the number of trips per year are provided in Attachment 1.

4.0 CONCLUSION

Calculated emissions for the Fishermen's Atlantic City nominal 25 MW Windfarm are less than the General Conformity applicability thresholds for both construction and operations for. VOC, NO_x, and $PM_{2.5}$. Because the calculated emissions are less than the ***de minimis*** emission levels, the Project is not subject to the General Conformity provisions and a Record of Non-Applicability (RONA) can be issued by the ACOE..

References

United States Environmental Protection Agency (USEPA), 2005. U***ser's Guide for the Final Nonroad2005 Model***; EPA420-R-05-013; Assessment and Standards Division Office of Transportation and Air Quality; Ann Arbor, Michigan; December 2005.

United States Environmental Protection Agency (USEPA), 2000. Frequently Asked Questions About NONROAD 2008; EPA420-F09-021. Office of Transportation and Air Quality; Ann Arbor, Michigan; April 2009.

United States Environmental Protection Agency (USEPA), 2010. Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling" Report No. NR-005d. July 2010. Assessment and Standards Division EPA, Office of Transportation and Air Quality.

United States Environmental Protection Agency (USEPA), 2003. ***User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model***. EPA420-R-03-010; Assessment and Standards Division Office of Transportation and Air Quality; Ann Arbor, Michigan; August 2003.

United States Environmental Protection Agency (USEPA), 2009 ***Current Methodologies in Preparing Mobile Source Port-Related Emissions Inventories.*** Final Report. USEPA , Office of Policy, Economics, and Innovation Washington D.C. and ICF International, Fairfax, VA. April 2009.

Attachment 1

Construction Emissions Calculations

Table 1. Project Emissions Summary

Project Emission Totals (TPY)						
Source Category	**THC**	**NOx**	**PM10**	**PM2.5**	**CO**	**SO2**
Nonroad	0.479	7.812	0.506	0.493	3.240	0.013
Marine	1.26	53.16	1.40	1.36	23.35	6.07
Mobile	0.005	0.149	0.00385	0.00292	0.022	0.00030
Generator	0.00042	0.197	0.006	0.006	0.109	0.00042
TOTALS	**1.75**	**61.32**	**1.92**	**1.86**	**26.72**	**6.08**

Upland Emission Totals (TPY)						
Source Category	**THC**	**NOx**	**PM10**	**PM2.5**	**CO**	**SO2**
Nonroad	0.174	2.556	0.217	0.208	1.644	0.0048
Marine	0.028	1.239	0.032	0.031	0.528	0.137
Mobile	0.005	0.149	0.00385	0.00292	0.022	0.00030
Generator	0.00042	0.1969	0.0063	0.0063	0.1089	0.00042
TOTALS	**0.21**	**4.14**	**0.26**	**0.25**	**2.30**	**0.14**

Offshore Emission Totals (TPY)						
Source Category	**THC**	**NOx**	**PM10**	**PM2.5**	**CO**	**SO2**
Nonroad	0.304	5.256	0.289	0.285	1.596	0.009
Marine	1.08	44.58	1.20	1.17	20.04	5.21
Marine Travel	0.15	7.34	0.17	0.16	2.78	0.72
TOTALS	**1.54**	**57.18**	**1.66**	**1.61**	**24.42**	**5.94**

Operational Marine Vessel Emission Totals (TPY)						
Source Category	**THC**	**NOx**	**PM10**	**PM2.5**	**CO**	**SO2**
Ferry	0.20	7.35	0.22	0.21	3.68	0.96
TOTALS	**0.20**	**7.35**	**0.22**	**0.21**	**3.68**	**0.96**

Table 2. Upland Nonroad Source Emissions

Emission Factors and Operating Limits													
Engine Description	Rating (hP)	Number	Total hP	Hours Per Day	Days Per Year	Tier	Load Factor	THC (g/hp·hr)	NOx (g/hp·hr)	PM10 (g/hp·hr)	PM2.5 (g/hp·hr)	CO (g/hp·hr)	SO2 (g/hp·hr)
Horizontal Directional Drill Rig	700	2	1400	10	55	3	0.59	0.17	2.61	0.22	0.21	2.03	0.00493
Tulsa Iron Triplex Pump	540	1	540	10	55	3	0.43	0.17	2.50	0.15	0.150	0.84	0.00487
CAT 345CL Excavator	600	2	1200	10	30	3	0.59	0.17	2.61	0.22	0.210	1.29	0.00487
CAT 325CL Excavator	300	1	300	10	30	3	0.59	0.19	2.61	0.22	0.210	1.14	0.00487
CAT IT28 Wheel Loader	131	1	131	10	55	3	0.21	0.42	3.03	0.52	0.500	2.23	0.00487
CAT 420DIT Backhoe	93	1	93	10	55	3	0.21	0.42	3.64	0.71	0.690	6.08	0.00487
Cable Winch	50	1	50	10	55	3	0.43	0.18	3.00	0.30	0.290	2.37	0.00487

Note: The HDD rig and Triplex pump emissions were estimated using the NONROAD2008 category "Diesel Trenchers".
Note: The Cable Winch emissions were estimated using the NONROAD2008 category "Diesel Cranes".
Note: The Triplex pump emissions were estimated using ther NONROAD2008 category

Emissions												
	THC		NOx		PM10		PM2.5		CO		SO2	
Engine Description	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Horizontal Directional Drill Rig	0.31	0.08513	4.75	1.30701	0.40	0.11017	0.38	0.10516	3.70	1.01657	0.0090	0.00247
Tulsa Iron Triplex Pump	0.09	0.02393	1.28	0.35193	0.08	0.02112	0.08	0.02112	0.43	0.11825	0.0025	0.00069
CAT 345CL Excavator	0.27	0.03980	4.07	0.61107	0.34	0.05151	0.33	0.04917	2.01	0.30202	0.0076	0.00114
CAT 325CL Excavator	0.07	0.01112	1.02	0.15277	0.09	0.01288	0.08	0.01229	0.44	0.06673	0.0019	0.00029
CAT IT28 Wheel Loader	0.03	0.00700	0.18	0.05054	0.03	0.00867	0.03	0.00834	0.14	0.03719	0.0003	0.00008
CAT 420DIT Backhoe	0.02	0.00497	0.16	0.04310	0.03	0.00841	0.03	0.00817	0.26	0.07199	0.0002	0.00006
Cable Winch	0.01	0.00235	0.14	0.03910	0.01	0.00391	0.01	0.00378	0.11	0.03089	0.0002	0.00006
TOTALS	**0.788**	**0.174**	**11.607**	**2.556**	**0.983**	**0.217**	**0.943**	**0.208**	**7.094**	**1.644**	**0.022**	**0.0048**

Table 3. Upland Marine Source Emissions

Emission Factors and Operating Limits													
Vessel Description	Rating (hp)	Rating (kW)	Hours Per day	Days Per Year	# Vessels	Total kW	Load Factor	THC (g/kWh)	NOx (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	CO (g/kWh)	SO2 (g/kWh)
Tug	1,200	895	10	20	1	895	0.31	0.27	13	0.3	0.29	5	1.3
Crew Boat	600	447	10	20	1	447	0.45	0.27	10	0.3	0.29	5	1.3

Note: * Marine emission factors based on U.S. EPA's "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories", April 2009.
* SO2 emission factors are conservatively based on 1.5% fuel oil sulfur content for harbor craft.

* Lay barge information not provided. Parameters assumed from similar project.
* As a worst case estimate, the small craft was also assumed to use diesel fuel at 1.5% sulfyr.

Emissions												
Vessel Description	THC (lb/hr)	THC (tpy)	NOx (lb/hr)	NOx (tpy)	PM10 (lb/hr)	PM10 (tpy)	PM2.5 (lb/hr)	PM2.5 (tpy)	CO (lb/hr)	CO (tpy)	SO2 (lb/hr)	SO2 (tpy)
Tug	0.17	0.02	7.95	0.80	0.18	0.02	0.18	0.02	3.06	0.31	0.80	0.08
Crew Boat	0.12	0.01	4.44	0.44	0.13	0.01	0.13	0.01	2.22	0.22	0.58	0.06
TOTALS	**0.28**	**0.03**	**12.39**	**1.24**	**0.32**	**0.03**	**0.31**	**0.03**	**5.28**	**0.53**	**1.37**	**0.14**

Table 4. Upland Mobile Source Emissions

Emission Factors and Operating Limits												
Vehicle	Number	Rating (hp)	Total hp	Trips Per Day	Trips Per Year	Trip Length (mi)	THC (g/mile)	NOx (g/mile)	PM10 (g/mile)	PM2.5 (g/mile)	CO (g/mile)	SO2 (g/mile)
Support Trucks	6	100	600	4	135	20	0.247	7.27	0.1875	0.1423	1.07	0.0144
Tractor Trailer	1	515	515	2	61	20	0.247	7.27	0.1875	0.1423	1.07	0.0144
Tandem Dump Truck	1	350	350	4	61	20	0.247	7.27	0.1875	0.1423	1.07	0.0144

Emissions												
Vehicle	THC (lb/day)	THC (tpy)	NOx (lb/day)	NOx (tpy)	PM10 (lb/day)	PM10 (tpy)	PM2.5 (lb/day)	PM2.5 (tpy)	CO (lb/day)	CO (tpy)	SO2 (lb/day)	SO2 (tpy)
Support Trucks	0.261	0.00441	7.693	0.12982	0.198	0.00335	0.151	0.00254	1.132	0.01911	0.0152	0.00026
Tractor Trailer	0.022	0.00033	0.641	0.00978	0.017	0.00025	0.013	0.00019	0.094	0.00144	0.0013	0.00002
Tandem Dump Truck	0.044	0.00033	1.282	0.00978	0.033	0.00025	0.025	0.00019	0.189	0.00144	0.0025	0.00002
TOTALS	**0.327**	**0.005**	**9.616**	**0.149**	**0.248**	**0.00385**	**0.188**	**0.00292**	**1.415**	**0.022**	**0.0190**	**0.00030**

Table 5. Upland Generator Engine Emissions

Emission Factors and Operating Limits							
Rating (hp)	Hours Per Year	THC (g/hp)	NOx (g/hp)	PM10 (g/hp)	PM2.5 (g/hp)	CO (g/hp)	SO2 (g/hp)
38	1000	0.01	4.7	0.15	0.15	2.6	0.01

Emissions											
THC		NOx		PM10		PM2.5		CO		SO2	
(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
0.0008	0.0004	0.394	0.197	0.0126	0.0063	0.0126	0.0063	0.218	0.109	0.0008	0.0004

Table 6. Offshore Nonroad Source Emissions

Emission Factors and Operating Limits													
Engine Description	Rating (hP)	Number	Total hP	Hours Per Day	Days Per Year	Tier	Load Factor	THC (g/hp·hr)	NOx (g/hp·hr)	PM10 (g/hp·hr)	PM2.5 (g/hp·hr)	CO (g/hp·hr)	SO2 (g/hp·hr)
Deck Barge Anchor Winch	300	2	600	24	37	3	0.43	0.18	2.50	0.22	0.210	0.87	0.00487
Deck Barge Cable Plow Pump	298	1	298	24	27	3	0.43	0.18	2.50	0.15	0.150	0.75	0.00487
Deck Barge Cable Engine	120	2	240	24	27	3	0.43	0.18	3.00	0.30	0.290	2.37	0.00487
Deck Barge 50 Ton Hydraulic Crane	102	1	102	24	37	3	0.43	0.18	2.50	0.22	0.210	0.87	0.00487
Deck Barge Dive Compressor	22.5	1	22.5	24	37	3	0.43	0.44	4.44	0.27	0.260	2.16	0.00487
Deck Barge Divers Jet Pump	68	1	68	24	37	3	0.43	0.18	3.00	0.30	0.290	2.37	0.00487
Deck Barge Air Compressor	440	1	440	24	37	3	0.43	0.17	2.50	0.15	0.150	0.84	0.00487
JU Barge 1 Jacking System	544	2	1088	24	25	3	0.43	0.17	2.50	0.15	0.150	0.84	0.00487
JU Barge 1 Crane	1000	1	1000	24	25	3	0.43	0.17	4.10	0.13	0.130	0.76	0.00487
Floating Derrick Crane	800	1	800	24	25	3	0.43	0.17	4.10	0.13	0.130	0.76	0.00487
JU Barge 2 Jacking System	425	2	850	24	25	3	0.43	0.17	2.50	0.15	0.150	0.84	0.00487

Note: Except for the cranes NONROAD2008, factors based on "Diesel Bore/Drill Rig" category. The cranes used the NONROAD2008 "Diesel Crane Category".
Note: The deck barge cable plow pump and engine will be used for the underwater cable only and will therefore be used for a 27 day period.

Emissions												
	THC		NOx		PM10		PM2.5		CO		SO2	
Engine Description	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Deck Barge Anchor Winch	0.10	0.04546	1.42	0.63135	0.13	0.05556	0.12	0.05303	0.49	0.21971	0.0028	0.00123
Deck Barge Cable Plow Pump	0.05	0.01648	0.71	0.22882	0.04	0.01373	0.04	0.01373	0.21	0.06865	0.0014	0.00045
Deck Barge Cable Engine	0.04	0.01327	0.68	0.22114	0.07	0.02211	0.07	0.02138	0.54	0.17470	0.0011	0.00036
Deck Barge 50 Ton Hydraulic Crane	0.02	0.00773	0.24	0.10733	0.02	0.00944	0.02	0.00902	0.08	0.03735	0.0005	0.00021
Deck Barge Dive Compressor	0.01	0.00417	0.09	0.04205	0.01	0.00256	0.01	0.00246	0.05	0.02046	0.0001	0.00005
Deck Barge Divers Jet Pump	0.01	0.00515	0.19	0.08586	0.02	0.00859	0.02	0.00830	0.15	0.06783	0.0003	0.00014
Deck Barge Air Compressor	0.07	0.03148	1.04	0.46299	0.06	0.02778	0.06	0.02778	0.35	0.15556	0.0020	0.00090
JU Barge 1 Jacking System	0.18	0.05260	2.58	0.77354	0.15	0.04641	0.15	0.04641	0.87	0.25991	0.0050	0.00151
JU Barge 1 Crane	0.16	0.04835	3.89	1.16601	0.12	0.03697	0.12	0.03697	0.72	0.21614	0.0046	0.00138
Floating Derrick Crane	0.13	0.03868	3.11	0.93280	0.10	0.02958	0.10	0.02958	0.58	0.17291	0.0037	0.00111
JU Barge 2 Jacking System	0.14	0.04109	2.01	0.60433	0.12	0.03626	0.12	0.03626	0.68	0.20306	0.0039	0.00118
TOTALS	**0.91**	**0.30**	**15.97**	**5.26**	**0.84**	**0.29**	**0.83**	**0.28**	**4.72**	**1.60**	**0.03**	**0.0085**

Table 7. Offshore Marine Source Emissions

Emission Factors and Operating Limits													
Vessel Description	Rating (hp)	Rating (kW)	Hours Per day	Days Per Year	# Vessels	Total kW	Load Factor	THC (g/kWh)	NOx (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	CO (g/kWh)	SO2 (g/kWh)
Tug	4,000	2,983	24	61	1	2,983	0.31	0.27	9.8	0.3	0.29	5	1.3
Tug	3,000	2,237	24	61	1	2,237	0.31	0.27	13.2	0.3	0.29	5	1.3
Tug	700	522	24	61	1	522	0.31	0.27	13.2	0.3	0.29	5	1.3
Tug	700	522	24	30	1	522	0.31	0.27	13	0.3	0.29	5	1.3
Crew Boat	1,800	1,342	24	63	1	1,342	0.45	0.27	10	0.3	0.29	5	1.3

Note: * Marine emission factors based on U.S. EPA's "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories", April 2009.
* SO2 emission factors are conservatively based on 1.5% fuel oil sulfur content for harbor craft.
*For load factors for the tug boats, it was conservatively assumed that the largest tug will be used to transport thepiles and and other parts to the wind farm as this results in the highest emission factors. See Table 3-4).
*The tug and crew boats will also be used to assist with cable laying.
* As a worst case estimate, the small craft was also assumed to use diesel fuel at 1.5% sulfyr.

Emissions												
Vessel Description	THC (lb/hr)	THC (tpy)	NOx (lb/hr)	NOx (tpy)	PM10 (lb/hr)	PM10 (tpy)	PM2.5 (lb/hr)	PM2.5 (tpy)	CO (lb/hr)	CO (tpy)	SO2 (lb/hr)	SO2 (tpy)
Tug	0.55	0.40	19.98	14.62	0.61	0.45	0.59	0.43	10.19	7.46	2.65	1.94
Tug	0.41	0.30	20.18	14.77	0.46	0.34	0.44	0.33	7.64	5.60	1.99	1.45
Tug	0.10	0.07	4.71	3.45	0.11	0.08	0.10	0.08	1.78	1.31	0.46	0.34
Tug	0.10	0.03	4.64	1.67	0.11	0.04	0.10	0.04	1.78	0.64	0.46	0.17
Crew Boat	0.36	0.27	13.32	10.07	0.40	0.30	0.39	0.29	6.66	5.03	1.73	1.31
TOTALS	**1.52**	**1.08**	**62.82**	**44.58**	**1.68**	**1.20**	**1.63**	**1.17**	**28.06**	**20.04**	**7.30**	**5.21**

Table 8. Marine Travel Emissions

Emission Factors and Operating Limits														
	Rating						Load	THC	NOx	PM10	PM2.5	CO	SO2	
Vessel Description	(hp)	(kW)	Travel Time (Hours)	# of Trips	# Vessels	Total Travel Time (Hours)	Factor	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)	(g/kWh)	Comments
Jacket Tug	4,000	2,983	22.4	1	1	22.4	0.68	0.27	13.2	0.3	0.29	5	1.3	Roundtrip: Elizabeth to Atlantic City (206 ocean miles)
Turbine Small Tug	3,000	2,237	19.8	1	2	39.5	0.68	0.27	13.2	0.3	0.29	5	1.3	Elizabeth to Camden mobilization (182 miles) - Ocean Travel
Turbine Small Tug	3,000	2,237	7.2	1	2	14.3	0.31	0.27	13.2	0.3	0.29	5	1.3	Elizabeth to Camden mobilization (66 miles) - River Travel
Turbine Small Tug	3,000	2,237	17.2	3	2	103.0	0.68	0.27	13.2	0.3	0.29	5	1.3	3 Roundtrips: Camden to Atlantic City (Ocean travel 158 miles round trip)
Turbine Small Tug	3,000	2,237	14.3	3	2	86.0	0.31	0.27	13.2	0.3	0.29	5	1.3	3 Roundtrips: Camden to Atlantic City (River travel 132 miles round trip)
Turbine Small Tug	3,000	2,237	11.2	1	2	22.4	0.68	0.27	13.2	0.3	0.29	5	1.3	Atlantic City to Elizabeth to demobilize (103 ocean miles)
Large Turbine Tug	4,000	2,983	22.4	1	1	22.4	0.68	0.27	13.2	0.3	0.29	5	1.3	Round trip Elizabeth to Atlantic City (206 ocean miles total)
Cable Large Tug	4,000	2,983	11.2	1	1	11.2	0.68	0.27	13.2	0.3	0.29	5	1.3	Elizabeth to Atlantic City (103 ocean miles)
Cable Large Tug	4,000	2,983	8.6	1	1	8.6	0.68	0.27	13.2	0.3	0.29	5	1.3	Atlantic City to Camden to offload material (79 ocean miles)
Cable Large Tug	4,000	2,983	7.2	1	1	7.2	0.31	0.27	13.2	0.3	0.29	5	1.3	Atlantic City to Camden to offload material (66 river miles)
Cable Large Tug	4,000	2,983	19.8	1	1	19.8	0.68	0.27	13.2	0.3	0.29	5	1.3	Camden to Elizabeth for demobilization (182 ocean miles)
Cable Large Tug	4,000	2,983	7.2	1	1	7.2	0.31	0.27	13.2	0.3	0.29	5	1.3	Camden to Elizabeth for demobilization (66 river miles)

Note: * Marine emission factors based on U.S. EPA's "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories", April 2009.
* SO2 emission factors are conservatively based on 1.5% fuel oil sulfur content for harbor craft.
*For load factors for the tug boats, it was conservatively assumed that the largest tug will be used to transport the piles and and other parts to the wind farm as this results in the highest emission factors. See Table 3-4). Ocean travel used a load factor of 0.68. Travel on the Delaware River used a load factor of 0.31
*The travel time for each vessel is based on the number of miles traveled (x2 where roundtrip) divided by 9.206 mph (8 knots).
*The total travel time (hours) is based on the travel time times the # trips times # vessels.

Emissions												
	THC		NOx		PM10		PM2.5		CO		SO2	
Vessel Description	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)	(lb/hr)	(tpy)
Jacket Tug	1.21	1.35E-02	59.03	6.60E-01	1.34	1.50E-02	1.30	1.46E-02	22.36	2.50E-01	5.81	6.50E-02
Turbine Small Tug	0.91	1.79E-02	44.27	8.75E-01	1.01	1.99E-02	0.98	1.93E-02	16.77	3.32E-01	4.36	8.62E-02
Turbine Small Tug	0.41	2.96E-03	20.18	1.45E-01	0.46	3.29E-03	0.44	3.19E-03	7.64	5.48E-02	1.99	1.42E-02
Turbine Small Tug	0.91	4.66E-02	44.27	2.28E+00	1.01	5.18E-02	0.98	5.02E-02	16.77	8.63E-01	4.36	2.24E-01
Turbine Small Tug	0.41	1.78E-02	20.18	8.68E-01	0.46	1.97E-02	0.44	1.91E-02	7.64	3.29E-01	1.99	8.55E-02
Turbine Small Tug	0.91	1.01E-02	44.27	4.95E-01	1.01	1.13E-02	0.98	1.09E-02	16.77	1.88E-01	4.36	4.88E-02
Large Turbine Tug	1.21	1.35E-02	59.03	6.60E-01	1.34	1.50E-02	1.30	1.46E-02	22.36	2.50E-01	5.81	6.50E-02
Cable Large Tug	1.21	6.75E-03	59.03	3.30E-01	1.34	7.50E-03	1.30	7.28E-03	22.36	1.25E-01	5.81	3.25E-02
Cable Large Tug	1.21	5.18E-03	59.03	2.53E-01	1.34	5.76E-03	1.30	5.58E-03	22.36	9.59E-02	5.81	2.49E-02
Cable Large Tug	0.55	1.97E-03	26.91	9.65E-02	0.61	2.19E-03	0.59	2.13E-03	10.19	3.65E-02	2.65	9.50E-03
Cable Large Tug	1.21	1.19E-02	59.03	5.83E-01	1.34	1.33E-02	1.30	1.29E-02	22.36	2.21E-01	5.81	5.75E-02
Cable Large Tug	0.55	1.97E-03	26.91	9.65E-02	0.61	2.19E-03	0.59	2.13E-03	10.19	3.65E-02	2.65	9.50E-03
TOTALS	**10.68**	**0.15**	**522.12**	**7.34**	**11.87**	**0.17**	**11.51**	**0.16**	**197.77**	**2.78**	**51.42**	**0.72**

Note: lb/hr = lb/hr per vessel; tpy= total tpy for all vessels on that travel leg

Attachment 2

Operational Emissions Calculations

Table 9. Operational Marine Vessel Emissions

Marine Vessels for Wind Turbine Maintenance

Vessel Type	Capacity (hp)	Capacity (kW)	No. of Engines	Total kW	Load Factor	THC (g/kWh)	NOx (g/kWh)	PM10 (g/kWh)	PM2.5 (g/kWh)	CO (g/kWh)	SO2 (g/kWh)
Ferry	500	372.85	2	745.70	0.42	0.27	10	0.3	0.29	5	1.3

Note: * Marine emission factors based on U.S. EPA's "Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories", April 2009.
* SO2 emission factors are conservatively based on 1.5% fuel oil sulfur content for harbor craft.

Marine Vessels for Wind Turbine Maintenance

Vessel Type	Capacity (kW)	Hours per Day	Activity Factor	THC (lb/hr)	NOx (lb/hr)	PM10 (lb/hr)	PM2.5 (lb/hr)	CO (lb/hr)	SO2 (lb/hr)
Ferry	745.70	10	0.42	0.19	6.90	0.21	0.20	3.45	0.90

Operational Marine Vessels TPY

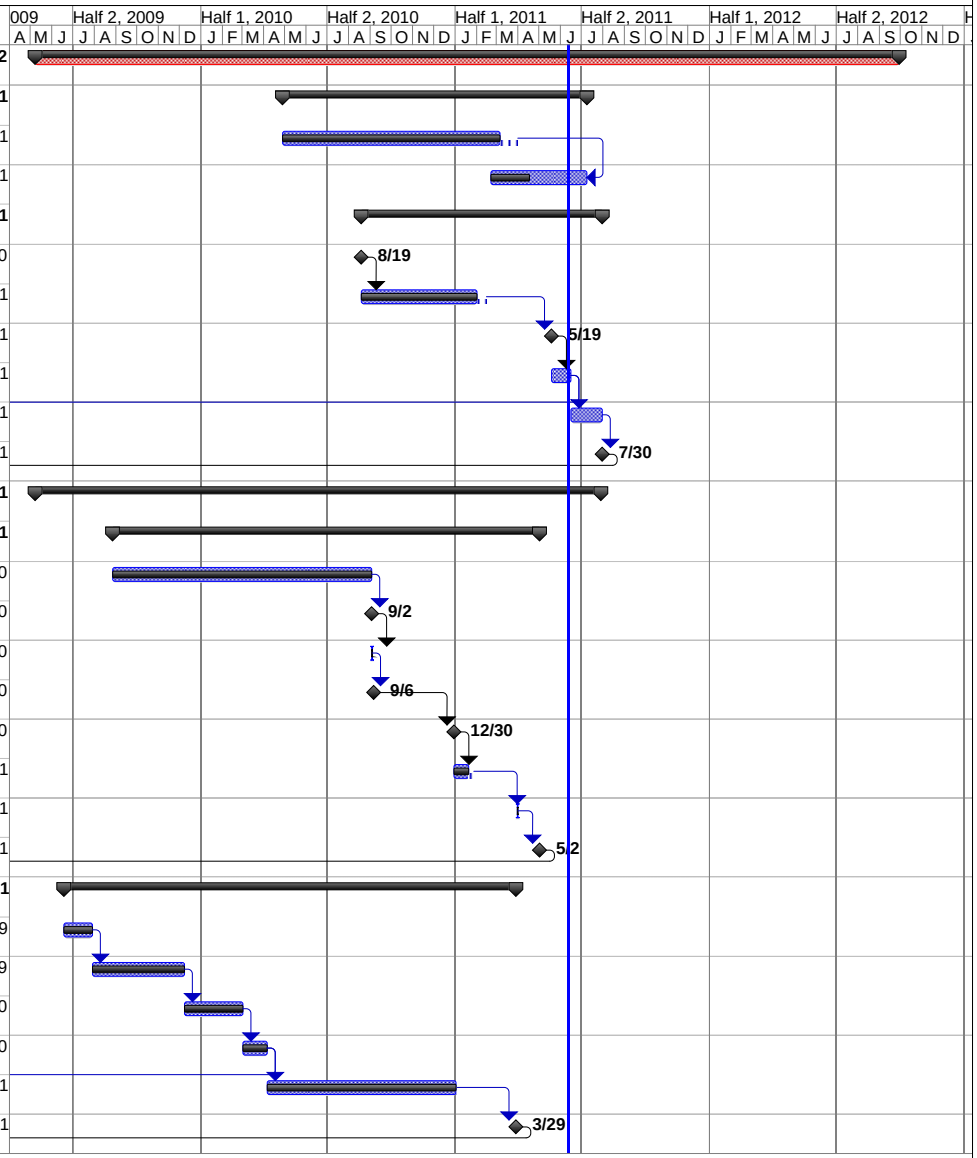
Vessel Type	Capacity (kW)	Hours per Year	Activity Factor	THC tpy	NOx tpy	PM10 tpy	PM2.5 tpy	CO tpy	SO2 tpy
Ferry	745.70	2130	0.42	0.20	7.35	0.22	0.21	3.68	0.96
Total				0.20	7.35	0.22	0.21	3.68	0.96

Attachment 3

Construction Schedule

CONFIDENTIAL

ID	Task Name	Duration	Start	Finish
1	**FACW 25MW State Waters Project Implementation**	**886 days**	**Fri 5/8/09**	**Fri 9/28/12**
2	**Wind Resource Data**	**313 days**	**Wed 4/28/10**	**Fri 7/8/11**
3	Initial Met Data and Model Calibration	242 days	Wed 4/28/10	Thu 3/31/11
4	AWS Bankable Document	138 days	Mon 2/21/11	Fri 7/8/11
5	**OREC**	**247 days**	**Thu 8/19/10**	**Sat 7/30/11**
6	Bill Becomes Law	0 days	Thu 8/19/10	Thu 8/19/10
7	BPU Develops Implementing Regulations	128 days	Thu 8/19/10	Mon 2/14/11
8	Project Submittal of OREC Pricing Plan	0 days	Thu 5/19/11	Thu 5/19/11
9	BPU Approval Date	28 days	Thu 5/19/11	Wed 6/15/11
10	Appeal Period	45 days	Thu 6/16/11	Sat 7/30/11
11	Date of non-appealable order	0 days	Sat 7/30/11	Sat 7/30/11
12	**Permitting**	**580 days**	**Fri 5/8/09**	**Fri 7/29/11**
13	**NJDEP Green Acres Clearance**	**437 days**	**Thu 8/27/09**	**Mon 5/2/11**
14	Meetings with State and City of AC	266 days	Thu 8/27/09	Thu 9/2/10
15	Public Notice on Beach & Newspaper	0 days	Thu 9/2/10	Thu 9/2/10
16	Public Meeting	1 day	Fri 9/3/10	Fri 9/3/10
17	File Application	0 days	Mon 9/6/10	Mon 9/6/10
18	Formal Application Submittal	0 days	Thu 12/30/10	Thu 12/30/10
19	NJDEP Internal Review Process	21 days	Thu 12/30/10	Thu 1/27/11
20	NJDEP Statehouse Meeting	1 day	Thu 3/31/11	Thu 3/31/11
21	Receive Approval	0 days	Mon 5/2/11	Mon 5/2/11
22	**NJDEP LURP/CAFRA Multiple Permit**	**463 days**	**Thu 6/18/09**	**Tue 3/29/11**
23	Prepare Application	29 days	Thu 6/18/09	Tue 7/28/09
24	Review/Update of Application	94 days	Wed 7/29/09	Mon 12/7/09
25	Finalize Permit	60 days	Tue 12/8/09	Mon 3/1/10
26	Submit NJDEP LURP Permit	25 days	Tue 3/2/10	Mon 4/5/10
27	Regulatory Review	195 days	Tue 4/6/10	Mon 1/3/11
28	Receive LURP Permit	0 days	Tue 3/29/11	Tue 3/29/11

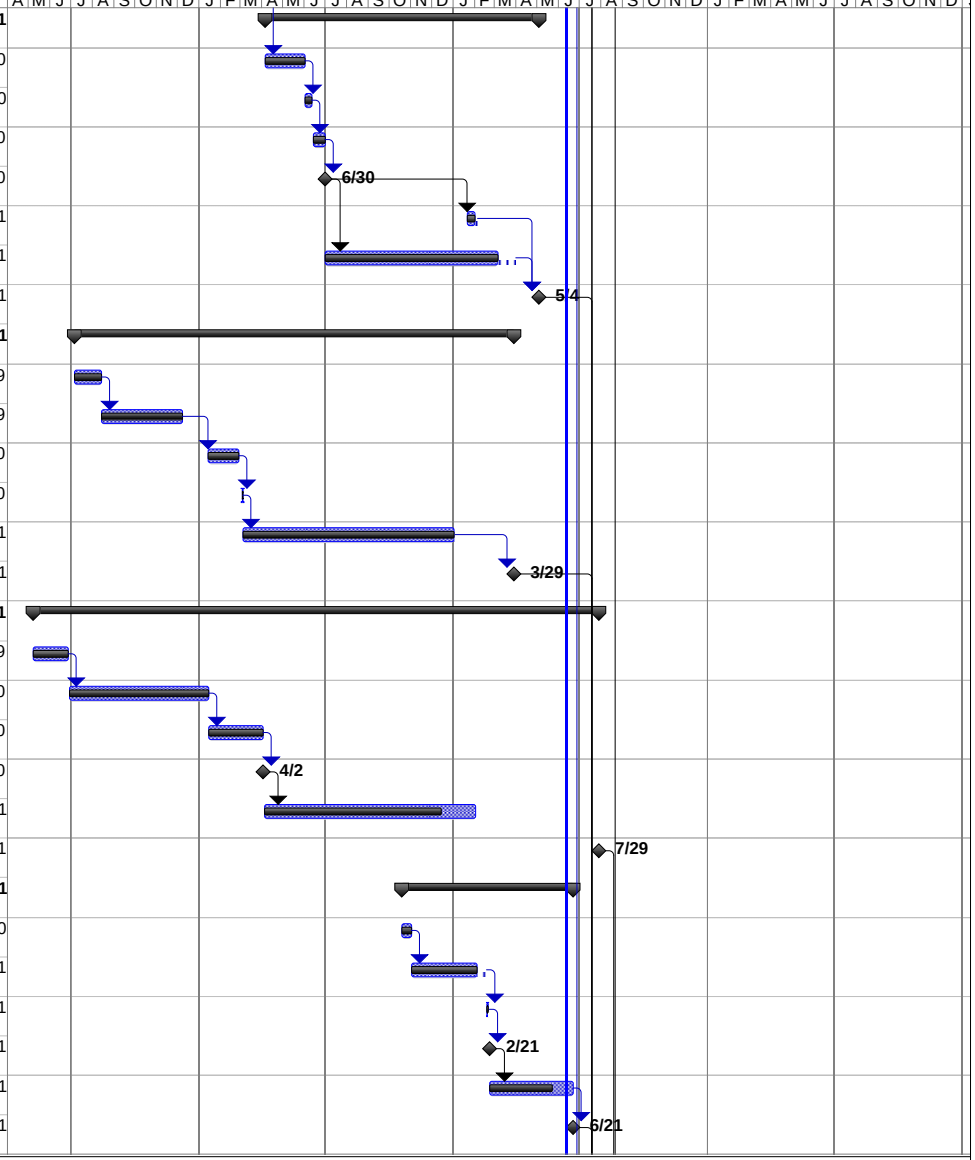


Project: FACW 25MW Project
Date: Mon 6/13/11

Normal	Summary	Manual Task	Start-only		
Critical Path	Inactive Task	Duration-only	Finish-only		
Split	Inactive Milestone	Manual Summary Rollup	Progress		
Milestone	Inactive Summary	Manual Summary	Deadline		

FACW Proprietary
Unauthorized Disclosure Prohibited

ID	Task Name	Duration	Start	Finish
29	**Tidelands Instrument**	**281 days**	**Tue 4/6/10**	**Wed 5/4/11**
30	Prepare Application	41 days	Tue 4/6/10	Tue 6/1/10
31	Review of Application	8 days	Wed 6/2/10	Fri 6/11/10
32	Finalize Application	13 days	Mon 6/14/10	Wed 6/30/10
33	Submit Tidelands Application	0 days	Wed 6/30/10	Wed 6/30/10
34	Interim Tidelands Discussion	11 days	Fri 1/21/11	Fri 2/4/11
35	Regulatory Review	196 days	Thu 7/1/10	Thu 3/31/11
36	Receive Tidelands License	0 days	Wed 5/4/11	Wed 5/4/11
37	**NJDEP Waterfront Permit**	**451 days**	**Mon 7/6/09**	**Tue 3/29/11**
38	Prepare Application	29 days	Mon 7/6/09	Thu 8/13/09
39	Review/Update of Application	82 days	Fri 8/14/09	Mon 12/7/09
40	Finalize Application	32 days	Thu 1/14/10	Fri 2/26/10
41	Submit Waterfront Application	1 day	Thu 3/4/10	Thu 3/4/10
42	Regulatory Review	217 days	Fri 3/5/10	Mon 1/3/11
43	Receive Waterfront Permit	0 days	Tue 3/29/11	Tue 3/29/11
44	**USACE 404 Permit**	**580 days**	**Fri 5/8/09**	**Fri 7/29/11**
45	Prepare Application	36 days	Fri 5/8/09	Fri 6/26/09
46	Review/Update of Application	144 days	Mon 6/29/09	Thu 1/14/10
47	Finalize Permit	56 days	Fri 1/15/10	Fri 4/2/10
48	Submit USACOE Permit	0 days	Fri 4/2/10	Fri 4/2/10
49	Regulatory Review and Hearings	227 days	Mon 4/5/10	Tue 2/1/11
50	Receive 404 Permit	0 days	Fri 7/29/11	Fri 7/29/11
51	**NWP-6 & MMPA LOC**	**176 days**	**Tue 10/19/10**	**Tue 6/21/11**
52	Prepare Application	10 days	Tue 10/19/10	Mon 11/1/10
53	Review of Application	78 days	Tue 11/2/10	Thu 2/17/11
54	Finalize Application	2 days	Fri 2/18/11	Mon 2/21/11
55	Submit NWP-6 and LOC Applications	0 days	Mon 2/21/11	Mon 2/21/11
56	Regulatory Review	120 days	Tue 2/22/11	Tue 6/21/11
57	Receive NWP-5/MMPA LOC	0 days	Tue 6/21/11	Tue 6/21/11

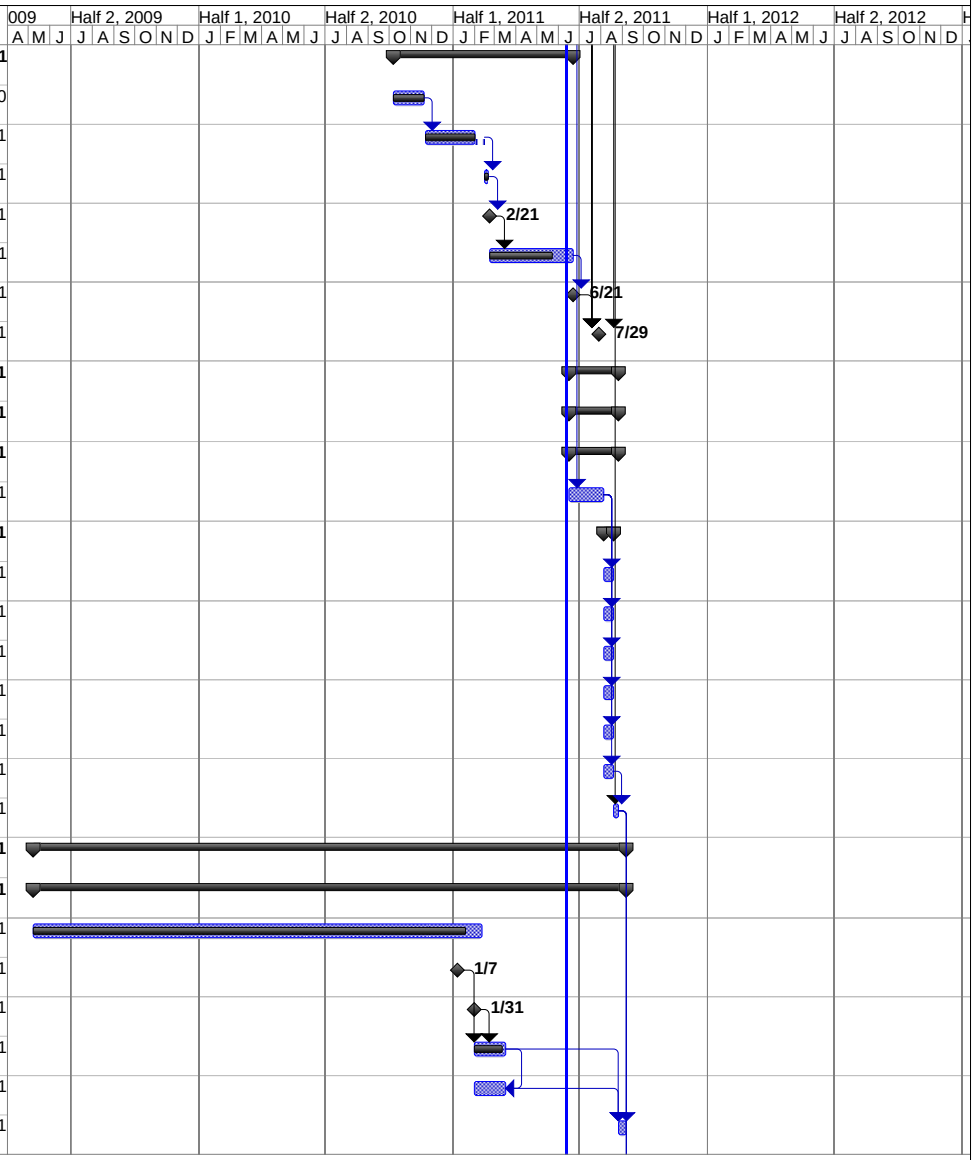


Project: FACW 25MW Project
Date: Mon 6/13/11

Normal	Summary	Manual Task	Start-only		
Critical Path	Inactive Task	Duration-only	Finish-only		
Split	Inactive Milestone	Manual Summary Rollup	Progress		
Milestone	Inactive Summary	Manual Summary	Deadline		

FACW Proprietary
Unauthorized Disclosure Prohibited

ID	Task Name	Duration	Start	Finish
58	**MMPA IHA**	**184 days**	**Thu 10/7/10**	**Tue 6/21/11**
59	Prepare Application	32 days	Thu 10/7/10	Fri 11/19/10
60	Review of Permit	61 days	Mon 11/22/10	Mon 2/14/11
61	Finalize Application	5 days	Tue 2/15/11	Mon 2/21/11
62	Submit MMPA IHA	0 days	Mon 2/21/11	Mon 2/21/11
63	Regulatory Review	120 days	Tue 2/22/11	Tue 6/21/11
64	Receive MMPA IHA	0 days	Tue 6/21/11	Tue 6/21/11
65	Regulatory Reviews Complete	0 days	Fri 7/29/11	Fri 7/29/11
66	**Financing**	**51 days**	**Thu 6/16/11**	**Thu 8/25/11**
67	**Construction Financing**	**51 days**	**Thu 6/16/11**	**Thu 8/25/11**
68	**Financial Closing**	**51 days**	**Thu 6/16/11**	**Thu 8/25/11**
69	Finalize All Documents	50 days	Thu 6/16/11	Thu 8/4/11
70	**Lenders Due Diligence**	**10 days**	**Fri 8/5/11**	**Thu 8/18/11**
71	Site visits	14 days	Fri 8/5/11	Thu 8/18/11
72	IE report	14 days	Fri 8/5/11	Thu 8/18/11
73	OREC review	14 days	Fri 8/5/11	Thu 8/18/11
74	Wind data report	14 days	Fri 8/5/11	Thu 8/18/11
75	Environmental report	14 days	Fri 8/5/11	Thu 8/18/11
76	Insurance report	14 days	Fri 8/5/11	Thu 8/18/11
77	Funding and Closing	7 days	Fri 8/19/11	Thu 8/25/11
78	**Pre-FEED Items**	**607 days**	**Fri 5/8/09**	**Mon 9/5/11**
79	**PJM Interconnection**	**607 days**	**Fri 5/8/09**	**Mon 9/5/11**
80	Facilities Study	472 days	Fri 5/8/09	Thu 2/10/11
81	Submit WTG Model Technical Info	0 days	Fri 1/7/11	Fri 1/7/11
82	Submit Incremental MW Application	0 days	Mon 1/31/11	Mon 1/31/11
83	Substation Hosting Agreement	45 days	Mon 1/31/11	Wed 3/16/11
84	Construction Agreement	45 days	Mon 1/31/11	Wed 3/16/11
85	Fund Construction Agreement	11 days	Fri 8/26/11	Mon 9/5/11

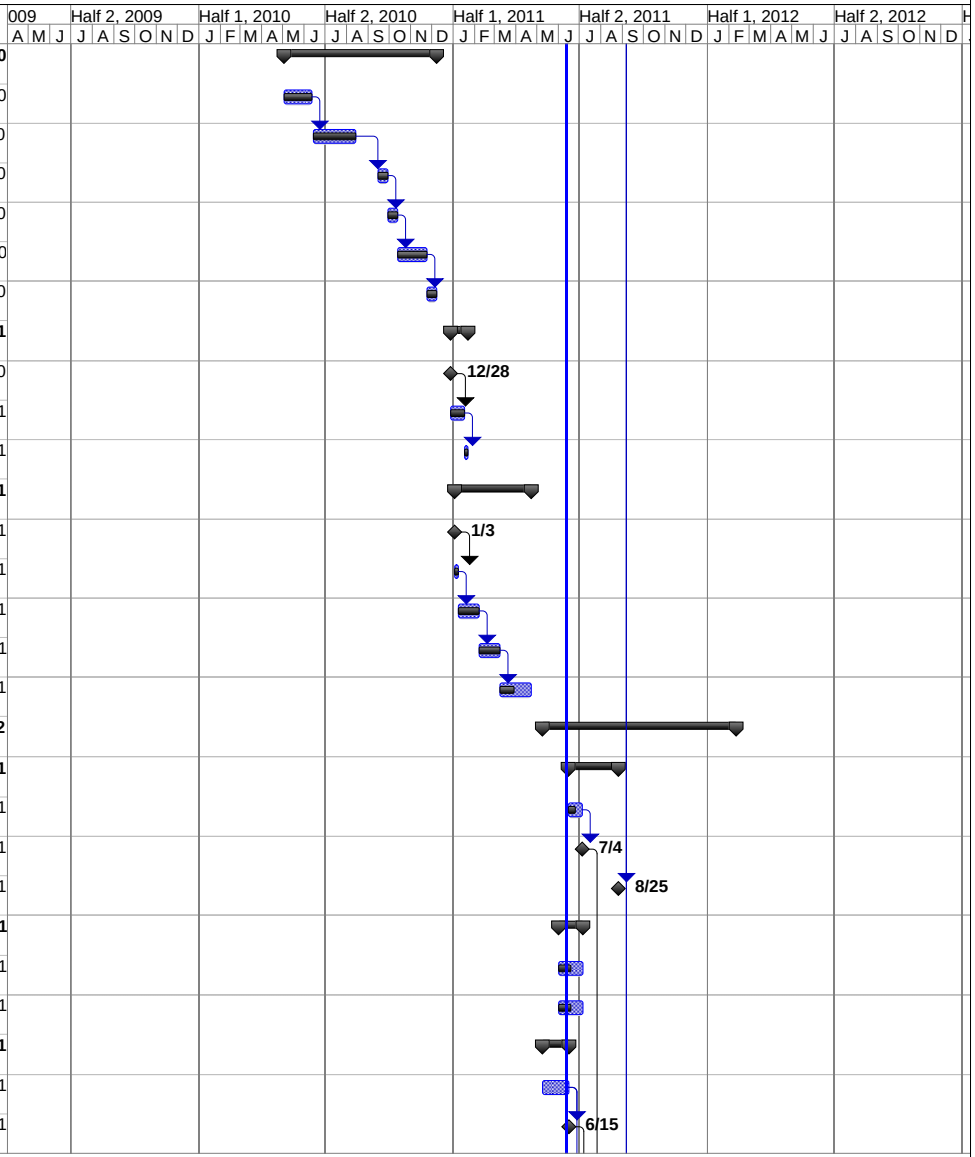


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Normal	Summary	Manual Task	Start-only		
Critical Path	Inactive Task	Duration-only	Finish-only		
Split	Inactive Milestone	Manual Summary Rollup	Progress		
Milestone	Inactive Summary	Manual Summary	Deadline		

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ID	Task Name	Duration	Start	Finish
86	**Geotechnical Survey**	**157 days**	**Mon 5/3/10**	**Tue 12/7/10**
87	Desktop study	30 days	Mon 5/3/10	Fri 6/11/10
88	Project scoping with selected vendors	45 days	Mon 6/14/10	Fri 8/13/10
89	Mobilization of resources.	10 days	Wed 9/15/10	Tue 9/28/10
90	Execution of offshore work	10 days	Wed 9/29/10	Tue 10/12/10
91	Draft final report	30 days	Wed 10/13/10	Tue 11/23/10
92	Issue final report	10 days	Wed 11/24/10	Tue 12/7/10
93	**Metocean Report**	**19 days**	**Tue 12/28/10**	**Fri 1/21/11**
94	Issue purchase order to Ramboll	0 days	Tue 12/28/10	Tue 12/28/10
95	Draft report issued for review	20 days	Tue 12/28/10	Sun 1/16/11
96	Final report issued	5 days	Mon 1/17/11	Fri 1/21/11
97	**Geophysical Survey**	**80 days**	**Mon 1/3/11**	**Fri 4/22/11**
98	Issue purchase order to Alpine Ocean Seismic	0 days	Mon 1/3/11	Mon 1/3/11
99	Mobilization of resources.	5 days	Mon 1/3/11	Fri 1/7/11
100	Execution of offshore work	30 days	Sat 1/8/11	Sun 2/6/11
101	Draft final report	30 days	Mon 2/7/11	Tue 3/8/11
102	Final report issued	45 days	Wed 3/9/11	Fri 4/22/11
103	**FEED Items**	**278 days**	**Mon 5/9/11**	**Fri 2/10/12**
104	**Turbines**	**72 days**	**Wed 6/15/11**	**Thu 8/25/11**
105	Finalize Turbine Supply Agreement	20 days	Wed 6/15/11	Mon 7/4/11
106	Issue LOI/NTP	0 days	Mon 7/4/11	Mon 7/4/11
107	Contract signing	0 days	Thu 8/25/11	Thu 8/25/11
108	**HSE/O&M**	**35 days**	**Wed 6/1/11**	**Tue 7/5/11**
109	HSE Procedures	35 days	Wed 6/1/11	Tue 7/5/11
110	O&M Procedures	35 days	Wed 6/1/11	Tue 7/5/11
111	**Foundation Design/Build/Install**	**38 days**	**Mon 5/9/11**	**Wed 6/15/11**
112	Develop Design Basis	38 days	Mon 5/9/11	Wed 6/15/11
113	Final selection of foundation designer	0 days	Wed 6/15/11	Wed 6/15/11

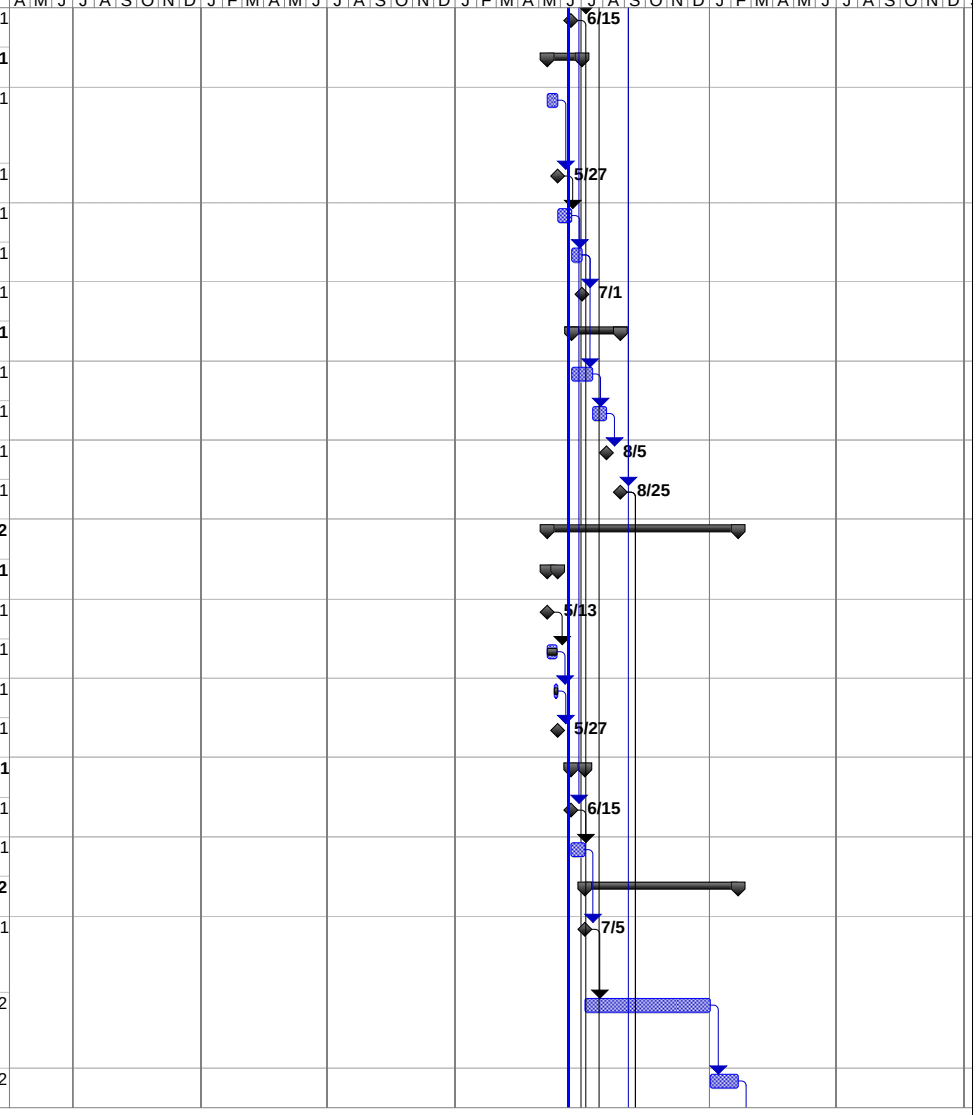


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ID	Task Name	Duration	Start	Finish
114	Issue LOI/NTP	0 days	Wed 6/15/11	Wed 6/15/11
115	**Cable Design/Build/Install**	**50 days**	**Fri 5/13/11**	**Fri 7/1/11**
116	Write revised bid spec to include EPCM and HDD work	15 days	Fri 5/13/11	Fri 5/27/11
117	Submit bid specs to select suppliers	0 days	Fri 5/27/11	Fri 5/27/11
118	Bid responses due from suppliers	20 days	Sat 5/28/11	Thu 6/16/11
119	Bid Review and supplier selection	15 days	Fri 6/17/11	Fri 7/1/11
120	Issue LOI/NTP	0 days	Fri 7/1/11	Fri 7/1/11
121	**Substation Design/Build/Install**	**70 days**	**Fri 6/17/11**	**Thu 8/25/11**
122	Design review with supplier	30 days	Fri 6/17/11	Sat 7/16/11
123	Finalize scope of work and pricing with supplier	20 days	Sun 7/17/11	Fri 8/5/11
124	Issue LOI/NTP	0 days	Fri 8/5/11	Fri 8/5/11
125	EPC contract signed	0 days	Thu 8/25/11	Thu 8/25/11
126	**Certification Services**	**196 days**	**Fri 5/13/11**	**Fri 2/10/12**
127	**Pre-certification of site planning data**	**11 days**	**Fri 5/13/11**	**Fri 5/27/11**
128	Issue order to ABS for pre-certification services	0 days	Fri 5/13/11	Fri 5/13/11
129	Review of FACW site data	10 days	Fri 5/13/11	Thu 5/26/11
130	Respond to CA remarks	5 days	Mon 5/23/11	Fri 5/27/11
131	Site planning data certified	0 days	Fri 5/27/11	Fri 5/27/11
132	**Phase 1 Detailed Design Basis**	**14 days**	**Wed 6/15/11**	**Tue 7/5/11**
133	Issue order to CA for detailed design basis	0 days	Wed 6/15/11	Wed 6/15/11
134	Detailed design basis development	20 days	Thu 6/16/11	Tue 7/5/11
135	**Phase 2 Foundation Design Certificate**	**158 days**	**Tue 7/5/11**	**Fri 2/10/12**
136	Issue order to CA for foundation detailed design approval	0 days	Tue 7/5/11	Tue 7/5/11
137	Detailed design and engineering review and approvals	180 days	Wed 7/6/11	Sun 1/1/12
138	Final review of foundation design	30 days	Mon 1/2/12	Fri 2/10/12

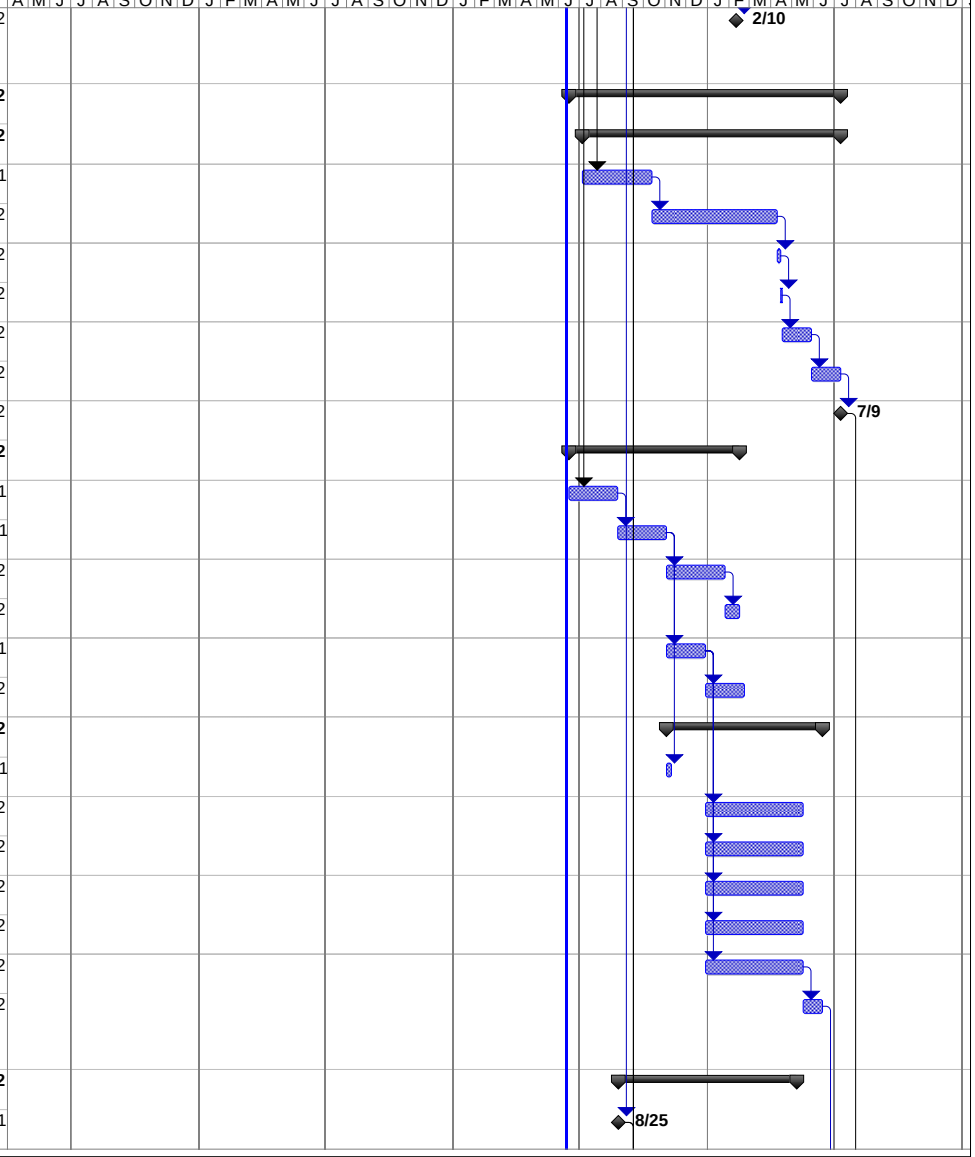


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Split	Inactive Milestone	Manual Summary Rollup	Progress
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ID	Task Name	Duration	Start	Finish
139	Final approval of foundation design, certificate issued	0 days	Fri 2/10/12	Fri 2/10/12
140	**EPC Supply**	**390 days**	**Thu 6/16/11**	**Mon 7/9/12**
141	**Turbines**	**371 days**	**Tue 7/5/11**	**Mon 7/9/12**
142	Deisgn load iterations with foundation designer	100 days	Tue 7/5/11	Wed 10/12/11
143	Commence manufacture of WTG components	180 days	Thu 10/13/11	Mon 4/9/12
144	FAT of WTG units	5 days	Tue 4/10/12	Sat 4/14/12
145	Warranty survey at load port	2 days	Sun 4/15/12	Mon 4/16/12
146	Transport & delivery of WTG units to US port	42 days	Tue 4/17/12	Mon 5/28/12
147	Pre-assembly of 6 WTG units	42 days	Tue 5/29/12	Mon 7/9/12
148	WTG units ready for installation	0 days	Mon 7/9/12	Mon 7/9/12
149	**Foundation Engineering**	**245 days**	**Thu 6/16/11**	**Wed 2/15/12**
150	Conceptual design	70 days	Thu 6/16/11	Wed 8/24/11
151	Front end engineering and design	70 days	Thu 8/25/11	Wed 11/2/11
152	Detailed design	84 days	Thu 11/3/11	Wed 1/25/12
153	Issue for construction	21 days	Thu 1/26/12	Wed 2/15/12
154	Procurement	56 days	Thu 11/3/11	Wed 12/28/11
155	Inspection - Fabrication	56 days	Thu 12/29/11	Wed 2/22/12
156	**Foundation Fabrication**	**160 days**	**Thu 11/3/11**	**Wed 6/13/12**
157	Order steel	7 days	Thu 11/3/11	Wed 11/9/11
158	Deck construction	140 days	Thu 12/29/11	Wed 5/16/12
159	Transition piece	140 days	Thu 12/29/11	Wed 5/16/12
160	Jackets	140 days	Thu 12/29/11	Wed 5/16/12
161	Piles above mudline	140 days	Thu 12/29/11	Wed 5/16/12
162	Piles below mudline	140 days	Thu 12/29/11	Wed 5/16/12
163	Loadout & delivery of system components and hardware	28 days	Thu 5/17/12	Wed 6/13/12
164	**Cables**	**256 days**	**Thu 8/25/11**	**Mon 5/7/12**
165	Sign EPC contract with supplier	0 days	Thu 8/25/11	Thu 8/25/11

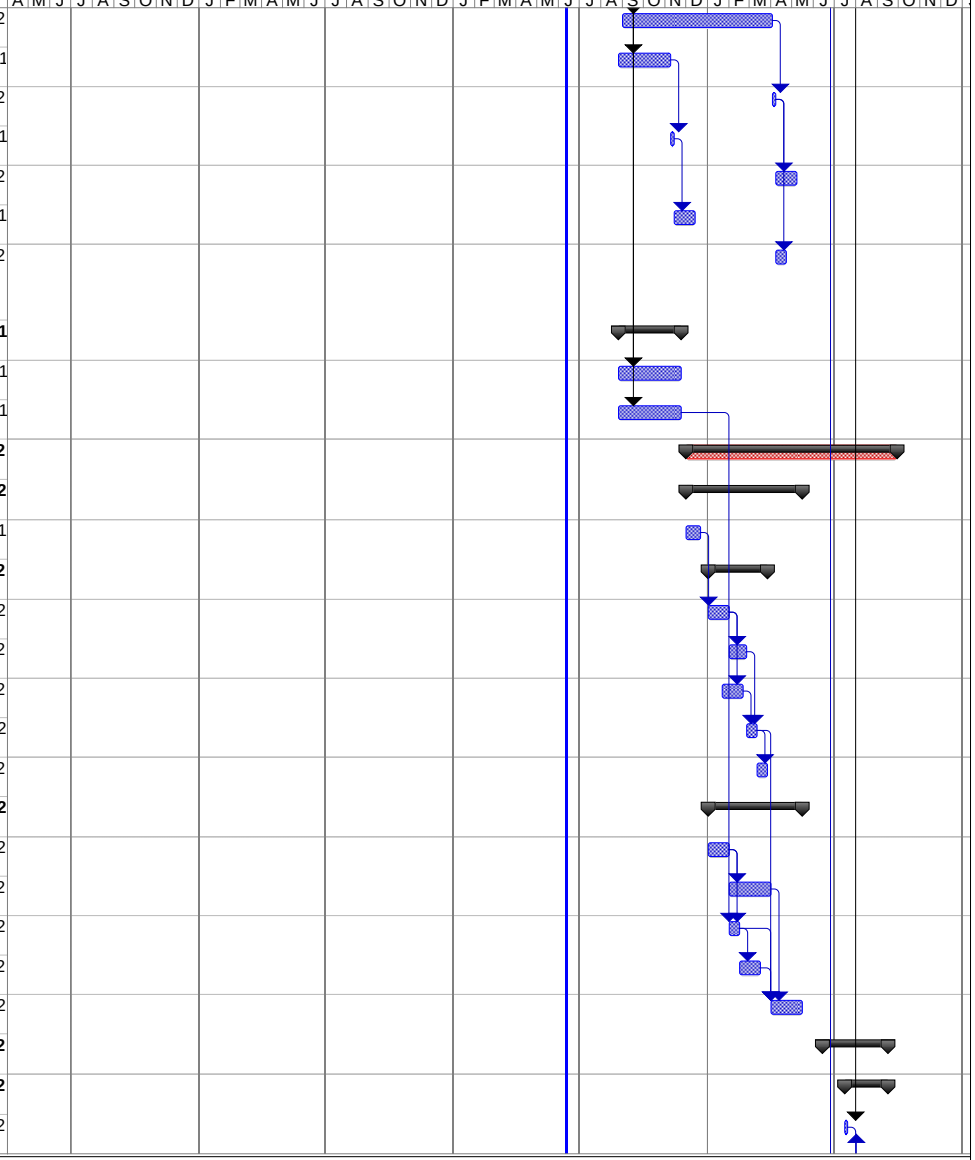


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ID	Task Name	Duration	Start	Finish
166	Fabrication of submarine cables	215 days	Thu 9/1/11	Mon 4/2/12
167	Fabricaton of terrestrial cables	75 days	Fri 8/26/11	Tue 11/8/11
168	FAT of submarine cables	5 days	Tue 4/3/12	Sat 4/7/12
169	FAT of terrestrial cables	5 days	Wed 11/9/11	Sun 11/13/11
170	Prep, loadout and delivery of submarine cables	30 days	Sun 4/8/12	Mon 5/7/12
171	Prep, loadout and delivery of terrestrial cables	30 days	Mon 11/14/11	Tue 12/13/11
172	Loadout & delivery of system components and hardware	15 days	Sun 4/8/12	Sun 4/22/12
173	**Substation Components**	**90 days**	**Fri 8/26/11**	**Wed 11/23/11**
174	Procure Substation Components	90 days	Fri 8/26/11	Wed 11/23/11
175	Procure Transformer	90 days	Fri 8/26/11	Wed 11/23/11
176	**Installation/Construction**	**303 days**	**Thu 12/1/11**	**Fri 9/28/12**
177	**Civil Construction**	**119 days**	**Thu 12/1/11**	**Tue 5/15/12**
178	Mobilize Off Site Yard	21 days	Thu 12/1/11	Wed 12/21/11
179	**Drilling**	**61 days**	**Mon 1/2/12**	**Mon 3/26/12**
180	HDD Tennessee (2 rigs working)	30 days	Mon 1/2/12	Tue 1/31/12
181	HDD Ocean	25 days	Wed 2/1/12	Sat 2/25/12
182	Install Vaults	30 days	Sun 1/22/12	Mon 2/20/12
183	Install Upland Cable	15 days	Sun 2/26/12	Sun 3/11/12
184	Demobilize Offsite yard	15 days	Mon 3/12/12	Mon 3/26/12
185	**Substation Construction**	**135 days**	**Mon 1/2/12**	**Tue 5/15/12**
186	Substation Foundation and U/G Ductbank Buildout	30 days	Mon 1/2/12	Tue 1/31/12
187	Buildout at Substation	60 days	Wed 2/1/12	Sat 3/31/12
188	Install Transformer	15 days	Wed 2/1/12	Wed 2/15/12
189	Install Switchgear House	30 days	Thu 2/16/12	Fri 3/16/12
190	Substation Commissioning/Start-up	45 days	Sun 4/1/12	Tue 5/15/12
191	**Marine Construction**	**94 days**	**Wed 6/13/12**	**Sat 9/15/12**
192	**WTGs**	**62 days**	**Mon 7/16/12**	**Sat 9/15/12**
193	Transport WTGs to Jobsite	4 days	Mon 7/16/12	Thu 7/19/12

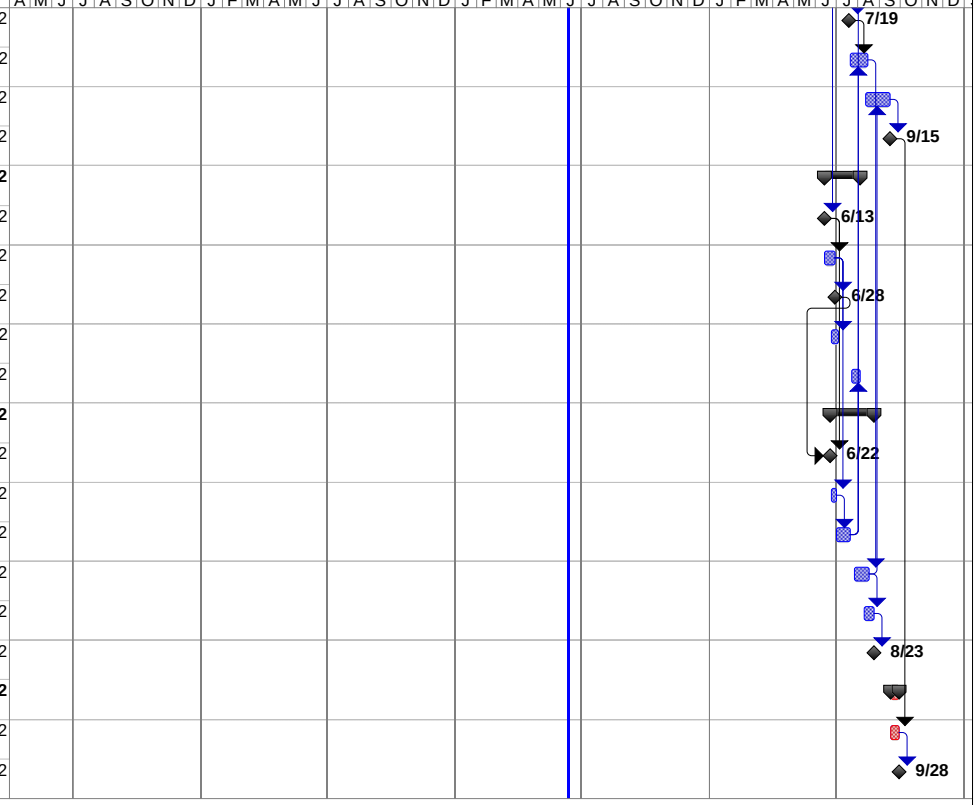


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ID	Task Name	Duration	Start	Finish
194	Heavy Lift Vessel arrives to jobsite	0 days	Thu 7/19/12	Thu 7/19/12
195	Install WTGs	25 days	Sat 7/21/12	Tue 8/14/12
196	Commission WTGs	35 days	Sun 8/12/12	Sat 9/15/12
197	Substantial Completion	0 days	Sat 9/15/12	Sat 9/15/12
198	**Foundations**	**37 days**	**Wed 6/13/12**	**Fri 8/3/12**
199	Heavy lift vessel arrives to jobsite	0 days	Wed 6/13/12	Wed 6/13/12
200	Install 6 foundations	15 days	Thu 6/14/12	Thu 6/28/12
201	Foundation Installation complete	0 days	Thu 6/28/12	Thu 6/28/12
202	Install Filter Stone/Scour Protection	10 days	Sun 6/24/12	Tue 7/3/12
203	Install Armor Stone	10 days	Mon 7/23/12	Fri 8/3/12
204	**Marine Cables**	**63 days**	**Fri 6/22/12**	**Thu 8/23/12**
205	Cable lay barge arrives to jobsite	0 days	Fri 6/22/12	Fri 6/22/12
206	Install Export Cable	7 days	Sun 6/24/12	Sat 6/30/12
207	Install Array Cables	20 days	Sun 7/1/12	Fri 7/20/12
208	Final connections to WTG switchgear	15 days	Fri 7/27/12	Thu 8/16/12
209	Testing and commissioning	10 days	Fri 8/10/12	Thu 8/23/12
210	Final Acceptance of Cable System	0 days	Thu 8/23/12	Thu 8/23/12
211	**COD**	**10 days**	**Mon 9/17/12**	**Fri 9/28/12**
212	Final Acceptance of WTG system	10 days	Mon 9/17/12	Fri 9/28/12
213	Commercail Operations Date	0 days	Fri 9/28/12	Fri 9/28/12



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Description of the Proposed Project – Fishermen's Atlantic City Windfarm

Changes to the Project Description (PD) that were previously submitted during consultation are highlighted in yellow and the change is explained in the accompanying footnote.

The Proposed Project consists of the construction, operation, maintenance, and eventual decommissioning[1] of a nominal 25 MW[2] offshore wind renewable energy facility, consisting of up to six turbines[3], a 33-kiloVolt (kV)[4] alternating current (AC) submarine cable interconnecting the turbines (inter-array cable), a 33-kV[4] AC submarine transmission cable (export cable), and a 33-kV[4] AC underground cable (onshore interconnection cable) that would connect the Proposed Project with existing onshore infrastructure located in Atlantic City, New Jersey.

The offshore components of the Proposed Project, including the turbines and the inter-array cable, would be located in state waters approximately 2.8 nautical miles from Atlantic City, New Jersey. The export cable would traverse state waters to shore. The onshore components, including the onshore interconnection cable, fiber optic cable, and interconnection facilities would be located in Atlantic City, New Jersey. Construction would be supported by a construction staging area(s) and a construction port. Onshore support facilities would be located at existing waterfront industrial or commercial sites in the cities of Camden and Atlantic City, New Jersey.

All remaining aspects of the project, including staging sites, vessel traffic, color and labeling of the turbines, seasonal restriction and maintenance schedules remain the same and are not impacted by the proposed project changes.

Annual net electricity production for this Project is anticipated to be approximately 80,000 MW-hours[5] (MWh). The total ocean area considered as the project area is approximately 170 acres (calculated as the perimeter around the group of six turbines, approximately 200 feet in each direction) plus a 5 foot width along the length of the export cable route from the turbines to the shore); however the actual portion of the area that would be physically disturbed by the placement of the turbines and cables is approximately 2 acres. The cable and turbines would be located in water depths of 26 to 40 feet below mean lower low water (MLLW).

Wind Turbine and Foundation Design

The offshore turbine assemblies would each be composed of three primary elements, a foundation, tower, and three blade turbine. The nacelle houses the major mechanical components of each turbine. Each tower would be approximately 16.5 feet in diameter at the base and taper to a diameter of 12.5 feet at the top.

[1] Previous PD did not include operation, maintenance, and eventual decommissioning of the Proposed Project
[2] Previous PD stated "20 MW (net)"
[3] Previous PD stated "six offshore wind turbines"
[4] Previous PD stated "34.5 kv"
[5] Previous PD stated "75,000 MWh"

Each turbine would have a name plate capacity of no more than 5 MW[6] and a blade rotor diameter of no more than 427 feet[7]. Each of the three (3) blades would be two hundred thirteen (213) feet long[8]. The blade at its lowest point would be located 80 feet above mean high water and 506.4 feet above mean high water at its highest point[9].

The turbine array would be oriented in one row parallel to the coastline running northeast to southwest. Spacing between the turbines would be approximately 3,543 feet. Each of the wind turbines would be supported by an Inward Battered Guide Structure (IBGS) jacket-type foundation[10] driven into the seabed (**Figure 1**). The IBGS jacket-type foundation consists of four legs, with each leg being a hollow steel pipe with an approximate outer diameter of 84 inches. The triangular structure has 90-inch diameter pile sleeves for each leg and bracing elements of the foundation will measure approximately 22 feet in length and 72 inches in diameter. At the mudline, each side of the foundation will measure approximately 53 feet from the center point of each leg. The IBGS extends upward from below the seabed, through the water column to exposure at the surface, then tapers to approximately 50 feet above mean lower low water. The structural braces for the towers would be seventy two (72) inches in diameter and would be located laterally along the entire foundation[11].

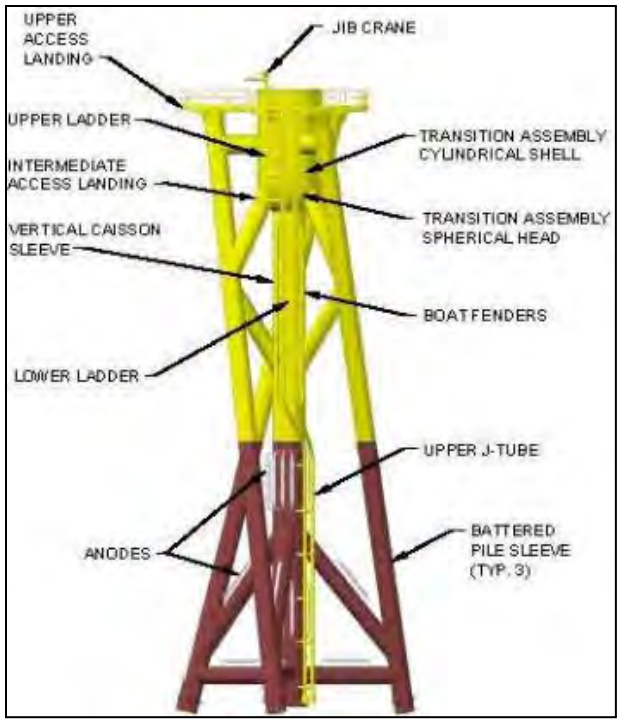


Figure 1. Foundation Design for the Proposed Project.

[6] Previous PD stated "3.6 MW"
[7] Previous PD stated "394 feet"
[8] Previous PD stated "approximately 192 foot long"
[9] Previous PD stated "blade at its lowest point would be located approximately 100 feet above the surface of the water and approximately 500 feet above the surface of the water at its highest point at mean high water"
[10] Previous PD referenced "monopole foundation"
[11] Previous PD did not reference these specifications since the tower was originally intended to be a monopole foundation

Engineering analyses have determined that the base of each foundation will no longer require a scour protection mat or rock scour protection around each foundation pile[12].

Installation of Turbines and Foundations

Fishermen's Atlantic City Windfarm, LLC (FACW) the project proponent, has thoroughly investigated vessel and port availability, and is currently in negotiations with multiple third parties to provide equipment and expertise in the installation of the turbine foundations and turbines. FACW has identified suitable existing US Jones Act-compliant vessels capable of installing the turbines in the 40 foot water depths at the project site. Specialty contractors would be required for delivery and installation of foundations, turbines and the subsea electrical cabling. Installing the array of turbines will require the ability to lift, place, and connect foundations, pilings nacelles, blades and heavy electrical equipment. These components can weigh well in excess of 200 tons each, and can only be lifted with specialized jack up barges or vessel-mounted cranes offering a stable, safe work platform.

FACW currently has a Memorandum of Understanding with the South Jersey Port Corporation for materials staging and preparation. The turbines and associated major components are envisioned to be delivered to the Beckett Street Marine Terminal in Camden, New Jersey. Up to 6 months before the scheduled installation, the turbines would be transported from the manufacturer to the Beckett Street Marine Terminal via barge, rail, and/or truck depending upon their origin. Existing waterfront bulkheads, cranes and laydown areas at Beckett Street would be used to support the staging for this project. At the facility, final turbine assembly including generator mounting and electrical hookups would be performed to minimize work performed offshore. At that point, the turbine manufacturer would lead the final assembly and configuration for the wind turbine generator components to be delivered by vessel to the offshore array field.

The steel turbine towers would be manufactured domestically and transported to the staging area at Beckett Street Marine Terminal via barge, rail, and/or truck. Each tower is approximately 250 feet in length (comprised of bolted segments) and is secured to the foundation by bolting to a transition piece (or flange) at the top of the foundation.

The foundations would be fabricated at a Gulf of Mexico facility and then transported by barge to the staging area at Beckett Street Marine Terminal. Once assembly is completed, the foundations would be loaded onto ABS class ocean deck barges that would carry three jackets per barge. It is anticipated that the two barges would be transported by two tugs directly to the project site. A floating crane barge or specialized jack-up barge or barge equipped with a high capacity crane pile handling frame and pile driving equipment would perform structure installations (**Figure 2**). The installation vessel would position itself near to each of the turbine installations. The vessel would then jack itself up out of the water to provide a stable platform in which to carry out the installation activities. Offshore experience has shown that it normally takes approximately 24 hours in fair weather conditions to position and anchor the

[12] Previous PD stated "scour mats and/or rock protection will be installed to prevent ocean currents from eroding the seabed around the foundation base".

installation vessel. Once the installation vessel is in the turbine array field, it would be moved as minimally as possible, but would, out of necessity, move from one turbine location to the next.



Figure 2. Typical heavy jackup vessel used for offshore wind turbine installations

To secure the foundation in place, steel pipe pilings 7 feet in diameter would be inserted down through the piling sleeves, and then driven to a depth of approximately 140 feet below the seabed using impact hammer methods. The jacket foundations would require the installation of four (4) eighty four (84) inch piles that would be driven inside, down and through the length of each of the ninety (90) inch diameter sleeves of the foundation for each turbine[13]. The anchoring piles would be driven to a depth of approximately 150 feet below the mudline. The maximum sound generation for each pile would be approximately 199 dB (re 1 uPa) at the source.

Each foundation would also be fitted with a ladder extending from the water surface up to a working deck to allow personnel access from vessels. Electrical power generated by the turbine would be cabled down through the structure to emerge from a J-Tube below the seabed.

The Proposed Project would be constructed using the following approach which has been successfully employed in Europe:

- All foundations are installed first;
- The submarine cable is installed next and energized to provide electricity from the grid to assist in turbine installation;
- Turbine towers are installed on the foundations;

[13] Previous PD stated "pile driving of eighteen (18) forty eight (48) inch diameter pipes placed in the openings on the three ends of the foundation structure"

- The turbines are installed on each tower; and
- Lastly the turbines are commissioned and made operational.

The complete wind turbine structure requires a series of main lifts for full assembly. The foundation center caisson (i.e., a watertight retaining structure) would be driven to the required depth using impact methods. The guide structure would then be lifted onto the caisson and secured. Each of the three pilings would then be lifted into the sleeves on the guide structure and hammered to the required depth below the seabed. The turbine tower would then be lifted and secured onto the foundation. Lastly the turbine components including the nacelle and turbine blades would be lifted to the tower top and installed.

Turbine system installations are anticipated to require four to seven fair weather days to complete. In order to minimize the complexity and duration of offshore operations, components of the turbines would be pre-assembled to the extent possible prior to transportation offshore.

Cable Route and Installation

Cables would be manufactured in Seymour, Connecticut and transported by rail to a staging pier in Port Elizabeth, New Jersey. The cable reels would be placed on a special cable laying barge and transported to the project site for installation.

Power output from the turbines would be transmitted via a 33 kV AC submarine cable (export cable) to access the shore. The inter-array transmission cable from each turbine structure would be linked to the export cable that would make landfall at a point in Atlantic City, at the base (southeast terminus) of Tennessee Avenue in Atlantic City. The cable would then continue northwest for 1.2 miles underground to the existing Huron Substation, located along Absecon Avenue. The path of this underground cable is roughly coincident with the line created by Tennessee Avenue. The submarine transmission cable route was selected after evaluations of alternative routes and landfall locations which included bringing the cable to shore through the Absecon Inlet. The route ultimately selected proved to present the least environmental impacts identified during the permitting process and was most acceptable to the USCG.

Offshore, the submarine export and inter-array cables would be arranged in a single string array. An additional fiber-optic cable bundle would also be included within the export cable for telecommunication purposes. At each turbine location, the power and telecommunication cables would extend down from the turbine within the tower structure, and then emerge through a J-tube just above the seabed where it would be connected to the adjacent turbine.

Jet plowing technology would be used to bury the export and inter-array cables to a target depth of 6 feet[14] below the seabed. The export cable would originate at Turbine #3. During this process the installation vessel slowly travels along the planned cable route while towing a weighted sled fitted with a trenching device (plow) and a nozzle which jets water into the bottom to create a narrow trench. The cable is simultaneously fed out from the vessel and laid into the trench. Blades at the back of the sled scrape bottom material over the trench to backfill. The cable would be buried in this manner to

[14] Previous PD stated “9 feet”

approximately 1,800 feet from the shoreline. The depth of the cable below the project along the Atlantic City Beach will be 20 feet. The cable that would run from the turbines to the shore would be five (5) inches in diameter[15].

Beginning at a distance approximately 1,800 feet from the shoreline, the cable would be routed through a lined conduit installed using Horizontal Directional Drilling (HDD) methods.[16] The installation of this HDD conduit would be performed from the landside. At the base of Tennessee Avenue (approximately 500 feet inland of the high water line), a concrete vault approximately 8 feet by 8 feet by 7 feet would be installed below roadway grade using typical upland excavation equipment. HDD equipment would then drill a 6-inch diameter cable-way 25 feet below the street level, underneath the boardwalk and beach, and emerge at the jet plow end point 1,800 feet from shore. While drilling, the cable-way would be lined with polyvinyl chloride (PVC) conduit to prevent collapse and to protect the cable after it has been installed. Soil material removed from the bored hole (approximately 13 cubic yards) would be removed from the site. All construction-related soil and debris would be appropriately disposed of depending upon the characteristics of the material, in accordance with relevant New Jersey Department of Environmental Protection (NJDEP) regulations. Once HDD is completed, the cable would be pulled from the offshore vessel through the conduit to emerge at the shore end vault, where the offshore cable would be connected.

A similar cable to that used offshore, but designed specifically for land applications would be used for the remaining 1.2 mile run below the Tennessee Avenue street level to the Huron substation. Again HDD methods would be used to route the cable 25 feet below street level. This burial depth was selected after a review of existing below grade infrastructure along this route. At 25 feet, the cable would be below all existing infrastructure. Soil material removed from the bored hole (approximately 46 cubic yards) would be removed from the site and properly disposed as described above. At the Huron substation facility, a breaker system, and other minor electrical components specific to the Proposed Project would need to be installed for connection of the export cable and to the power grid.

The following sections were not part of the original project description.

Operations and Maintenance

Upon completion of the construction activities, FAWC would conduct several weeks of commissioning activities that would entail the testing of the turbines as well as the offshore and onshore transmission systems. The project would begin operations approximately in October 2017 and continue until the end of the 25-year expected operational life of the facility.

Operation of the turbines would require continuous remote (shore-based) monitoring and control, scheduled onsite maintenance, and unscheduled responses to faults or damage. Additionally, the

[15] Previous PD stated “8 inches in diameter”

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

- Remote monitoring and supervision of the wind turbines and associated equipment 24 hours a day, 7 days a week using the wind power supervisory control and data acquisition system;
- Initiation of any required corrective action;
- Operation of the Turbine Condition Monitoring (TCM) system;
- Performing diagnostic assessment of data from the TCM;
- Managing the inventory of spare parts, including performing any maintenance of these spare parts;
- Scheduling and logistics planning of maintenance activities; and
- Performing daily communication with the facility operator.

Each turbine would undergo scheduled maintenance and inspection as well as a full annual maintenance program as prescribed by the turbine manufacturer. This work would be performed by personnel qualified by the manufacturer. Additionally, inspections of the underwater structures and seabed would be performed at a minimum of once per year.

As access to the turbines can only be achieved by vessel, sea conditions would dictate when service may be performed. Heavy annual work would be scheduled to occur during summer months when conditions for accessing the turbines are typically suitable (waves less than 3 feet). During winter months, accessibility may be limited for extended periods of time.

Service crews would board a dedicated service vessel based in Atlantic City, New Jersey. Personnel would gain access to the turbines via the ladder system incorporated into each foundation. Tools and light parts would be lifted onto the structure using a small crane system provided on the structure working deck. Annual maintenance for each turbine is expected to require 5 to 8 days of onsite work. Turbines would be returned to normal operation at the end of each service day.

No oils or other waste would be discharged during service events. Appropriate measures would be implemented to provide for containment and collection of hazardous material spills should they occur. It is not expected that any painting would be necessary during the life of the turbines, other than to repair damage. The original coating system on the towers is designed to last the lifetime of the structure.

Decommissioning

While the project is presently planned for a 25 year operational period, the potential for equipment upgrades and continued operation would be evaluated throughout the project life. When it is determined that the project is to be decommissioned, all physical elements of the project would be removed and the site would be restored to its original condition. A financial instrument to fund decommissioning activities would be set in place at the start of the project to ensure that sufficient funds are available for removal of the turbines and support infrastructure.

A comprehensive Decommissioning Plan which addresses the engineering, environmental, regulatory, and economic elements of the decommissioning task. The plan addresses state requirements presently in place as well as those established by the Bureau of Ocean Energy Management (BOEM) guidelines described in 30 CFR Parts 250.1700 – 1754. An overview of the Decommissioning Plan is provided below.

Decommissioning of the project would involve the removal of equipment both offshore and onshore and would be performed utilizing similar equipment to that used during the construction process. This equipment may include barges, lift boats, tugs and crew vessels. Deep draft vessels would port at the Beckett Street Terminal in Camden, New Jersey, while smaller crew vessels would operate from Atlantic City. Onshore, trucks, trailers, and cable handing equipment would be used to recover the cable and substation equipment. Removed materials would be refurbished, recycled, or disposed of, as appropriate.

Offshore Equipment Removal

Removal of the offshore equipment would consist of the following tasks:

- Removal of the wind turbines;
- Removal of towers and foundations;
- Removal of inter-array and export cables; and
- Site clearance survey.

The removal processes would be performed with full consideration of environmental and safety compliance. Federal and state permits would be in place as required prior to initiating decommissioning. During decommissioning, safety exclusion zones would be established and marked with buoys and navigational aids to protect the workforce and vessel traffic. FACW would ensure that any subsea obstacles would be adequately marked until they are made safe or removed.

Removal of the turbine equipment would essentially be the reverse of the installation. Using a barge supported heavy lift crane, each rotor and nacelle would be lowered to a transport barge and secured for transit to port. Power cables would be removed from the tower and at the sea bed. The steel turbine tower would be removed as one unit above the transition joint at water level.

Each tower foundation is comprised of three driven pilings, a center caisson and a guide structure. The guide structure would first be removed and loaded onto a barge for recycling. Each of the pilings and the caisson would be cut 15 feet below the seabed and removed. The remaining piling structures (below -15 feet) would be left in place.

Because full removal off all buried cable would cause disturbance to the established sea bed, power cables at each turbine location would be excavated to the 6 foot burial depth, cut and removed. All cabling at or below the 6-foot depth would be left in place undisturbed.

Upon completion of structural decommissioning, a site clearance survey would be performed to ensure that no debris remains within the project area, and to document the physical condition of the seabed. Similar to the geophysical survey performed pre-construction, the clearance survey would employ side

scan sonar for imaging the seabed, a magnetometer to detect ferrous materials, and depth mapping systems. Any objects detected would be investigated and removed as appropriate. Demonstration of clearance would be provided to the appropriate agencies.

Onshore Equipment Removal

Removal of the onshore equipment would consist of the following tasks:

- Removal of sea-to-shore transition cable;
- Abandonment of sea-to-shore directionally drilled conduit;
- Abandonment of the onshore cable vault;
- Removal of land cable; and
- Removal of substation equipment.

After removal of the offshore equipment, the remaining power transmission cable would be pulled back through its HDD conduit to the vault at the base of Tennessee Avenue from where it would be removed for recycling. The 6-inch conduit would be left in place, 25 feet below the boardwalk and beach, and extending offshore to the former transition point.

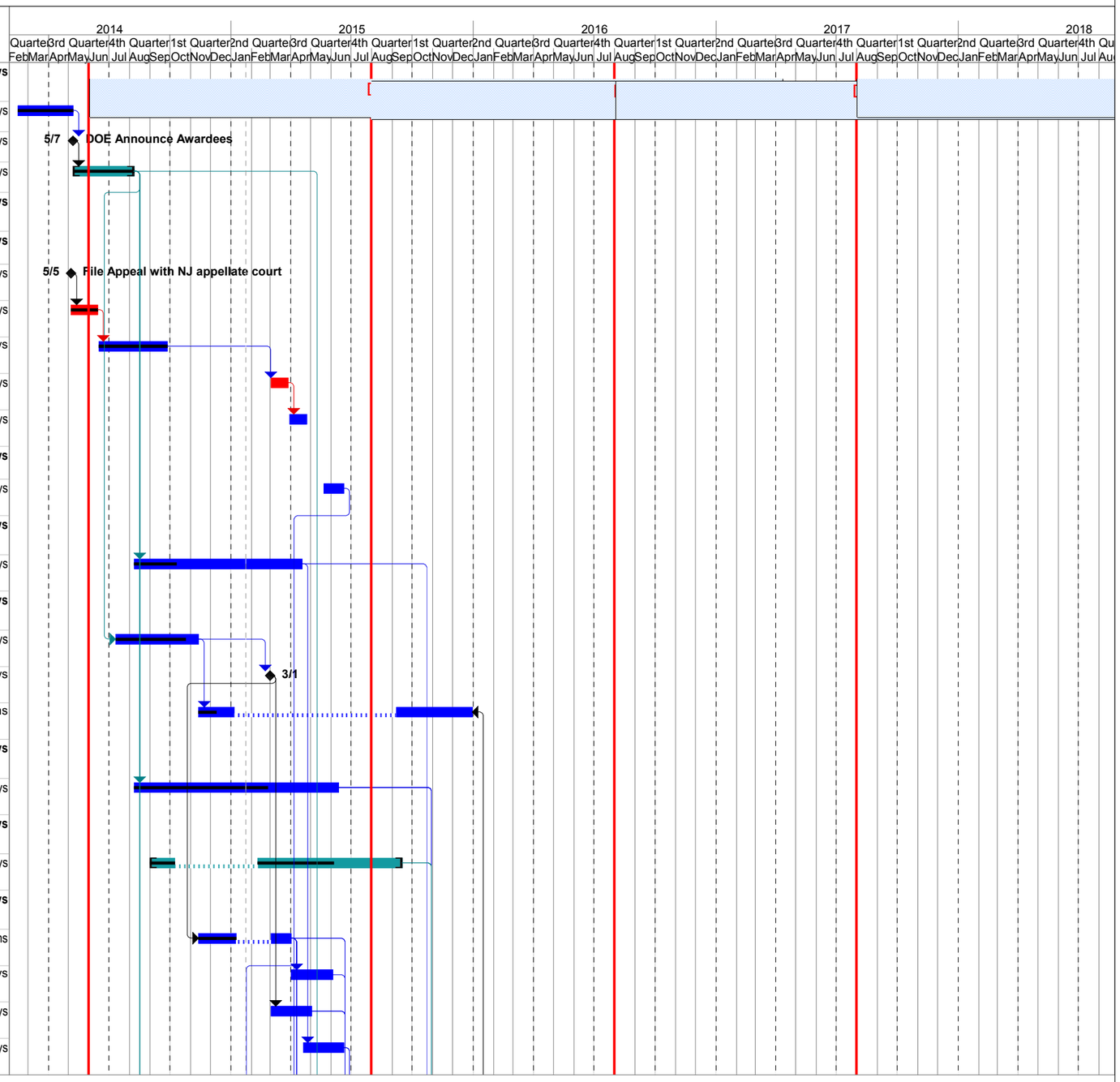
All equipment would be removed and the vault would be abandoned in accordance with Atlantic City, New Jersey regulations or, at the discretion of the city, the vault would be removed and the excavated site backfilled.

The land based cable extending from the vault to the Huron substation would be removed from its conduit by pulling from the substation end. The cable would be trucked from the location and recycled. The 6-inch buried conduit (approximately 25 feet below grade) would be capped and left in place for future use by the city or other projects.

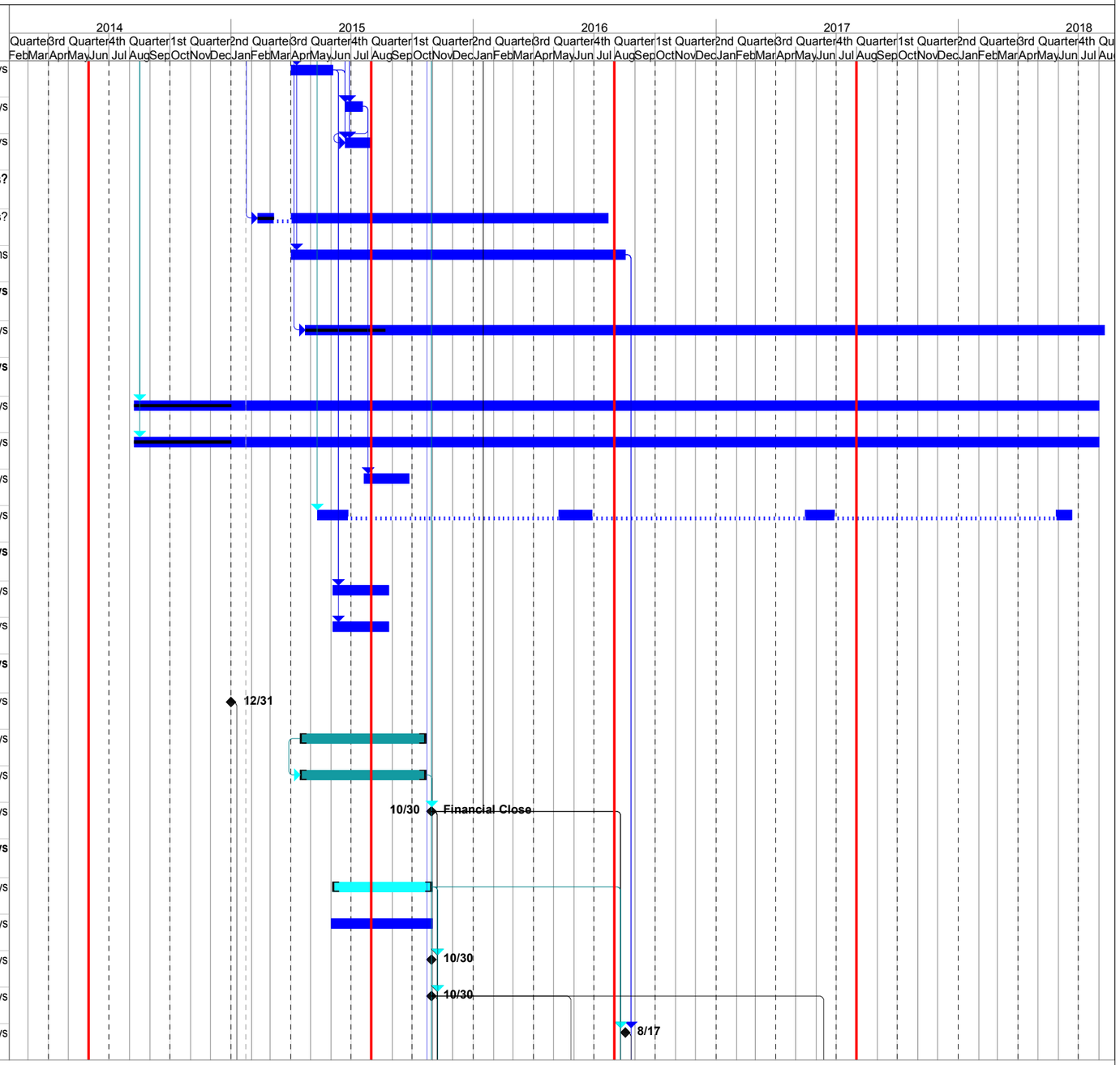
Switchboxes and other electrical equipment at the substation will be removed in accordance with requirements set by Atlantic County Electric. Any other ancillary equipment would either be removed or left in place as preferred by Atlantic County Electric.

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ID	SOPO Task	Task Name	% Compl	Start	Finish	Duration
1		**DOE FACW Grant Award**	**100%**	**Fri 2/14/14**	**Thu 8/7/14**	**125 days**
2		DOE down select process	100%	Fri 2/14/14	Wed 5/7/14	59 days
3		DOE Announce Awardees	100%	Wed 5/7/14	Wed 5/7/14	0 days
4		BP2 contract signed	100%	Thu 5/8/14	Thu 8/7/14	66 days
5	8.1	**Power Offtake**	**63%**	**Mon 5/5/14**	**Fri 6/19/15**	**295 days**
6	8.1.1	**BPU Appeal Process**	**72%**	**Mon 5/5/14**	**Fri 4/24/15**	**255 days**
7		File Appeal with NJ appellate court	100%	Mon 5/5/14	Mon 5/5/14	0 days
8		Scheduling order by court	100%	Mon 5/5/14	Fri 6/13/14	30 days
9		File Briefs by both parties	100%	Mon 6/16/14	Fri 9/26/14	75 days
10		Oral agruments	0%	Mon 3/2/15	Fri 3/27/15	20 days
11		Appellate court opinion	0%	Mon 3/30/15	Fri 4/24/15	20 days
12	8.1.2	**BPU OREC Order**	**0%**	**Thu 5/21/15**	**Fri 6/19/15**	**22 days**
13		Implement appellate division ruling (Issue Final Board Order)	0%	Thu 5/21/15	Fri 6/19/15	22 days
14	8.2	**Grid Interconnection**	**25%**	**Fri 8/8/14**	**Fri 4/17/15**	**181 days**
15		Interconnect agreement (sign and suspend until financial close)	25%	Fri 8/8/14	Fri 4/17/15	181 days
16	8.3	**Turbine Model Selection**	**45%**	**Fri 7/11/14**	**Wed 12/30/15**	**383.2 days**
17		Sourcing, technical and financial assessments	85%	Fri 7/11/14	Wed 11/12/14	89 days
18		Term sheet signed	80%	Sun 3/1/15	Sun 3/1/15	0 days
19		Turbine Supplier Pre-Contract Engineering	16%	Thu 11/13/14	Wed 12/30/15	6 mons
20	8.4	**Federal NEPA Review**	**65%**	**Fri 8/8/14**	**Thu 6/11/15**	**220 days**
21		NEPA Review and approval	65%	Fri 8/8/14	Thu 6/11/15	220 days
22	8.5	**Permit Modifications**	**60%**	**Mon 9/1/14**	**Tue 9/15/15**	**272 days**
23		Permit Modifications	60%	Mon 9/1/14	Tue 9/15/15	183 days
24	8.6	**Front End Engineering Design (FEED) 100%**	**14%**	**Thu 11/13/14**	**Fri 7/31/15**	**187 days**
25		Foundation preliminary engineering	65%	Thu 11/13/14	Wed 4/1/15	3.15 mons
26		Foundations - finalize pricing	0%	Wed 4/1/15	Wed 6/3/15	45 days
27		Cabling - finalize design basis & pricing	0%	Mon 3/2/15	Fri 5/1/15	45 days
28		Substation - finalize design basis & pricing	0%	Mon 4/20/15	Fri 6/19/15	45 days

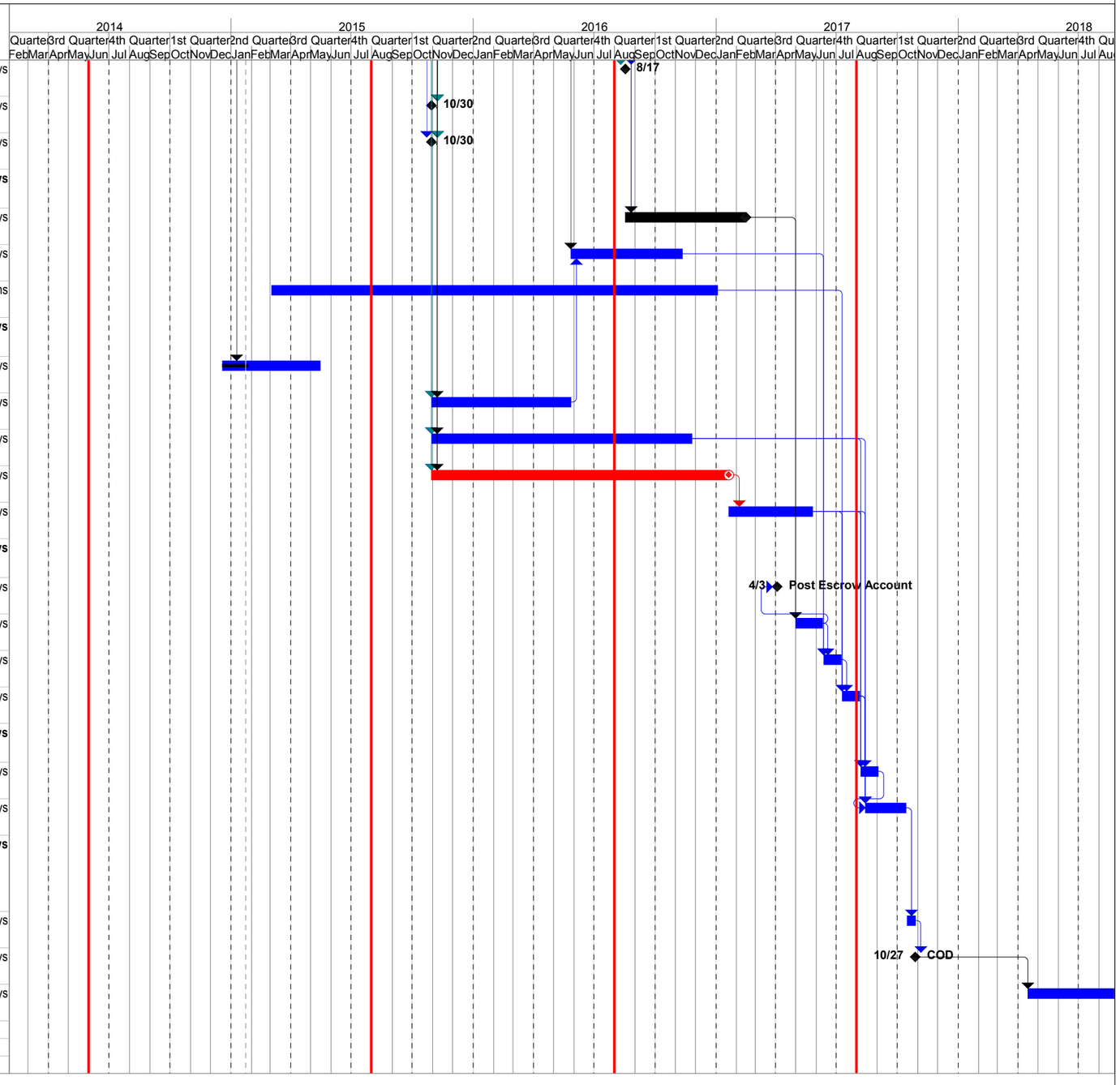


ID	SOPO Task	Task Name	% Compl	Start	Finish	Duration
29		Update Quotations	0%	Wed 4/1/15	Wed 6/3/15	45 days
30		Capex and Opex 3rd party review	0%	Mon 6/22/15	Fri 7/17/15	20 days
31		Report	0%	Mon 6/22/15	Fri 7/31/15	30 days
32	8.7, 9.1	**Foundation Final Engineering**	**3%**	**Tue 2/10/15**	**Wed 8/17/16**	**396.05 days?**
33		Detailed foundation engineering	5%	Tue 2/10/15	Fri 7/22/16	360 days?
34		Detailed turbine engineering	0%	Wed 4/1/15	Wed 8/17/16	18 mons
35	8.8, 9.4, 10.2, 11.2	**Plan and Implement R&D**	**10%**	**Thu 4/23/15**	**Wed 8/8/18**	**860 days**
36		Project R&D tasks	10%	Thu 4/23/15	Wed 8/8/18	860 days
37	8.9, 9.2, 10.1, 11.1	**Project Management and Reporting**	**9%**	**Fri 8/8/14**	**Tue 7/31/18**	**1038 days**
38		Project management planning and execution	10%	Fri 8/8/14	Tue 7/31/18	1038 days
39		DOE interface	10%	Fri 8/8/14	Tue 7/31/18	1038 days
40		100% FEED Report	0%	Mon 7/20/15	Fri 9/25/15	50 days
41		Annual Reports	0%	Mon 5/11/15	Wed 6/20/18	120 days
42	8.10	**Installation and O&M Methods**	**0%**	**Wed 6/3/15**	**Wed 8/26/15**	**60 days**
43		Finalize methods and scopes of work	0%	Wed 6/3/15	Wed 8/26/15	60 days
44		Update to facility and service vessel	0%	Wed 6/3/15	Wed 8/26/15	60 days
45	9.3	**Financial Close**	**0%**	**Wed 12/17/14**	**Fri 10/30/15**	**227 days**
46		ITC extension approved by Congress	100%	Wed 12/17/14	Wed 12/31/14	0 days
47		Due Diligence / Consultation	0%	Wed 4/15/15	Wed 10/21/15	136 days
48		Document Drafting and Negotiation	0%	Wed 4/15/15	Wed 10/21/15	136 days
49		Financial Close	0%	Fri 10/30/15	Fri 10/30/15	0 days
50	9.5	**Finalize and Execute Vendor Supplier Contracts**	**0%**	**Mon 6/1/15**	**Wed 8/17/16**	**317.05 days**
51		Contract Negotiations	0%	Wed 6/3/15	Fri 10/30/15	108 days
52		Legal support	0%	Mon 6/1/15	Fri 10/30/15	110 days
53		TSA executed	0%	Fri 10/30/15	Fri 10/30/15	0 days
54		Cable contract executed	0%	Fri 10/30/15	Fri 10/30/15	0 days
55		Foundation contract executed	0%	Wed 8/17/16	Wed 8/17/16	0 days



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ID	SOPO Task	Task Name	% Compl	Start	Finish	Duration
56		Turbine Transport and Lift contract executed	0%	Wed 8/17/16	Wed 8/17/16	0 days
57		FACW Substation contract executed	0%	Fri 10/30/15	Fri 10/30/15	0 days
58		Interconnect Agreement - notice to proceed	0%	Fri 10/30/15	Fri 10/30/15	0 days
59	10.5	**Fabrication, Manufacturing and Delivery**	**0%**	**Tue 3/3/15**	**Wed 2/15/17**	**511.05 days**
60		Foundations	0%	Wed 8/17/16	Wed 2/15/17	130 days
61		Export and array cables	0%	Fri 5/27/16	Thu 11/10/16	120 days
62		Turbines, towers and blades	0%	Tue 3/3/15	Mon 1/2/17	24 mons
63	9.8, 10.6	**Landward Cable and Electrical Infrastructure**	**3%**	**Fri 12/19/14**	**Thu 5/25/17**	**635 days**
64		Upland cable vault installations (IRS Continuous Construction)	25%	Fri 12/19/14	Thu 5/14/15	105 days
65		Kerite start upland cable and civil works	0%	Fri 10/30/15	Thu 5/26/16	150 days
66		DCO start FACW Substation at MTF	0%	Fri 10/30/15	Thu 11/24/16	280 days
67		PJM start Mods to Huron Substation	0%	Fri 10/30/15	Thu 1/19/17	320 days
68		Power Backfeed	0%	Fri 1/20/17	Thu 5/25/17	90 days
69	10.7, 11.3	**Offshore Contruction**	**0%**	**Mon 4/3/17**	**Fri 8/4/17**	**90 days**
70		Post Escrow Account	0%	Mon 4/3/17	Mon 4/3/17	0 days
71		Foundation Installation	0%	Mon 5/1/17	Fri 6/9/17	30 days
72		Cable Installaton	0%	Mon 6/12/17	Fri 7/7/17	20 days
73		Turbine Transport and Lift	0%	Mon 7/10/17	Fri 8/4/17	20 days
74	11.4	**Commissioning**	**0%**	**Mon 8/7/17**	**Fri 10/13/17**	**50 days**
75		Early commissioning tasks	0%	Mon 8/7/17	Fri 9/1/17	20 days
76		Turbine commissioning	0%	Mon 8/14/17	Fri 10/13/17	45 days
77	11.5	**Commercial Operations, Observation and Performance Optimization**	**0%**	**Mon 10/16/17**	**Fri 4/10/20**	**650 days**
78		Substantial Completion & Turnover	0%	Mon 10/16/17	Fri 10/27/17	10 days
79		COD	0%	Fri 10/27/17	Fri 10/27/17	0 days
80		Data collection program.	0%	Mon 4/16/18	Fri 4/10/20	520 days



Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 17, 2015

Daniel Saunders
Deputy State Historic Preservation Officer
Mail Code 501-04B
State of New Jersey
Department of Environmental Protection
Historic Preservation Office
PO Box 420
Trenton, NJ 08625-0420

SUBJECT: DOE and USACE Request for Re-Initiation of Section 106 Consultation for Fishermen's Atlantic City Windfarm, LLC - HPO project number 08-1708

Pursuant to Section 106 of the *National Historic Preservation Act* of 1966 (NHPA) as amended, and its associated implementing regulations codified at 36 CFR Part 800, the U.S. Department of Energy (DOE) requests initiation of consultation with your office on the effects of DOE providing funding to Fishermen's Atlantic City Windfarm, LLC (project proponent) to support the development of an offshore wind renewable energy facility (Proposed Project) located approximately 2.8 miles off the New Jersey coast from Atlantic City. The Proposed Project would consist of the construction, operation, maintenance, and eventual decommissioning of up to six wind turbine generators that would generate a maximum of approximately 25 megawatts (MW) of electricity, a 33-kilovolt (kV) alternating current (AC) submarine cable interconnecting the turbines, a 33-kV AC submarine transmission cable (export cable), and a 33-kV AC underground cable (onshore interconnection cable) that would connect the project with existing onshore infrastructure in Atlantic City, New Jersey.

Background
The U.S. Army Corps of Engineers, Philadelphia District (USACE) previously completed Section 106 consultation (HPO project number 08-1708) for portions of this project and issued Department of the Army Permit CENAP-OP-R-2008-0777-39 for the Proposed Project on June 14, 2013.

The USACE previously determined that no historic properties would be affected by the Proposed Project. This determination was based on the following reports that were provided to your office by the USACE:

- *Marine Geophysical Survey in Support of an Offshore Wind Farm and Cable Route Construction, Atlantic City, Jew Jersey,* prepared for Fishermen's Energy of New Jersey, LLC by Alpine Ocean Seismic Survey, Inc. and Fathom Research, LLC dated March 18, 2011.

- *(Draft) Phase I Marine Archaeological Survey, Fishermen's Energy Project, Atlantic City, Atlantic County, New Jersey,* prepared by Fathom Research, LLC dated April 2011.

On May 17, 2011 your office concurred with the determination that no historic properties would be affected. Since this concurrence, the following changes have occurred:

- A permit modification package has been submitted to the USACE. The USACE plans to issue a Public Notice to solicit comments and recommendations from the public concerning modification of the Department of the Army permit. The USACE will include your office on the distribution list to be notified when the Public Notice is published.
- DOE is completing an Environmental Assessment (EA) for the proposed project under the *National Environmental Policy Act* (NEPA) and the USACE is a cooperating agency. DOE will include your office on the distribution list to be notified when the draft EA is posted for the public comment period.

To streamline the NEPA process and to avoid redundancy, DOE and USACE have decided to jointly re-initiate the Section 106 process for the Proposed Project. DOE has been designated as the lead action agency under NEPA for this project.

Project Description
A detailed project description is attached which includes the proposed changes to the project since USACE completed Section 106 consultation (Enclosure 1).

Undertaking
DOE has determined that providing funding to support the development of the Proposed Project constitutes an undertaking subject to Section 106 of the NHPA.

Area of Potential Effect
Consideration has been given to the potential for a range of effects in addition to direct effects that might result from the undertaking, including visual effects.

DOE has defined the area of potential effect (APE) to include the total ocean area considered as the project area which is approximately 170 acres (calculated as the perimeter around the group of turbines, approximately 200 feet in each direction) plus a 5 foot width along the length of the export cable route from the turbines to the shore; and the on-shore portion of the project which is located within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues in Atlantic City, New Jersey for the underground cable to be installed that connects the project to existing infrastructure at the Huron Substation, located along Abescon Avenue in Atlantic City, New Jersey. The APE also includes the coastline between Ventnor City and Atlantic City, NJ for potential visual impacts.

Historic Properties Affected
Per 36 CFR 800.4, DOE is required to identify all properties listed, or eligible for listing in the National Register of Historic Places which may be affected by the proposed undertaking. As discussed above two documents were submitted, during the USACE Section 106 consultation, which covered the marine portion of the APE. From this information, it was determined that no historic properties would be affected by the marine portion of the Proposed Project.

A Phase Ia Archaeological Survey for the onshore APE was completed for the project (Enclosure 2). Research performed for this survey indicates that there is no prehistoric archaeological potential within the APE due to disturbances associated with utility and building construction and indicates that the APE is under existing roadways. The research also determined there were no historic buildings or structures formerly present within the APE; and that there is no historic archaeological potential.

In addition, a viewshed analysis report has been completed for the Proposed Project (Enclosure 3). Based upon the photographs generated with the overlying depiction of the turbines and their respective size and location in relation to the various historically sensitive areas investigated as part of the viewshed analysis, it was determined the turbines will only be visible from six National/and/or State Registered Historic Places between Ventnor City and Atlantic City, NJ. In all of these locations, the turbines on the horizon will appear as structures that will be much smaller in comparison to surrounding structures and therefore will not diminish the integrity of any of these properties significant historic features.

Assessment of Effect
Based on information in the Phase Ia Archaeological Survey (enclosed) for onshore components and the viewshed analysis (enclosed); and the information submitted during the previous USACE Section 106 consultation, DOE, as the funding agency, and USACE, as the permitting agency, have determined that no historic properties would be adversely affected by their respective actions of funding and modifying the permit for the proposed project.

DOE and USACE respectfully request your concurrence in their conclusion that no historic properties would be adversely affected by their funding and permitting actions. Please send any correspondence to:

U.S. Department of Energy
Golden Field Office
Attn: Ms. Lori Gray
NEPA Division Director
15013 Denver West Parkway
Golden, CO 80401

U.S. Army Corps of Engineers
Regulatory Branch, Philadelphia District
Attn: Ms. Nicole Minnichbach
Cultural Resource Specialist/Tribal Liaison
Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107-3390

If you have any questions or require any additional information, please contact Lori Gray at (720)356-1568 or lori.gray@ee.doe.gov or Nicole Minnichbach, USACE at 215-656-6556 or Nicole.C.Minnichbach@usace.army.mil.

Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

Electronic cc:
Lori Gray, DOE
Michael Hahn, DOE
Roak Parker, DOE
Nicole Cooper Minnichbach, USACE
Lawrence M Slavitter, USACE

Description of the Proposed Project

Changes to the Project Description (PD) that were previously submitted during consultation are highlighted in yellow and the change is explained in the accompanying footnote.

The Proposed Project consists of the construction, operation, maintenance, and eventual decommissioning[1] of a nominal 25 MW[2] offshore wind renewable energy facility, consisting of up to six turbines[3], a 33-kiloVolt (kV)[4] alternating current (AC) submarine cable interconnecting the turbines (inter-array cable), a 33-kV[4] AC submarine transmission cable (export cable), and a 33-kV[4] AC underground cable (onshore interconnection cable) that would connect the Proposed Project with existing onshore infrastructure located in Atlantic City, New Jersey.

The offshore components of the Proposed Project, including the turbines and the inter-array cable, would be located in state waters approximately 2.8 nautical miles from Atlantic City, New Jersey. The export cable would traverse state waters to shore. The onshore components, including the onshore interconnection cable, fiber optic cable, and interconnection facilities would be located in Atlantic City, New Jersey. Construction would be supported by a construction staging area(s) and a construction port. Onshore support facilities would be located at existing waterfront industrial or commercial sites in the cities of Camden and Atlantic City, New Jersey.

All remaining aspects of the project, including staging sites, vessel traffic, color and labeling of the turbines, seasonal restriction and maintenance schedules remain the same and are not impacted by the proposed project changes.

Annual net electricity production for this Project is anticipated to be approximately 80,000 MW-hours[5] (MWh). The total ocean area considered as the project area is approximately 170 acres (calculated as the perimeter around the group of six turbines, approximately 200 feet in each direction) plus a 5 foot width along the length of the export cable route from the turbines to the shore); however the actual portion of the area that would be physically disturbed by the placement of the turbines and cables is approximately 2 acres. The cable and turbines would be located in water depths of 26 to 40 feet below mean lower low water (MLLW).

Wind Turbine and Foundation Design

The offshore turbine assemblies would each be composed of three primary elements, a foundation, tower, and three blade turbine. The nacelle houses the major mechanical components of each turbine. Each tower would be approximately 16.5 feet in diameter at the base and taper to a diameter of 12.5 feet at the top.

[1] Previous PD did not include operation, maintenance, and eventual decommissioning of the Proposed Project
[2] Previous PD stated “20 MW (net)”
[3] Previous PD stated “six offshore wind turbines”
[4] Previous PD stated “34.5 kv”
[5] Previous PD stated “75,000 MWh”

Each turbine would have a name plate capacity of no more than 5 MW[6] and a blade rotor diameter of no more than 427 feet[7]. Each of the three (3) blades would be two hundred thirteen (213) feet long[8]. The blade at its lowest point would be located 80 feet above mean high water and 506.4 feet above mean high water at its highest point[9].

The turbine array would be oriented in one row parallel to the coastline running northeast to southwest. Spacing between the turbines would be approximately 3,543 feet. Each of the wind turbines would be supported by an Inward Battered Guide Structure (IBGS) jacket-type foundation[10] driven into the seabed (**Figure 1**). The IBGS jacket-type foundation consists of four legs, with each leg being a hollow steel pipe with an approximate outer diameter of 84 inches. The triangular structure has 90-inch diameter pile sleeves for each leg and bracing elements of the foundation will measure approximately 22 feet in length and 72 inches in diameter. At the mudline, each side of the foundation will measure approximately 53 feet from the center point of each leg. The IBGS extends upward from below the seabed, through the water column to exposure at the surface, then tapers to approximately 50 feet above mean lower low water. The structural braces for the towers would be seventy two (72) inches in diameter and would be located laterally along the entire foundation[11].

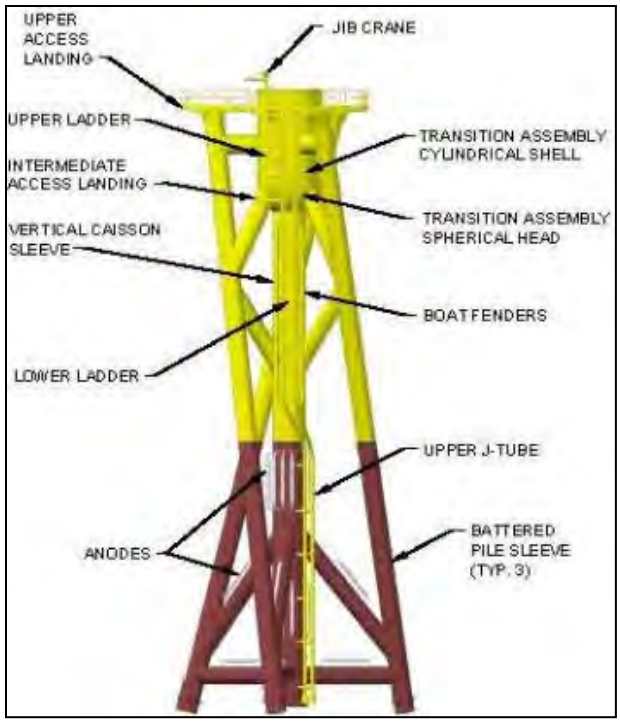


Figure 1. Foundation Design for the Proposed Project.

[6] Previous PD stated "3.6 MW"
[7] Previous PD stated "394 feet"
[8] Previous PD stated "approximately 192 foot long"
[9] Previous PD stated "blade at its lowest point would be located approximately 100 feet above the surface of the water and approximately 500 feet above the surface of the water at its highest point at mean high water"
[10] Previous PD referenced "monopole foundation"
[11] Previous PD did not reference these specifications since the tower was originally intended to be a monopole foundation

Engineering analyses have determined that the base of each foundation will no longer require a scour protection mat or rock scour protection around each foundation pile[12].

Installation of Turbines and Foundations

Fishermen's Atlantic City Windfarm, LLC (FACW) the project proponent, has thoroughly investigated vessel and port availability, and is currently in negotiations with multiple third parties to provide equipment and expertise in the installation of the turbine foundations and turbines. FACW has identified suitable existing US Jones Act-compliant vessels capable of installing the turbines in the 40 foot water depths at the project site. Specialty contractors would be required for delivery and installation of foundations, turbines and the subsea electrical cabling. Installing the array of turbines will require the ability to lift, place, and connect foundations, pilings nacelles, blades and heavy electrical equipment. These components can weigh well in excess of 200 tons each, and can only be lifted with specialized jack up barges or vessel-mounted cranes offering a stable, safe work platform.

FACW currently has a Memorandum of Understanding with the South Jersey Port Corporation for materials staging and preparation. The turbines and associated major components are envisioned to be delivered to the Beckett Street Marine Terminal in Camden, New Jersey. Up to 6 months before the scheduled installation, the turbines would be transported from the manufacturer to the Beckett Street Marine Terminal via barge, rail, and/or truck depending upon their origin. Existing waterfront bulkheads, cranes and laydown areas at Beckett Street would be used to support the staging for this project. At the facility, final turbine assembly including generator mounting and electrical hookups would be performed to minimize work performed offshore. At that point, the turbine manufacturer would lead the final assembly and configuration for the wind turbine generator components to be delivered by vessel to the offshore array field.

The steel turbine towers would be manufactured domestically and transported to the staging area at Beckett Street Marine Terminal via barge, rail, and/or truck. Each tower is approximately 250 feet in length (comprised of bolted segments) and is secured to the foundation by bolting to a transition piece (or flange) at the top of the foundation.

The foundations would be fabricated at a Gulf of Mexico facility and then transported by barge to the staging area at Beckett Street Marine Terminal. Once assembly is completed, the foundations would be loaded onto ABS class ocean deck barges that would carry three jackets per barge. It is anticipated that the two barges would be transported by two tugs directly to the project site. A floating crane barge or specialized jack-up barge or barge equipped with a high capacity crane pile handling frame and pile driving equipment would perform structure installations (**Figure 2**). The installation vessel would position itself near to each of the turbine installations. The vessel would then jack itself up out of the water to provide a stable platform in which to carry out the installation activities. Offshore experience has shown that it normally takes approximately 24 hours in fair weather conditions to position and anchor the

[12] Previous PD stated "scour mats and/or rock protection will be installed to prevent ocean currents from eroding the seabed around the foundation base".

installation vessel. Once the installation vessel is in the turbine array field, it would be moved as minimally as possible, but would, out of necessity, move from one turbine location to the next.



Figure 2. Typical heavy jackup vessel used for offshore wind turbine installations

To secure the foundation in place, steel pipe pilings 7 feet in diameter would be inserted down through the piling sleeves, and then driven to a depth of approximately 140 feet below the seabed using impact hammer methods. The jacket foundations would require the installation of four (4) eighty four (84) inch piles that would be driven inside, down and through the length of each of the ninety (90) inch diameter sleeves of the foundation for each turbine[13]. The anchoring piles would be driven to a depth of approximately 150 feet below the mudline. The maximum sound generation for each pile would be approximately 199 dB (re 1 uPa) at the source.

Each foundation would also be fitted with a ladder extending from the water surface up to a working deck to allow personnel access from vessels. Electrical power generated by the turbine would be cabled down through the structure to emerge from a J-Tube below the seabed.

The Proposed Project would be constructed using the following approach which has been successfully employed in Europe:

- All foundations are installed first;
- The submarine cable is installed next and energized to provide electricity from the grid to assist in turbine installation;
- Turbine towers are installed on the foundations;

[13] Previous PD stated "pile driving of eighteen (18) forty eight (48) inch diameter pipes placed in the openings on the three ends of the foundation structure"

- The turbines are installed on each tower; and
- Lastly the turbines are commissioned and made operational.

The complete wind turbine structure requires a series of main lifts for full assembly. The foundation center caisson (i.e., a watertight retaining structure) would be driven to the required depth using impact methods. The guide structure would then be lifted onto the caisson and secured. Each of the three pilings would then be lifted into the sleeves on the guide structure and hammered to the required depth below the seabed. The turbine tower would then be lifted and secured onto the foundation. Lastly the turbine components including the nacelle and turbine blades would be lifted to the tower top and installed.

Turbine system installations are anticipated to require four to seven fair weather days to complete. In order to minimize the complexity and duration of offshore operations, components of the turbines would be pre-assembled to the extent possible prior to transportation offshore.

Cable Route and Installation

Cables would be manufactured in Seymour, Connecticut and transported by rail to a staging pier in Port Elizabeth, New Jersey. The cable reels would be placed on a special cable laying barge and transported to the project site for installation.

Power output from the turbines would be transmitted via a 33 kV AC submarine cable (export cable) to access the shore. The inter-array transmission cable from each turbine structure would be linked to the export cable that would make landfall at a point in Atlantic City, at the base (southeast terminus) of Tennessee Avenue in Atlantic City. The cable would then continue northwest for 1.2 miles underground to the existing Huron Substation, located along Absecon Avenue. The path of this underground cable is roughly coincident with the line created by Tennessee Avenue. The submarine transmission cable route was selected after evaluations of alternative routes and landfall locations which included bringing the cable to shore through the Absecon Inlet. The route ultimately selected proved to present the least environmental impacts identified during the permitting process and was most acceptable to the USCG.

Offshore, the submarine export and inter-array cables would be arranged in a single string array. An additional fiber-optic cable bundle would also be included within the export cable for telecommunication purposes. At each turbine location, the power and telecommunication cables would extend down from the turbine within the tower structure, and then emerge through a J-tube just above the seabed where it would be connected to the adjacent turbine.

Jet plowing technology would be used to bury the export and inter-array cables to a target depth of 6 feet[14] below the seabed. The export cable would originate at Turbine #3. During this process the installation vessel slowly travels along the planned cable route while towing a weighted sled fitted with a trenching device (plow) and a nozzle which jets water into the bottom to create a narrow trench. The cable is simultaneously fed out from the vessel and laid into the trench. Blades at the back of the sled scrape bottom material over the trench to backfill. The cable would be buried in this manner to

[14] Previous PD stated “9 feet”

approximately 1,800 feet from the shoreline. The depth of the cable below the project along the Atlantic City Beach will be 20 feet. The cable that would run from the turbines to the shore would be five (5) inches in diameter[15].

Beginning at a distance approximately 1,800 feet from the shoreline, the cable would be routed through a lined conduit installed using Horizontal Directional Drilling (HDD) methods.[16] The installation of this HDD conduit would be performed from the landside. At the base of Tennessee Avenue (approximately 500 feet inland of the high water line), a concrete vault approximately 8 feet by 8 feet by 7 feet would be installed below roadway grade using typical upland excavation equipment. HDD equipment would then drill a 6-inch diameter cable-way 25 feet below the street level, underneath the boardwalk and beach, and emerge at the jet plow end point 1,800 feet from shore. While drilling, the cable-way would be lined with polyvinyl chloride (PVC) conduit to prevent collapse and to protect the cable after it has been installed. Soil material removed from the bored hole (approximately 13 cubic yards) would be removed from the site. All construction-related soil and debris would be appropriately disposed of depending upon the characteristics of the material, in accordance with relevant New Jersey Department of Environmental Protection (NJDEP) regulations. Once HDD is completed, the cable would be pulled from the offshore vessel through the conduit to emerge at the shore end vault, where the offshore cable would be connected.

A similar cable to that used offshore, but designed specifically for land applications would be used for the remaining 1.2 mile run below the Tennessee Avenue street level to the Huron substation. Again HDD methods would be used to route the cable 25 feet below street level. This burial depth was selected after a review of existing below grade infrastructure along this route. At 25 feet, the cable would be below all existing infrastructure. Soil material removed from the bored hole (approximately 46 cubic yards) would be removed from the site and properly disposed as described above. At the Huron substation facility, a breaker system, and other minor electrical components specific to the Proposed Project would need to be installed for connection of the export cable and to the power grid.

The following sections were not part of the original project description.

Operations and Maintenance

Upon completion of the construction activities, FAWC would conduct several weeks of commissioning activities that would entail the testing of the turbines as well as the offshore and onshore transmission systems. The project would begin operations approximately in October 2017 and continue until the end of the 25-year expected operational life of the facility.

Operation of the turbines would require continuous remote (shore-based) monitoring and control, scheduled onsite maintenance, and unscheduled responses to faults or damage. Additionally, the

[15] Previous PD stated “8 inches in diameter”

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

- Remote monitoring and supervision of the wind turbines and associated equipment 24 hours a day, 7 days a week using the wind power supervisory control and data acquisition system;
- Initiation of any required corrective action;
- Operation of the Turbine Condition Monitoring (TCM) system;
- Performing diagnostic assessment of data from the TCM;
- Managing the inventory of spare parts, including performing any maintenance of these spare parts;
- Scheduling and logistics planning of maintenance activities; and
- Performing daily communication with the facility operator.

Each turbine would undergo scheduled maintenance and inspection as well as a full annual maintenance program as prescribed by the turbine manufacturer. This work would be performed by personnel qualified by the manufacturer. Additionally, inspections of the underwater structures and seabed would be performed at a minimum of once per year.

As access to the turbines can only be achieved by vessel, sea conditions would dictate when service may be performed. Heavy annual work would be scheduled to occur during summer months when conditions for accessing the turbines are typically suitable (waves less than 3 feet). During winter months, accessibility may be limited for extended periods of time.

Service crews would board a dedicated service vessel based in Atlantic City, New Jersey. Personnel would gain access to the turbines via the ladder system incorporated into each foundation. Tools and light parts would be lifted onto the structure using a small crane system provided on the structure working deck. Annual maintenance for each turbine is expected to require 5 to 8 days of onsite work. Turbines would be returned to normal operation at the end of each service day.

No oils or other waste would be discharged during service events. Appropriate measures would be implemented to provide for containment and collection of hazardous material spills should they occur. It is not expected that any painting would be necessary during the life of the turbines, other than to repair damage. The original coating system on the towers is designed to last the lifetime of the structure.

Decommissioning

While the project is presently planned for a 25 year operational period, the potential for equipment upgrades and continued operation would be evaluated throughout the project life. When it is determined that the project is to be decommissioned, all physical elements of the project would be removed and the site would be restored to its original condition. A financial instrument to fund decommissioning activities would be set in place at the start of the project to ensure that sufficient funds are available for removal of the turbines and support infrastructure.

A comprehensive Decommissioning Plan which addresses the engineering, environmental, regulatory, and economic elements of the decommissioning task. The plan addresses state requirements presently in place as well as those established by the Bureau of Ocean Energy Management (BOEM) guidelines described in 30 CFR Parts 250.1700 – 1754. An overview of the Decommissioning Plan is provided below.

Decommissioning of the project would involve the removal of equipment both offshore and onshore and would be performed utilizing similar equipment to that used during the construction process. This equipment may include barges, lift boats, tugs and crew vessels. Deep draft vessels would port at the Beckett Street Terminal in Camden, New Jersey, while smaller crew vessels would operate from Atlantic City. Onshore, trucks, trailers, and cable handing equipment would be used to recover the cable and substation equipment. Removed materials would be refurbished, recycled, or disposed of, as appropriate.

Offshore Equipment Removal

Removal of the offshore equipment would consist of the following tasks:

- Removal of the wind turbines;
- Removal of towers and foundations;
- Removal of inter-array and export cables; and
- Site clearance survey.

The removal processes would be performed with full consideration of environmental and safety compliance. Federal and state permits would be in place as required prior to initiating decommissioning. During decommissioning, safety exclusion zones would be established and marked with buoys and navigational aids to protect the workforce and vessel traffic. FACW would ensure that any subsea obstacles would be adequately marked until they are made safe or removed.

Removal of the turbine equipment would essentially be the reverse of the installation. Using a barge supported heavy lift crane, each rotor and nacelle would be lowered to a transport barge and secured for transit to port. Power cables would be removed from the tower and at the sea bed. The steel turbine tower would be removed as one unit above the transition joint at water level.

Each tower foundation is comprised of three driven pilings, a center caisson and a guide structure. The guide structure would first be removed and loaded onto a barge for recycling. Each of the pilings and the caisson would be cut 15 feet below the seabed and removed. The remaining piling structures (below -15 feet) would be left in place.

Because full removal off all buried cable would cause disturbance to the established sea bed, power cables at each turbine location would be excavated to the 6 foot burial depth, cut and removed. All cabling at or below the 6-foot depth would be left in place undisturbed.

Upon completion of structural decommissioning, a site clearance survey would be performed to ensure that no debris remains within the project area, and to document the physical condition of the seabed. Similar to the geophysical survey performed pre-construction, the clearance survey would employ side

scan sonar for imaging the seabed, a magnetometer to detect ferrous materials, and depth mapping systems. Any objects detected would be investigated and removed as appropriate. Demonstration of clearance would be provided to the appropriate agencies.

Onshore Equipment Removal

Removal of the onshore equipment would consist of the following tasks:

- Removal of sea-to-shore transition cable;
- Abandonment of sea-to-shore directionally drilled conduit;
- Abandonment of the onshore cable vault;
- Removal of land cable; and
- Removal of substation equipment.

After removal of the offshore equipment, the remaining power transmission cable would be pulled back through its HDD conduit to the vault at the base of Tennessee Avenue from where it would be removed for recycling. The 6-inch conduit would be left in place, 25 feet below the boardwalk and beach, and extending offshore to the former transition point.

All equipment would be removed and the vault would be abandoned in accordance with Atlantic City, New Jersey regulations or, at the discretion of the city, the vault would be removed and the excavated site backfilled.

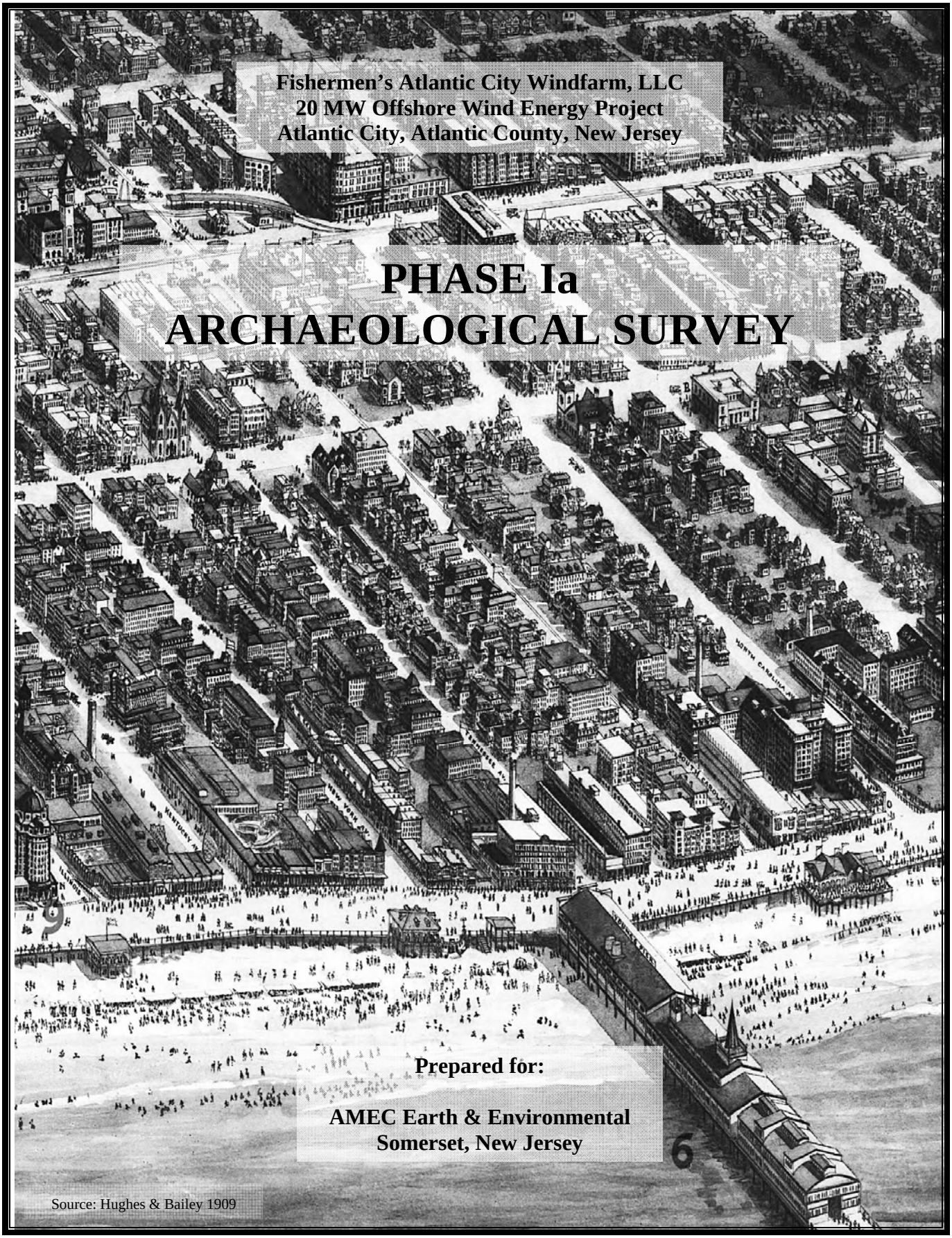
The land based cable extending from the vault to the Huron substation would be removed from its conduit by pulling from the substation end. The cable would be trucked from the location and recycled. The 6-inch buried conduit (approximately 25 feet below grade) would be capped and left in place for future use by the city or other projects.

Switchboxes and other electrical equipment at the substation will be removed in accordance with requirements set by Atlantic County Electric. Any other ancillary equipment would either be removed or left in place as preferred by Atlantic County Electric.

Enclosure 2

Fishermen's Atlantic City Windfarm, LLC
20 MW Offshore Wind Energy Project
Atlantic City, Atlantic County, New Jersey

PHASE Ia
ARCHAEOLOGICAL SURVEY



Prepared for:

AMEC Earth & Environmental
Somerset, New Jersey

Source: Hughes & Bailey 1909

Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project
Atlantic City, Atlantic County, New Jersey

PHASE Ia ARCHAEOLOGICAL SURVEY

by

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AMEC Earth & Environmental
Somerset, New Jersey

July 2011

ABSTRACT

This report documents the results of a Phase Ia Archaeological Survey performed for AMEC Earth & Environmental as part of the Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project in Atlantic City, Atlantic County, New Jersey. The Area of Potential Effect (APE) for the project is located in the Coastal Plain Physiographic Province. The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

Research performed for the Phase Ia Archaeological Survey indicates that there is no prehistoric archaeological potential within the APE due to disturbances associated with utility and building construction. Historical research indicates that the APE is under existing roadways. No historic buildings or structures were formerly present within the APE. There is no historic archaeological potential. No additional archaeological research is recommended.

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INTRODUCTION

This report documents the results of a Phase Ia Archaeological Survey performed for AMEC Earth & Environmental as part of the Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project in Atlantic City, Atlantic County, New Jersey (Figure 1; USGS 1994, 1995). The Area of Potential Effect (APE) for the project is located in the Coastal Plain Physiographic Province. The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

This Phase Ia Archaeological Survey was conducted in accordance with federal and state laws that protect significant cultural resources, including historic and archaeological sites. Federal and state mandates for cultural resources protection include: the National Historic Preservation Act of 1966; the National Environmental Policy Act of 1969; Executive Order 11593; the Archaeological and Historic Preservation Act of 1974; and New Jersey State Act No. 7:22-10. All work was performed in compliance with 36 CFR §800; and the New Jersey Historic Preservation Office's (NJHPO) guidelines as outlined in "Guidelines for Phase I Archaeological Investigations: Identification of Archaeological Resources" (New Jersey Historic Preservation Office 1996).

The Phase Ia Archaeological Survey was undertaken in May and June of 2011. The work was performed by Cultural Heritage Research Services, Inc. (CHRS) of Lansdale, Pennsylvania. Kenneth J. Basalik, Ph.D. was the project's Principal Investigator. Historical research was conducted by Philip Ruth. Graphics for the report were prepared by Crystal Hall. Editorial work was undertaken by Kevin Quigg and Maria Rossi of the CHRS staff (Appendix A). The Phase Ia Archaeological Survey report was prepared under contract to AMEC Earth & Environmental of Somerset, New Jersey.

PROJECT DESCRIPTION

Fishermen's Atlantic City Windfarm, LLC (FISHERMEN'S) is proposing the development of a nominal 20 megawatt (MW) offshore wind renewable energy facility (the Project). The in-water portion of the Project would be located within State waters, with the turbines located approximately 2.8 miles off the coast of Atlantic City. The upland portion of the project consists of an underground transmission cable extending from where the submarine cable makes landfall to the existing Huron Substation. The path of this underground cable is roughly coincident with the line created by Tennessee Avenue.

The project proposes the construction and operation of six, 3.6 MW Siemens turbines, oriented in one row, for a total of approximately 20 MW (net). The total ocean area considered as the project area is approximately 170 acres (calculated as the perimeter around the group of six turbines [approximately 200 feet in each direction] plus a 5 foot width along the length of the cable route from the turbines to the shore); however, the actual portion of the area that will be physically



AREA OF POTENTIAL EFFECT

	SCALE	SOURCE
N	0ft 2000ft 0m 609.6m Prepared by CHRS, Inc.	USGS 1994 ATLANTIC CITY, NJ USGS 1995 OCEANVILLE, NJ

PROJECT LOCATION MAP | **FIGURE 1**

disturbed by the placement of the turbines and cables is approximately 2 acres. A review of the National Oceanic and Atmospheric Administration (NOAA) nautical charts indicates that the proposed cable and turbines for the in-water portion of the Project would be located in water depths of approximately 24 to 39 feet below mean lower low water (MLLW). Power output from the turbines will be transmitted via a 34.5 kilovolt (kV) submarine cable to access the shore. The submarine transmission cable will continue underground to the existing Huron Substation, along a route that is roughly coincident with Tennessee Avenue.

BACKGROUND RESEARCH

Introduction

Background research was conducted in order to identify and provide a context for evaluating cultural resources within and immediately adjacent to the Area of Potential Effect (APE). Institutions and repository records consulted include those associated with the New Jersey State Museum; the New Jersey Historic Preservation Office; the Free Library of Philadelphia; and the Coastal and Hydraulics Laboratory, Engineer Research and Development Center (Table 1). A variety of source materials were consulted, including regional and municipal histories, historical and archaeological resource files, as well as environmental, geological, archaeological, and other pertinent studies. Historic maps and aerial photographs were consulted in an attempt to identify and pinpoint the locations of historic structures within and immediately adjacent to the APE.

TABLE 1

INSTITUTIONS AND REPOSITORY RECORDS CONSULTED

Fisherman's Energy Project, Tennessee Avenue Underground Cable Routing
Atlantic City, New Jersey
Phase Ia Archaeological Survey

Institution/Repository	Records Consulted
New Jersey State Museum	Archaeological site survey files
New Jersey Historic Preservation Office	Archaeological site/Historic Resources Survey forms and maps
Free Library of Philadelphia	Historic maps
Coastal and Hydraulics Laboratory, Engineer Research and Development Center	Historic aerial photographs

The initial background research work was a file search at the New Jersey State Museum and the New Jersey Historic Preservation Office. The file search revealed that no archaeological sites have been recorded along South and North Tennessee Avenues in or adjacent to the project's APE. No historic districts are located within or adjacent to the APE. Only one historic property adjoining either South or North Tennessee Avenues has been determined eligible for listing in either the New Jersey Register of Historic Places or the National Register of Historic Places. Identified as the St. Nicholas of Tolentine Church, the property stands at 1409-1421 Pacific Avenue, on the northwest

corner of that avenue's intersection with South Tennessee Avenue. The property was listed in the New Jersey Register of Historic Places in 2000, and in the National Register the following year. No project-related surface-level or above-ground impacts are anticipated within 1,000 feet of this resource.

Environment

New Jersey has undergone substantial environmental changes in the last 40,000 years as several ice ages changed the climate and topography of the state. Sixteen-thousand years ago, the last ice sheet, called the Wisconsin Stage, began to form as the climate cooled in the Quaternary Period (Wolfe 1977). This ice sheet advanced no further than northern New Jersey. One of the most dramatic effects of the ice sheet was the lowering of ocean levels worldwide as sea water was frozen and trapped in glaciers and continental ice sheets. Along the Atlantic continental shelf sea levels 30,000 to 35,000 years ago were close to those at present (Milliman and Emery 1968). Sea levels dropped subsequently as much as 130 meters during the final Wisconsinan glacial advance around 16,000 years ago. Along the Atlantic coast, ocean beaches during this period lay at the edge of the modern continental shelf, perhaps 100 kilometers east of the modern New Jersey coastline. Belknap and Kraft (1977) question the maximum depth of sea level drop, but agree with the overall pattern. Disagreement exists over the extent of the cooling and the type of vegetation that survived. The area may have consisted of treeless vegetation similar to that found in the Arctic or Canada, or the vegetation may have been that of a more temperate environment.

Climatic patterns changed subsequent to the retreat of the ice sheets. Sea levels rose as a result of the release of water from melting ice sheets. As the sea level rose, it began to cover what is now the Atlantic continental shelf. The sea level rise began around 14,000 years ago and proceeded rapidly until around 7,000 years ago (Milliman and Emery 1968). As temperatures warmed, open grassy environments were replaced by boreal evergreen forests and then by deciduous forests (Robichaud and Buell 1973). As the continental shelf was covered by rising sea levels, the environment shifted from inland forest to tidal salt marshes (ca. 5,000 years ago) to lagoons or to coastal sand barriers (ca. 3,000 years ago) (Dolan Research Inc. and Hunter Research Inc. 1997). Climatic conditions were warm and somewhat moister than in the preceding Boreal phase with oak and hemlock as dominant vegetation species and with pine persisting in coastal areas (Dent 1979).

The late Pleistocene-early Holocene witnessed the extinction of large mammals such as the mastodon (Robichaud and Buell 1973; Wolfe 1977). This might be related to activities of Native Americans (Wolfe 1977), who destroyed local environments as well as modifying their composition. Recent ethnohistoric studies demonstrated that Native American deforestation had a considerable impact on settlement and subsistence systems prior to European entry into North America (Heidenreich 1971). The Lenape Indians, for example, cleared land for the construction of villages and crops, and modified the composition of the forest by setting fires to drive game and make travel easier by creating paths (Robichaud and Buell 1973). Gathering wood for fuel, tools, and building materials depleted forest resources and often necessitated the relocation of entire communities to areas of more abundant assets. Large populations of transplanted Europeans intensified the deforestation process through their search for fuel, lumber, and for agricultural purposes. Similarly, faunal resources (elk, deer, bear, wolf, fox, rabbit, hare, beaver, turkey, partridge, pigeon, and other fowl) were exploited by the Amerind populations, but their habitats

were largely destroyed by European settlement, causing severe population depletion. Europeans specifically changed the environment of the uplands in the Inner Coastal Plain by clearing land, again destroying parts of the forest and modifying its composition (Robichaud and Buell 1973).

Prehistory

Evidence from prehistoric sites in the eastern United States indicates a number of successive regional cultural traditions. Although the exact number and nature of these traditions, which varied locally, remains the subject of debate, three major cultural periods can be defined: Paleo-Indian, Archaic, and Woodland. These traditions are best viewed as responses to changing social and environmental conditions.

The Paleo-Indian Tradition, 11,500–8,000 years ago: The earliest, widely recognized tradition in the northeastern United States is the Paleo-Indian. This tradition is believed to have been characterized by small hunter-gatherer groups subsisting mainly on large mammals, many of which are now extinct or no longer present in the area (woolly mammoth, mastodon, and caribou). The artifact distinctive to this tradition is the fluted projectile point, which is lanceolate-shaped with a central flake removed from both faces along its longitudinal axis. This and related tools have been found in association with various floral and faunal resources in sites across the eastern United States (Funk 1969; Gardner 1974; Adovasio 1977; Dent and Kauffman 1978). This evidence suggests that the Paleo-Indian population exploited a wide variety of terrestrial, subsistence resources. The Paleo-Indian Period is marked by specific cultural ecological adaptations to the Pleistocene and Early Holocene environments. Custer (1984, 1985) has outlined the expected site types for the Paleo-Indian Period, which include the following: quarry, quarry reduction, base camps, base camp maintenance stations, and hunting sites. The larger sites or base camps are quarry-related (i.e., lithic resource focus) and located near major waterways (Gardner 1976; Custer 1984).

The number of Paleo-Indian sites found in undisturbed contexts is very low throughout New Jersey. Approximately 200 fluted points have been found, primarily as surface finds throughout the state (Marshall 1982). The largest concentration of these artifacts has been recovered in the vicinity of the Delaware River drainage (Marshall 1982). Three Paleo-Indian sites are located in the far-extended vicinity of the study area: the Plenge Site (Kraft 1973), Turkey Swamp (Cavallo 1981), and Port Mobil (Kraft 1977). The majority of Paleo-Indian and Archaic sites found to date onshore in New Jersey have been situated in upland locations of major river terraces, often at confluences, overlooking wide expanses of land. This distribution of sites suggests a preference for high, well-drained ground, near streams or wetlands, offering vantage points for observing game. Paleo-Indian sites have been documented in rockshelters, near lithic source areas, and on boulder and cobble-edged coastal plain meltwater drainages, which provided raw materials for chipped stone tool industries. It is probable that many Paleo-Indian sites were situated on the now inundated continental shelf, and that the margins of its formerly exposed river mouths, bays, estuaries, and salt marshes all provided settings that would have been attractive to humans for settlement and/or exploitation. Edwards and Emery (1977) provide a reconstruction of the land area of the Middle Atlantic coast around 10,000 to 12,000 years ago. The current site of the South Jersey coastline was covered by inland forest, probably with surface water locations. Any evidence of Paleo-Indian occupation in the vicinity of the current shoreline would not relate directly to coastal environments but to exploitation of inland forest/riverine habitats (Dolan Research, Inc. and Hunter Research Inc.

1997). Documented submerged archaeological sites along the New Jersey coast are few. Lanceolate points have been recovered from dredge spoils out on the continental shelf (Edwards and Emery 1977). Sixteen sites are listed by Grossman-Bailey (2001).

The Archaic Tradition, 8,000–3,000 years ago: The Archaic Tradition emerged from the Paleo-Indian with a more generalized subsistence strategy in response to changing environmental and, perhaps, social conditions. Approximately 10,000 years ago, as glacial conditions slowly gave way to the warmer Holocene climate, hardwood forests gradually replaced the tundra-like vegetation (Sirkin 1977:214). The socio-cultural response to the climatic amelioration and resultant environmental diversification was one of resource exploitative expansion in terms of biotic and lithic consumption. The Early Archaic settlement pattern for the Coastal Plain has been theorized to contain a wide variety of sites including base camps. These notions are predicated upon models of resource optimization.

The period of time that signals the cultural adaptation to the fully emergent Holocene milieu is the Middle Archaic division. Settlement patterns on the Coastal Plain are anticipated to contain a more diverse array of site types based upon the high productivity rating for this environment. The foci for base camps in this province are projected to be the extensive swamp lands (Custer and Wallace 1982:34) and the relict periglacial features (Bonfiglio and Cresson 1978, 1982). Changes in habitat are reflected in cultural artifacts by the presence of new tool types (Bryan 1977:363).

Evidence suggests that Archaic people lived in small nomadic groups (Cushman 1981:9). The resources exploited varied on the basis of local availability. This factor, coupled with the types and quantities of the lithic materials employed in toolmaking, results in different artifact assemblages at different sites. It is therefore difficult to characterize a typical regional Archaic tool assemblage. Archaic assemblages are, however, clearly distinguished from those of the preceding Paleo-Indian Tradition by the replacement of fluted points with smaller points of cruder materials and the emergence of grinding and ground stone tool (axes, chisels, and gouges) technologies. In general, tool assemblages from this tradition are marked by increasing diversification and specialization through time.

The increased number of sites which date to the Archaic is evidence that population density was greater during the Archaic than it was during the Paleo-Indian Tradition. This increase in population density was possible because, as climatic fluctuations stabilized and hardwood forests became established, the carrying capacity of the environment increased. In addition, the warming trend caused a rise in the sea level, which allowed for the formation of extensive marshes and estuaries along the Delaware River. As resources became more abundant in and around major waterways and marshes, settlement was increasingly focused along them (Kraft 1977; Gardner 1980). Despite this trend, there is evidence of continued seasonal nomadism based on a resource-scheduling strategy (Cushman 1981:12).

During the Late Transitional Archaic, trade—particularly in non-local lithic material—expanded, and new artifact forms, such as steatite (soapstone) vessels, were used. The large number of sites and the more diverse cultural assemblages found in the region from this cultural period point towards this increased trade and artifact creation. A larger population with more diverse procurement activities is likely to have increased the importance of upland areas in the region

during this period. Custer (1985), feeling a continuity in resource exploitation, combines the traditional Late Archaic, Early Woodland, and Middle Woodland Periods together under the term "Woodland I." This division is marked by the following items: "focus on the highest productivity settings, an intensified use of certain resources, appearance of large semi-sedentary macro-band base camps, development of storage and processing facilities, extensive use of a wide range of environments, development and maintenance of trade and exchange networks, and the appearance of incipient ranked societies" (Custer 1985:36-37).

Also notable towards the end of the Archaic is the appearance of several prominent cultural traditions, including the Small Stemmed Point Tradition (probably an in situ development) and the Susquehanna Tradition (which originated in the southeast) (Kraft and Mounier 1982a:81-82). The Small Stemmed Point Tradition occurs in the mid-Atlantic coast, with some penetration into upland areas and along major rivers, and is characterized in part by small stemmed projectile points, ground stone woodworking tools, and paintstones, often of hematite or graphite (Kraft and Mounier 1982a:81). The Susquehanna Tradition in New Jersey is exemplified by the Koens-Crispin Complex, which is characterized in part by stone vessels, woodworking tools, implements fashioned from broken points, and a complex mortuary technology (Kraft and Mounier 1982a:82).

Settlement location patterns during the Archaic Period for the Coastal Plain are depicted as a diverse array of site types occupying a multitude of suitable micro-environs. These attractive settings or micro-environs would include the well-drained soils and land juxtaposed to the flood plains, swamps, and/or marshes (Custer and Wallace 1982; Custer 1985). Early Archaic sites have been identified in numerous locations on New Jersey's Coastal Plain, although it is commonly believed that many Early Archaic sites may be buried under river sand or slope wash, or at former coastal locations that have been submerged by rising sea levels (Grossman-Bailey 2001). As a result, the present understanding of the social and technological adaptations of Early Archaic indigenous peoples is limited. Recorded sites in the coastal plain of New Jersey are located primarily along rivers, near confluences of smaller waterways and headwaters. For the coastal plain of New Jersey, Grossman-Bailey (2001) lists 166 sites believed to represent the Late Archaic Period. The majority of these sites are located in the interior.

The Woodland Tradition, 3,000 to 500 years ago: The beginning of the Woodland Tradition in this region is marked by the introduction of ceramics (Gardner 1980:3) and by two major trends: increasing sedentism and the development of extensive agriculture (Curry and Custer 1982:4; Cushman 1981:14). During the Woodland Tradition permanent or semi-permanent settlements replaced the seasonal base camp. Settlement patterns derived from sites which date to this period are focused on major waterways (Curry and Custer 1982:1), where the exploitable biomass was the greatest. The harvesting of various plants, waterfowl, fish and shellfish would have provided a more than adequate supply of food. These waterways supplied relatively easy transportation, facilitating trade and increasing the range and quantity of resources that could be exploited. The Late Woodland Period (Custer's "Woodland II") is generally characterized by the introduction of maize and squash cultigens and the appearance of sedentary villages. These developments were neither unilateral nor temporally concomitant throughout the Mid-Atlantic region.

The Late Woodland Period reflects a continuation of similar land use patterns and settlement location of the earlier Late Archaic/Early Woodland through Middle Woodland Periods. The major

difference appears as an "increasing use of floodplain settings for relatively large semi-sedentary communities and the habitation-utilization of certain levees along major drainages" (Custer and Wallace 1982:159). As one might expect, it appears that the primary determinant of prehistoric settlement pattern distributions, excluding mortuary or ceremonial sites, is the location of water resources (Stewart 1981; Custer and Wallace 1982; Gardner 1987). The Abbott Farm Site complex located near Trenton, New Jersey, was the locus of a substantial Woodland Period occupation which was investigated over the years by numerous researchers, notably Cross (1956), Cavallo (1987) and Stewart (1986, 1987, 1998).

Sites with Early Woodland components are relatively scarce in comparison to the number of Transitional, Late, and Middle Archaic sites. Most of the known Early Woodland Period sites in the region occur in coastal or estuarine zones, and are less frequently found along major rivers and lakes. This suggests that coastal resources became an increasingly significant part of the subsistence collecting activities and diets of the region's indigenous peoples. The Late Woodland sites represent more sedentary lifestyles with year-round base camps located on the fertile flood plains of major rivers, while smaller, temporary seasonal camp sites are numerous along tributaries and natural springs.

The Contact Period, AD 1500–1700: The Late Woodland Period ended with European contact, which appears in the archaeological record as an intrusion of European artifacts into Late Woodland assemblages. At the time of Native American/European contact, relations between the two groups took various forms, usually beginning as trade interactions and religious proselytization. Relations then often proceeded to armed conflict, ultimately leading to the displacement of Native populations. At the time of European contact, New Jersey was occupied by the Unami branch of the Lenape (Kraft 1986).

Previous Regional Archaeological Research: A Brief Summary

No archaeological sites have been recorded along or adjacent to the project's Area of Potential Effect (APE), although sites have been found in the general region. The first statewide survey to inventory prehistoric resources was sponsored by the New Jersey legislature and was undertaken by Skinner and Schrabisch (1913). The survey recorded about 1,000 sites including several sites in Pleasantville. During the Depression years of the 1930s, a more intensive survey of New Jersey was conducted under the auspices of the Works Project Administration (WPA) (Cross 1941). During the 1950s, Kier, an avocational archaeologist, conducted a number of surveys in the Outer Coastal Plain along parts of the Necochaque Creek, Mullica Creek, and Batsto River. He was successful in locating 19 prehistoric sites (Cavallo and Mounier 1980:37). During the late 1960s and early 1970s, Regensburg conducted investigations within the Pinelands. His work resulted in the discovery of several prehistoric site locations including Savich Farm, an Early Archaic to Late Woodland site which contains a substantial Late Archaic component and an associated cemetery (Regensburg 1971).

Mounier (1972, 1974, 1975) conducted a series of excavations and surveys in the Maurice and Great Egg Harbor Rivers, and Rancocas Creek drainages which allowed him to define a number of archaeological complexes and begin examining the nature of regional prehistoric settlement patterns (Mounier 1978; Kraft and Mounier 1982a, 1982b). Mounier (1978:62) found that "the distribution

of aboriginal sites in the Rancocas Valley section of Burlington County shows a pattern of closely spaced units forming nearly continuous bands of occupation along the main branches and tributaries." He also observed that "site placement, size, and function appear not to correlate directly with stream order within the Inner Coastal Plain possibly as a function of general environmental resource distribution" (Mounier 1978:65).

Cavallo and Mounier completed a survey of prehistoric aboriginal sites in the New Jersey Pinelands in 1980. Their research utilized data collected from archival sources, publications and interviews from professional and avocational archaeologists, as well as artifact collectors. This endeavor resulted in the listing of 1,046 sites which were then analyzed for co-relating variables of environmental attributes (Cavallo and Mounier 1980).

Temple University, under the direction of Ranere and Hansell, initiated research into the prehistoric occupation of the Outer Coastal Plain of New Jersey in 1980. Their investigations during the summer field seasons of 1980-81 focused on the large, multi-component campsite of Gravelly Run along the Great Egg Harbor River. During the following years of 1982, 1984, 1986 and 1987, Temple University was engaged in a systematic survey of the Lower Great Egg Harbor River watershed (Ranere and Hansell 1984a, 1984b, 1985, 1989). This survey observed that the pattern distribution for the sites in the study sample crosscuts the entire range of temporal periods from the Middle Archaic through the Late Woodland. This phenomenon strongly suggests a case for the ubiquitous presence of ephemerally-based procurement camps through time which were engaged in similar extractive activities, perhaps in response to a similar set of environmental parameters in the Outer Coastal Plain of New Jersey. Few sites other than procurement camps are known in the region.

Investigations by Bonfiglio and Cresson (1978, 1982) in both the Inner and Outer Coastal Plains of New Jersey resulted in a remarkable contribution to regional settlement pattern studies. They found an association between relict periglacial features (i.e., pingos and thermokarst basins) and sites of suspected Paleo-Indian and Early/Middle Archaic Periods. Continual archaeological surveys over the years leading to the present time period have added a substantial amount of data to confirm this landform/cultural association (Jack Cresson, pers. com., June 29, 1998). In fact, some of the sites identified by Cresson have a suspected periglacial component (Jack Cresson, pers. com., June 29, 1998).

Study Area History

The Area of Potential Effect (APE) is located within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues in Atlantic City, New Jersey (Figure 1; USGS 1994, 1995). A historical sketch of Atlantic City, posted on the Atlantic-City-Online.com website (Kozek 2010:n.p.), reads as follows:

> Atlantic City has a long and varied history. Though much has been written about the post 1977 casino years, and the heyday years of the 30's and 40's when the Atlantic City Boardwalk was the in place to be seen, there is a wealth of rich history which dates back over two hundred years before the first dice were thrown or the first jitney hit the

pavement. Let's take a look back into history and discover all the people who helped make Atlantic City, not only what it is today, but what it will be in the future.

The original inhabitants of Absecon Island, on which Atlantic City rests, were the Lenni-Lenape Indians. The Lenni-Lenapes would travel over the Old Indian Trail from the Mainland to the island to spend the summer months. The trail, which was located approximately where Florida Ave. is today, was five miles long over the marshland. The Indians would partake of the abundance the ocean and bay had to offer, along with the varieties of wildlife and flora of the island.

The first recorded owner of Absecon Island was Thomas Budd, an Englishman, who arrived in Atlantic County in [the] late 1670's. Budd was given the island and other acreage as settlement of a claim he had against the holders of the royal grant. His mainland property was then valued at $0.40 an acre, while the beach land [was valued at] a mere $0.04 an acre. That same piece of beach front property today would be worth millions of dollars per acre.

For the next hundred years, the island would be visited by not only the Indians, but also hunters and some of the early mainland settlers. Among these brave soles [*sic*] was Jeremiah Leeds. Leeds, born in Leeds Point in 1754, was the first white man to build a permanent structure on the island in 1785 at what is now Arctic and Arkansas Ave. His grandfather had built a cedar log cabin on Baltic Ave. at the site of the recently demolished bus terminal as early as 1783. Jeremiah and his family were the first official residents of Atlantic City. Their home and farm was called Leeds Plantation, and Leeds grew corn and rye and raised cattle. A year after Leeds [*sic*] death in 1838, his second wife Millicent got a license to operate a tavern called Aunt Millie's Boarding House, located at Baltic and Massachusetts Ave. Thus, the first business in Atlantic City was born.

Several of Jeremiah and Millicent's children were important in their own right. Robert B. Leeds, born in Atlantic City on May 2, 1828, was the city's first postmaster. Another son Chalkey S. Leeds, born in Atlantic City in 1824, became the city's first mayor in 1854.

By the year 1850, there were seven permanent dwellings on the island, all but one [of] which were owned by descendants of Jeremiah Leeds. Dr. Jonathan Pitney, a prominent physician who lived in Absecon, felt that the island had much to offer, and even had ideas of making the island a health resort, but access to the island had to be improved. Pitney, along with a civil engineer from Philadelphia, Richard Osborne, had the idea to bring the railroad to the island. In 1852, construction began on the Camden-Atlantic City Railroad. On July 5, 1854, the first train arrived from Camden after a grueling 2½-hour trip, and the invasion of the tourists had begun.

Osborne has been given credit with naming the city, while his friend Dr. Pitney thought up the plan for the names and placements of the city streets which remains today. Streets running parallel to the ocean would be named after the world's great

bodies of water, Pacific, Atlantic, Baltic, Mediterranean, Adriatic, and Arctic, while the streets which ran east to west would be named after the States.

Visitors to Atlantic City didn't only arrive by train. Atlantic City was becoming a bustling seaport. But along with the increasing number of sailing vessels, came an increasing number of tragic wrecks off the coast. One of the most tragic was the sinking of the Powhattan, a vessel carrying 311 German immigrants, which sank on April 16, 1854. For days, bodies washed up on the shoreline. Because it was impossible to identify the dead, 54 bodies were buried in a mass grave in the cemetery at the Smithville Methodist Church, and 45 bodies were buried in Absecon. At the urging of Dr. Pitney, a lighthouse was erected in 1854, and turned on one year later. The lighthouse, in the Inlet section of the city, was originally at the edge of the ocean, but it now stands over ½-mile from the beach.

The first official road from the mainland to the island was completed in 1870, after 17 years of construction. The road, which ran from Pleasantville, had a $.30 toll. The first free road was Albany Ave., constructed over the meadows from Pleasantville.

By 1878, one railroad couldn't handle all the passengers wanting to go to the Shore, so the Narrow Gauge Line to Philadelphia was constructed. At this point massive hotels like the United States and the Surf House, as well as smaller rooming houses, had sprung up all over town. The first commercial hotel the Belloe House, located at Massachusetts and Atlantic Ave., was built in 1853, and operated till 1902. The United States Hotel took up a full city block between Atlantic, Pacific, Delaware, and Maryland (the current site of the Showboat Parking lot). These grand hotels were not only impressive in size, but featured the most updated amenities, and were considered quite luxurious for the time.

There were beautiful hotels, elegant restaurants, and convenient transportation, but the businessmen of Atlantic City had one big problem to contend with: sand. It was everywhere, from the train cars to the hotel lobbies. In 1870, Alexander Boardman, a conductor on the Atlantic City-Camden Railroad, was asked to think up a way to keep the sand out of the hotels and rail cars. Boardman, along with a hotel owner Jacob Keim, presented an idea to City Council. In 1870, and costing half the towns [*sic*] tax revenue that year, an eight foot wide wooden foot walk was built from the beach into town. This first Boardwalk, which was taken up during the winter, was replaced with another larger structure in 1880. On Sunday September 9, 1889, a devastating hurricane hit the island, destroying the boardwalk. Most of the city was under 6 feet of water, and the ocean met the bay at Georgia Ave. The Boardwalk of today is 60 feet wide, and 6 miles long. Its planks, placed in a herringbone pattern, are laid on a substructure of concrete and steel. Steel railings are in place to keep visitors from falling off to the beach below, and in accordance with an old City Council ordinance, hotels, restaurants and shops are kept on one side of the boards, with amusement piers on the other.

On June 16, 1880, Atlantic City was formally opened. With fanfare the likes [of which] few in the area had seen, a resort was born. By the census of 1900, there were

over 27,000 residents in Atlantic City, up from a mere 250 just 45 years before. The first public school was opened in 1858 at Maryland and Arctic Ave. Before this, mainlanders were sent over to teach the island's children. By 1883, the city had built its first school on Texas Ave., at a cost of $25,000.

The next twenty-five years saw many firsts in the city. The First National Bank of Atlantic City was opened on May 23, 1881, and a little over a year later in July 1882, the first use of electricity, a street light in front of Keuhnles Hall at Atlantic and South Carolina Ave., shown bright. The Atlantic City Beach Patrol opened in August 1881, posting strict 9am to 5pm bathing hours. By the next season, there were 20 guards on duty. The Atlantic City Hospital opened Nov. 30, 1898, while the public library opened Jan. 31, 1900. Trolley service began in the city in 1893, extending out to Ventnor in 1900. The trolleys ran till 1955. Atlantic City's famous jitney service started up in 1915, with a ride around town costing just 5 cents.

The late 1800's were a growth time for the city. Nearly 2/3^{rds} of the city's 6,500 dwellings in 1899 were cottages. These cottages were elaborate 2-3 story private homes, many the summer homes of prominent doctors and businessmen from Philadelphia. Beautifully coifed lawns and magnificently decorated interiors made these homes a symbol of the glory days of the city. At the same time, along the Boardwalk, amusement piers began popping up. With names like Million Dollar, Steel, [and] Iron, the piers of Atlantic City were a major draw. Everyone could find some sort of entertainment to meet their tastes from the Diving Horse, Dr. Couney's Premature Infant Exhibit, marathon dance contests to side show acts. Despite the variety of draws to the city, one issue remained: how to extend the tourist season past summer. That question was answered by a 16-year-old girl from Washington in 1921 who was the first Miss America. The pageant, which was held intermittently from 1930-1935, became synonymous with Atlantic City when it began being held at the Convention Hall in 1940.

Atlantic City became *the* place to go. Entertainers from vaudeville to Hollywood graced the stages of the piers. Glamorous hotels like Haddon Hall, the Traymore, the Shelburne and the Marlborough-Blenheim drew guests from all over the world. Atlantic City's future seemed bright, until World War II. After the war, the public seemed to stop its love affair with The World's Favorite Playground. Possibly because of the public's access to national air travel, the shift of the population westward, the general deterioration of the city, or a shift in the public's taste for more sophisticated entertainment, Atlantic City lost much of its shine; and most of its tourists.

With the passage of the Casino Gambling Referendum in 1976, Atlantic City began an upward battle, not unlike one it had started two hundred years before, to use the glorious resources it has been given by nature, to make it once again a world renown tourist Mecca (Kozek 2010:n.p.)

The Area of Potential Effect (APE) comprises a 20-foot-wide corridor beneath the western (southbound) lane of South and North Tennessee Avenues, except for three locations where the

buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection. The three proposed vault locations are discussed below as Area 1 (southern vault location), Area 2 (central vault location), and Area 3 (northern vault location).

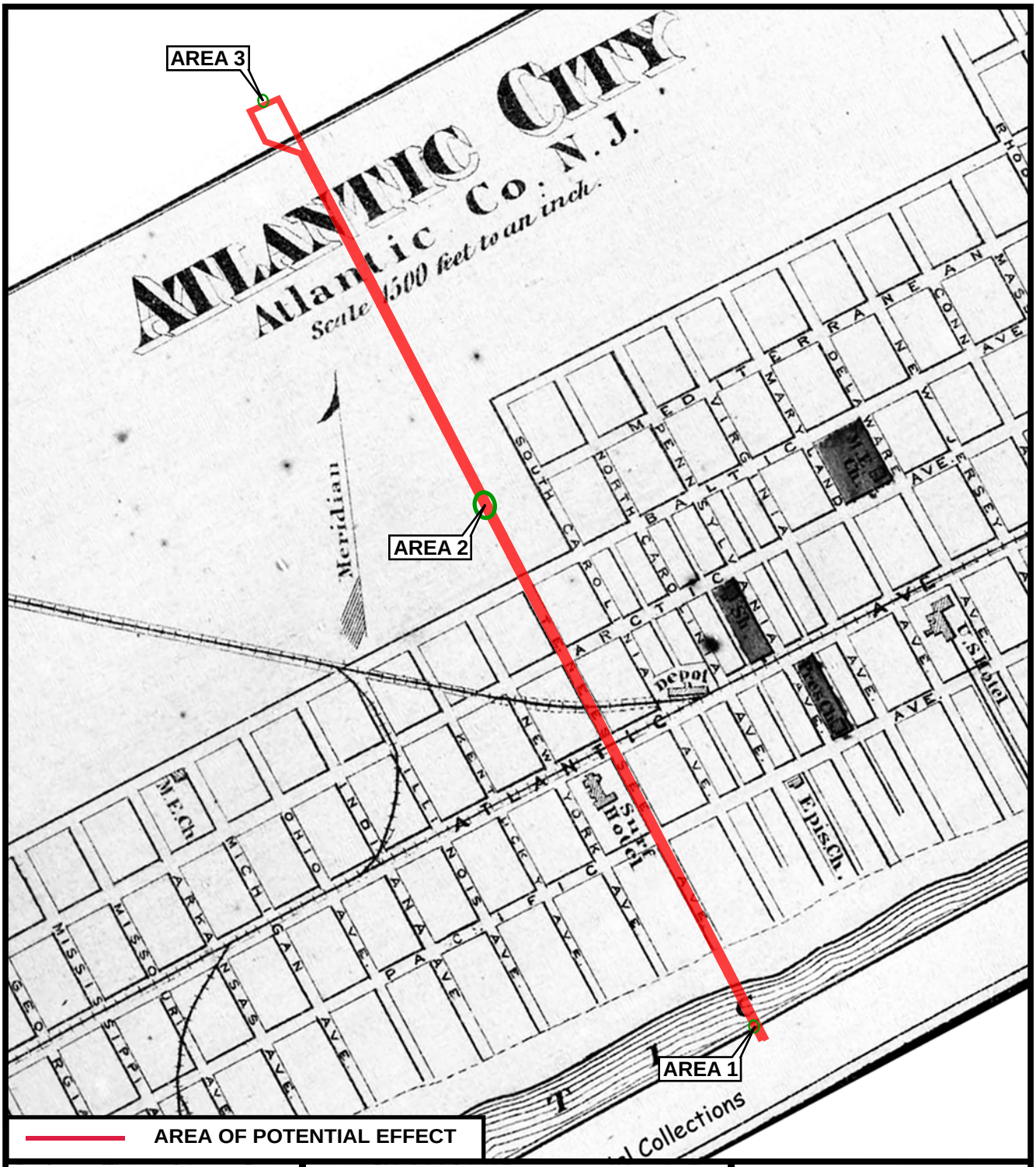
In an effort to identify historical conditions within Areas 1, 2, and 3 of the APE, CHRS, Inc. researchers examined historic maps of Atlantic City and Atlantic County published in 1872 (Beers 1872a [Figure 2]; Beers 1872b), 1878 (Woolman, Rose and Price 1878 [Figure 3]; Rose, Ruff and Woolman 1878), 1886 (Sanborn Map & Publishing Company 1886), 1888 (Geological Survey of New Jersey 1888 [Figure 4]), 1896 (Sanborn-Perris Map Company Limited 1896), 1900 (Mueller 1900 [Figure 5]), 1907 (Sanborn Map Company 1907), 1921 (Sanborn Map Company 1921), 1949 (Sanborn Map Company 1949), 1979 (Sanborn Map Company 1979), 1989 (USGS 1989), and 1990 (Sanborn Map Company 1990), as well as aerial photographs taken in 1920 (Anonymous 1920 [Figure 6]), 1933 (Anonymous 1933 [Figure 7]), 1944 (United States Army 1944 [Figure 8]), 1995 (Google Earth 1995), and 2002 (Google Earth 2002a, 2002b). The results of this historical research for each of the proposed vault locations are discussed below.

Area 1 (Southern Vault Location)

The proposed location of the southern vault (Area 1) is under the pavement of South Tennessee Avenue. The east side of South Tennessee Avenue in the vicinity of Area 1 is currently occupied by the Boardwalk National Arcade Building (a.k.a. the Boardwalk National Bank Building), a 100- by 380-foot multi-use structure built in 1925 (Wilson 1953:xiv; Appendix B, Photographs 1 and 2). The west side of South Tennessee Avenue in this vicinity is occupied by a parking lot, laid over a site formerly occupied by a succession of historic structures (Appendix B, Photograph 3), as will be described in greater detail below.

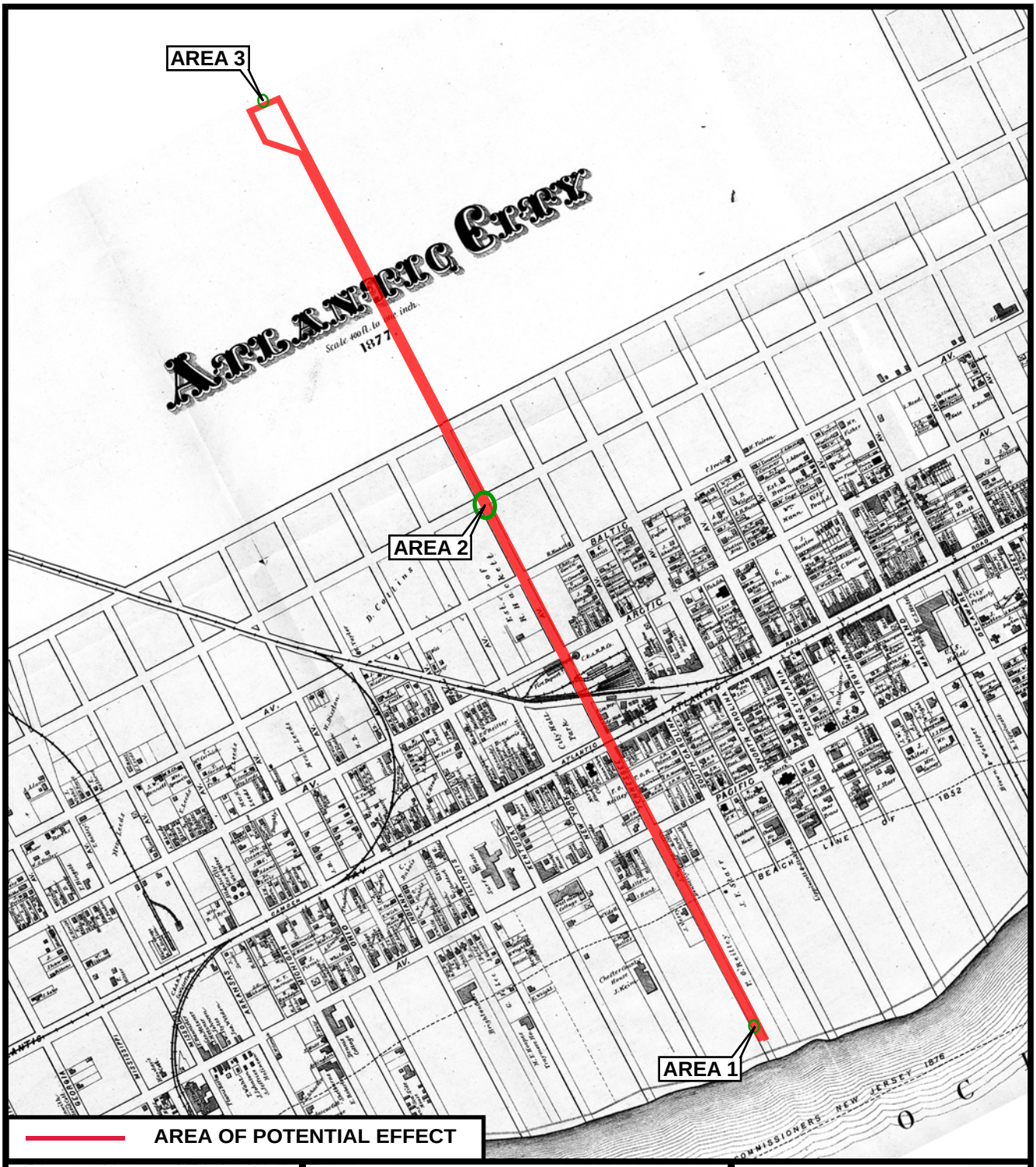
On maps of Atlantic City and Atlantic County published in 1872, Area 1 was located between 80 and 200 meters southeast of the denoted waterline, within the Atlantic Ocean (Beers 1872a [Figure 2]; Beers 1872b). Between 1872 and 1878, fill comprising mainly quartz sand and gravel was imported into this area, creating fill land extending southeastward to a new waterline approximately 150 meters southeast of Area 1 (Woolman, Rose and Price 1878 [Figure 3]; Rose, Ruff, and Woolman 1878). By 1878, Tennessee Avenue had been extended southeastward across this fill land and through Area 1 to the new shoreline. No above-ground structures were denoted on the 1878 Atlantic City maps within 200 meters of Area 1.

South Tennessee Avenue and the Boardwalk were depicted on their current alignments in the vicinity of Area 1 on an insurance map published in 1886 (Sanborn Map & Publishing Company 1886). As noted above, the larger, second Boardwalk had been installed in 1880 (Kozek 2010:n.p.). By 1886, the west side of South Tennessee Avenue was occupied in this vicinity by a one-story structure identified as “Central Baths.” The east side of South Tennessee Avenue was occupied by a one-story office building at the southern end of a long block of one-story “Bath Houses.” No utilities were denoted along South Tennessee Avenue on the 1886 map (Sanborn Map & Publishing Company 1886).



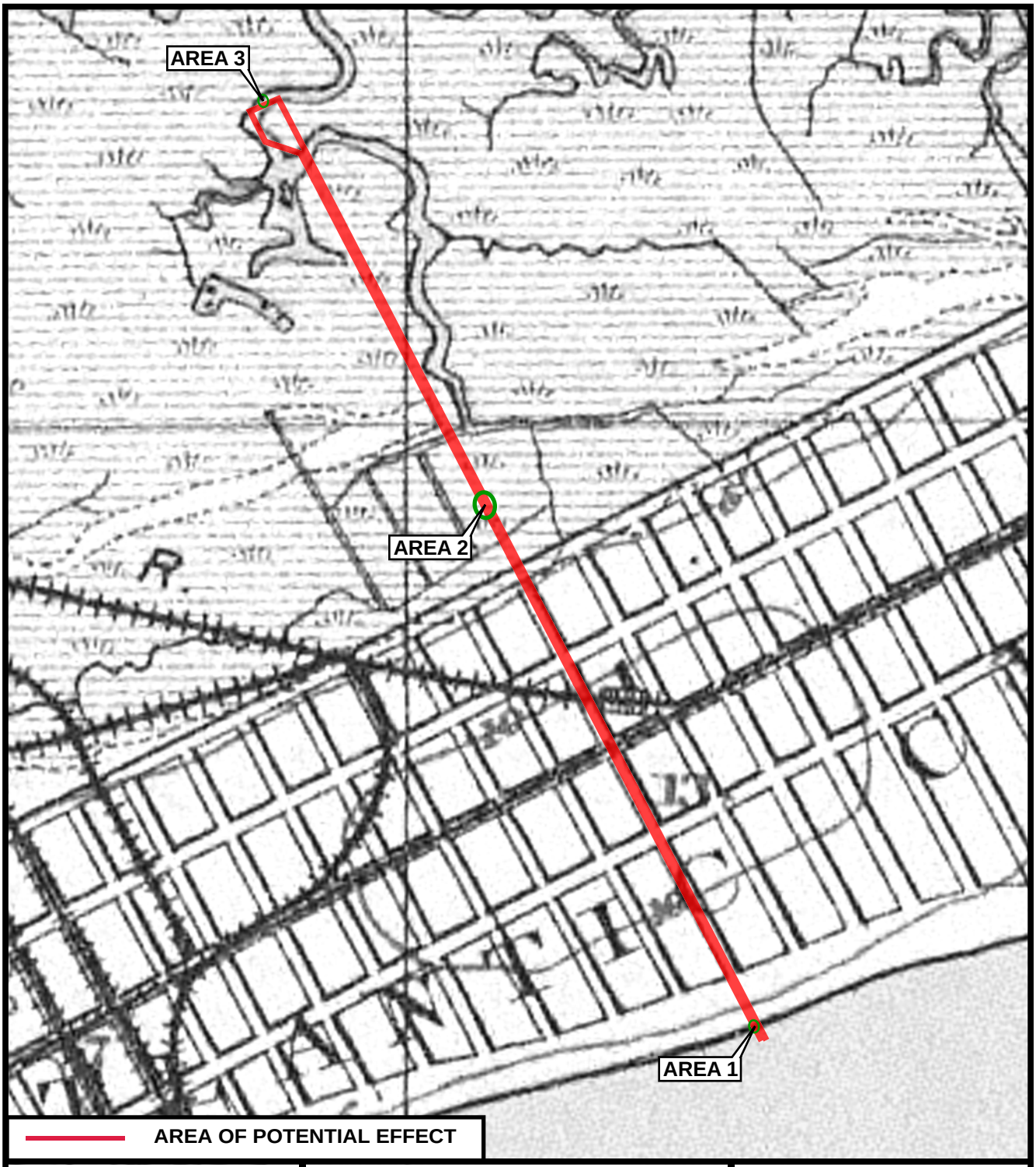
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	BEERS 1872a

PROJECT AREA CIRCA 1872 | **FIGURE 2**



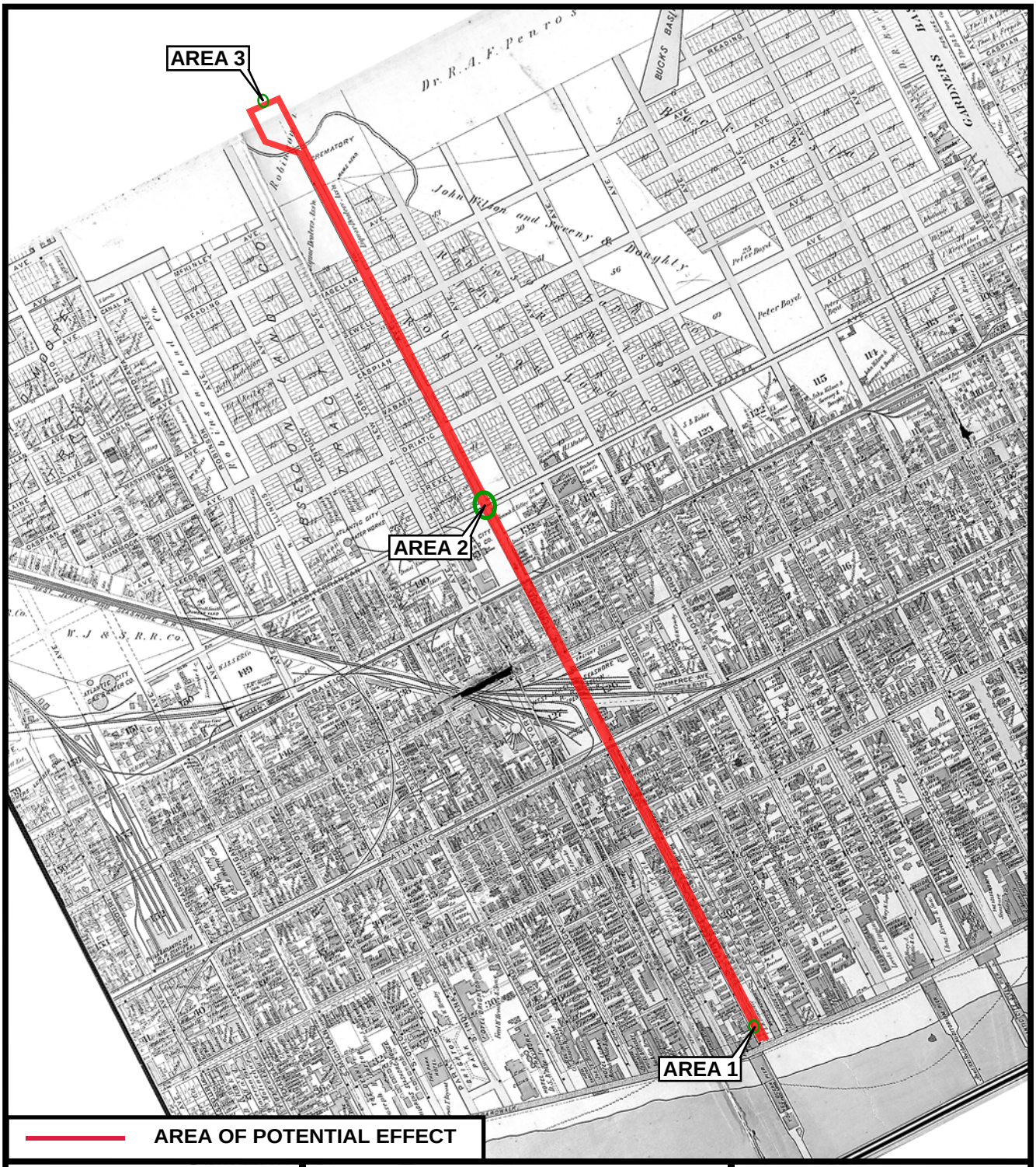
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	WOOLMAN, ROSE AND PRICE 1878

PROJECT AREA CIRCA 1878 | **FIGURE 3**



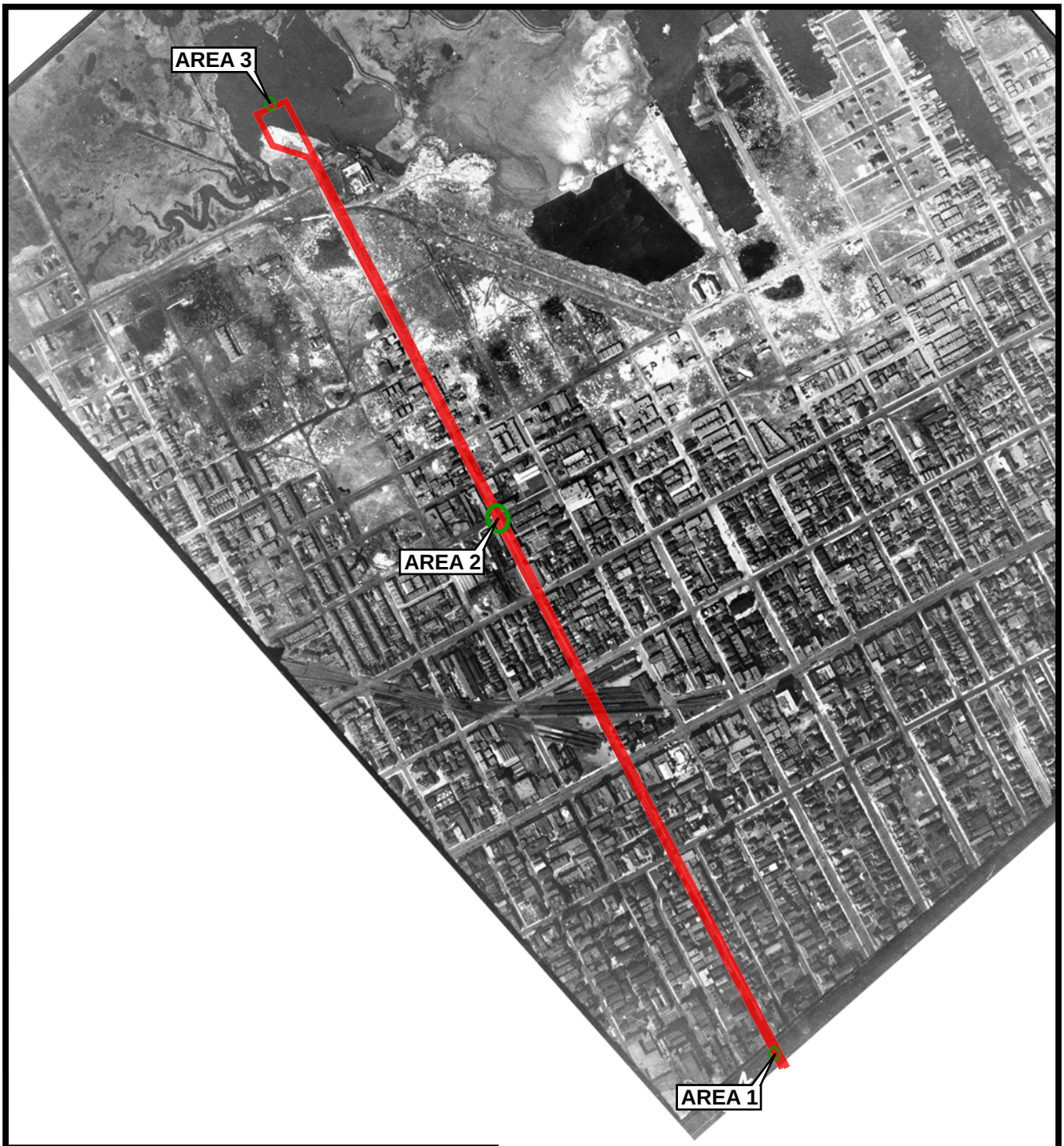
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	GEOLOGICAL SURVEY OF NEW JERSEY 1888

PROJECT AREA CIRCA 1888 | **FIGURE 4**



	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	MUELLER 1900

PROJECT AREA CIRCA 1900 | **FIGURE 5**



AREA OF POTENTIAL EFFECT

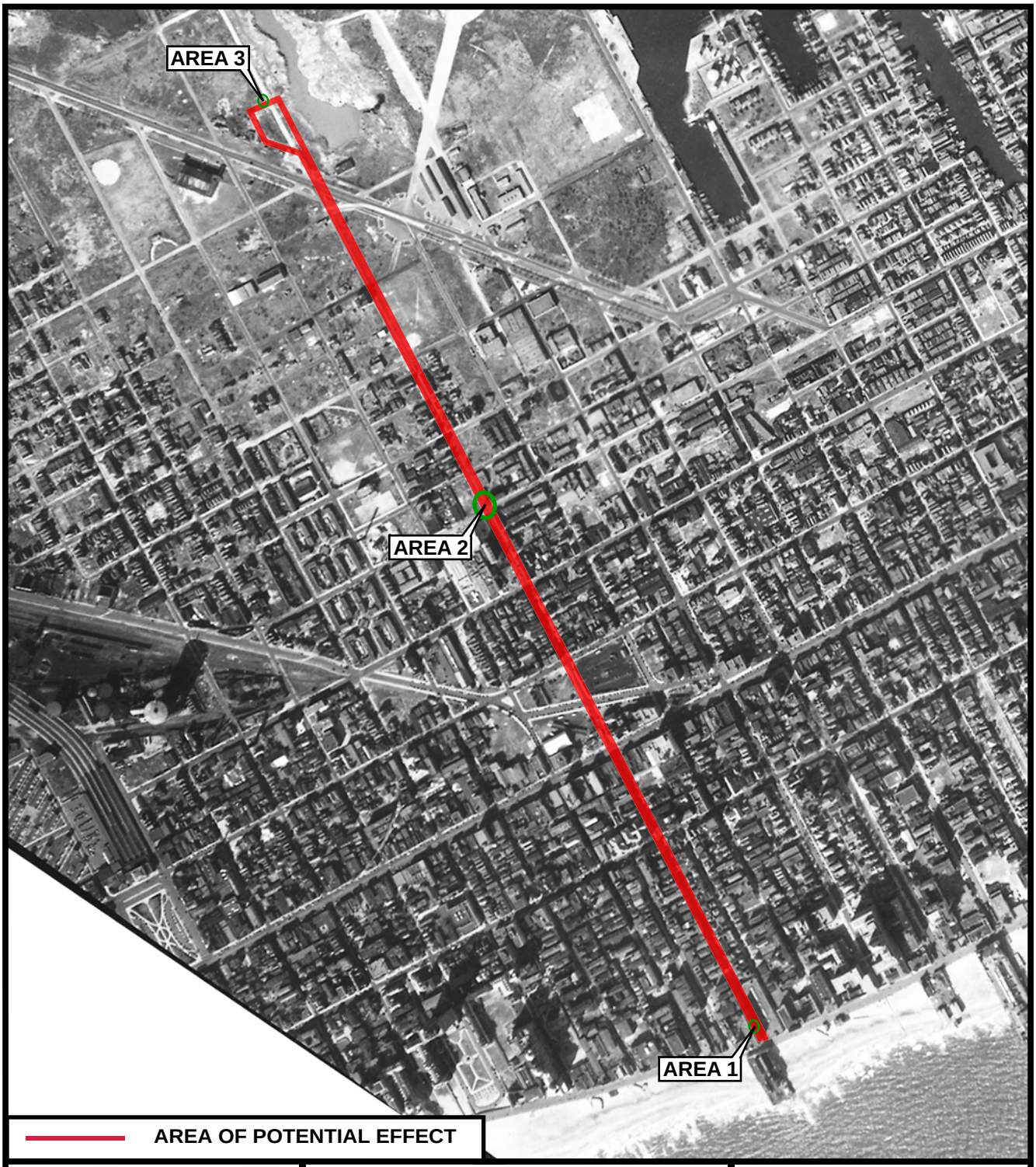
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	ANONYMOUS 1920

PROJECT AREA CIRCA 1920 | **FIGURE 6**



	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	ANONYMOUS 1933

PROJECT AREA CIRCA 1933 | **FIGURE 7**



	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	UNITED STATES ARMY 1944

PROJECT AREA CIRCA 1944 | **FIGURE 8**

Bathhouses on either side of South Tennessee Avenue in the vicinity of Area 1 were replaced by larger multi-use structures by 1896, as reflected on an insurance map published in that year (Sanborn-Perris Map Company Limited 1896). Both sides of South Tennessee Avenue were lined with three-story recreational multiplexes in 1896. A wooden "incline" had been installed for pedestrian use along the west side of South Tennessee Avenue, extending from the elevated Boardwalk approximately 40 feet northwestward, descending to street level. Along the east side of South Tennessee Avenue, a longer and more elevated "incline" had been installed for use by toboggans. A 12-inch water pipe was denoted beneath the western half of South Tennessee Avenue. As this utility had not been denoted on the 1886 map, it appears to have been installed between 1886 and 1896 (Sanborn Map & Publishing Company 1886; Sanborn-Perris Map Company Limited 1896).

The recreational multiplex on the east side of South Tennessee Avenue in the vicinity of Area 1 was removed between 1896 and 1900, as reflected on a map of Atlantic City published in the latter year (Mueller 1900 [Figure 5]). The lot formerly occupied by that multiplex was depicted on the 1900 map as vacant and owned by L.H. Donnelly. The lot lining the west side of the Avenue was occupied in 1900 by frame structures attributed to John L. Young.

By 1921, the lot adjoining the west side of South Tennessee Avenue in the vicinity of Area 1 was occupied by the six-story, brick Hotel Alamac, as noted on an insurance map published in that year (Sanborn Map Company 1921). The "basement story" of the hotel was located beneath the wooden pedestrian incline extending from the Boardwalk down to street level. The formerly vacant lot on the east side of South Tennessee Avenue was occupied in 1921 by a brick and cement building measuring approximately 50 by 200 feet, housing Child's Restaurant. A subsurface utility is denoted beneath South Tennessee Avenue. The utility was the 12-inch water pipe that had been in place since at least 1896.

In 1925, the Child's Restaurant structure on the east side of South Tennessee Avenue was razed and replaced by a 100 by 380-foot structure known as the Boardwalk National Arcade Building. In addition to accommodating multiple recreational facilities, the Boardwalk National Arcade Building also housed the Boardwalk National Bank of Atlantic City (Wilson 1953:xiv). Still standing today, the structure is also known as the Boardwalk National Bank Building (Appendix B, Photographs 1 and 2).

The large brick structure on the west side of South Tennessee Avenue in the vicinity of Area 1—identified as Hotel Alamac in 1921—was still standing in 1949, as indicated on an insurance map published in that year (Sanborn Map Company 1949). The building was identified in 1949 as the Mayflower Hotel. The Mayflower was still standing in 1978, when it was described in a *Time Magazine* article as "bedraggled" (Anonymous 1978:n.p.). Between 1978 and 1990, the building was razed, leaving a lot along the west side of South Tennessee Avenue that is presently used for parking (Sanborn Map Company 1990; Appendix B, Photograph 3).

Area 2 (Central Vault Location)

The proposed location of the central vault (Area 2) is under the pavement at the intersection of North Tennessee Avenue and Mediterranean Avenue. The northeast corner of this intersection had

been occupied by an early twentieth-century warehouse (as discussed below), but it is currently vacant (Appendix B, Photograph 4). The southeast corner of the intersection is occupied by Atlantic City Townhouse, a high-rise residential facility reportedly erected in 1980 (Appendix B, Photograph 5; Sanborn Map Company 1990). A residence built after 1995 occupies the southwest corner of the intersection, and a wholesale grocery supply building, constructed in 1964, occupies the intersection's northwest corner (Appendix B, Photographs 6 and 7; Sanborn Map Company 1979; Google Earth 1995).

No features were denoted in the vicinity of Area 2 on a map of Atlantic City published in 1872 (Beers 1872a [Figure 2]). Neither Tennessee Avenue nor Mediterranean Avenue extended into this vicinity, which was characterized as marshland on a map of Atlantic County also published in 1872 (Beers 1872b).

Between 1872 and 1877, Tennessee Avenue (or its proposed alignment) was extended northward through Area 2 to an intersection with Adriatic Avenue, as reflected on a map of Atlantic City as it existed in 1877 (; Woolman, Rose and Price 1878 [Figure 3]). During that same period, Mediterranean Avenue (or its proposed alignment) was extended westward so that it crossed Tennessee Avenue in Area 2. No features other than those roadways were depicted in or near Area 2 on this map.

No structures were depicted in or immediately adjacent to Area 2 on maps of Atlantic City published in 1886, 1888, 1896, and 1900 (Sanborn Map & Publishing Company 1886; Geological Survey of New Jersey 1888 [Figure 4]; Sanborn-Perris Map Company Limited 1896; Mueller 1900 [Figure 5]). On the 1888 map, Area 2 and its vicinity were characterized as marshland (Geological Survey of New Jersey 1888 [Figure 4]). Sometime prior to 1896, a single-track railroad was laid down the center of Mediterranean Avenue. On the 1896 map, the tracks were attributed to "W.J. & S.S. R.R." (the West Jersey and Seashore Railroad) (Sanborn-Perris Map Company Limited 1896). In May of that year, the Pennsylvania Railroad Company had consolidated all of its railroads and several smaller properties in southern New Jersey into the West Jersey and Seashore Railroad (Baer 2010:n.p.). Multiple sets of "W.J. & S.S. R.R." tracks were denoted reaching into various corners of Atlantic City by 1896 (Sanborn-Perris Map Company Limited 1896).

Between 1900 and 1906, the first structures were erected on the southeastern and northeastern corners of the North Tennessee-Mediterranean Avenue intersection, near Area 1. These developments were reflected on a 1906 insurance map of Atlantic City, published the following year (Sanborn Map Company 1907). Denoted on the southeastern corner of the intersection was a block of three-story structures, fronting on North Tennessee Avenue, and comprising dwellings, a store, and a saloon. Denoted on the northeastern corner of the intersection was a three-story "Eldredge Storage Ware Ho.," with a warehouse yard (including a railroad siding and multiple wagon sheds) to its immediate north. Four-inch water pipes were depicted running down the centers of both avenues. Mediterranean Avenue was still equipped in 1906 with a single set of West Jersey and Seashore Railroad tracks.

Structures were denoted on all four corners of the North Tennessee-Mediterranean Avenue intersection on an insurance map published in 1921 (Sanborn Map Company 1921). The former Eldridge warehouse on the northeastern corner had been replaced in 1908 (as noted on the map) by

a longer, brick warehouse, owned in 1921 by the "Eldredge Storage & Ware Ho. Co." The block of three-story structures on the southeastern corner of the intersection—six row homes bookended by stores, fronting on North Tennessee Avenue—was still standing in 1921. The southwestern corner of the intersection was occupied by a one-story "Auto[mobile] Ho[use]," flanked by a two-story garage and a one-story wagon shed. The northwestern corner of the intersection was occupied by the one-story factory of Alex E. Bass, manufacturer of children's dresses.

The structures on the southwest and northwest corners of the North Tennessee-Mediterranean Avenue intersection were razed or removed between 1921 and 1949, as reflected on an insurance map published in the latter year (Sanborn Map Company 1949). The structures on the intersection's other corners do not appear to have been significantly altered during that period.

A wholesale grocery supply building was constructed in 1964 on a lot on the northwest corner of the North Tennessee-Mediterranean Avenue intersection (Sanborn Map Company 1979). That structure is still standing in the same location (Appendix B, Photograph 7). No significant changes were effected to structures on the other three corners of the intersection between 1949 and 1979. During the following 11 years, the early twentieth-century Eldredge Warehouse structure on the northeastern corner of the intersection was razed or removed, leaving a vacant lot which currently occupies that location (Appendix B, Photograph 4; Sanborn Map Company 1979, 1990). The block of early twentieth-century dwellings and commercial establishments on the southeastern corner of the intersection was razed or removed around 1979-80, and the present high-rise residential facility known as Atlantic City Townhouse was built in the latter year (Appendix B, Photograph 5; Sanborn Map Company 1979, 1990). A two-story residence was constructed on the southwestern corner of the intersection after April 1995 (Appendix B, Photograph 6; Google Earth 1995).

Area 3 (Northern Vault Location)

The proposed location of the northern vault (Area 3) is located in the northwestern portion of an electrical substation facility bounded on the south by McKinley Avenue, on the west by the Marina Thermal complex, on the north by roadways associated with the Atlantic City Express Brigantine Connector, and on the east by vacated North Tennessee Avenue (Appendix B, Photograph 8).

This area comprised marshland bisected or partly occupied by the eastward meandering South Fork of Clam Creek from at least 1872 through 1920 (Beers 1872a [Figure 2]; Beers 1872b; Woolman, Rose and Price 1878 [Figure 3]; Rose, Ruff and Woolman 1878; Sanborn Map & Publishing Company 1886; Geological Survey of New Jersey 1888 [Figure 4]; Mueller 1900 [Figure 5]; Sanborn Map Company 1907; Anonymous 1920 [Figure 6]). Between 1920 and 1933, the area was at least partially built up on fill (Anonymous 1920 [Figure 6]; Anonymous 1933 [Figure 7]). No structures were visible within 200 feet of Area 3 on aerial photographs taken in 1920, 1933, and 1944, though the latter photograph documented the northward extension of North Tennessee Avenue along the east side of Area 3 (it has since been vacated) (Anonymous 1920 [Figure 6]; Anonymous 1933 [Figure 7]; United States Army 1944 [Figure 8]). No structures were denoted on or within 200 feet of Area 3 on insurance maps published in 1949 and 1979 (Sanborn Map Company 1949, 1979). Between March 25, 2002 and December 30, 2002—as reflected on aerial photographs taken on those two dates—all of the structures on the north side of McKinley

Avenue in the vicinity of Area 3 were razed or removed in preparation for the construction of the present Marina Thermal Building (immediately west of Area 3), roadways associated with the Atlantic City Express Brigantine Connector (immediately north of Area 3), and the present electrical substation facilities (Google Earth 2002a, 2002b).

ARCHAEOLOGICAL POTENTIAL

The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

The proposed location of the southern vault (Area 1) is under the pavement of South Tennessee Avenue. The area is disturbed. This area was filled in and Tennessee Avenue was constructed across the area in the 1870s. Utilities were constructed under Tennessee Avenue in this area beginning in the 1890s. No historic buildings or other structures other than the roadway and subsurface utilities were present that would have resulted in significant archaeological deposits in this area. Area 1 has no prehistoric or historic archaeological potential.

The proposed location of the central vault (Area 2) is under the pavement at the intersection of North Tennessee Avenue and Mediterranean Avenue. The area is disturbed. This area was characterized as a marshland in 1872 and 1888. Tennessee Avenue and Mediterranean Avenue are mapped across the area in 1877, and a railroad was built on Mediterranean Avenue in the 1890s. Buildings were erected along the roadways between 1900 and 1906 as were the first subsurface utilities. No historic buildings or other structures other than the roadway and subsurface utilities were present that would have resulted in significant archaeological deposits in this area. Area 2 has no prehistoric or historic archaeological potential.

The proposed location of the northern vault (Area 3) is located in the northwestern portion of an electrical substation facility bounded on the south by McKinley Avenue, on the west by the Marina Thermal complex, on the north by roadways associated with the Atlantic City Express Brigantine Connector, and on the east by vacated North Tennessee Avenue. The area is disturbed. This area comprised marshland bisected or partly occupied by the eastward meandering South Fork of Clam Creek through 1920 when the marshland was filled in. No historic buildings or other structures other than the roadway and subsurface utilities were present that would have resulted in significant archaeological deposits in this area. Area 3 has no prehistoric or historic archaeological potential.

SUMMARY AND RECOMMENDATIONS

This report documents the results of a Phase Ia Archaeological Survey performed for AMEC Earth & Environmental as part of the Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project in Atlantic City, Atlantic County, New Jersey (Figure 1; USGS 1994, 1995). The Area of Potential Effect (APE) for the project is located in the Coastal Plain Physiographic Province. The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

Research performed for the Phase Ia Archaeological Survey indicates that there is no prehistoric archaeological potential within the APE due to disturbances associated with utility and building construction. Historical research indicates that the APE is under existing roadways. No historic buildings or structures were formerly present within the APE. There is no historic archaeological potential. No additional archaeological research is recommended.

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APPENDIX A

QUALIFICATIONS OF RESEARCHERS

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Principal Investigator:	Kenneth J. Basalik, Ph.D.
Professional Experience:	32 years
Education:	Ph.D. Anthropology, Temple University
	M.A. Anthropology, Temple University
	B.A. Anthropology, University of Pennsylvania
Project Responsibility:	Administration, report writing and review

Senior Historian:	Philip Ruth
Professional Experience:	25 years
Education:	M.A. English, University Of New Hampshire
	B.A. English, Goshen College
Project Responsibility:	Historical research, review, analysis, and report writing

Graphic Illustrator:	Crystal Hall
Professional Experience:	2 years
Education:	Advertising Design, Hussian School of Art
	Social Services, Bucks County Community College
Project Responsibility:	Graphics preparation

Editor:	Kevin Quigg
Professional Experience:	15 years
Education:	M.A. English, Beaver College
	B.A. Communications, Temple University
Project Responsibility:	Report editing

Editor:	Maria Rossi
Professional Experience:	5 years
Education:	B.A. English with Communications, Gwynedd-Mercy College
Project Responsibility	Report editing

APPENDIX B

PHOTOGRAPHS



Photograph 1: Northward view of the front of the Boardwalk National Arcade Building, on the northeast corner of the intersection of South Tennessee Avenue and the Boardwalk.



Photograph 2: Southeastward view of the Boardwalk National Arcade Building. South Tennessee Avenue is in the foreground. Area 1 (southern vault location) is located in the lower right-hand corner of this view.



Photograph 3: Southward view of Area 1 (southern vault location) and vicinity. The Boardwalk National Arcade Building is on the left. The area west (to the right) of the visible sidewalk is occupied by a parking lot.



Photograph 4: Northeastward view of Area 2 (central vault location) and the vacant lot on the northeast corner of the North Tennessee-Mediterranean Avenue intersection.



Photograph 5: Southeastward view of Area 2 (central vault location) and the Atlantic City Townhouse (built in 1980) on the southeast corner of the North Tennessee-Mediterranean Avenue intersection.



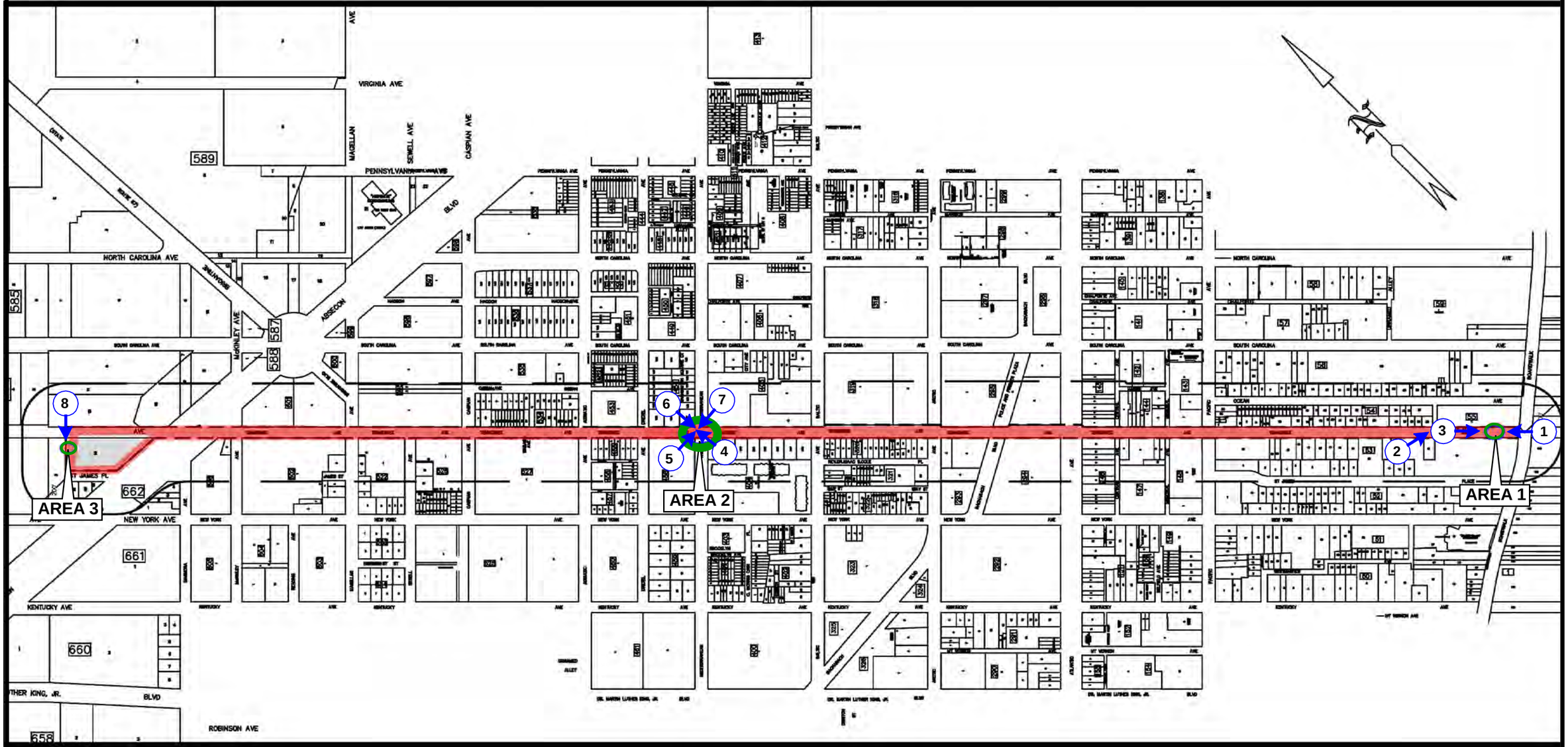
Photograph 6: Southwestward view of Area 2 (central vault location) and the dwelling built after April 1995 on the southwest corner of the North Tennessee-Mediterranean Avenue intersection.



Photograph 7: Northwestward view of Area 2 (central vault location) and the wholesale grocery supply building constructed in 1964 on the northwest corner of the North Tennessee-Mediterranean Avenue intersection.



Photograph 8: Westward view of Area 3 (northern vault location) and vicinity. The large brick building is the Marina Thermal Building, constructed in 2002 along with the electrical substation facilities visible on the left.



	SCALE	SOURCE
N	0ft 467ft 0m 142.3m *Prepared by CHRS, Inc.*	ATLANTIC CITY TAX PARCEL

AREA OF POTENTIAL EFFECT

PHOTO LOCATION

PHOTOGRAPH LOCATION MAP

VIEWSHED ANALYSIS REPORT

Fishermen's Atlantic City Windfarm, LLC
20 MW Offshore Wind Energy Project
~2.8 Miles Offshore of Atlantic City, NJ

Prepared for

Fishermen's Atlantic City Windfarm, LLC
985 Ocean Avenue
Cape May, NJ 08204

Prepared by

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July 29, 2010

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1.0 INTRODUCTION

This *Viewshed Analysis Report* has been prepared by AMEC Earth & Environmental, Inc. (AMEC) on behalf of Fishermen's Atlantic City Windfarm, LLC (FISHERMENS). This report summarizes the results of a viewshed analysis whose purpose was to determine if a nominal 20 megawatt (MW) offshore wind renewable energy facility (the "Project") within New Jersey (NJ) State waters would visually impair the viewshed from existing historic resources in the vicinity of the project. The project is the proposed development of on offshore wind farm comprising six electric generating windmills located approximately 2.8 miles off the coast from Atlantic City (see **Figure 1**). The six windmills will be supported by monopile foundations. A submarine electric transmission cable from each windmill will be linked to a single main submarine transmission cable that will make landfall at a point in Atlantic City.

Photographs were taken from various historic locations within Atlantic County NJ from Atlantic City down to Longport. Digital overlays of the precise location and size of the turbines were placed over those photographs in which at least one turbine would be seen, if constructed.

The results of this analysis show that, even from historically sensitive areas, the sight of the turbines nearly 3.0 miles offshore does not have a significant effect on the overall Atlantic County viewscape.

2.0 PROJECT DESCRIPTION AND SETTING

The following sections present an overview of the proposed Project and a general description of the geographic location and existing visual setting surrounding the Project site.

2.1 PROJECT DESCRIPTION

The reference design for this Project is the construction and operation of six, 3.6 MW Siemens turbines, oriented in one row (see **Figure 1**). The total ocean area considered as the Project area is approximately 170 acres (calculated as the perimeter around the group of six turbines (approximately 200 feet in each direction) plus a five foot width along the length of the cable route from the turbines to the shore); however, the actual portion of the area that will be physically disturbed by the placement of the turbines and cables is approximately 2.0 acres.

The six, 3.6 MW, Siemens turbines are each composed of three primary elements, a foundation, transition piece, and nacelle with three blade turbine assembly.

The turbine foundation is the base of the structure and extends from below the seabed to approximately 9 feet above the water surface. Based on geotechnical conditions, environmental loading and economic considerations, monopile foundations have been selected for this project. A single steel pile, with a diameter of approximately 16 feet and wall thickness of 2+ inches will be driven into the bottom to the required depth (approximately 150 feet). The foundation will extend 40 feet through the water column to exposure at the surface.

The transition section extends from the top of foundation (9 feet above sea level) to the turbine at approximately 295 feet. Normally for the type of turbine proposed for this project (Siemens SWT-3.6-107/120), the monopile outer diameter would be approximately 15.4 feet, and the Transition Piece (TP) which is normally connected to the monopile via a grouted connection would be approximately 16.4 feet in diameter. A boat landing for service access is located just above water level, as well as an access door to the structure interior spaces and ladder. The

transition pile interior is also used as the conduit for the electrical cable as it runs from the turbine motor to the seabed where it emerges from a "J-tube" to connection with the cabling network,

The primary wind turbine components are the nacelle, which houses the gearbox and generator, and the rotor works which include the hub and three turbine blades (see **Appendix A**). Each turbine will have a rotor diameter of approximately 394 feet and a center hub height of 295 feet above sea level. The turbines are installed on the transition pile top and will automatically rotate to orient the blades into the wind to most effectively capture energy

In array size, turbine size, and location, FISHERMEN'S believes that this 20 MW windfarm Project is relatively similar to, and can be viewed as an "offshore equivalent" of the successful five-turbine windfarm operating on the grounds of the ACUA in Atlantic City. The five turbines at the ACUA facility are currently considered to be a tourist attraction. FISHERMEN'S believes the presence of the turbines off of Atlantic City will showcase Atlantic City's and New Jersey's commitment to renewable resources and will become a symbol for the City, while located far enough offshore to not be intrusive. Most importantly, the Project will demonstrate the efficacy of the new technology and will propel New Jersey to the forefront of a new green industry.

2.2 PROJECT LOCATION AND VISUAL SETTING

The turbines would be located within State waters, approximately 2.8 miles off the coast of Atlantic City (see **Figure 2**). The proposed turbine locations were selected to maximize wind energy potential while minimizing visual impacts by orienting the turbines parallel to the shore to create a uniform appearance, and by locating them as far offshore as possible, while still remaining within State waters. Table 1.1 below presents the latitude and longitude of the proposed six turbine locations in various units.

Table 1.1
Latitude and Longitude of Major Project Components

Turbine Number/Cable location	Latitude (NAD83) (N)	Longitude (NAD83) (W)	NJ State Plane (ft) (X)	NJ State Plane (ft) (Y)	UTM Zone 18 (X)	UTM Zone 18 (Y)
1	39.2999	-74.4369	509979.27	169929.48	549070	4350509
2	39.3048	-74.4260	513053.18	171713.54	549887	4351013
3	39.3099	-74.4154	516054.26	173590.33	550709	4351518
4	39.3150	-74.4047	519078.95	175427.07	551528	4352023
5	39.3198	-74.3939	522148.68	177193.85	552345	4352526
6	39.3250	-74.3832	525152.27	179097.02	553161	4353029
Waterward extent of submarine cable	39.3250	-74.3832	525152.27	179097.02	553161	4353029

Per N.J.A.C. 7:7E-8.12, scenic resources include the views of the natural and/or built landscape. Large-scale elements of building and site design are defined as the elements that compose the developed landscape such as size, geometry, massing, height, and bulk structures. New coastal development that is visually compatible with its surroundings in terms of building and site design, and enhances scenic resources is encouraged. New coastal development that is not visually compatible with existing scenic resources in terms of large-scale elements of building and site design is discouraged.

The existing visual and aesthetic conditions in the Project area consists of open water punctuated by fishing and other vessels of various sizes. The waters off southern New Jersey are active vessel traffic areas, and the Atlantic City port serves as a hub for a large fleet of both fishing vessels and pleasure craft. The view of the turbines from the shoreline will be unobstructed, with the exception of the occasional passing vessel.

Atlantic City and Ocean City (just south of Atlantic City) are located on barrier beach islands separated from the mainland by estuarine wetlands. The cities are both densely developed, with

some tall buildings. Most of the barrier beach between them (including Chelsea Heights, Ventnor City, Margate City, and Longport), and beyond them to the north (Brigantine) and south (Strathmere), is also developed. This developed barrier beach effectively blocks most views of the ocean from further inland in the vicinity of the Project.

3.0 VIEWSHED SITE SELECTION

AMEC visited the NJ State Historic Preservation Office (SHPO) on January 26, 2010 in order to develop a list of sites that are present on the National and/or State Register of Historic Places from Brigantine, NJ down to Longport, NJ. The sites from that list that finally chosen for inclusion in the viewshed project were selected due to their close proximity to the ocean (within 500 feet) or their public appeal and vantage point of the shore area. The original list of sites included the following:

1) Church of the Redeemer – Longport, NJ (National and State registered)
2) Great Egg Coast Guard Station – Longport, NJ (National and State registered)
3) Lucy the Margate Elephant – Margate City, NJ (National and State registered)
4) John Stafford Historic District – Ventnor City, NJ (National and State registered)
5) Raphael-Gordon House – Atlantic City, NJ (State registered)
6) The Strand and Marine Apartments – Atlantic City, NJ (State registered)
7) Atlantic City Convention Hall – Atlantic City, NJ (National and State registered)
8) Warner Theater (façade) – Atlantic City, New Jersey (State registered)
9) Shelburne Hotel – Atlantic City, New Jersey (National and State registered)
10) Holmhurst Hotel – Atlantic City, NJ (National and State registered)
11) Morton Hotel – Atlantic City, NJ (National and State registered)
12) Absecon Lighthouse – Atlantic City, NJ (National and State registered)

Upon further research into the individual sites, it was discovered that the three hotels in Atlantic City (Shelburne Hotel, Holmhurst Hotel, and Morton Hotel) have all been demolished and are no longer in existence. The Holmhurst Hotel was demolished in March 1985 (see **Appendix B**). No dates of demolition were available for the other two buildings.

Based upon the above information, the field evaluation was limited to the nine places still in existence from the original list (see **Figure 3**).

4.0 VIEWSHED SITE EVALUATIONS

On March 9 and 19, 2010, AMEC visited the nine selected locations based on the SHPO review. At each location, the closest and/or highest vantage point was selected to take photographs facing the direction in which the turbines will be located. At least two or three photos were taken towards the ocean in order to fully cover the entire viewscape in the direction of the turbines.

Each of the photographs was then digitally overlaid with a depiction of the turbines, documenting exactly how they would appear from those vantage points. Once that was completed, it was determined that the following places were the only ones from the original list in which the turbines would be visible:

1) The John Stafford Historic District
2) The Raphael-Gordon House
3) The Strand and Marine Apartments
4) The Atlantic City Convention Hall
5) The Warner Theater (façade); and
6) The Absecon Lighthouse

Details regarding each of these locations are provided in the following sections.

It should be noted that Lucy the Margate Elephant was closed for the season so a photo from the top level (approximately two stories high) could not be taken. However, photos from the base of the elephant and from the snack shop located between Lucy and the ocean were taken. The turbines will be blocked from view at the snack shop by another building located next door, and the view of the turbines from the bottom of the elephant is completely shielded by multiple buildings and other tall structures. Therefore, it was determined that the turbines will most likely not be visible from the top of Lucy the Margate Elephant and this site was not investigated further.

4.1 THE JOHN STAFFORD HISTORIC DISTRICT

The John Stafford Historic District is comprised of four city blocks along the eastern border of Ventnor City, NJ (see **Figure 4**). The streets contained within this district include South Austin Avenue, South Marion Avenue, South Baton Rouge Avenue, and South Vassar Square.



View of S. Baton Rouge Avenue – facing northwest

Although this area is listed as a National and State Historic District, there were no obvious signs along the boardwalk declaring it as such. In addition, the houses within the district appeared to be older homes mixed in with more recent and modern construction. It is not expected that visitors to Atlantic City would be attracted to this area. The only good vantage point of the

ocean within this district is from the boardwalk lining the southeast border. It is from the boardwalk at the end of each of the four streets in which the field photographs were taken.

4. 2 THE RAPHAEL-GORDON HOUSE

This house is located at 118 South Newton Street, just within the western border of Atlantic City, NJ (see **Figure 4**). It is nestled within a residential area with no obvious signage from the street. A small plaque located next to the front door is the only sign indicating the name of the house.



View of the Raphael-Gordon House – facing west

The property is privately owned by the Raphel and Gordon Families. It is not open to the public; however, one of the owners, Murry Raphel, will invite people in for tours if they are interested.

It is unlikely that visitors to Atlantic City would specifically come to visit this house. The only good vantage point of the ocean was from the second story balcony in the southeast corner of the house or from the furthest southeast corner of the property. It is from these two locations in which the field photographs were taken.

4. 3 THE STRAND AND MARINE APARTMENTS

The former Strand and Marine Apartments complex buildings are located at 3821- 3825 Boardwalk Avenue in Atlantic City, NJ (see **Figure 4**). The buildings are currently vacant and boarded up. In addition, a "for sale" sign is hanging in front of one of them.

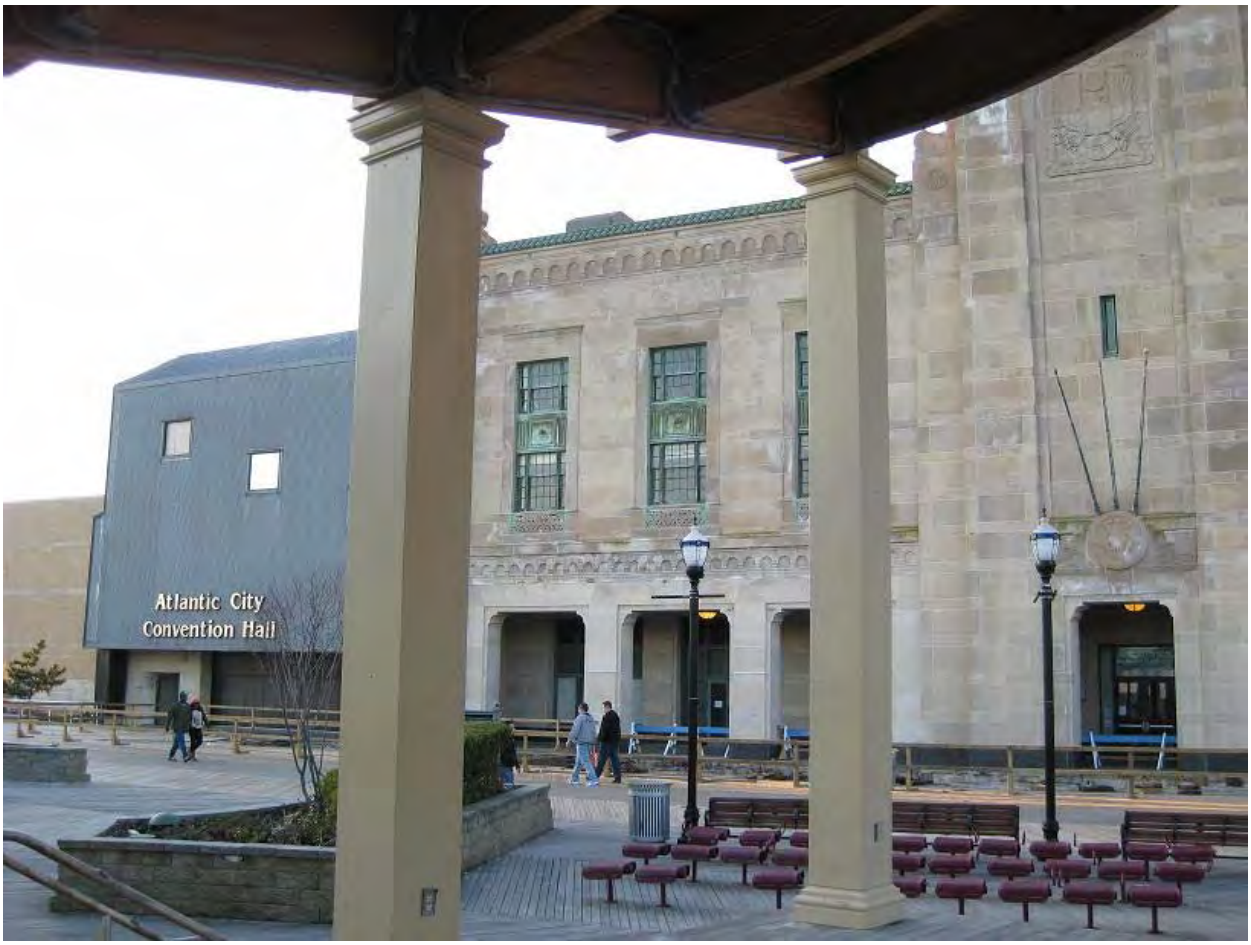


View of the Strand and Marine Apartments – facing north

It is very unlikely that visitors to Atlantic City would be interested in visiting this site. The best vantage point of the ocean that was accessible to the public was from the boardwalk adjacent to the southeast sides of the buildings. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

4.4 THE ATLANTIC CITY CONVENTION HALL

The Atlantic City Convention Hall is located at 2301 Boardwalk, Atlantic City, NJ (see **Figure 5**). The building is no longer being used as a convention hall. It is currently named "Atlantic City Boardwalk Hall" and is the home to various sporting and concert events.



View of the Atlantic City Convention Hall – facing northwest

According to their website *(*www.boardwalkhall.com), approximately 33 million people visit the arena each year, the majority of whom are assumed to be visiting specifically for the entertainment held within the building. The best vantage point of the ocean that was accessible to the public without a ticket to an event was from the open air stage adjacent to the southeast side of the building. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

4.5 THE WARNER THEATER (FAÇADE)

The Warner Theater façade is located along the boardwalk, between Michigan and Arkansas Avenues, Atlantic City, NJ (see **Figure 5**). The outer façade, which used to be the original entrance, is the only existing portion of the former theater. The much larger auditorium was demolished in 1960 (see **Appendix C**).



View of the Warner Theater (façade) – facing northwest

The façade now is part of the Bally's Wild West Casino. It is unlikely that visitors to the casino would specifically come to visit this façade. The ocean was visible from the boardwalk in front of the site. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

4.6 THE ABSECON LIGHTHOUSE

The Absecon Lighthouse is located at 31 South Rhode Island Avenue, Atlantic City, NJ (see **Figure 6**). This is the only historic place on the list that was not located within 500 feet of the ocean. It was chosen due to the fact that the observation deck is available to the public which provides a birds-eye view of the surrounding area.



View of the Absecon Lighthouse – facing southwest

According to their staff, approximately 20,000 people visited the lighthouse last year. They also stated that tourism to the lighthouse has been increasing each year and has nearly doubled in the last five years. The best vantage point of the ocean was from the observation deck over 160 feet in the air along the southern and southeastern sides of the tower. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

5.0 VIEWSHED RESULTS

The following sections summarize the results of the turbine overlays from each of the historical sites in which the turbines would be visible.

5.1 THE JOHN STAFFORD HISTORIC DISTRICT

The viewscape from the boardwalk at the end of all the streets associated with the John Stafford Historic District includes various structures typically seen along the NJ shore. High dunes and dune fencing, boardwalk associated railings and signs, lifeguard stations, and light poles are all visible (see **Appendix D, photos 1, 3, 5, 7, 9, 11, 13, and 15**). The turbines will be visible from the boardwalk at the end of each street, however the size of the turbines that far off the coast will appear to be smaller than many of the surrounding structures, including the life guard stations (see **Appendix D, photos 2, 4, 6, 8, 10, 12, 14, and 16**). In addition, it is believed that the turbines would not be visible from street level within the district; that the only observation point for the turbines is from the boardwalk which is just outside the district boundary.

5.2 THE RAPHAEL-GORDON HOUSE

The viewscape from the second story balcony of the Raphael-Gordon House (which is only accessible to the public upon a request to the owner) includes portions of another two-story building nearby and a large evergreen tree to the east (see **Appendix D, photo 17**). Only two turbines will be visible from the balcony; however, the size of the turbines that far off the coast will appear to be smaller than the surrounding building and tree (see **Appendix D, photo 18**).

The viewscape from the street level at the Raphael-Gordon House includes portions of another two-story building nearby, large evergreen tree trunks, high dunes, a light pole, and the adjacent roadway (see **Appendix D, photo 19**). Although four turbines will be visible from the street, the view of two of them is almost entirely blocked by the high dunes. Again, the size of the turbines

that far off the coast will appear to be smaller than the surrounding building, lightpole, and trees (see **Appendix D, photo 20**).

5.3 THE STRAND AND MARINE APARTMENTS

The viewscape from the boardwalk in front of the former Strand and Marine Apartment complex includes various structures typically seen along the NJ shore. High dunes and dune fencing, boardwalk associated railings, a pavilion, and light poles are all visible (see **Appendix D, photos 21 and 23**). Although the turbines will be visible from the boardwalk in front of the buildings, the majority of the turbine structures will be hidden by the high dunes in that area (see **Appendix D, photos 22 and 24**).

5.4 THE ATLANTIC CITY CONVENTION HALL

The viewscape from the stage in front of the Atlantic City Convention Hall building includes various pillars associate with the roof of the stage and high dunes typically seen along the NJ shore (see **Appendix D, photos 25, 27, and 29**). Although the turbines will be visible from the stage, the size of the turbines that far off the coast will appear to be much smaller than surrounding pillars (see **Appendix D, photos 26, 28, and 30**).

5.5 THE WARNER THEATER (FAÇADE)

The viewscape from the boardwalk in front of the Warner Theater façade includes structures typically seen along the NJ shore. High dunes and dune fencing, boardwalk associated railings and other public structures, a pier with large billboards attached to the side towards the south, light poles, and a life guard station are all visible (see **Appendix D, photos 31, 33, and 35**). Although the turbines will be visible from the boardwalk in front of the façade, the majority of turbine bases will be hidden by the high dunes in that area (see **Appendix D, photos 32, 34, and 36**). In addition, the size of the turbines that far off the coast will appear to be much smaller in comparison to many of the surrounding structures.

5.6 THE ABSECON LIGHTHOUSE

The viewscape from the Absecon Lighthouse public observation deck includes many structures typically seen within Atlantic City, NJ. Many high-rise buildings and smaller housing units, streets, parking lots, and construction equipment are all visible (see **Appendix D, photo 37**). Only one turbine will be visible from the observation deck of the Absecon Lighthouse; however, the size of the turbines that far off the coast will appear to be smaller than the surrounding buildings (see **Appendix D, photo 38**).

6.0 CONCLUSION

Based upon the photographs generated with the overlying depiction of the turbines and their respective size and location in relation to the various historically sensitive areas investigated as a part of this viewshed analysis, the conclusion is that the views of the turbines will not negatively affect the viewscape. The turbines will only be visible from six National and/or State Registered Historic Places between Ventnor City and Atlantic City, NJ. In all of these locations, the turbines in the horizon will appear as structures that will be much smaller in comparison to surrounding structures.

While not associated with the Viewshed Analysis, it is important to note that a public survey conducted by the William J. Hughes Center for Public Policy on behalf of FISHERMEN'S (see **Appendix E**) suggested that the potential view of the proposed project was not seen as an issue by the general public. The executive summary of their report reads as follows:

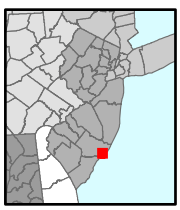
> *In preparation for a proposed wind turbine project approximately three miles off the Atlantic City, New Jersey shoreline, Fishermen's Energy, LLC, approached the William J. Hughes Center for Public Policy at The Richard Stockton College of New Jersey and asked that we undertake a statistically significant polling project that would measure attitudes and issues of both residents and visitors to the area. The intent was to:*
>
> 1. *Submit a specific project plan to the respondents;*
> 2. *Observe if there would be any substantial positive or negative impact on the area's tourism industry and/or the quality of life for residents;*
> 3. *Contrast where applicable the attitudes measured in a 2006 survey undertaken by the State of New Jersey Department of Commerce and note any changes.*
>
> *Following is a brief summary of the findings:*
>
> - *90% of the respondents were aware that electricity could be produced by using offshore wind turbines*

- *Support for a wind turbine project three miles off the Atlantic City shore is strong among all subgroups and almost 30 percentage points higher than a similar question asked in 2006*
- *Most respondents do not feel that this project would have a negative impact on Atlantic City and the local environment. In fact, 66% thought it would have a positive impact.*
- *More than three-quarters of the visitors said it would have no effect on whether or not they would visit the Atlantic City area and another 19% said that they would be a little or a lot more likely to visit the area.*

Based on those results, FISHERMEN'S believes that this 20 MW windfarm Project will be more likely to attract tourists, similar to the effect of the five-turbine windfarm operating on the grounds of the ACUA in Atlantic City. FISHERMEN'S believes the presence of the turbines off of Atlantic City will showcase Atlantic City's and New Jersey's commitment to renewable resources and will become a symbol for the City, while located far enough offshore to not be intrusive.

Figures





0 0.15 0.3 0.6 0.9 1.2 1.5 Miles

Legend

- Proposed cable route
- Proposed turbine locations
- (S) Huron substation

N W E S

DATA SOURCE: United States Geological Survey Quadrangles: Oceanville, New Jersey 1989; Atlantic City, New Jersey 1989

amec Earth & Environmental

Figure 1
Site Location Map
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey

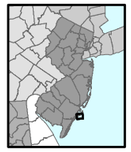
Reviewed By: PP	Contract Number: 7-7523-0002	April 2010

amec Earth & Environmental

Figure 2

Site Plans
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey

Reviewed By: CH	Contract Number: 7-7523-0002	Revised April 2010



Legend

- Proposed turbine locations
- Landfall location
- Huron substation
- Installation changeover point
- Proposed buoy location
- Proposed cable route - Horizontal directional drilling (HDD) installation
- Proposed cable route - Jet-plow installation

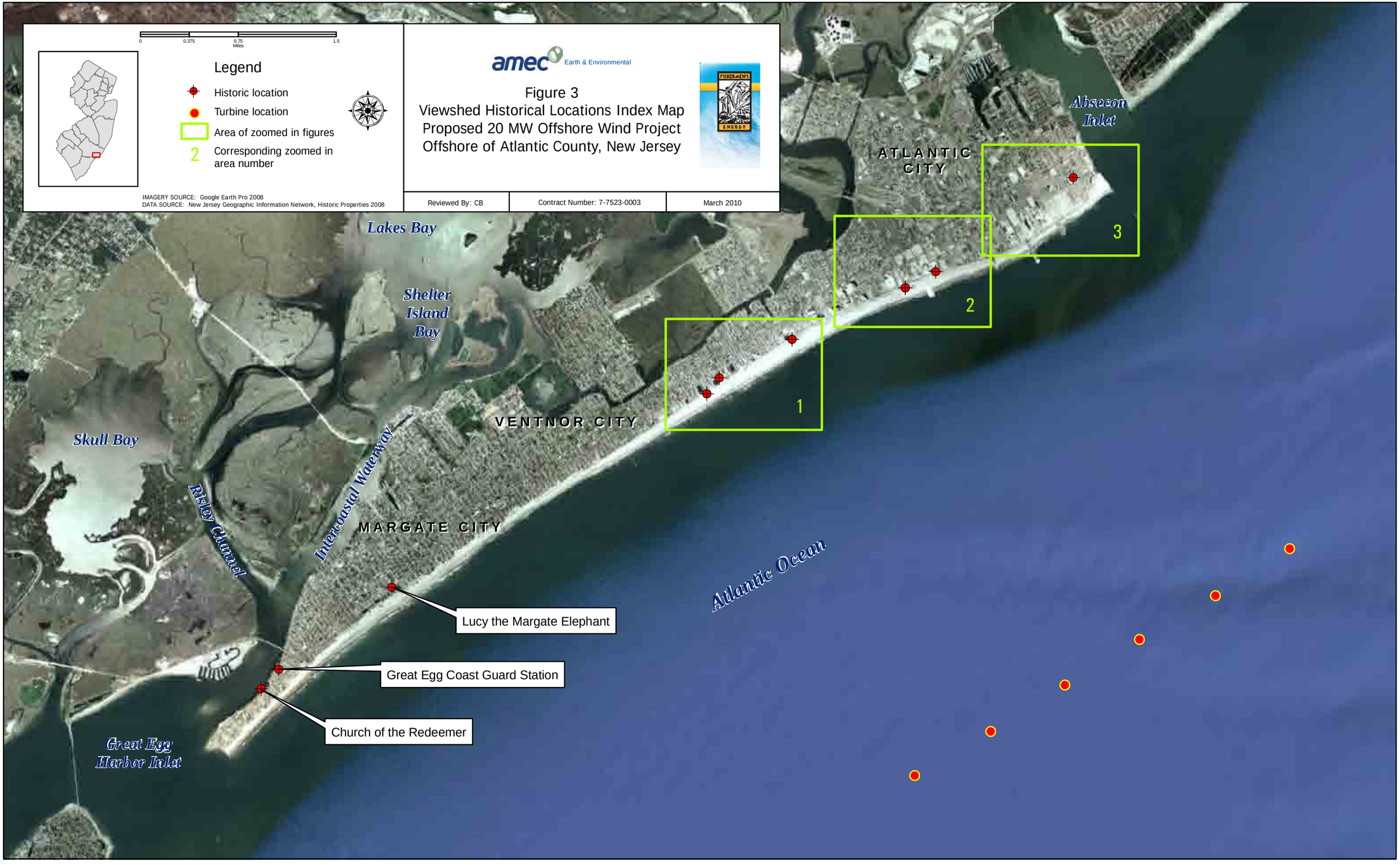
N W E S

Data source: Google Earth Pro 2009; 2009 Digital Globe; United States Geological Survey; United States Department of Agriculture; National Oceanic and Atmospheric Administration 2009.

Feature	Latitude (N)	Longitude (W)	State Plane NJ ft (X)	State Plane NJ ft (Y)	UTM Zone 18 (X)	UTM Zone 18 (Y)
Wind Turbine 1	39.2999	-74.4369	509979.27	169929.48	549070	4350509
Wind Turbine 2	39.3048	-74.4260	513053.18	171713.54	549887	4351013
Wind Turbine 3	39.3099	-74.4154	516054.26	173590.33	550709	4351518
Wind Turbine 4	39.3150	-74.4047	519078.95	175427.07	551528	4352023
Wind Turbine 5	39.3198	-74.3939	522148.68	177193.85	552345	4352526
Wind Turbine 6	39.3250	-74.3832	525152.27	179097.02	553161	4353029
Buoy location	39.3124	-74.4036	519404.95	174472.04	551418	4351610
Landfall location	39.3559	-74.4239	513630.63	190331.03	549631	4356433
Installation changeover location	39.3509	-74.4216	514302.15	188493.92	549839	4355874

Miles 0 0.125 0.25 0.5 0.75 1

Feet 0 1,250 2,500 5,000 7,500 10,000


0
0.375
0.75
Miles
1.5
Legend
Historic location
Turbine location
Area of zoomed in figures
2
Corresponding zoomed in area number
IMAGERY SOURCE: Google Earth Pro 2008
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Figure 3
Viewshed Historical Locations Index Map
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
Reviewed By: CB
Contract Number: 7-7523-0003
March 2010
Absecon Inlet
ATLANTIC CITY
Lakes Bay
Shelter Island Bay
VENTNOR CITY
Skull Bay
Risley Channel
Intercoastal Waterway
MARGATE CITY
Atlantic Ocean
Lucy the Margate Elephant
Great Egg Coast Guard Station
Church of the Redeemer
Great Egg Harbor Inlet
1
2
3


Intercoastal Waterway Inside Thorofare
Atlantic Ocean
WINCHESTER AVE
RALEIGH AVE
BARTRAM PL
KINGSTON AVE
TALLAHASSEE AVE
CLAYHAGY AVE
DELANCY PL
RICHMOND AVE
ELBERON AVE
DOVER AVE
RIDGEWAY AVE
ANNAPOLIS AVE
LINCOLN PL
ROOSEVELT PL
The Strand and Marine Apartments
NEWTON AVE
ABERDEEN PL
ATLANTIC AVE
PLAZA PL
BERKLEY SQ
BOARDWALK
CALLENDER AVE
OAKLAND AVE
HILLSIDE AVE
MARION AVE
AUSTIN AVE
BATON ROUGE AVE
JACKSON AVE
VASSAR SQ
Raphael-Gordon House
John Stafford Historic District
FRANKFORT AVE
WEYMOUTH AVE
LITTLE ROCK AVE
VICTORIA AVE
SURREY AVE
AMHERST AVE
NASHVILLE AVE
OAKLAND AVE
0
250
500
1,000
Feet
Legend
Historic location
Historic district
IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Viewshed Historical Locations - Area 1
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
FISHERMEN ENERGY
Reviewed By: CB
Contract Number: 7-7523-0003
March 2010


Intercoastal Waterway
TURNPIKE RD
NEVADA AVE
ARIZONA AVE
FAIRMOUNT AVE
GEORGIA AVE
ARCTIC AVE
ATLANTIC AVE
CALIFORNIA AVE
TEXAS AVE
BRIGHTON AVE
MORRIS AVE
IOWA AVE
BELMONT AVE
BELLEVUE AVE
FLORIDA AVE
PACIFIC AVE
Atlantic City Convention Hall
MISSISSIPPI AVE
COLUMBIA PL
MISSOURI AVE
ARKANSAS AVE
MICHIGAN AVE
OHIO AVE
INDIANA AVE
DR MARTIN LUTHER KING BLVD
ST JAMES PL
TENNESSEE AVE
OCEAN AVE
Warner Theatre (facade)
BOARDWALK
Atlantic Ocean
0
250
500
1,000
Feet
Legend
Historic location
IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Viewshed Historical Locations - Area 2
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
FISHERMEN'S ENERGY
Reviewed By: CB
Contract Number: 7-7523-0003
March 2010

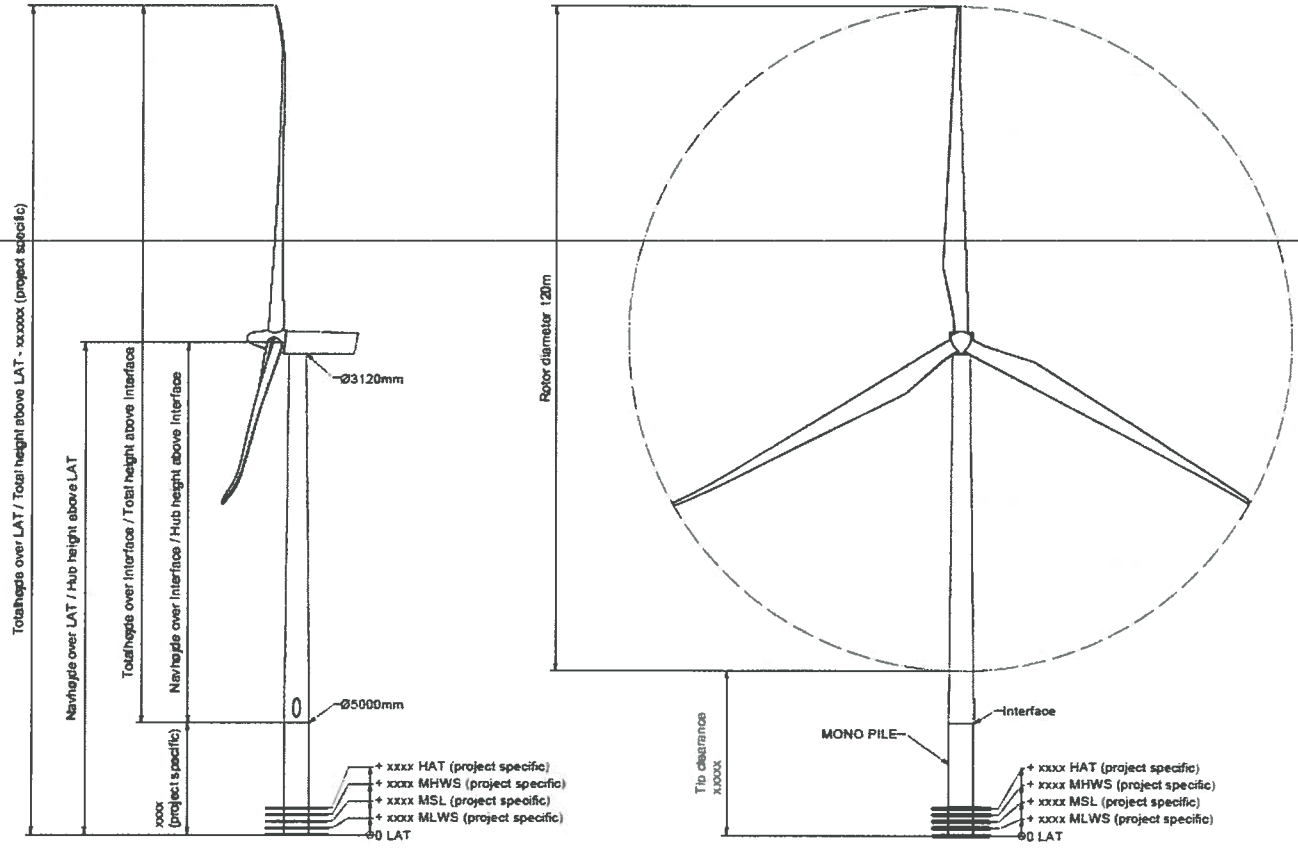

Absecon Lighthouse
Atlantic Ocean
MASSACHUSETTS AVE
ATLANTIC AVE
PENNSYLVANIA AVE
DEWEY PL
ORIENTAL AVE
VERMONT AVE
RHODE ISLAND AVE
SEASIDE AVE
VICTORIA AVE
METROPOLITAN AVE
CONNECTICUT AVE
NEW JERSEY AVE
DELAWARE AVE
STATES AVE
MARYLAND AVE
VIRGINIA AVE
MANSION AVE
SOUTH CAROLINA AVE
OCEAN AVE
TENNESSEE AVE
ST JAMES PL
0
250
500
1,000
Feet
Legend
Historic location
IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Viewshed Historical Locations - Area 3
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
FISHERMEN'S ENERGY
Reviewed By: CB
Contract Number: 7-7523-0003
March 2010

Appendix A

Turbine Information

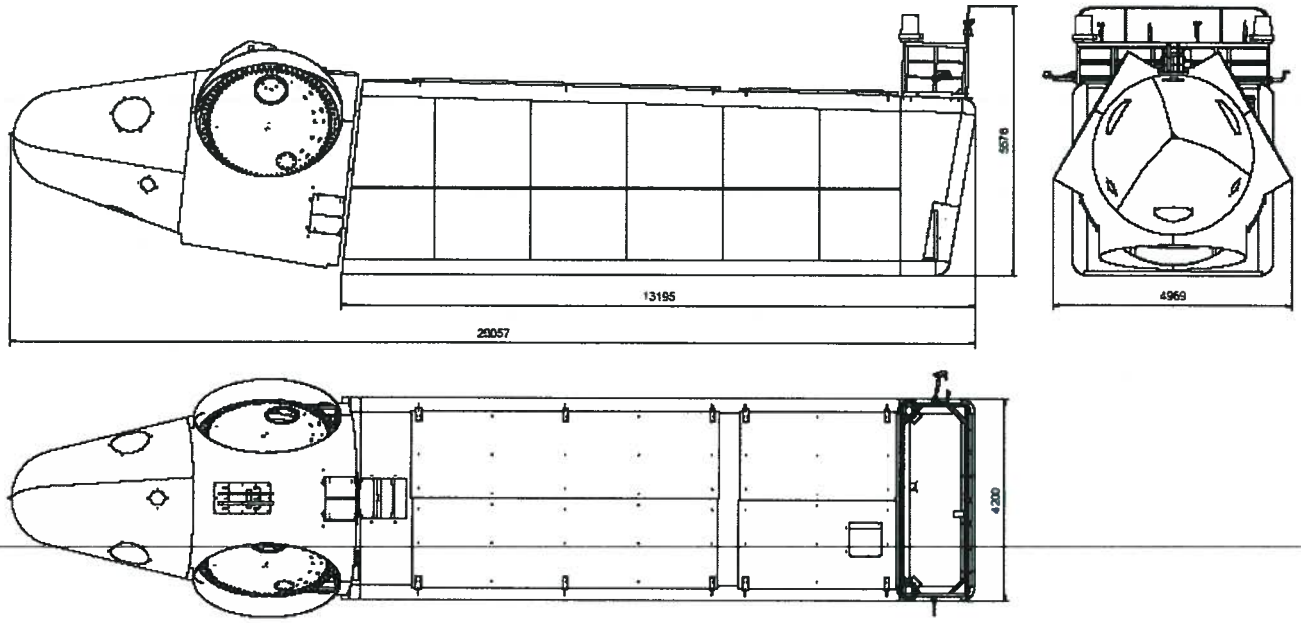
SWT-3.6-120, Offshore
Outside Dimensions and Weights

The following data regarding weights and dimensions of the SWT-3.6-120 wind turbine is generic and as such for information only.

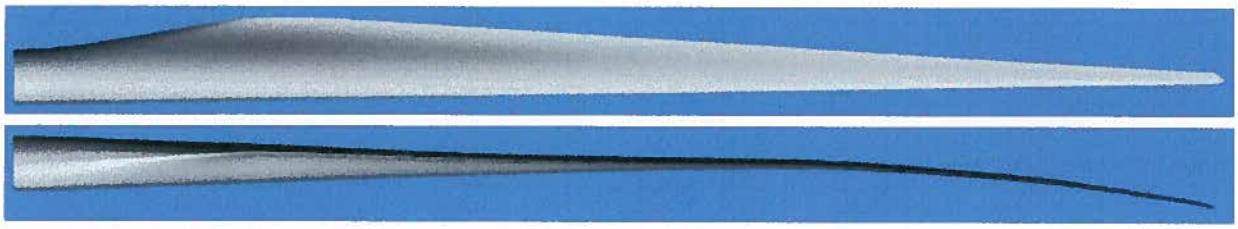


Elevation, SWT-3.6-120

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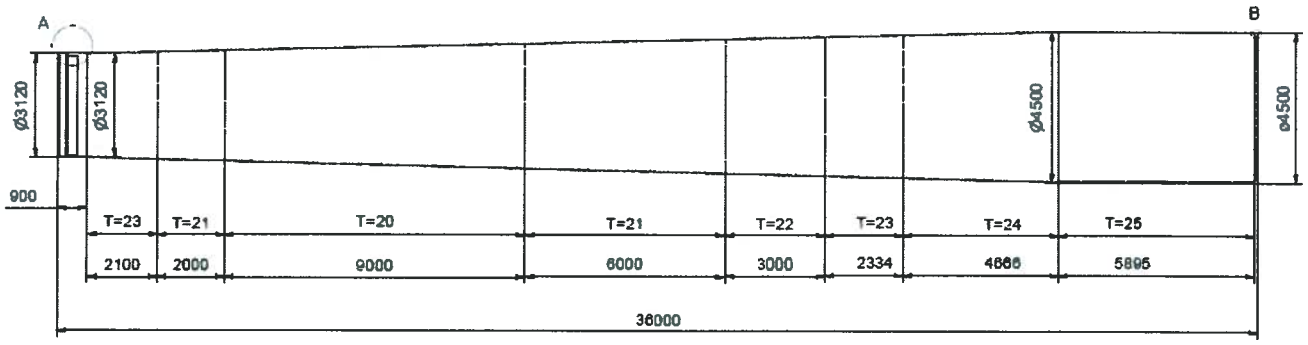


Nacelle and Hub, SWT-3.6-120
Weight app. 185 t without transport frame and lifting equipment

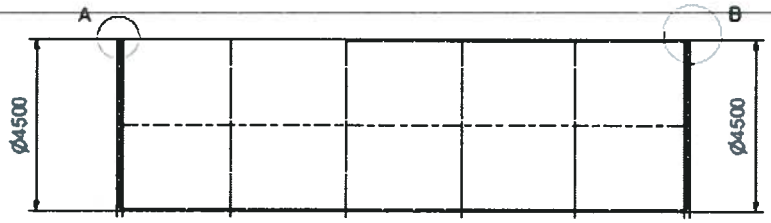


Blade B58, SWT-3.6-120
Length: 58.8 m, root diameter: 2.5 m, width: 4.2 m.
Weight app. 18 t (Weight of blade is without transport frame and lifting equipment)

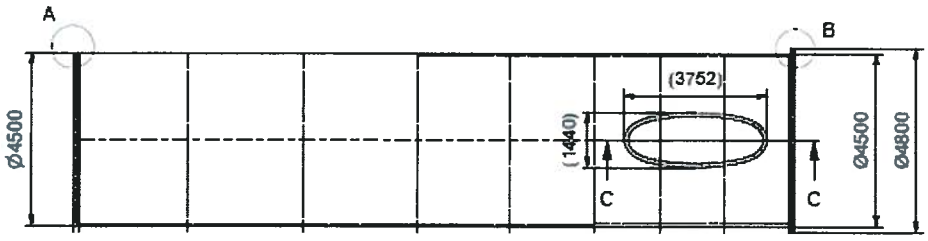
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Tower Top Section, SWT-3.6-120
Length: 36 m. Generic weight: app. 80 t without transport frame and lifting equipment
As towers are site specific, the weight may vary from the a.m.



Tower Intermediate Section, SWT-3.6-120
Length: 12.55 m. Generic weight: app. 50 t without transport frame and lifting equipment
As towers are site specific, the weight may vary from the a.m.



Tower Bottom Section, SWT-3.6-120
Length: 17.5 m. Generic weight: app. 95 t without internals, transport frame and lifting equipment
As towers are site specific, the weight may vary from the a.m.

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Appendix B

Atlantic County - New Jersey and National Registers of Historic Places

Atlantic County

Absecon City

Captain Francis Babcock House (ID#172)
324 South Shore Road
NR: 7/28/1999 (NR Reference #: 99000907)
SR: 5/27/1999

Camden and Atlantic Railroad Historic District (ID#3862)
Railroad right-of-way from Pensauken and Camden to Atlantic City
SHPO Opinion: 9/17/2001
See Main Entry / Filed Location:
Atlantic County, Atlantic City

John Doughty House (ID#3946)
40 North Shore Road
NR: 3/5/2002 (NR Reference #: 02000107)
SR: 12/20/2001

Hinchman Warehouse Site (28-At-110) (ID#4243)
SHPO Opinion: 2/6/2004

North Shore Road Historic District (ID#3570)
North Shore Road from Creek Road Northward to Galloway Township Municipal Boundary
SHPO Opinion: 2/14/1996

Dr. Jonathan Pitney House (ID#1838)
57 North Shore Road
NR: 8/14/1998 (NR Reference #: 98001062)
SR: 6/26/1998

South Shore Road Historic District (ID#2935)
South side of Ohio Avenue, West of Absecon Creek and extends Southward along South Shore Road to Nevada Avenue
SHPO Opinion: 2/14/1996

Atlantic City

Absecon Lighthouse (ID#389)
Pacific and Rhode Island avenues
NR: 1/25/1971 (NR Reference #: 71000492)
SR: 9/11/1970

Administration Building for the Board of Education (ID#4870)
1809 Pacific Ave
SHPO Opinion: 3/17/2006

Atlantic City Armory (ID#4163)
Absecon Boulevard and New York Avenue
SHPO Opinion: 9/10/2004
(Previous SHPO opinion 4/17/2003)

Atlantic City Convention Hall (NHL, ID#390)
Boardwalk between Pacific, Mississippi, and Florida avenues
NR: 2/27/1987 (NR Reference #: 87000814)
SR: 3/2/1993
SHPO Opinion: 9/30/1983
(Previous SHPO Opinions: 6/15/1977, 5/11/1978)

Atlantic City High School (ID#4386)
Pacific and Ohio avenues
SHPO Opinion: 4/7/2004

Atlantic City Post Office (ID#391)
1701 Pacific Avenue
SHPO Opinion: 2/20/1980

Barclay Court (ID#392)
9-11 South Pennsylvania Avenue
NR: 6/22/1988 (NR Reference #: 88000725)
SR: 4/26/1988
SHPO Opinion: 12/8/1987
(Demolished)

Beth Israel Synagogue (ID#1849)
34 South Pennsylvania Avenue
SR: 11/16/1992

Beth Kehillah Synagogue Building (H.G. Rosin Senior Center) (ID#401)
901 Pacific Avenue
SHPO Opinion: 9/20/1993

Blenhiem Hotel (ID#3576)
Boardwalk and Ohio Avenue
NR: 8/23/1977
(Demolished October 1978)

Camden and Atlantic Railroad Historic District (ID#3862)
Railroad right-of-way from Pensauken and Camden to Atlantic City
SHPO Opinion: 9/17/2001
Also located in:
Atlantic County, Absecon City
Atlantic County, Egg Harbor Township
Atlantic County, Galloway Township
Atlantic County, Hammonton Town
Atlantic County, Mullica Township
Atlantic County, Pleasantville City
Camden County, Berlin Borough
Camden County, Camden City
Camden County, Cherry Hill Township
Camden County, Collingswood Borough
Camden County, Haddon Township
Camden County, Haddonfield Borough
Camden County, Lindenwold Borough
Camden County, Merchantville Borough
Camden County, Pennsauken Township
Camden County, Somerdale Borough
Camden County, Voorhees Township
Camden County, Waterford Township
Camden County, Winslow Township

Church of the Ascension (ID#393)
1601 Pacific Avenue
NR: 7/24/1986 (NR Reference #: 86001941)
SR: 6/16/1986

Equitable Trust Bank Building (ID#2927)
2030 Atlantic Avenue
SHPO Opinion: 6/9/1989

Federal Building and Post Office (ID#2928)
Pacific and Pennsylvania avenues
SHPO Opinion: 4/16/1986
(Demolished)

Fire Station #8 (ID#396)
140 North Indiana Avenue
DOE: 4/23/1981
SHPO Opinion: 3/30/1981

Fire Station #9 (ID#397)
734 North Indiana Avenue
DOE: 4/23/1981
SHPO Opinion: 3/30/1981

Friends Meeting House (ID#2929)
Pacific and South Carolina avenues
SHPO Opinion: 5/31/1985

Holmhurst Hotel (ID#398)
South Pennsylvania Avenue
NR: 1/18/1978 (NR Reference #: 78001732)
SR: 8/19/1977
(Demolished, March 1985.)

The Knife and Fork Restaurant (ID#4798)
29 S. Albany Avenue
SHPO Opinion: 7/30/2008

Madison Hotel (ID#399)
123 South Illinois Avenue
NR: 12/20/1984 (NR Reference #: 84000506)
SR: 11/1/1984
SHPO Opinion: 5/8/1984

The Strand and Marine Apartments (ID#4800)
3821- 3825 Boardwalk Avenue
SHPO Opinion: 7/30/2008

Morton Hotel (ID#400)
150 Virginia Avenue
NR: 7/15/1977 (NR Reference #: 77000843)
SR: 5/26/1977
(Demolished)

1315 Pacific Avenue (ID#2930)
1315 Pacific Avenue
SHPO Opinion: 12/16/1987

Raphael-Gordon House (ID#2931)
118 South Newton Street
SHPO Opinion: 4/11/1997

St. Nicholas of Tolentine Church (ID#395)
1409-1421 Pacific Avenue
NR: 2/2/2001 (NR Reference #: 00010039)
SR: 12/12/2000
SHPO Opinion: 7/11/1990
(SHPO Opinion for Convent Only)

Santa Rita Apartments (ID#402)
66 South Carolina Avenue
NR: 6/14/1991 (NR Reference #: 91000675)
SR: 4/12/1991

Segal Building (ID#394)
1200 Atlantic Avenue
NR: 2/9/1984 (NR Reference #: 84002517)
SR: 1/6/1984

Shelburne Hotel (ID#403)
Michigan Avenue and the Boardwalk
NR: 5/19/1978 (NR Reference #: 78001733)
SR: 3/7/1978
(Demolished)

South Maine Avenue Streetscape (ID#404)
South Maine Avenue between Atlantic Avenue and the Boardwalk
SHPO Opinion: 6/30/1993
(Demolished)

2-6 South Virginia Avenue (ID#405)
2-6 South Virginia Avenue
SHPO Opinion: 7/10/1991

Traymore Hotel (ID#3577)
Boardwalk and Illinois Avenue
NR: 12/13/1971
(Demolished)

Union Railroad Station (Bus Station) (ID#406)
2101 Arctic Avenue
SHPO Opinion: 3/31/1994
(Demolished)

USCG Station Atlantic City (ID#4745)
900 Beach Thorofare
SHPO Opinion: 7/16/2007

Warner Theatre (façade) (ID#2932)
Atlantic City Boardwalk between Michigan and Arkansas avenues
SHPO Opinion: 1/9/1996

Westside All Wars Memorial Building (ID#4524)
1510 Adriatic Avenue
SHPO Opinion: 9/23/2005

World War I Memorial (ID#407)
South Albany Avenue, Ventnor Avenue, an d O'Donnell Parkway
NR: 8/28/1981 (NR Reference #: 81000388)
SR: 7/2/1981

Buena Borough

Hebron Button Factory (ID#4801)
Weymouth Malaga Road & Aberdeen Avenue
SHPO Opinion: 7/21/2008

Buena Vista Township

Richland Hotel (ID#4825)
1302 Harding Way
COE: 7/31/2008

Corbin City

NJ Route 50 Bridge (SI&A #0510152) (ID#2933)
NJ Route 50 over Tuckahoe River
SHPO Opinion: 8/28/1996
(Previous SHPO Opinion 7/19/91)
See Main Entry / Filed Location:
Cape May County, Upper Township

South Tuckahoe Historic District (ID#3062)
NJ Route 50 and north portion of Tuckahoe-Mount Pleasant Road
NR: 3/7/1997 (NR Reference #: 97000103)
SR: 1/8/1997
SHPO Opinion: 8/28/1996
(SHPO Opinion was for a larger North and South Tuckahoe Historic Distirct)
See Main Entry / Filed Location:
Cape May County, Upper Township

North and South Tuckahoe Historic District (ID#3063)
NJ Route 50 and the Tuckahoe River
SHPO Opinion: 8/28/1996
(Southern portion listed as the South Tuckahoe Historic District)
See Main Entry / Filed Location:
Cape May County, Upper Township

Egg Harbor City

Egg Harbor City Fire Station (ID#409)
351 Cincinnati Avenue
SHPO Opinion: 9/20/1993
COE: 5/23/2006
(Previous SHPO Opinion 5/26/1988)

Egg Harbor City Historic District (ID#410)
Philadelphia Avenue
(7/24/2008: SHPO Opinion that HD is NOT ELIGIBLE)

Egg Harbor Commercial Bank (ID#4274)
134 Philadelphia Avenue
NR: 8/28/2007 (NR Reference #: 07000875)
SR: 6/25/2007
COE: 5/3/2004
(formerly identified as Old Commercial Bank)

Lower Bank Road Bridge (SI&A #03G8045) (ID#411)
Lower Bank Road (County Route 542) over Mullica River
SHPO Opinion: 5/15/1990
(Demolished c. 1992)
Also located in:
Burlington County, Washington Township

Mullica River / Chestnut Neck Archaeological Historic District (ID#385)
North and south sides of the Mullica River
SR: 10/1/1976
SHPO Opinion: 9/16/2002
See Main Entry / Filed Location:
Atlantic County, Mullica Township

Neutral Water Health Resort Sanitarium (ID#412)
Corner of Claudius Street and London Avenue
NR: 3/20/1991 (NR Reference #: 91000267)
SR: 1/29/1991
SHPO Opinion: 1/17/1978
(aka Dr. Smith's Sanitarium Site)

Egg Harbor Township

Camden and Atlantic Railroad Historic District (ID#3862)
Railroad right-of-way from Pensauken and Camden to Atlantic City
SHPO Opinion: 9/17/2001
See Main Entry / Filed Location:
Atlantic County, Atlantic City

Cannon Court Roadside Cabins (ID#4331)
6124 Black Horse Pike
SHPO Opinion: 9/28/2004

Garden State Parkway Historic District (ID#3874)
Entire Garden State Parkway Right-of-Way
SHPO Opinion: 10/12/2001
See Main Entry / Filed Location:
Cape May County, Lower Township

Captain John Jeffries Burial Marker (ID#414)
Palestine Bible Church Cemetery, County Route 559
NR: 6/14/1984 (NR Reference #: 84002511)
SR: 5/1/1984

Lakes Creek Prehistoric Site (28-At-96) (ID#413)
SHPO Opinion: 5/6/1992

Andrew B. Scull House (ID#4722)
1647 Mays Landing-Somers Point Road (CR 559)
SHPO Opinion: 5/15/2007

Studebaker Showroom (ID#310)
North West Corner Verona and Toulon avenues
SHPO Opinion: 12/18/1995

Estell Manor City

Bethlehem Loading Company Mays Landing Plant Archaeological Historic District (ID#427)
109 NJ Route 50
NR: 7/12/2006 (NR Reference #: 06000559)
SR: 12/19/2005
SHPO Opinion: 4/11/1985
(Remains of internal rail system)

Estellville Glassworks Industrial Historic District (ID#415)
Estell Manor Park, Stevens Creek, Maple Avenue, Walkers Forge Road, and NJ Route 50
NR: 11/21/1991 (NR Reference #: 91001678)
SR: 10/2/1991
COE: 1/18/1990

Head of the River Church (ID#416)
NJ Route 49 at Aetna Drive
NR: 3/7/1979 (NR Reference #: 79001467)
SR: 12/19/1977

Folsom Borough

Jacobus Evangelical Lutheran Church (ID#417)
Mays Landing Road
NR: 6/9/1988 (NR Reference #: 88000635)
SR: 9/1/1987

Galloway Township

Anonymous Roadside Cabins (ID#4329)
US Route 30 and Taylor Avenue
SHPO Opinion: 9/28/2004

Camden and Atlantic Railroad Historic District (ID#3862)
Railroad right-of-way from Pensauken and Camden to Atlantic City
SHPO Opinion: 9/17/2001
See Main Entry / Filed Location:
Atlantic County, Atlantic City

Conovertown Historic District (ID#418)
Along New York Road between Brook Lane and the border with Absecon City, west on Biscayne Avenue to the Lutheran Church
SHPO Opinion: 8/5/1992

The Country Motel Roadside Cabins (ID#4330)
201 White Horse Pike
SHPO Opinion: 9/28/2004

Frankfurt Avenue Bridge (ID#4464)
Frankfurt Avenue over New Jersey Transit Atlantic City Line
SHPO Opinion: 7/13/2005

Garden State Parkway Historic District (ID#3874)
Entire Garden State Parkway Right-of-Way
SHPO Opinion: 10/12/2001
See Main Entry / Filed Location:
Cape May County, Lower Township

Modern Boat Works (ID#419)
US Route 9 at Nacote Creek
SHPO Opinion: 6/12/1987

Mullica River / Chestnut Neck Archaeological Historic District (ID#385)
North and south sides of the Mullica River
SR: 10/1/1976
SHPO Opinion: 9/16/2002
See Main Entry / Filed Location:
Atlantic County, Mullica Township

Oceanville / Leeds Point / Moss Mill Historic District (ID#420)
Bounded by New York Road, Somers Town Lane, Leeds Point Road, and Moss Mill Road
SHPO Opinion: 8/5/1992

Old US Coast Guard Station (ID#4041)
Little Beach Island, Brigantine National Wildlife Refuge
NR: 6/23/1976
(Demolished)

L.N. Renault and Sons Winery (ID#421)
Bremen Avenue and Leibig Street
SR: 6/15/1973

Roadside Cabins (ID#4339)
US Route 30 and 5th Avenue
SHPO Opinion: 7/28/2003

Smithville Apothecary (ID#422)
Smithville-Old Towne and Moss Mill roads
NR: 6/9/1978 (NR Reference #: 78001734)
SR: 12/20/1976

Hamilton Township

Abbott's Modern Cabins (ID#336)
217 NJ Route 40
SR: 9/7/1982
DOE: 10/26/1982
(DOE/Owner Objection)

Charcoal Kilns [Site] (ID#337)
SHPO Opinion: 6/24/1987

Mays Landing Historic District (ID#338)
East and West Main streets and intersecting streets
NR: 8/23/1990 (NR Reference #: 90001245)
SR: 1/11/1990

Mays Landing Presbyterian Church (ID#339)
Main Street and Cape May Avenue
NR: 4/20/1982 (NR Reference #: 82003261)
SR: 4/21/1981

Samuel Richards Hotel (ID#340)
106 East Main Street
NR: 8/31/1979 (NR Reference #: 79001468)
SR: 6/19/1979

Schooner "Weymouth" [Site] (ID#342)
NR: 4/25/1985 (NR Reference #: 85000874)
SR: 3/12/1985

US Route 322 and NJ Route 50 Cloverleaf (ID#2937)
SHPO Opinion: 11/8/1993
(DOE denied, 1997; Demolished)

West Jersey and Atlantic Railroad Historic District (ID#2938)
Mays Landing, Hamilton Township to Pleasantville City, Atlantic County
SHPO Opinion: 8/28/1996
Also located in:
Atlantic County, Pleasantville City

Weymouth Archaeological Historic District (ID#341)
SHPO Opinion: 11/1/1984
COE: 1/18/1990
(Previous SHPO Opinion 4/3/1984)

Weymouth Road Bridge (SI&A #01HML22) (ID#3791)
Weymouth Road Bridge over Great Egg Harbor River
NR: 6/21/2001 (NR Reference #: 01000671)
SR: 5/7/2001
(SI&A #01HML22)

Woodland Period Prehistoric Archaeological Site (28-At-24) (ID#343)
SHPO Opinion: 6/20/1983

Hammonton Town

William L. Black House (ID#344)
458 Bellevue Avenue
NR: 8/26/1993 (NR Reference #: 93000828)
SR: 7/2/1993

Camden and Atlantic Railroad Historic District (ID#3862)
Railroad right-of-way from Pensauken and Camden to Atlantic City
SHPO Opinion: 9/17/2001
See Main Entry / Filed Location:
Atlantic County, Atlantic City

Eagle Theatre (ID#4869)
208 Vine Street
COE: 2/20/2009

Hammonton Commercial Historic District (ID#345)
Roughly bounded by Third, Washington, Orchard and Vine streets
SHPO Opinion: 9/20/1993

Linwood City

Linwood Borough School No. 1 (Linwood Public Library) (ID#346)
16 West Poplar Street
NR: 12/20/1984 (NR Reference #: 84000510)
SR: 11/1/1984

Linwood Historic District (ID#347)
Maple and Poplar avenues, and Shore Road
NR: 7/13/1989 (NR Reference #: 89000800)
SR: 4/27/1989

Thomas & Mary Ingersall Naylor House (ID#4866)
204 West Garfield Avenue
COE: 1/28/2009

Longport Borough

Church of the Redeemer (ID#382)
20th and Atlantic avenues
NR: 9/10/1992 (NR Reference #: 92001179)
SR: 7/27/1992

Great Egg Coast Guard Station Building (ID#4255)
2301 Atlantic Avenue
NR: 10/31/2005 (NR Reference #: 05000128)
SR: 1/4/2005
COE: 4/1/2004

Ocean City-Longport Bridge (SI&A #3100001) (ID#1012)
Ocean Drive over Great Egg Harbor
SHPO Opinion: 11/10/1993
(Demolished)
See Main Entry / Filed Location:
Cape May County, Ocean City

Margate City

Lucy, The Margate Elephant (NHL, ID#383)
Decatur and Atlantic avenues
NR: 8/12/1971 (NR Reference #: 71000493)
SR: 4/7/1971

Marven Gardens Historic District (ID#384)
Between Ventnor, Fredericksburg, Winchester and Brunswick avenues
NR: 9/13/1990 (NR Reference #: 90001440)
SR: 8/9/1990

Mullica Township

Camden and Atlantic Railroad Historic District (ID#3862)
Railroad right-of-way from Pensauken and Camden to Atlantic City
SHPO Opinion: 9/17/2001
See Main Entry / Filed Location:
Atlantic County, Atlantic City

Green Bank Road Bridge over Mullica River (SI&A #01M0001) (ID#2810)
SHPO Opinion: 8/31/1995
Also located in:
Burlington County, Washington Township

Mullica River / Chestnut Neck Archaeological Historic District (ID#385)
North and south sides of the Mullica River
SR: 10/1/1976
SHPO Opinion: 9/16/2002
Also located in:
Atlantic County, Egg Harbor City
Atlantic County, Galloway Township
Burlington County, Bass River Township
Burlington County, Washington Township
Ocean County, Little Egg Harbor Township

Pleasant Mills (ID#2802)
Elwood-Pleasant Mills Road
NR: 3/3/1995 (NR Reference #: 95000182)
SR: 1/24/1995
SHPO Opinion: 8/31/1995
(Included within boundaries of previously listed Batsto Historic Distirct)

Northfield City

1715 Tilton Road (ID#25)
1715 Tilton Road
SHPO Opinion: 11/9/1999

Risley Homestead (ID#386)
8 Virginia Avenue
NR: 5/31/1991 (NR Reference #: 91000609)
SR: 4/2/1991

Pleasantville City

Camden and Atlantic Railroad Historic District (ID#3862)
Railroad right-of-way from Pensauken and Camden to Atlantic City
SHPO Opinion: 9/17/2001
See Main Entry / Filed Location:
Atlantic County, Atlantic City

213 Verona Avenue (ID#2939)
213 Verona Avenue
SHPO Opinion: 12/18/1995

West Jersey and Atlantic Railroad Historic District (ID#2938)
Mays Landing, Hamilton Township to Pleasantville City, Atlantic County
SHPO Opinion: 8/28/1996
See Main Entry / Filed Location:
Atlantic County, Hamilton Township

Port Republic City

Amanda Blake Store (ID#387)
104 Main Street
NR: 1/25/1979 (NR Reference #: 79001469)
SR: 9/5/1978

Chestnut Neck Battle Monument (ID#4327)
US Route 9 and Old York Road
SHPO Opinion: 9/28/2004

Garden State Parkway Historic District (ID#3874)
Entire Garden State Parkway Right-of-Way
SHPO Opinion: 10/12/2001
See Main Entry / Filed Location:
Cape May County, Lower Township

Gulf Service Station (ID#4328)
758 Old New York Road
SHPO Opinion: 9/28/2004

Port Republic Historic District (ID#388)
Central and Pomona avenues, Riverside Drive, St. Johns Lane, Chestnut Neck, Clarks Landing, and Port Republic-Smithville roads
NR: 5/16/1991 (NR Reference #: 91000596)
SR: 4/1/1991

Smithville-Port Republic Road Bridge (SI&A #01PR007) (ID#2940)
Smithville-Port Republic Road over Nacote Creek
SHPO Opinion: 9/3/1993

Somers Point City

Bay Front Historic District (ID#423)
Parts of Anna, Bay, Decatur, Delaware, Gibbs, Higbee, New Jersey, and Somers avenues
NR: 3/23/1989 (NR Reference #: 89000227)
SR: 2/9/1989

Garden State Parkway Historic District (ID#3874)
Entire Garden State Parkway Right-of-Way
SHPO Opinion: 10/12/2001
See Main Entry / Filed Location:
Cape May County, Lower Township

Somers Mansion (ID#424)
Shore Road, adjacent to NJ Route 52 traffic circle
NR: 12/18/1970 (NR Reference #: 70000378)
SR: 9/11/1970

World War [One] Memorial Bridge (SI&A# 0511153) (ID#3059)
NJ Route 52 over Ship Channel
SHPO Opinion: 1/26/1996
See Main Entry / Filed Location:
Cape May County, Ocean City

Ventnor City

Saint Leonard's Tract Historic District (ID#426)
Bounded by Atlantic Avenue, South Cambridge Avenue, Winchester Avenue and South Surrey Avenue
SHPO Opinion: 12/30/1993

John Stafford Historic District (ID#425)
Portions of Atlantic, Austen, Baton Rouge, Marion, and Vassar avenues
NR: 6/9/1988 (NR Reference #: 88000723)
SR: 4/26/1988
SHPO Opinion: 5/28/1987

Ventnor City Hall (ID#2941)
6201 Atlantic Avenue
NR: 10/10/1996 (NR Reference #: 96001088)
SR: 8/20/1996
SHPO Opinion: 11/30/1977
COE: 5/14/1992

Weymouth Township

Belcoville Post Office (ID#4190)
1201 Madden Avenue
NR: 3/14/2008 (NR Reference #: 08000174)
SR: 12/21/2007
COE: 7/23/2003

Appendix C

Additional Information on Historical Sites

7. Description

CONDITION	(Check One)					
	☐ Excellent	☒ Good	☐ Fair	☐ Deteriorated	☐ Ruins	☐ Unexposed
	(Check One)		(Check One)			
	☐ Altered	☒ Unaltered	☐ Moved	☒ Original Site		

DESCRIBE THE PRESENT AND ORIGINAL (If known) PHYSICAL APPEARANCE

The Absecon Lighthouse was built in 1856 by the United States Government at the northern end of Absecon Island, now Atlantic City. It was built of iron and brick and towers 171 feet above the ground. It is circular measuring 27 feet in diameter at the base and 13' 7½" at the lens chamber. An iron spiral staircase extends from the base to the lens chamber. Iron frames with large, rectangular glass panes support a 12 sided pyramid roof. A catwalk at a storage level just below the lens provided the lightkeeper with a view of the inlet.

The light was installed in the lighthouse in 1857. It was fired by mineral oil and intensified by a "Fresnel lens of the first order". It was replaced in 1910 by an incandescant oil vapor lamp and in 1925 by electricity.

The lighthouse was decommissioned in 1933. Originally there was a keepers house, an assistant keepers house and an oil house on the property. These are shown in early photographs, but were greatly remodeled and torn down before the property was deeded to the State.

The lighthouse which was built near the inlet in an area where there were few houses is now one mile from the same inlet in a totally built-up area.

RECEIVED
OCT 7 1970
NATIONAL REGISTER

SEE INSTRUCTIONS

8. Statement of Significance

PERIOD *(Check One or More as Appropriate)*

☐ Pre-Columbian	☐ 16th Century	☐ 18th Century	☒ 20th Century
☐ 15th Century	☐ 17th Century	☒ 19th Century	

SPECIFIC DATE(S) *(If Applicable and Known)* 1856 - (1933 decommissioned)

AREAS OF SIGNIFICANCE *(Check One or More as Appropriate)*

Aboriginal	☐ Education	☐ Political	☐ Urban Planning
☐ Prehistoric	☐ Engineering	☐ Religion/Philosophy	☒ Other *(Specify)* nautical
☐ Historic	☐ Industry	☐ Science	
☐ Agriculture	☐ Invention	☐ Sculpture	
☒ Architecture	☐ Landscape Architecture	☐ Social/Humanitarian	
☐ Art	☐ Literature	☐ Theater	
☐ Commerce	☐ Military	☒ Transportation	
☒ Communications	☐ Music		
☐ Conservation			

STATEMENT OF SIGNIFICANCE

The Absecon Lighthouse is significant for navigational history and for it architecture. The building was erected in 1856 under the direction of Lt. George Meade, later commander of Union forces at Gettysburg. It served mariners along the coast from 1857 until 1933. It was erected as one of several lighhouses extending from Sandy Hook to Cape May. Its beacon, visible for 20 miles, provided a measure of safety to ships engaged in coastal trade and to yachtsmen searching for the inlet.

Prior to being built several ships and well over a thousand people perished along the shoal area of Brigantine Beach and Atlantic City.

The building, discribed in the preceeding physical appearance has Historic American Building's Survey status for the lighthouse structures. The keeper's dwelling was demolished before drawings were made of that structure.

Today there is a small museum in a new building erected at the base. It is opened to the public during Atlantic City's tourist season, May through September.

RECEIVED
OCT 7 1970
NATIONAL REGISTER

SEE INSTRUCTIONS

TES
OMMERCE
C SURVEY

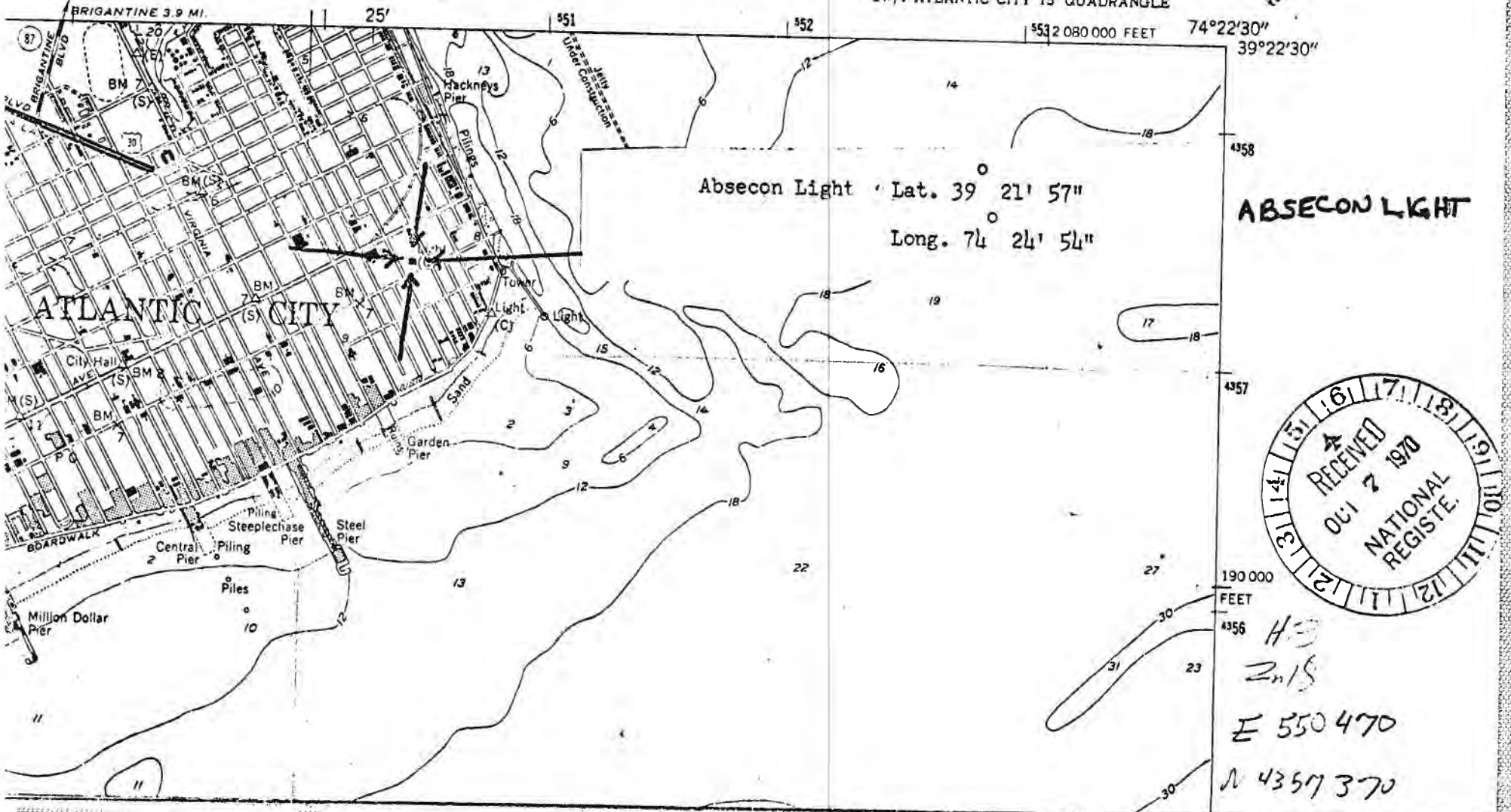
ATLANTIC CITY QUADRANGLE

NEW JERSEY—ATLANTIC CO.

7.5 MINUTE SERIES (TOPOGRAPHIC)

SW/4 ATLANTIC CITY 15' QUADRANGLE

6162 IV NE (BRIGANTINE INLET)



RECEIVED
OCT 7 1970
NATIONAL REGISTER

H3
2n15
E 550 470
N 4357 370

7. Description

Condition		Check one	Check one
___ excellent	___ deteriorated	___ unaltered	X original site
X good	___ ruins	X altered	___ moved date _____
___ fair	___ unexposed		

Describe the present and original (if known) physical appearance

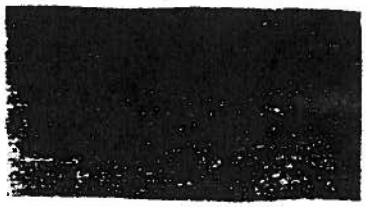
The Atlantic City Convention Hall, a vast 650-foot by 350-foot structure built in 1926-29, provides a dramatic focus on the Boardwalk at a significant bend in the beachfront.[1] It draws attention partly because of the great curving limestone exedra that curves out toward the beach and emphasizes the entrance of the Hall. Within, behind the massive pylons of the entrance, looms the great arched volume of the auditorium. Thus, the building really exists in two parts, unified by materials, function, and scale: the exedra with the covered curving double row of columns terminated by public bath houses, and the 2-story, limestone-clad front block of Convention Hall, backed by the immense brick-clad arched volume of the main hall. The main building contains the Great Hall, or Auditorium, large ballroom, and smaller public rooms.

Detailed Description

The exedra and public facade of the hall are both constructed in cut limestone. Their detail draws on the then-popular Lombard Romanesque, with elements of Neo-Assyrian design, especially in the capitals of the main arcade. That fusion of architectural styles no doubt occurred because both styles were being rediscovered by historians in the 1920s. The "First Romanesque Style" was the subject of volumes by Arthur Kingsley Porter and the Spaniard Puig y Chadafach, while the Assyrian archeological finds made by the British Museum were much noted in the popular press.

The Boardwalk-beach edge is appropriately ocean-oriented, with decoration, like that of contemporary Atlantic City hotels, using forms of ocean flora and fauna. Stone seahorses, porpoises, shells, and crustaceans are set into panels on the upper surfaces. The architectural forms are somewhat Mediterranean, with tile roofs, shallow corbels, and stylized Ravennate basket capitals similar to Italian 9th- and 10th-century Romanesque. At the corners of the site, just beyond the east and west walls of the facade, are public bath houses, small 3 x 5 bay rectangular limestone-clad buildings which are narrower on the north and south fronts. Shallow relief panels are set above their lintels, while corbel tables and tile roof edges crown their walls.

A short gap along the edge of the Boardwalk separates the rest rooms from the cubic baldachini that terminate the exedra. The latter are great piers that terminate the upper facade of the hall, bringing its overwhelming scale down onto the beachfront. Four square stone shafts carry an entablature that is capped by a series of stepped flat plates of stone. From the baldachini, the exedra curves out toward the ocean, then back toward the Boardwalk. It continues the entablature at the same level while the interior is clad with Gustavino tile; these are the same materials originally used in the vaulted entrance of the hall.



The front of the Convention Hall follows a Beaux Arts monumental scheme, again with Lombard Romanesque detail. A multi-story arcade above the broad Boardwalk entrance is flanked by tall pylons. The lower 3-story-high blocks, flanking the main block, contain shops on the first floor and offices and conference rooms on the second and third. The stone is coursed in regular, alternating wide and narrow bands, of a sort associated with Neo-Romanesque style in the 1890s. Pronounced variations in the color and tone of the limestone form an overall pattern.

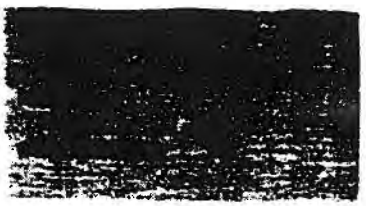
The Beaux Arts rhythm, of lower end wings, terminating towers, and central arcade block, contrasts with the secondary patterns of Lombard Romanesque, in a smaller decorative scale. A corbel table supporting a string course sets off the openings of the first floor from the fenestrated and arcaded second floor; it is repeated again below the tile roof edge across the upper levels. Heraldic shields of the State of New Jersey are flanked by porpoises and seahorses above the doors in the towers and over the broad Boardwalk entrance, while a great frieze of sea fauna caps the towers.

This facade remains essentially intact, although the original architects modified it at the time of the Democratic National Convention in 1964. They walled in the large window openings of the second-floor gallery and removed the store fronts to the sides of the main entrance, as well as the doors in the towers. The original Boardwalk entrance was also modernized. Grained marble column covers and blue tile were placed on the wall, below a new stainless steel canopy, leading into a modernized foyer.

Behind the cut-stone front block, the main bulk of the building is sheathed in variegated yellow brick laid in decorative patterns, panels, and diaperwork. Massive piers along Georgia and Misissippi Avenues mark the great structural arches of the interior. Blind arcades along the side again recall the Lombard Romanesque. Bullseye windows and corbel tables fill the walls below the tiles of the roof edge, and limestone continues the color of the front on the upper surfaces of spur buttresses on the pier caps along the sides.

The same large rhythm of piers, infilled with brick wall panels, marks the north, or stage house, end. There the tall central volume, flanked by lower side wings, recalls the front composition. The street level is again detailed with limestone pier caps. Light-toned brick with limestone-colored concrete piers was carried on to the west wall.

The vestibule that connected the Hall to the Boardwalk was designed to be an immense vaulted passageway 50 feet wide, linking the beach and the Convention Hall and of sufficient size to permit the floats of Boardwalk pageants to be driven directly into the Auditorium for judges to view. It was sheathed in limestone, with a shallow Gustavino tile vault (resembling the outdoor exedra). The vestibule led to great sloping ramps to the upper levels and the front Ballroom and, through a low entrance, to the Great Hall itself. This vestibule was also modified in 1964.



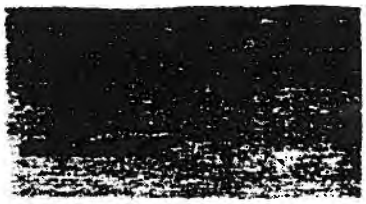
The front Ballroom occupies a space behind the front loggia, or promenade, which is 12 feet wide by 185 feet long. Its axis runs across that of the main building to form a rectangular room 185 feet by 130 feet. A coved cornice leads to a central border, containing lights and speakers, that sets off a central flat panel raised above ventilation grills. The central panel is richly painted with clouds opening around square gold panels containing the signs of the zodiac, from which reach golden rays from the sun in the center. An organ balcony on the north wall, framed by three large arches, rests on capitals carved with seahorses. Though altered by new paint colors, stainless steel doors on the north side, and closed off from the balcony, the room remains an important Art Deco space. (Its original character is being restored.)

The extraordinary Great Hall is still one of the world's largest interior spaces, more than half a century after its completion. Its great roof gives the building its characteristic shape. It takes its form from the ten pairs of immense three-hinged arch roof trusses spanning its full 350-foot width. They recall the shape of the great railroad train sheds on which they were modelled. The result is a room 300 feet wide by 480 feet long, seating 30,000 on the floor, and surrounded on three sides by a mezzanine that seats another 10,000.

The Great Hall focuses on a handsome proscenium arch, flanked by eagle-capped pilasters. They frame the stage, which is alone 110 feet wide and 85 feet deep, at the north end of the building. The room survives nearly intact, with its original Art Deco decorative schemes still visible. Instead of primary tones, Lockwood and Greene used a color scheme based on secondary tones: sea foam green on the pilasters, accented by bright blue trim which continues along the triple arches of the side arcades. There, the emblems of all the States emphasize the theme of Atlantic City as a national resort. The whole space is covered by the massive steel arches, which are infilled with a continuous web covered by an early attempt at acoustic sound-absorbent material, painted a dull silver that sheds a metallic gleam.

The pipe organ of the Great Hall contains some 33,000 pipes in 8 chambers. These are placed:

> one on either side of the stage in the same plane, separated by 175 feet, two spaced along each side wall between the seating gallery and the ceiling vault, and two high in the ceiling itself, close to the middle of the auditorium. It is as if the listener were inside the instrument, surrounded by sound which not only issues from two positions in every quadrant for anyone stationed forward of the middle chambers, but echoes and reverberates from everywhere else. Even visually, it is not an "object." One sees only grills flush with the room surfaces; there are no display pipes.[2]



The ancillary spaces off the Great Hall are almost plain by contrast to it; imitation red granite wainscotting, set off by dark borders, accents the long ramps to the mezzanine and the upstairs corridors. The walls and ceilings in the corridors, small conference rooms, and dressing rooms are painted plaster. Stairwells that lead to the side exits on the major axes follow the detail of the public areas, with the imitation granite wainscotting. The metalwork is painted the dull silver of the main hall.

In general, the Convention Hall is in excellent condition, with alterations only minimally detracting from the great structure. The principal changes have occurred on the sides, where recent construction has obscured much of the side walls. In 1964, the original architects, Lockwood and Greene, were called back to erect a large, single-story, columned exhibition hall connected by doors and an escalator to the major levels of the Convention Hall. Its exterior of concrete and block construction recalls the monumental scale of the original building, but in different materials. Though it serves an allied purpose and functions together with the original hall as one of the East Coast's premier convention facilities, the new hall is separated by deed. (Only the original hall and exedra are included in this nomination.)

While the new hall is adjacent to the original hall, it only conceals the lower portion of the west side, leaving the hall's two major facades intact. More recently, the Trump Casino has been constructed abutting the east wall of Convention Hall.

A major restoration and rehabilitation of the Convention Hall began in 1983, and should be complete in 1985.[3] The Great Hall and Grand Ballroom are being carefully restored; the entrances from the ballroom onto the loggia will be reopened, as will the arcaded shopping area beneath it. A new main lobby will replace the vestibule area modified in 1964.

Footnotes

[1]This description is an edited and condensed version of the description contained in the draft National Register of Historic Places nomination form, prepared by Dr. George E. Thomas of the Clio Group, Inc., for the Atlantic City Convention Center Authority in 1983.

[2]David Fuller, "Atlantic City and the Ideal Organ," The American Organist, 19, 11 (November 1985), p. 74.

[3]Atlantic City Convention Center Authority, "Atlantic City Convention Center, the Second Renaissance Begins" (Atlantic City: Atlantic City Convention Center Authority, 1985), unpaginated. (Pamphlet.)

8. Significance

Period	Areas of Significance—Check and justify below			
___ prehistoric	___ archeology-prehistoric	___ community planning	___ landscape architecture	___ religion
___ 1400–1499	___ archeology-historic	___ conservation	___ law	___ science
___ 1500–1599	___ agriculture	___ economics	___ literature	___ sculpture
___ 1600–1699	___ architecture	___ education	___ military	___ social/ humanitarian
___ 1700–1799	___ art	X engineering	___ music	___ theater
___ 1800–1899	___ commerce	___ exploration/settlement	___ philosophy	___ transportation
X 1900–	___ communications	___ industry	___ politics/government	X other (specify) (recreation - pageantry, sports)
		___ invention		

Specific dates 1926-1929; 1964 **Builder/Architect** Lockwood-Greene & Co.

Statement of Significance (in one paragraph)

Atlantic City introduced a number of elements to American seaside amusements before beauty pageants, including the Boardwalk (1870), the amusement pier (1882), the rolling chair (1884), and the American picture postcard (imported from Germany) (1895). Even in the first decades of the 20th century, it also featured fine hotels.[1]

The present Boardwalk is concrete. All of the storied amusement piers have been destroyed or modified beyond recognition. The leading hotels from early in the century have been demolished. Only one major edifice remains that recalls the city's heyday as a seaside resort: the Atlantic City Convention Hall. This structure is also the scene of one of America's greatest pageants, the Miss America Contest.

The Atlantic City Convention Hall is the largest structure on the Atlantic City Boardwalk.[2] Its construction in 1926 marked the coming of age of "The World's Play Ground," as the nation's most popular resort dubbed itself; it culminated a half-century of development that created the Boardwalk, lined with great hotels. The city became the center of many of America's most popular folk events, beginning with the Easter Parade, and crowned in the 1920s with the public relations coup of the Miss America Pageant. More than half a century after its completion by architects Lockwood and Greene, the Hall continues to serve its original use as a convention center. It is also of interest for its size and engineering.

As engineering, the Atlantic City Convention Hall occupies a significant place in the history of large-span structures. Indeed, when it was built, it contained the largest room with an unobstructed view in the history of architecture. That feat was accomplished by the use of an architectural form developed for railroad train sheds, the three-hinged arched truss. The form had already been used for a similar exhibition purpose, in the Hall of Machinery of the Paris Exhibition of 1888, but it had not been used in a public auditorium. The engineering triumph of building so vast a hall on the seashore site resulted, on its 50th anniversary, in its being the recipient of the Civil Engineering Landmark designation of the American Society of Civil Engineers.

Atlantic City Convention Hall is also highly regarded by connoisseurs of American pipe organs, for it features what is, arguably, the largest organ in the world, with 33,000 pipes, arranged in chambers built into the walls of the Great Hall.[3]

History

The Atlantic City Convention Hall opened in 1929, on the 75th anniversary of the founding, by the directors of the Pennsylvania Railroad, of the city, which began as a speculative resort on Absecon Island. The role of the building in local history is clear from its position on the Boardwalk, the seaside boulevard that set Atlantic City apart from other American cities, and near the railroad stations, built by the capitalists who established the community.

The building was first proposed in 1926 when the Atlantic City beachfront was at its peak of popularity. In that year, architects Lockwood and Greene of Boston and New York were selected to design it because of their experience with long-span structures. They were charged by Mayor Edward Bader to build "the world's largest auditorium," as befitting "The World's Play Ground." When completed in 1929, the Hall was the world's largest auditorium and had the largest permanent span 3-hinged roof arch system ever built.

The Great Hall of the Convention Center was multi-purpose from the start. It has been transformed alternately into an ice-skating rink, a football gridiron, a polo and horse-show field and a steeplechase course; the ice-skating rink (90 feet by 200 feet) and one of the world's largest pipe organs were built into the structure.

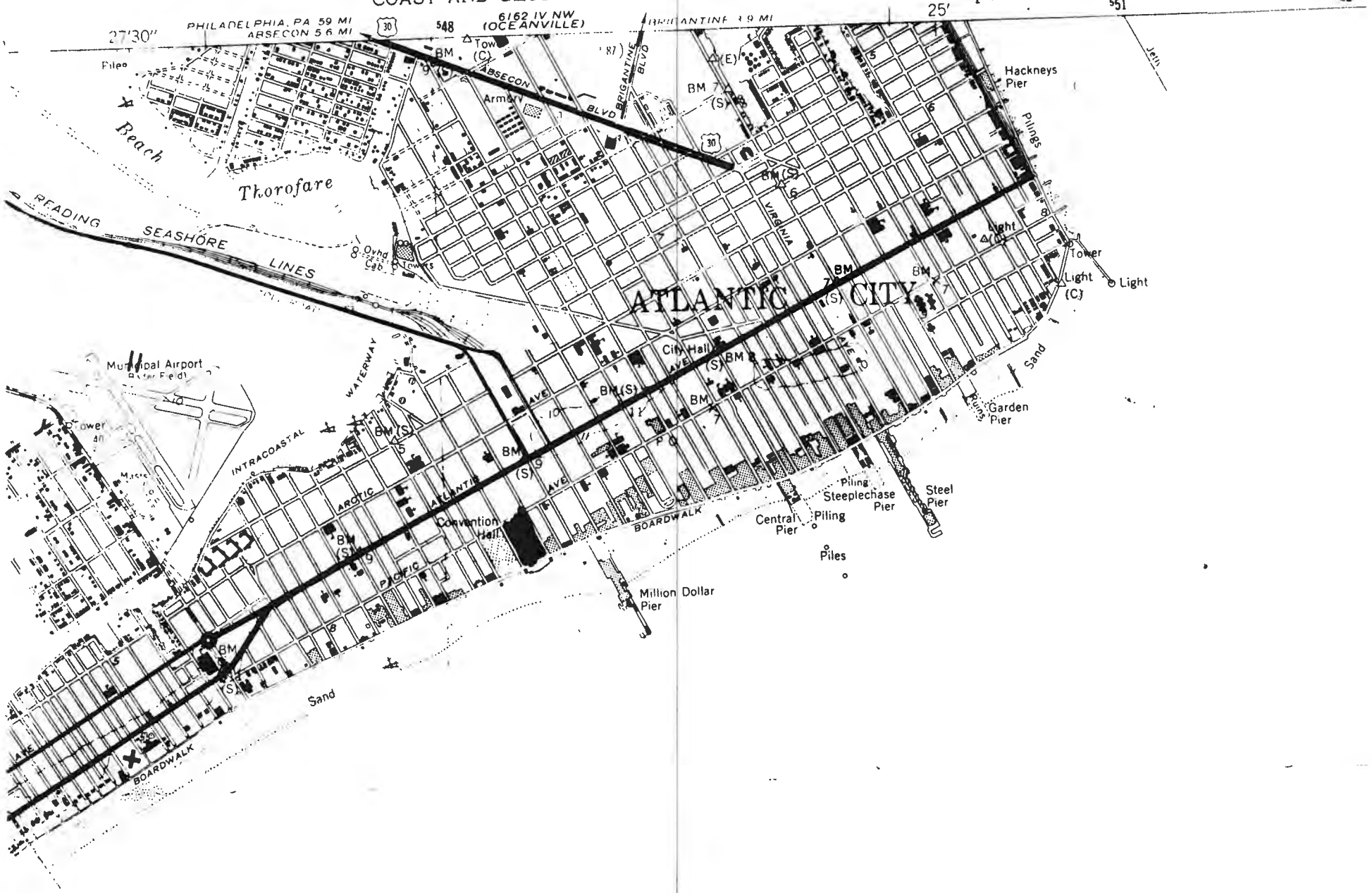
The Hall was dedicated on the traditional weekend of the opening of the summer season, on May 31, 1929, exactly 75 years after the first train steamed into newly laid out Atlantic City. The event was attended by luminaries who included the Vice President of the United States Charles F. Curtis and the Ambassadors of the United Kingdom and Spain.

Atlantic City Convention Hall still holds national interest as the site of the typically American and much copied beauty pageant, the "Miss America" Contest. Though Bert Parks and the song "Here She Comes, Miss America" are part of the past, the Convention Hall has, since its completion, been the traditional scene of the event, now more than 60 years old. The first pageant was held in 1921; the following year that great recorder of Americana, Norman Rockwell, was one of the judges. By the early 1930s, the event had been invested with such significance by the media that Mayor Charles White boasted: "This is a cultural event seeking a high type of beauty. Atlantic City has a keen interest in the way of art, beauty and culture."

The hall has also been used for other nationally important events. For example, the Democratic National Convention of 1964, at which Lyndon B. Johnson and Hubert H. Humphrey were nominated for President and Vice President, respectively, was held there. The hall continues as one or the Nation's principal convention centers. That position has been enhanced in the 1980s, as Atlantic City's casino boom has brought revived prosperity to the city.

UNITED STATES
DEPARTMENT OF COMMERCE
COAST AND GEODETIC SURVEY

Atlantic City Quadrangle
New Jersey-Atlantic County
7.5 minute series
updated 1972



TYPE:
- ☐ New District
- ☑ Individually Eligible
- ☐ Individual and Contributing
- ☐ Contributing Only

☐ Mapped
USGS Quad Name Atlantic
Quad Reference Number 35
Digital Identification Number _____

ELIGIBLE PROPERTY WORKSHEET

Name The ~~Stand~~ Strand & Marine Apartments A.K.A. _____

Address /Location 3821 - 3825 Boardwalk Ave

_____ Block / Lot 1

County and Municipality Atlantic City - Atlantic County

District (If applicable) _____

☒ SHPO OPINION ☐ DOE ☐ COE ☐ ITC (HPCA-Part 1)

DATE SIGNED 7/30/08 CHRONO G08-261 PROD LOG 08-0941-1 AUTHOR DS

REPORT (Accession Number) _____ _____

_____ _____

SURVEY FORM# (Historic Sites Inventory, Historic Bridge Survey) _____

Enclosure Checklist

- ✓ SHPO Signed Document
- ✓ NPS Signed Document
- ✓ Report Information (Title Page, Photograph copies, Relevant Sections)
- ✓ Property Information (Survey forms)
- ✓ Photographs (Historic and Current)
- ✓ HABS/HAER documentation
- ✓ Maps (Copy of Historic Properties USGS Quad, Historic, Tax)
- _____ Other

_____

PROJECT FILE NAME _____

CABINET LOCATION OF FILE _____

COVENANT / AGREEMENT _____

STATUS OF THE PROPERTY _____

Prepared by: Stamer Date: 8/29/08

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Natural and Historic Resources, Historic Preservation Office
PO Box 404, Trenton, NJ 08625
TEL: (609) 292-2023 FAX: (609) 984-0578
www.state.nj.us/dep/hpo

JON S. CORZINE
Governor

LISA P. JACKSON
Commissioner

July 30, 2008
HPO-G2008-261 PROD
08-0941-1

MEMORANDUM

TO: Janet Stewart, Project Review Officer
Land Use Regulation

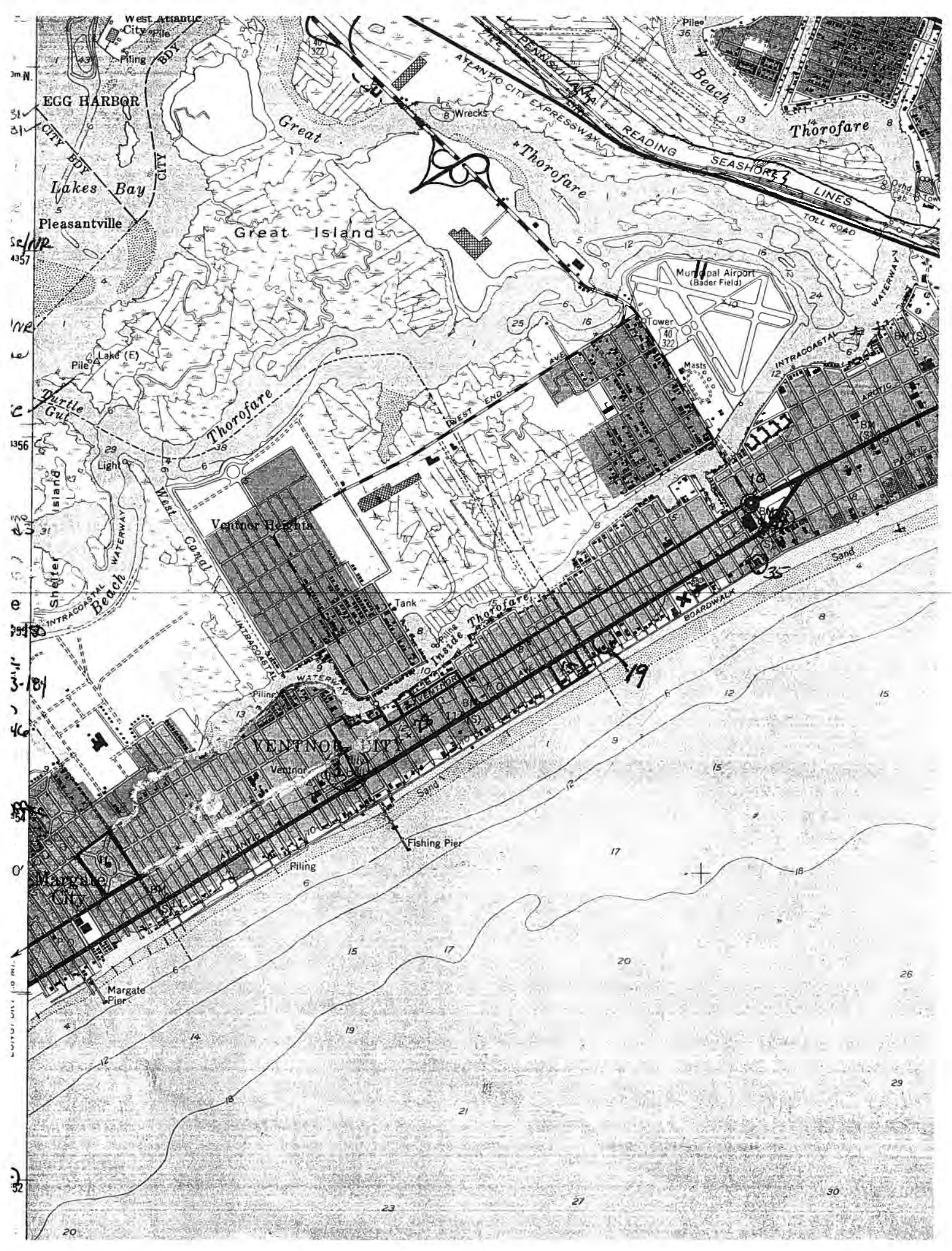
FROM: Terry Karschner, Acting Administrator
Historic Preservation Office

PROJECT: **Atlantic County, Atlantic City**
Atlantic Beach Hotel and Casino, Albany Avenue and the Boardwalk
Blocks 18, 19, 20, 21, 189 and
Block 157 Lots 1, 2, 3, 5
LUR file #0102-08-0002.1

Summary: The project is located adjacent to the New Jersey Register listed World War I Memorial. The proposed move of the WW I Memorial has been reviewed and approved by the Department pursuant to the New Jersey Register of Historic Places Act.

The Knife and Fork Restaurant, 29 S. Albany Avenue, is a significant example of the relatively rare Flemish Revival Style, and is an important landmark in Atlantic City. This **new SHPO Opinion** finds the Knife and Fork Restaurant to be eligible for listing on the National Register of Historic Places under Criterion C. The project includes the move of the Knife and Fork Restaurant to a new location.

The Marine Apartments, 3821 Boardwalk, and the Stand Apartments 3825 Boardwalk, are increasingly rare surviving examples of the architecturally designed apartments that were once common in Atlantic City. This **new SHPO Opinion** finds the Marine and Strand Apartments to be eligible for listing on the National Register of Historic Properties under Criterion C at the local level of significance.


West Atlantic City
Piling
BDY
EGG HARBOR
CITY BDY
Lakes Bay
CITY
Pleasantville
Great Island
Great Thorofare
Wrecks
ATLANTIC CITY EXPRESSWAY
PENNSYLVANIA
READING
SEASHORE LINES
TOLL ROAD
Beach Thorofare
Municipal Airport (Bader Field)
Tower
Masts
Lake (E)
Pile
Turtle Gut
Thorofare
Light
Island
Shelter
Beach
INTRACOASTAL WATERWAY
West Canal
Ventnor Heights
WEST END AVE
ARCTIC AVE
Tank
Piling
Inside Thorofare
BOARDWALK
Sand
VENTNOR CITY
Ventnor
Fishing Pier
Atlantic
Margate City
Margate Pier

PRELIMINARY HISTORIC ARCHITECTURAL AND ARCHAEOLOGICAL ASSESSMENT

GATEWAY PROJECT (OPTION 19)

ATLANTIC CITY, ATLANTIC COUNTY NEW JERSEY

Prepared For:

Cape Advisors, Inc.

Prepared By:

Richard Hunter, Principal Investigator
William Liebeknecht, Principal Investigator
Charles H. Ashton, Principal Architectural Historian
Cheryl Hendry, Historian
Hunter Research, Inc.

and

Seth Hinshaw, Senior Preservation Planner
Wise Preservation Planning

MARCH 2008

MANAGEMENT SUMMARY

Hunter Research, Inc., under contract to Cape Advisors, Inc., has conducted a cultural resources study of all or part of six blocks in Atlantic City, New Jersey in advance of Cape Advisors' application for a permit under New Jersey's Coastal Area Facilities Review Act (CAFRA). The project as proposed would result in the construction of a casino and related structures and the reconfiguration of some streets.

These studies were intended to identify historic architectural resources within the project footprint that may be eligible for inclusion in the New Jersey and National Register of Historic Places; to identify foreseeable effects to any such properties; and to make appropriate recommendations to mitigate adverse effects, where warranted. Preliminary assessment of the project site's archaeological potential was also a goal of this study.

The project site and its vicinity were largely developed after the initial wave of construction in Atlantic City, about the last decade of the 19th century and later. The first buildings were related to railroad excursions serving patrons from Philadelphia, who would alight from their trains and spend the day at the "New Sea View Excursion House" attached to the railroad station. At this location, food, beach access, dancing and various other amusements were provided. In later decades, the project site was redeveloped with hotels, apartment buildings and other commercial buildings. One entire block would be occupied by the Atlantic City High School.

As a result of this investigation, the five surviving buildings over 50 years of age within the project footprint were intensively surveyed. Of these, the Knife & Fork on Albany Avenue and the Marine and Strand Apartments at the Boardwalk between Lincoln Place and Roosevelt Avenue were found to be potentially eligible for inclusion in the New Jersey and National Registers due to their architectural attributes. Since all three will be removed by the project (although the Knife & Fork is slated to be moved to a new site less than a block away), recording to the standards of the Historic American Buildings Survey prior to removal is recommended.

This same pattern of development and redevelopment has resulted in the site's archaeological potential being judged at from low to moderate. Monitoring of ground-disturbing activities in certain specified areas by a qualified archaeologist is therefore recommended.

To address the small zone of potential Native American and early historic archaeological interest, a limited geoarchaeological investigation is recommended, either as soil auger tests or borings accomplished in conjunction with project-related geotechnical studies or as a program of independent backhoe trenching If significant archaeological remains are identified in this section of the project site, some form of archaeological data recovery may be necessary to mitigate the effects of the project.

Immediately after the current road network was in place, the area was developed with apartments. By 1924, the block bounded by the Boardwalk, Lincoln Place, Atlantic Avenue and Roosevelt Place contained four apartment buildings – one unnamed building, the Roosevelt Apartments and the Marine and Neptune (now the Strand) Apartments. Two of these early apartment buildings are still standing: the Marine and Strand Apartments. These two apartment buildings were most likely built between 1923 and 1924 by the Lincoln Development Company, who owned the property from 1923 to 1925 (Atlantic County Deeds 727/181, 765/298 and 772/185). They first appear on Mueller's *Atlas of Absecon Island, New Jersey* (1924) and were most likely built after the Finance Company of New Jersey sold the property on February 8, 1923 (Figure 4.19). The Marine Apartments were known as such since their construction, but the Strand Apartments were originally called the Adriatic Court Apartments (R.L. Polk & Co. 1926). While Mueller's *Atlas* identifies the building as the "Neptune Apartments," city directories from that year place the Neptune Apartments at 132 Kentucky Avenue (R.L. Polk & Co. 1924). The first city directory to list the Marine and Strand/Adriatic Court Apartments was published in 1926, so it is likely that the first residents moved in after the Lincoln Development Company sold the property (R.L. Polk & Co. 1926).

Parts of the current project area were also commercially developed in the 1920s. The President Hotel was constructed in 1926 on the Boardwalk between Albany and Hartford Avenues (Plate 4.7). At a cost of $5 million, the President was envisioned as a destination for the rich and powerful. In fact, it was constructed with a top-floor "Presidential Suite," intended to be the summer White House for the nation's presidents. Calvin Coolidge was the first president to be invited to inhabit the Presidential Suite, but he declined, putting an end to the idea of the "summer White House" before it began (Funnell 1975:146).

The President Hotel however, would host other rich and powerful guests – Lucky Luciano, Al Capone, Nig Rosen and other notorious mobsters. Wanting to extend his network of organized crime, Lucky Luciano called for a national convention of the major racket bosses and Atlantic City seemed the perfect in which to meet. During the second week of May in 1929, mobsters from around the country descended on Atlantic City – their destination was the Breakers Hotel. When Al Capone and Nig Rosen were denied entrance to the hotel, the entire party headed for the President. All of the decisions involved in the birth of a national network of crime organizations were made that week and the President was home base (Johnson 2003:99-101).

Several restaurants opened in the project area in the 1920s as well. By 1929, the Neptune Inn provided competition to the still thriving Knife & Fork Inn. The Neptune Inn opened around 1929 on Pacific Avenue, directly across the street from the Knife & Fork. Though a postcard from *circa* 1962 claims that the "Neptune Inn was the first bank building in the United States to be converted into a Restaurant and Cocktail Lounge" there is no evidence that suggests a bank existed at this location (Postcard of Neptune Inn, Collection of Allen Pergament).

The project area witnessed tremendous growth in the 1920s and by the end of the decade it contained a mix of residential, commercial and civic structures. Two historic images dating to *circa* 1929 or 1930 -- a postcard intended to provide an aerial view of the city's new convention hall and an oblique aerial photograph taken from a "sea gull flying boat" — provide excellent visual coverage of the landscape (Plates 4.8 and 4.9). Chelsea Park, the World War Memorial, the High School and the President Hotel were focal points of the neighborhood, but smaller dwellings, apartment buildings and restaurants surrounded these prominent structures. Moreover, unlike the central part of

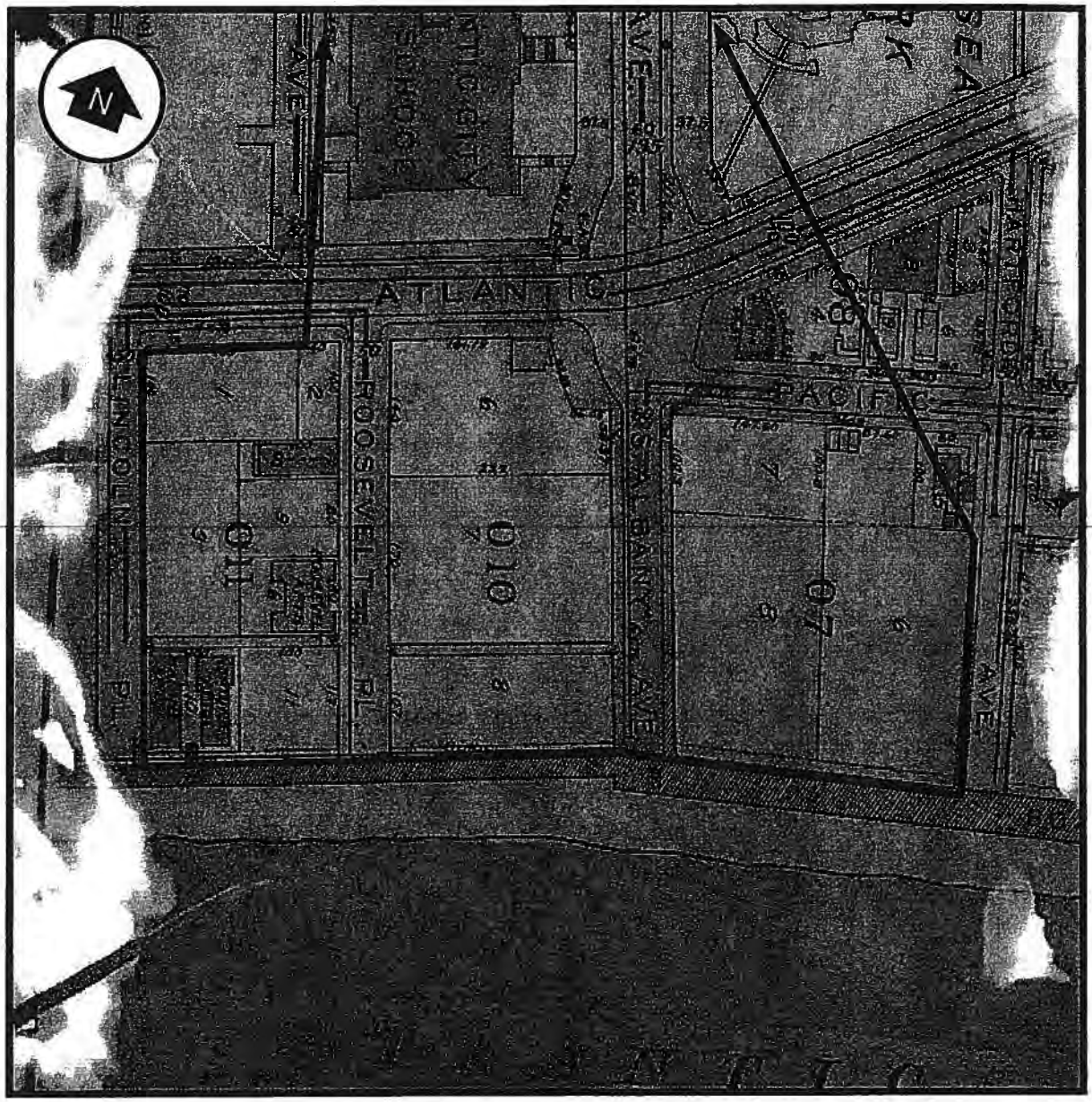


Figure 4.19a. Mueller, A.H. *Atlas of Absecon Island, New Jersey. Volume One, embracing the City of Atlantic City and the City of Brigantine.* 1924. Project Area Outlined. Scale: 1 inch= 200 feet (approximately).

Atlantic City in which nearly every lot was built upon, this area still contained a number of undeveloped lots. Surprisingly, several of these lots would be developed in the first years of the 1930s, in the midst of the Great Depression.

Four apartments were built on Lincoln Place between Atlantic Avenue and the Boardwalk between 1930 and 1931. Two of these buildings, 109 and 111 Lincoln Place are still standing. Herman M. Ellis purchased all four lots, which were then undeveloped, in 1930 for $300 (Atlantic County Deed 955/295). On February 20, 1931 he sold the lot at 111 Lincoln Place to the Royal Apartment Company of New Jersey for $12,500 (Atlantic County Deed 963/157). This significant increase in the property's value suggests that the apartment building that stands on the lot dates to this period. Ellis sold the lots at 105, 107 and 109 Lincoln Place to the Roselle Corporation on May 4, 1931 for $500. That corporation in turn sold 109 Lincoln Place to the Lincoln Building Company on June 15, 1931 for $14,000 (Atlantic County Deed 974/5). Again, the increase in the property's value is certainly indicative that this apartment too was built in 1931. Based on architectural evidence, the two buildings were likely designed and constructed by the same company, though each lot was under different ownership. The Franklin Survey Company's *Property Atlas of Absecon Island, N.J.* (1938) (Figures 4.20a-b) provides evidence that apartment buildings of similar size and form were built at 105 and 107 Lincoln Place at some point between 1931 and 1938 as well.

World War Two brought significant changes to Atlantic City as the United States military occupied much of the resort town from 1942 to 1946. The beach, boardwalk, Boardwalk Hall and even the roof of the President Hotel served as training facilities for soldiers and many of the resort's large hotels, including the President, were converted to barracks (Levi and Eisenberg 1979:107-110). In many of the hotels, "'Lobbies, mezzanines, dining rooms, halls and other parts of the hotels were stripped of rugs, carpets, draperies, and other adornments,' reported the *New York Times*. 'Over the concrete of the floors march thousands of leather-heeled recruits. Most bedroom furniture has been replaced by army equipment'" (quoted in Levi and Eisenberg 1979:111). The President, which was occupied by the AAF Redistribution Station No. 1 and the Army Ground and Service Forces beginning on August 7, 1942, did not return to private ownership until November 30, 1945 (Atlantic City Daily Press 1945, 1946).

With much of the city's resources occupied by the military and the war, very little changed in physical structure of the project area during the war years. In 1949, the structural landscape of the project area was nearly identical to what it was in 1938 (Figures 4.21a-c and Plate 4.10). Then next significant change to the area occurred in 1950 when four stores and a gas station on the south side of Atlantic Avenue between Albany Avenue and Roosevelt Place were demolished to make room for the Mayfair Apartments. Built in 1950, the twelve-story Mayfair Apartments occupied the entire southerly side of Atlantic Avenue between Albany Avenue and Roosevelt Place (Plates 4.11 and 4.12).

F. DEVELOPMENT AND DESTRUCTION SINCE 1958

Since 1958, the project area has gone through a series of large scale construction and demolition projects (Figures 4.23a-c). In 1959, the 137-unit President Motel was constructed to the southeast of the Mayfair Hotel on a lot that had previously been occupied by a small restaurant on Albany Avenue (Plates 4.13 and 4.14; Franklin Survey Company 1938; Sanborn Map Company 1952; Prendergast 1968). In the mid- to late 1960s, Roosevelt Beach Realty, Inc. built the Roosevelt

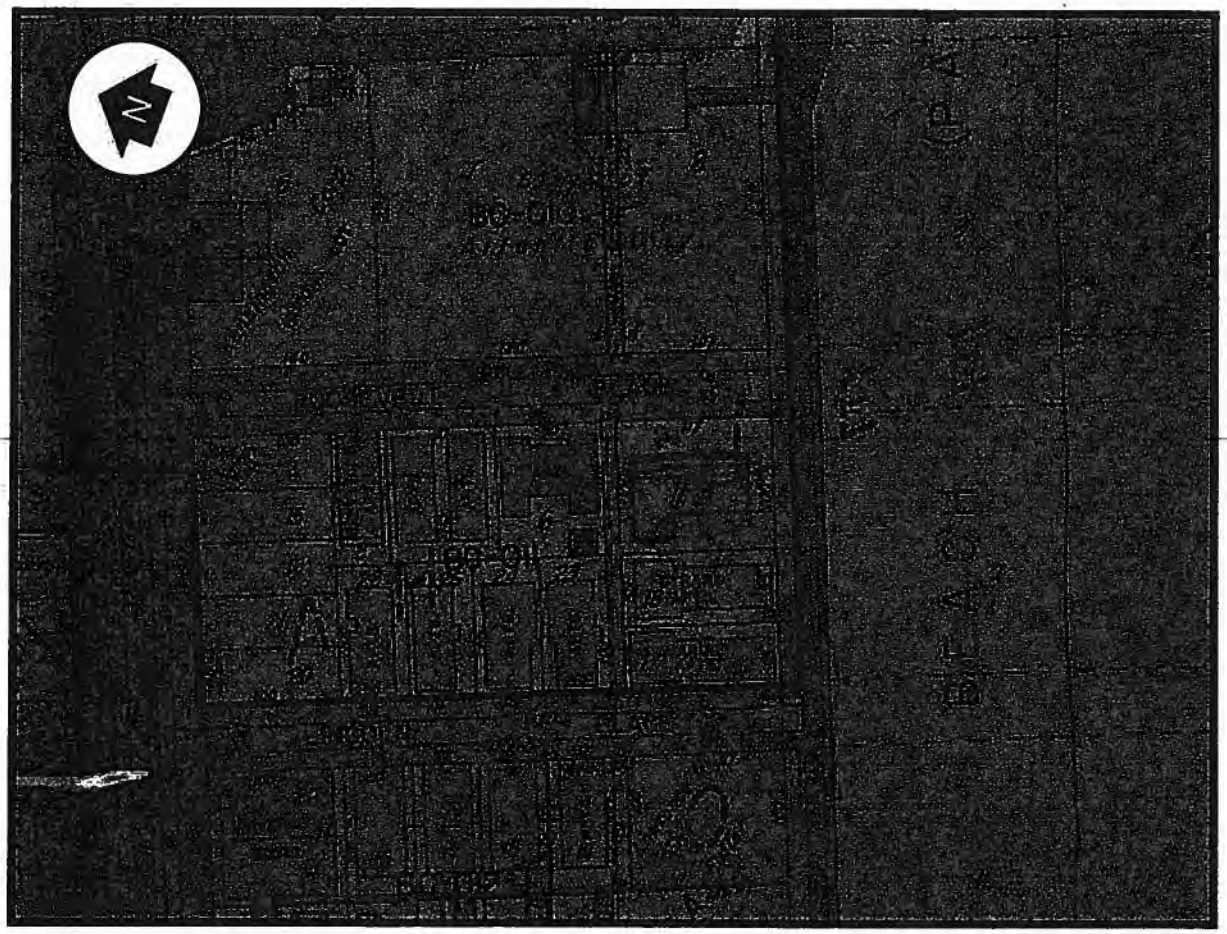


Figure 4.20a . Franklin Survey Company. *Property Atlas of Absecon Island, N.J., complete in one volume including Atlantic City, Ventnor, Margate City, Longport and Brigantine.* 1938. Project Area Outlined. Scale: 1 inch= 150 feet (approximately).

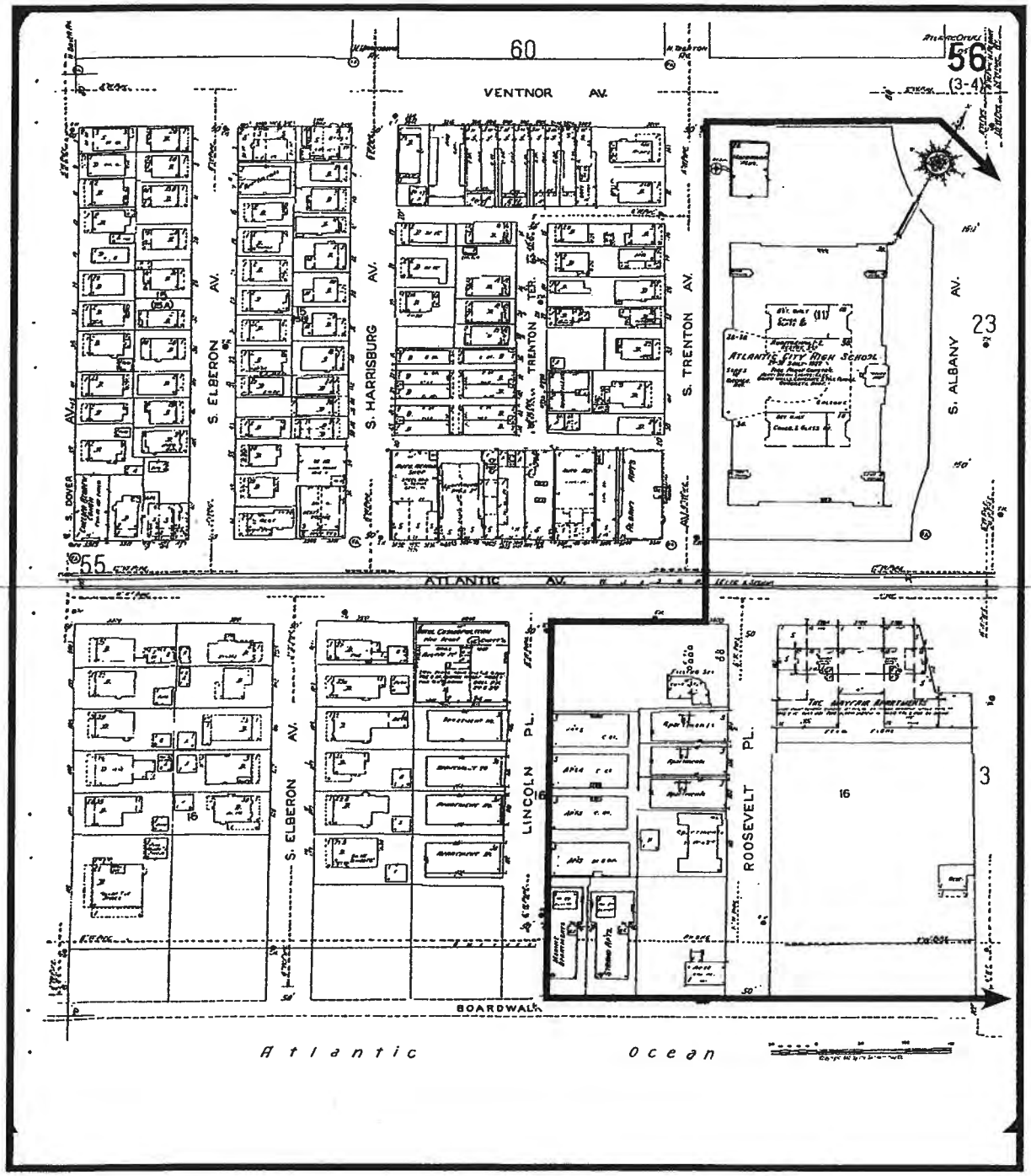


Figure 4.22c. Sanborn Map Company. *Insurance Maps of Atlantic City, New Jersey.* 1952. Project Area Outlined. Scale: 1 inch= 165 feet (approximately).

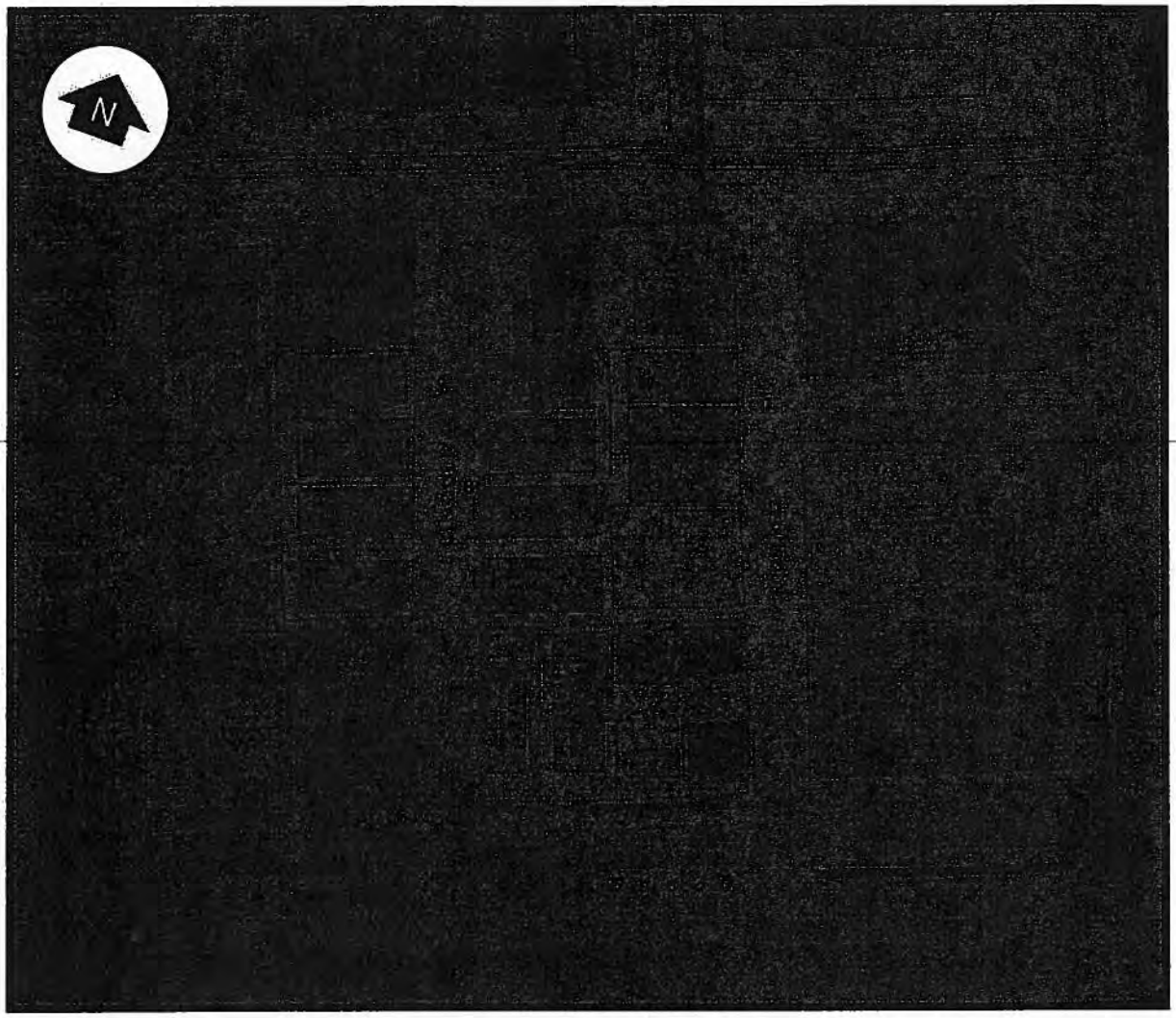


Figure 4.23a. Sanborn Map Company. *Insurance Maps of Atlantic City, New Jersey.* 1976. Project Area Outlined. Scale: 1 inch= 140 feet (approximately).

Motel on Block 19 Lot 3 to the northeast of the Strand and Marine Apartments on a lot formerly occupied by Junior's Luncheonette. Harold Zeltner and Maxwell Goldberg had built Junior's Luncheonette, a small cinder block building fronting on the Boardwalk, in 1951 or 1952 where it operated until 1962. By 1963, the lot was vacant (Atlantic County Deed 1544/174; R.L. Polk & Co. 1954, 1961, 1963).

In the 1970s, the combination of an economic upswing in Atlantic City and a shortage of luxury housing in the resort created a demand for condominium housing. The current project area, with several apartment buildings and motels located on prime beachfront property, was not immune from the growing trend toward condominium conversion (Binder 1979). In 1976, Harold Zeltner created the Roosevelt Beach Condominium Association and converted his 33 unit Roosevelt Beach Motel into condominiums (Figures 4.24a-b; Atlantic County Deed 3005/173). Three years later, the Costas Corporation, owner of both the Marine and Strand apartments, converted those two buildings into the Strand Marine Condominiums (Figures 4.25a-d; Atlantic County Deed 23413/59).

The advent of casino gambling in Atlantic City also resulted in great changes for the current project area. The blocks bounded by the Boardwalk, Roosevelt Place, Atlantic and Pacific Avenues and Hartford Avenue were the sites of two proposed casinos. In 1968 Friendship House Inc. purchased the President Hotel from the President Hotel of Atlantic City Corporation to convert it to an apartment building. However, ten years after the President was converted into apartments, then-owner Del E. Webb Company relocated the President's tenants and demolished the building to make way for a $100 million casino construction. The President was to be replaced by the Sahara Boardwalk, a 48,000 square foot casino and hotel, though this casino was never built and today a parking lot sits on the site of the former President Hotel (Prendergast 1968; Heneghan 1979; Schwartz 2006). In 1989, the Dunes Casino had been partially built on the site of the former Mayfair Apartments and President Motel. However, this project was never fully realized and a skeleton of the proposed building sat on the lot until 1991 when it was torn down (Plate 4.15; Schwartz 2006b).

Even the Atlantic City High School was not immune to casino construction. After the High School relocated to a new building on Great Island in 1994 the old building was demolished, and like the site of the President Hotel, now serves as a parking lot for Atlantic City (Plate 4.16).

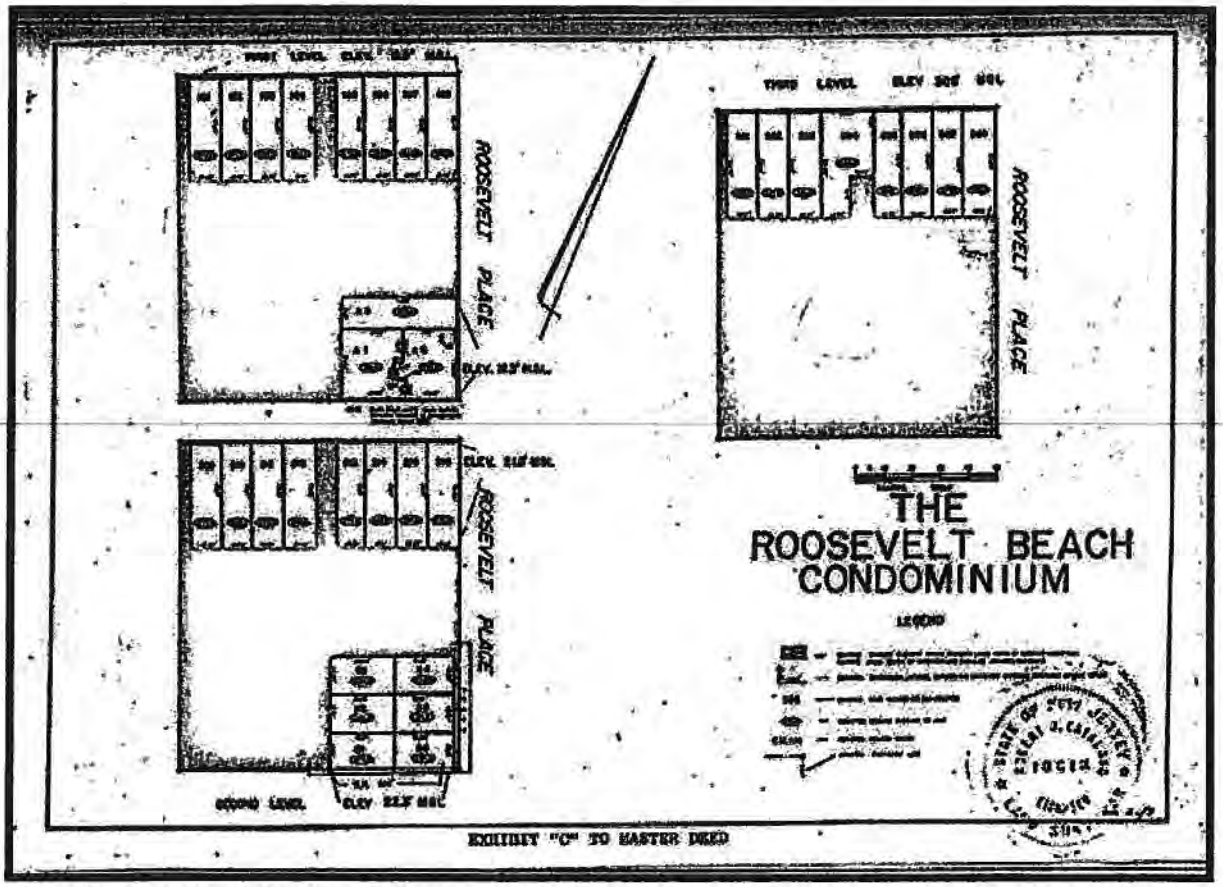


Figure 4.24a. Robert J. Catalono & Associates. *The Roosevelt Beach Condominium: Survey of Premises, Atlantic City, Atlantic County, N.J.* 1976. Source: Atlantic County Deed 3005/173. Scale as shown.

installed in 1929. The sculpture, entitled "Liberty in Distress," was the work of Frederick MacMonnies who also created the Revolutionary War battle monument in Princeton, New Jersey. In 1988 new lighting was installed and the memorial rededicated (Plates 5.2 and 5.3).

C. THE KNIFE & FORK

The Knife & Fork occupies the entire tax parcel except for portions of the surrounding side walk. Its design draws heavily on Flemish architecture rarely found in America. Major design elements include its stepped cross-gables, parapets, chimney, diamond-paned windows, and irregular shape. The building has an irregular footprint, made necessary by the intersection of the three roads on three sides. It has three large Flemish stepped cross-gables facing Atlantic Avenue and one such gable on the ends facing Atlantic and Pacific Avenues (Plate 5.4).

Though the present Knife & Fork was built in 1912, it stands on a piece of ground that has been home to an inn and restaurant since 1896 (Mueller 1896) (Figure 4.14). In fact, the name "Knife & Fork Inn" predates the current building by at least 4 years (C.E. Howe Company 1908). Some sources contend that former mayor William Riddle opened the inn as a saloon, or a private drinking club (Tyler 1997). When the current Knife & Fork building opened in 1912, the property was owned by the Mary A. Riddle Company of Pennsylvania who leased it to William Riddle (Atlantic County Deed 489/247; Atlantic City Press 1914) (Table 5.1). Mary A. Riddle was William Riddle's mother.

Accounts differ as to the fate of the inn's bar. According to one source, Riddle removed it during Prohibition; another states that the bar was in fact destroyed by federal agents who raided the Knife & Fork (Tyler 1997; Swavy 2002).

Milton Latz began leasing the Knife & Fork Inn from the Riddles as early as 1927. In 1944 the Riddles had suffered financial losses from a hurricane and though the Knife & Fork escaped unharmed, the Riddles put the property up for sale. Milton and Evalyn Latz purchased it outright (Atlantic County Deed 1220/27; Waltzer 2005). When Evalyn Latz died in 1968, the property passed to her sons, Mack and Jim. Mack bought his brother's share in 1986 and put the entire property up for sale in 1996. The property was not sold and Mack's son Andrew Latz reopened the Knife & Fork in 1999. He made minor changes to the interior of the building – removing carpet and restoring old wood floors – and while the new Knife & Fork Inn was successful, a family dispute caused it to close again.

During the Latzes' ownership the Knife & Fork was nationally prominent – it catered to celebrities, politicians and business men and was the setting for a scene from the film "Atlantic City" (starring Burt Lancaster and Susan Sarandon) in 1979 (Swavy 2002; Waltzer 2005).

In 2005, the Knife & Fork reopened after a change in ownership and a major six-month renovation. New owner Frank Dougherty removed "Inn" from the restaurant's name, transformed the glass-enclosed porch into a "sleek martini bar," installed a large window looking into the kitchen and planned to turn the old 3rd and 4th floor apartments into a wine cellar (LaBan 2005).

This local landmark appears to be eligible for the National Register of Historic Places. It is one of very few buildings incorporating Flemish architectural

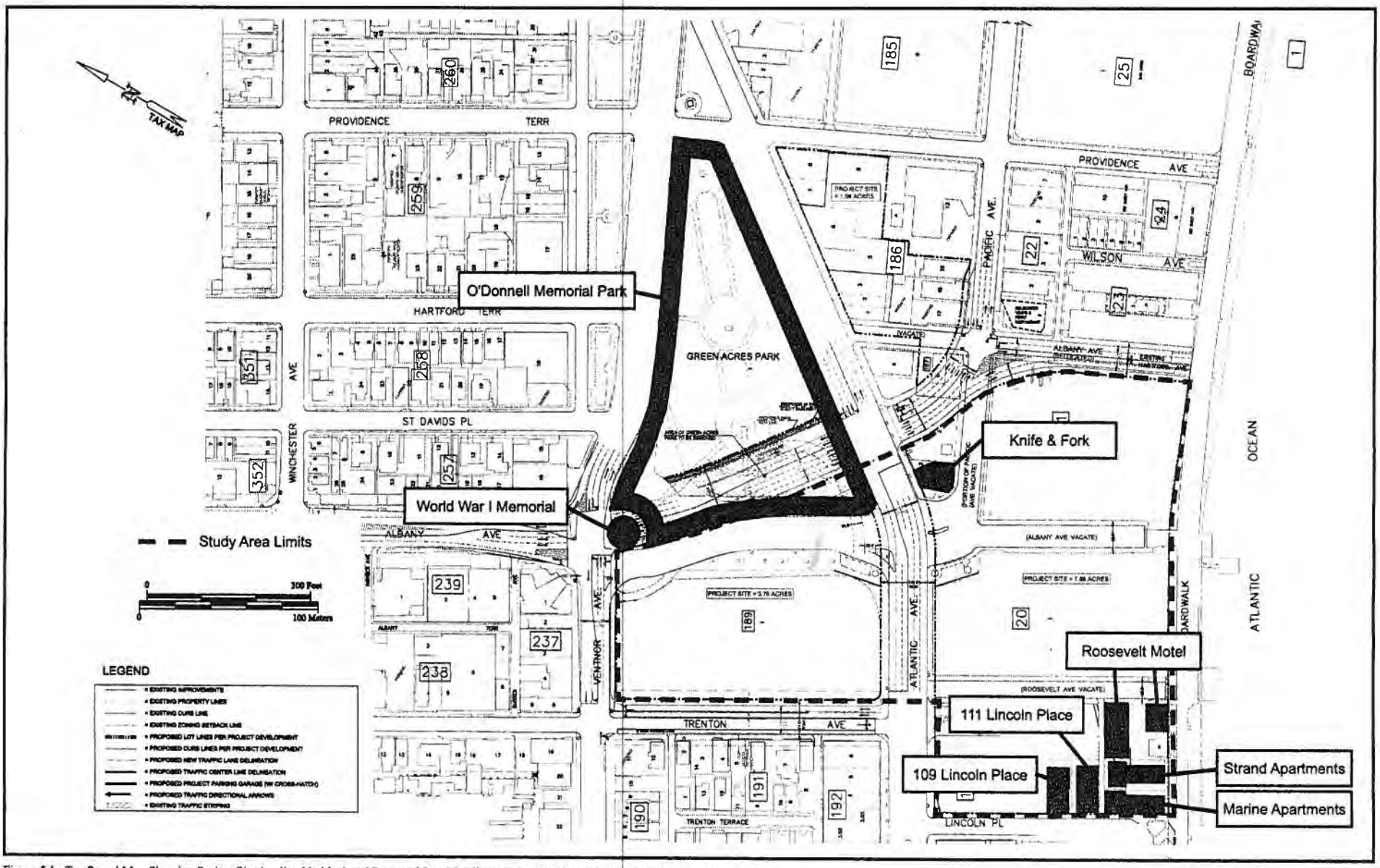


Figure 5.1. Tax Parcel Map Showing Project Site (outlined in blue) and Proposed Road Realignments in Relation to Historic Architectural Properties.

elements (mainly the stepped gables, fenestration and chimneys). Although the building has undergone alterations, particularly the enclosure of its porch on the front of the building, it appears to be significant under Criterion C for architecture in the context of northern European revival architecture.

D. THE MARINE AND STRAND APARTMENT BUILDINGS

Although two separate buildings on separate lots, the architectural form (and more importantly, history of ownership) of the two buildings is so similar that they are treated together (Plate 5.5). Both are five-story yellow brick veneer apartment buildings with cement trim, standing side by side on adjacent lots and separated by a small courtyard. The two structures were intensively surveyed separately (see Appendix C).

The Strand and Marine Apartments were most likely built in 1923 or 1924 by the Lincoln Development Company, who owned the property from 1923 to 1925 (Atlantic County Deeds 727/181, 765/298 and 772/185) (Table 5.2). The two buildings are nearly identical and were probably constructed at the same time. Both are brick buildings with a steel frame and with similar interior layouts. The buildings share a narrow cement courtyard. An alley forms the northwest border of the property. The original interior and exterior detailing are mainly intact.

The Marine Apartments first appear on Mueller's *Atlas of Absecon Island, New Jersey* (1924) (see Figure 4.19) and subsequent map evidence indicates that the size, form and use of the building remained unchanged into the 1970s.

An apartment building was definitely on the Strand site by March 19, 1925 when the Lincoln Development Company sold the lot "together with that certain apartment house thereon erected" (Atlantic County Deed 765/298) (Table 5.3). The Strand Apartments were originally known as the Adriatic Court Apartments (R.L. Polk & Co. 1926). While Mueller's *Atlas of Absecon Island, New Jersey* (1924) identifies the building as the "Neptune Apartments," city directories from that year place the Neptune Apartments at 132 Kentucky Avenue (R.L. Polk & Co. 1924). By 1938, the name of the apartment building had changed from Adriatic Court to Strand Apartments (R.L. Polk & Co. 1938). Subsequent map evidence indicates that the size, form and use of the building remained unchanged into the 1970s. In 1979, the Costas Corporation owned both the Marine and Strand Apartments and converted them into the Strand Marine Condominiums (Atlantic County Deed 23413/59).

The Strand and Marine apartments, particularly when evaluated together rather than as individual buildings, each appear to be eligible for the National Register of Historic Places. Both buildings incorporate distinctive design features on the interior and exterior that make them architecturally significant within the context of mid-rise apartment buildings. On the exterior, the ornamentation not only demonstrates the craftsmanship of the time, but gives the buildings a sense of Sullivanesque verticality and thus a commanding presence along the Boardwalk. This is particularly true when the buildings are considered as a pair. The interior plan of both buildings is similar, and incorporates several features that were specifically built to take advantage of the seaside location albeit on a small city lot. As such both buildings appear eligible under Criterion C for architecture.

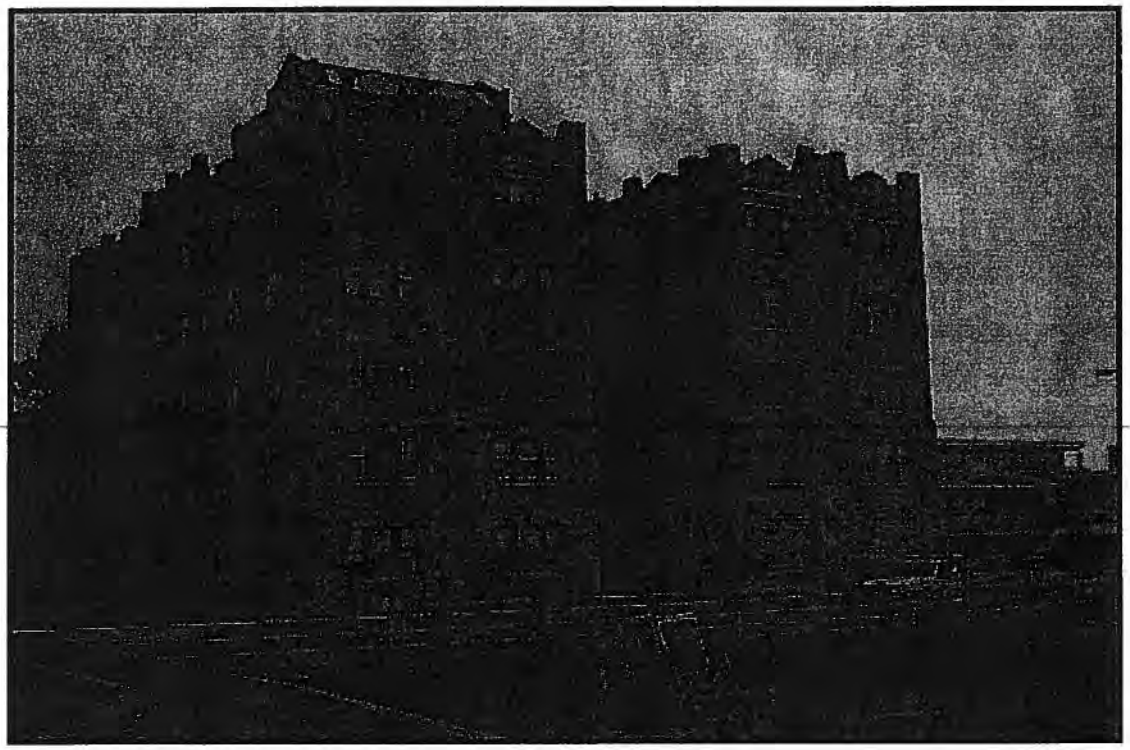


Plate 5.5. View generally west of the Marine (left) and Strand Apartments from the beach (Photographer: Charles Ashton, February 2008)[HRI Neg. #08011/D1:36].

Chapter 7

CONCLUSIONS AND RECOMMENDATIONS

A. HISTORIC ARCHITECTURAL RESOURCES

The intensive-level architectural survey of the project site identified three buildings that, in the opinion of this consultant, are eligible for inclusion in the New Jersey and National Registers of Historic Places. These are the Knife & Fork at 29 Albany Avenue, the Marine Apartments at 3821 Boardwalk and the Strand Apartments at 3825 Boardwalk. All three are deemed eligible on the basis of their architecture rather than for association with significant individuals or events. The removal of all three buildings is proposed under Option 19 as it now exists, thus carrying the potential to cause an adverse effect under the definition of that term quoted in Chapter 1.

Under Option 19 the Knife & Fork would be relocated about one block east on Pacific Avenue, to a site at the eastern corner of its intersection with Hartford Avenue. Prior to the relocation, the building should be recorded in its current (historic) location to the standards of the Historic American Buildings Survey (HABS). Such recording would typically include large-format photography of the building in its context, including general views and significant architectural details. Recording would also include preparation of a historical narrative with reproductions of historic photographs and maps as appropriate to illustrate its history. One full copy of the recording (with photographic negatives) should be filed with the New Jersey Historic Preservation Office. Archivally stable copies of the photographs and the narrative should also be made available to the Atlantic City Public Library and the Atlantic Heritage Center in Somers Point. Since the significance of the Knife & Fork is architectural, this treatment should adequately mitigate the adverse effect resulting from the project.

Under Option 19 both the Marine and Strand Apartments would be demolished. Unlike the Knife & Fork, relocation of these two five-story buildings is probably not feasible (although this question has not been addressed in the course of this investigation). However, like the Knife & Fork, their significance is architectural and the adverse effect could be mitigated by a program of photographic and written (narrative) recording to HABS standards as described above. Due to their similarities in ownership, history and particularly design, the two buildings could be recorded together, as a complex, rather than as two individual structures. The recording products should be distributed as in the case of the Knife & Fork.

Since none of the other three buildings in the project area—109 and 111 Lincoln Place and the Roosevelt Beach Motel—are considered eligible for inclusion in the New Jersey or National Registers of Historic Places, no mitigation is called for and no further work is recommended.

B. ARCHAEOLOGICAL RESOURCES

The majority of the project site has no archaeological potential. Mid- to late 20-century land use has been of sufficient intensity and scale that the construction of modern buildings, their subsequent demolition and infrastructure improvements will have removed most traces of Native American and historic occupation pre-dating the early 20th century.

Only in limited parts of the eastern and southwestern sections of the project site is there a low to moderate potential of archaeological remains surviving intact (Figure 6.1). In these areas, two approaches are recommended to clarify whether or not significant archaeological remains are present:

1. to address the small zone of potential Native American and early historic archaeological interest within the eastern part of Block 21, it is recommended that a limited geoarchaeological study be performed by a qualified geomorphologist and prehistorian to ascertain whether or not the underlying natural landform is of sufficient age and character to contain archaeological evidence from the period *circa* 3,000 B.C. to A.D. 1900. Such a study could take the form of soil auger tests or borings, which could be accomplished in conjunction with project-related geotechnical studies. Alternatively, a program of independent backhoe trenching could be carried out at the combined Phase I and II survey level, which would allow for a more thorough consideration of archaeological potential. If significant archaeological remains are identified in this section of the project site, some form of archaeological data recovery may be necessary to mitigate the effects of the project.

2. for those areas of the project site identified as holding a low to moderate potential for yielding late 19th- and early 20th-century archaeological remains (a small area in the center of Block 18; the northeastern corner of Block 21; the southwestern corner of Block 187, including the site of the Knife & Fork; and the southern corner of O'Donnell Memorial Park), archaeological monitoring during the ground preparation stage of construction is recommended. The goal of such monitoring would be to recover an artifact sample and record potentially valuable information about late 19th- and early 20th-century residential, commercial and resort-related land use in this rapidly developing section of Atlantic City.

Archaeological monitoring work should entail systematic observation by a qualified archaeologist of contractor excavations for the footings, landscaping and related elements of the new construction in areas where archaeological deposits of potential interest are suspected. The archaeological monitor should take notes, measurements and photographs, conduct limited recovery of artifacts as necessary, and record stratigraphy and features of particular historical and archaeological importance. The archaeological monitor should have the authority to halt work for brief periods to facilitate recording if stratigraphy or features of importance are noted.

Provision should also be made for the development of contingency plans for more intensive archaeological recording in the unlikely event that more significant archaeological resources are encountered than are presently anticipated. In this event, the New Jersey Historic Preservation Office should be contacted concerning the scope of any further archaeological work. Details of the archaeological monitoring program should be incorporated into the construction plans, specifications and contract documents to ensure that all parties involved in the construction process are aware of the project's obligations with reference to archaeological resources and respect the need for and the authority of the archaeological monitor during ground disturbing activities.

ATLANTIC CITY QUAD # 27

A:\checklist
01/98

✓ Mapped on main USGS

SHPO Opinion Checklist

Property Name: WARNER THEATER

Location/Address: BOARDWALK

County/Municipality: ATLANTIC CITY

SHPO Opinion date: 1/9/96 Chrono # A96-61 Log File # 96-543

Information in this file includes:
(checkmark or fill in data where applicable)

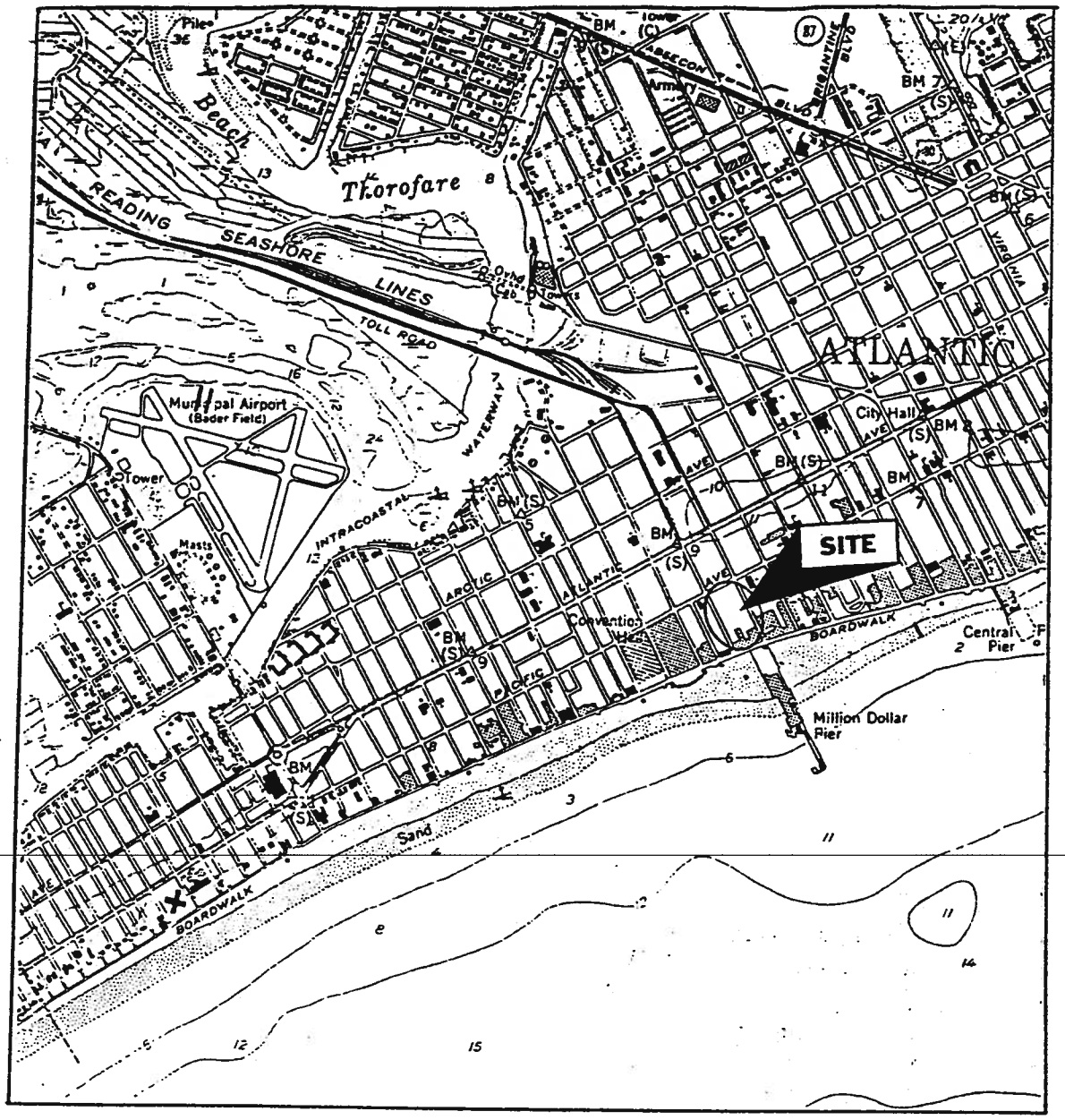
- ✓ SHPO Opinion letter
- ✓ Accessioned report title page and report #
- ____ Property information from accessioned report or historic sites inventory (indicate HSI#)
- ____ Photograph(s)
- ✓ Map(s) (USGS map with property located, labelled & showing quad name; tax map; site plan)

Additional information available in report or HSI: ✓ yes ___ no

Other Materials (check if applicable):

- ____ HABS/HAER documentation
- ____ Preservation Plan
- ✓ Conditions Assesment
- ✓ Historic Structure Report
- ____ Alternative Analysis Report
- ____ Project file
  ProjectName: CAESARS CASINO - HOTEL EXPANSION
  0102-95-0021.1
- ____ Other

Prepared by: D SAUNDERS Date: 7-9-98



Scale: 1" = 2000'

SITE LOCATION MAP

CAESARS HOTEL/CASINO

ATLANTIC CITY, ATLANTIC CO., NJ

LJG REF. NO. 3078.P1/9

PLATE 1

THE WARNER THEATER

Atlantic City, New Jersey

ATL
HSR
38

ARCHITECTURAL SURVEY

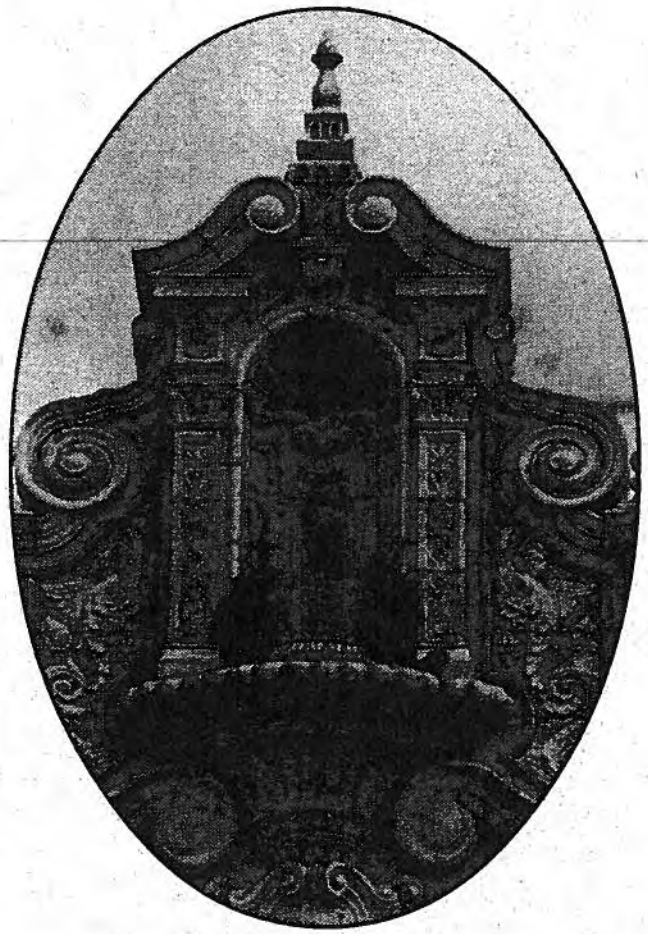
ID 581

(Existing Conditions Report)

prepared for

CAESARS ATLANTIC CITY

Renovation/Expansion



by

JOHN MILNER ASSOCIATES, INC.
309 North Matlack St.
West Chester, PA 19380

November 1996

INTRODUCTION

The Warner Theater, Atlantic City, New Jersey, has been determined eligible for listing on the National Register of Historic Places by the New Jersey State Historic Preservation Office. Based on that determination of eligibility and to comply with the terms of the Coastal Area Facility Review Act (CAFRA) of New Jersey permitting process, Caesars Atlantic City was asked to prepare an architectural assessment of the Warner Theater. The assessment addresses the condition of existing building fabric and proposes recommendations for renovation. During the months of June and July, 1996, John Milner Associates, Inc. (JMA's) project team visited the Warner Theater site to observe the existing condition of the exterior envelope and roof system of the building, including brick, terra cotta masonry, windows and doors, significant interior finishes, roofing and related structural elements. Observations were made from grade using the naked eye and binoculars, from ladders, and from roof areas. In addition, a sixty foot hi-reach lift was made available to the JMA survey team to allow documentation of the roofs and upper levels of the terra cotta facade elements. JMA reviewed a report made available by the Caesars Hotel and Casino, Atlantic City (owners of the property) written by Elton Engineers, Inc. (Elton), dated May 2, 1996. Lastly, four test openings were made in the roof materials to determine number of layers and the presence of asbestos containing materials: two in the upper roof area, and two in the lower roof. In addition, the concrete roof deck was tested for compressive strength following the removal of roofing materials. The test openings and evaluations were done by Lippincott, Jacobs & Gouda, Civil Engineers.

The purpose of this Report is to inform Caesars Atlantic City of our findings, to provide recommendations for addressing identified problems, and to satisfy Caesar's obligations under the CAFRA permitting process for evaluation of properties deemed eligible for nomination to the National Register of Historic Places. The existing conditions survey of the building provided a detailed record of its present condition. Recommendations were developed to address noted problems. Repair recommendations were based on JMA's experience in assessing the rate of deterioration of building materials and the consequences of permitting this process to remain unchecked, life safety issues, the severity of observed deterioration, the threat to adjacent building fabric, and the cost of accessing work areas.

The existing building shell of the Warner Theater in Atlantic City, New Jersey, represents only the original entrance lobby space, the much larger theater auditorium having been demolished in 1960. Main access to the theater was from the boardwalk through the extant lobby space, the floor sloped gently upward from south to north leaving theater patrons even with the rear of the auditorium, with seating dropping toward the screen to the west. The sloping grade change from the boardwalk level to the rear of the theater was almost six feet, paved with an elaborate tile pattern and tile base, little of which remains at the jagged edges of the removed original slab. The present floor is a flat concrete slab paved with a variety of materials reflecting the changing uses of the structure over time. The original mezzanine, located at the front two bays of the building, was used to access the marquee and window lighting. Several intermediate mezzanine floors have been inserted in the rear large volume of the structure, obscuring the original decorative plaster ceiling and wall finishes, and severely altering perceptions of the original space.

Appendix D

Photograph Log and Key Map


Intercoastal Waterway Inside Thorofare
Atlantic Ocean
The Strand and Marine Apartments
Raphael-Gordon House
John Stafford Historic District
ROOSEVELT PL
LINCOLN PL
ELBERON AVE
DOVER AVE
RIDGEWAY AVE
ANNAPOLIS AVE
RICHMOND AVE
RALEIGH AVE
WINCHESTER AVE
BARTRAM PL
KINGSTON AVE
CLAYHAGY AVE
DELANCY PL
ABERDEEN PL
ATLANTIC AVE
TALLAHASSEE AVE
NEWTON AVE
PLAZA PL
CALLENDER AVE
OAKLAND AVE
HILLSIDE AVE
BATON ROUGE AVE
MARION AVE
AUSTIN AVE
BERKLEY SQ
BOARDWALK
JACKSON AVE
VASSAR SQ
FRANKFORT AVE
WEYMOUTH AVE
LITTLE ROCK AVE
VICTORIA AVE
SURREY AVE
NASHVILLE AVE
AMHERST AVE
OAKLAND AVE
23, 24
21, 22
19, 20
17, 18
15, 16
13, 14
11, 12
9, 10
7, 8
5, 6
3, 4
1, 2
0
245
490
980
Feet
Legend
Photograph location and direction
7 Photograph number
IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Appendix D - Photo Key Map 1 of 3
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
Reviewed By: CB
Contract Number: 7-7523-0003
August 2010



0 250 500 1,000
Feet

Legend

Photograph location and direction

7 Photograph number

IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008

amec Earth & Environmental

Appendix D - Photo Key Map 2 of 3
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey

Reviewed By: CB	Contract Number: 7-7523-0003	August 2010



0 250 500 1,000
Feet

Legend

Photograph location and direction

7 Photograph number

IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008

amec Earth & Environmental

Appendix D - Photo Key Map 3 of 3
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey

Reviewed By: CB	Contract Number: 7-7523-0003	August 2010



Photo 1 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Austin Avenue - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34237
W -074.46662



Photo 2 – Ventnor City, NJ

Same photo as above with turbine position overlay.

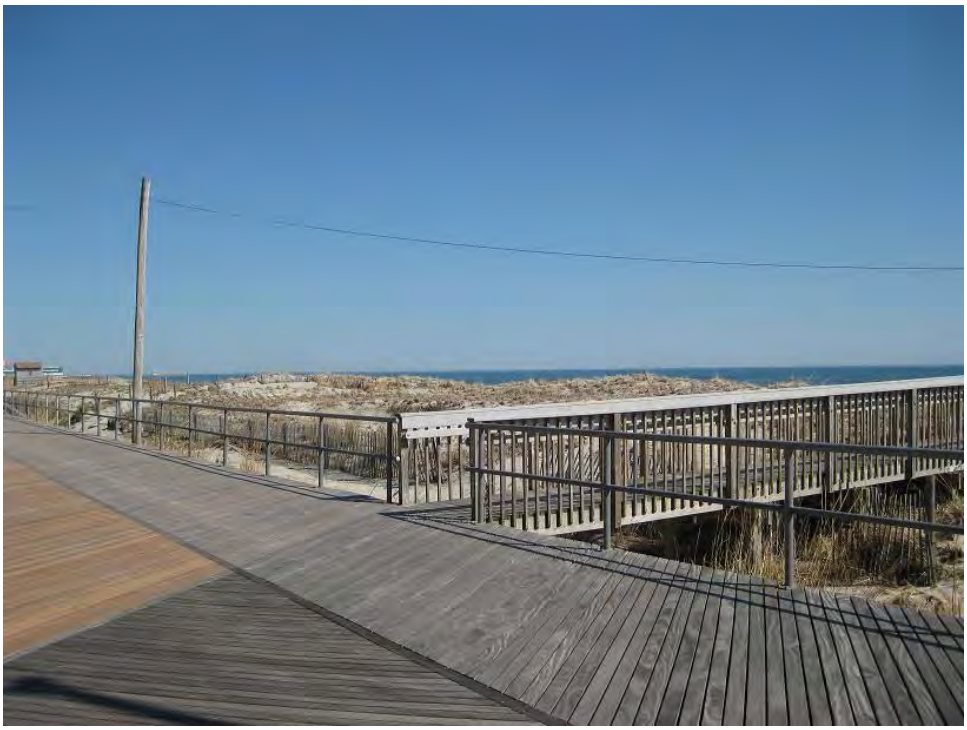


Photo 3 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Austin Avenue - facing E.

(This street is part of the John Stafford Historic District).

N 39.34237
W -074.46662

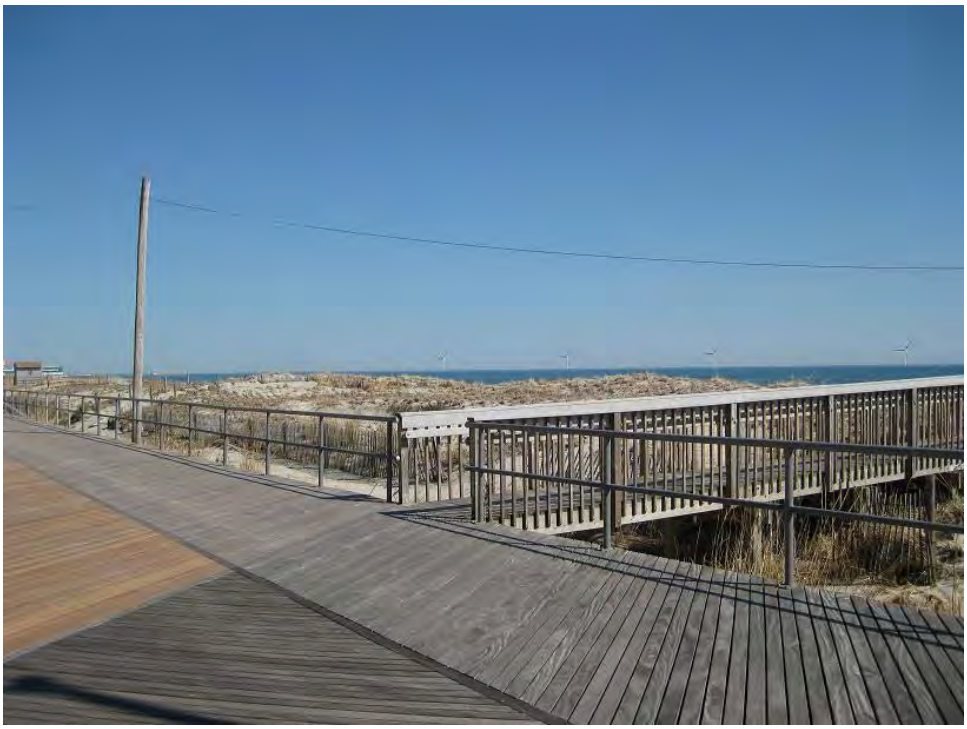


Photo 4 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 5 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Marion Avenue - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34262
W -074.46609



Photo 6 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 7 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Marion Avenue - facing E.

(This street is part of the John Stafford Historic District).

N 39.34262
W -074.46609



Photo 8 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 9 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Baton Rouge Avenue - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34284
W -074.46552



Photo 10 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 11 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Baton Rouge Avenue - facing E.

(This street is part of the John Stafford Historic District).

N 39.34284
W -074.46552



Photo 12 – Ventnor City, NJ

Same photo as above with turbine position overlay.

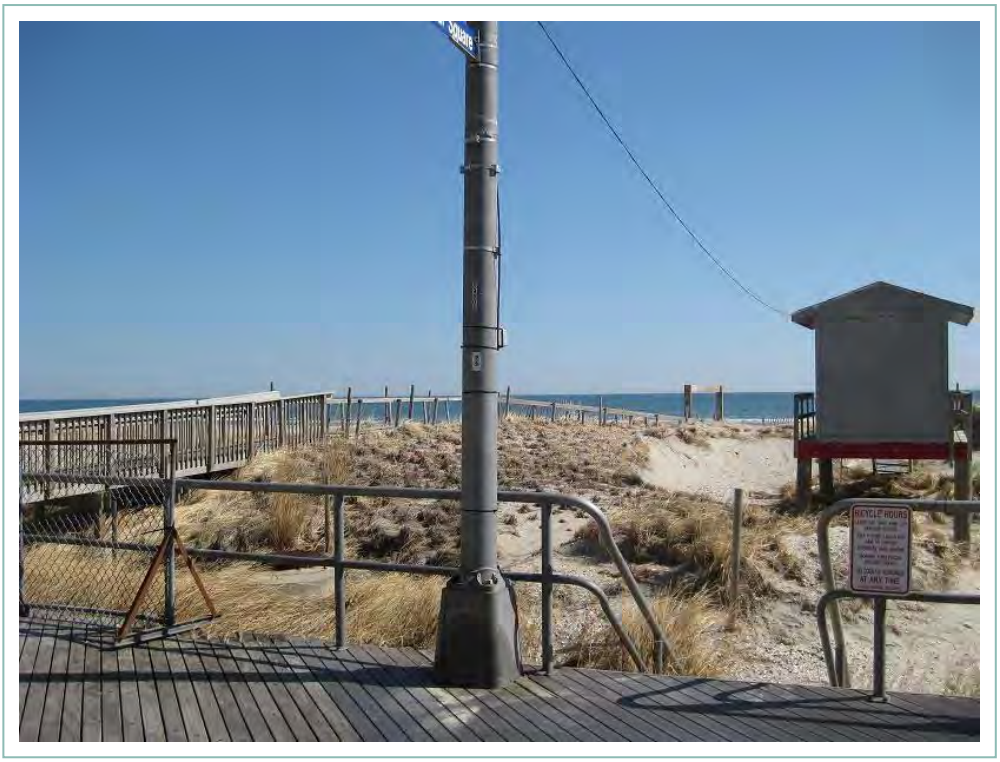


Photo 13 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Vassar Square - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34308
W -074.46505



Photo 14 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 15 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Vassar Square - facing E.

(This street is part of the John Stafford Historic District).

N 39.34308
W -074.46505



Photo 16 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 17 – Atlantic City, NJ

View from the 2nd story balcony of the Raphael-Gordon House - facing SE.

N 39.34409
W -074.46476



Photo 18 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 19 – Atlantic City, NJ

View from the SE corner of the Raphael-Gordon House property - facing SE.

N 39.34408
W -074.46472



Photo 20 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 21 – Atlantic City, NJ

View from the boardwalk at the SE faces of the former Strand and Marine Apartments - facing SE.

N 39.34826
W -074.45434



Photo 22 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 23 – Atlantic City, NJ

View from the boardwalk at the SE faces of the former Strand and Marine Apartments - facing E.

N 39.34826
W -074.45434



Photo 24 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 25 – Atlantic City, NJ

View from the stage in front of the former Atlantic City Convention Hall - facing S.

(The building is now the "Boardwalk Hall" arena)

N 39.35376
W -074.43798



Photo 26 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 27 – Atlantic City, NJ

View from the stage in front of the former Atlantic City Convention Hall - facing SE.

(The building is now the "Boardwalk Hall" arena)

N 39.35376
W -074.43798



Photo 28 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 29 – Atlantic City, NJ

View from the stage in front of the former Atlantic City Convention Hall - facing E.

(The building is now the "Boardwalk Hall" arena)

N 39.35376
W -074.43798



Photo 30 – Atlantic City, NJ

Same photo as above with turbine position overlay.

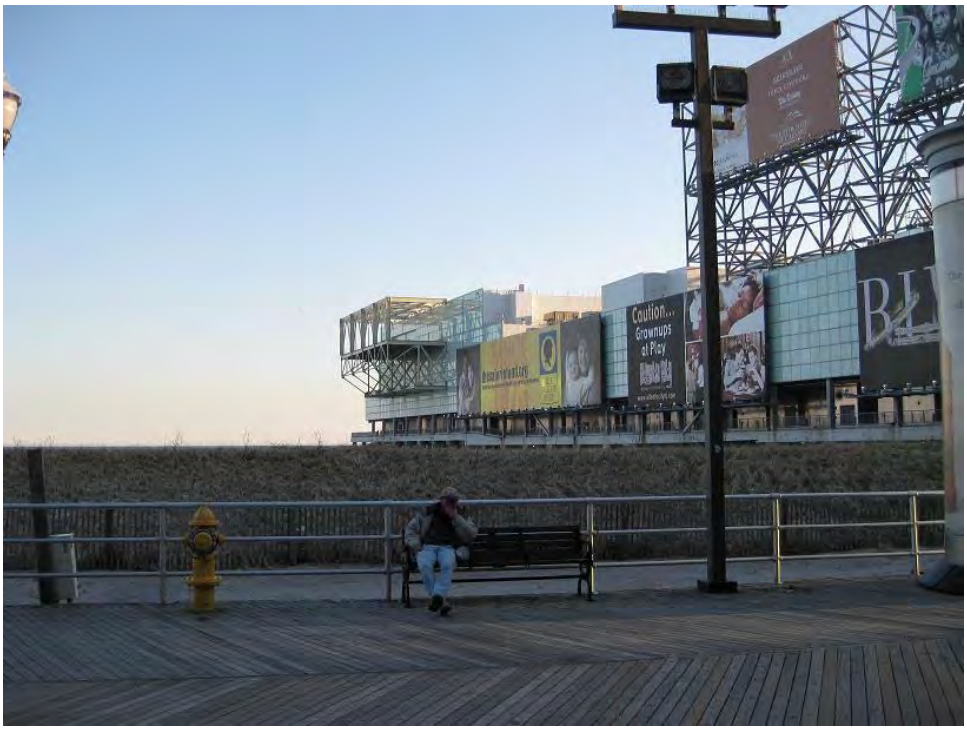


Photo 31 – Atlantic City, NJ

View from the boardwalk at the base of the Warner Theatre façade - facing S.

(Façade is now part of the Bally's Hotel and Casino)

N 39.35528
W -074.43387

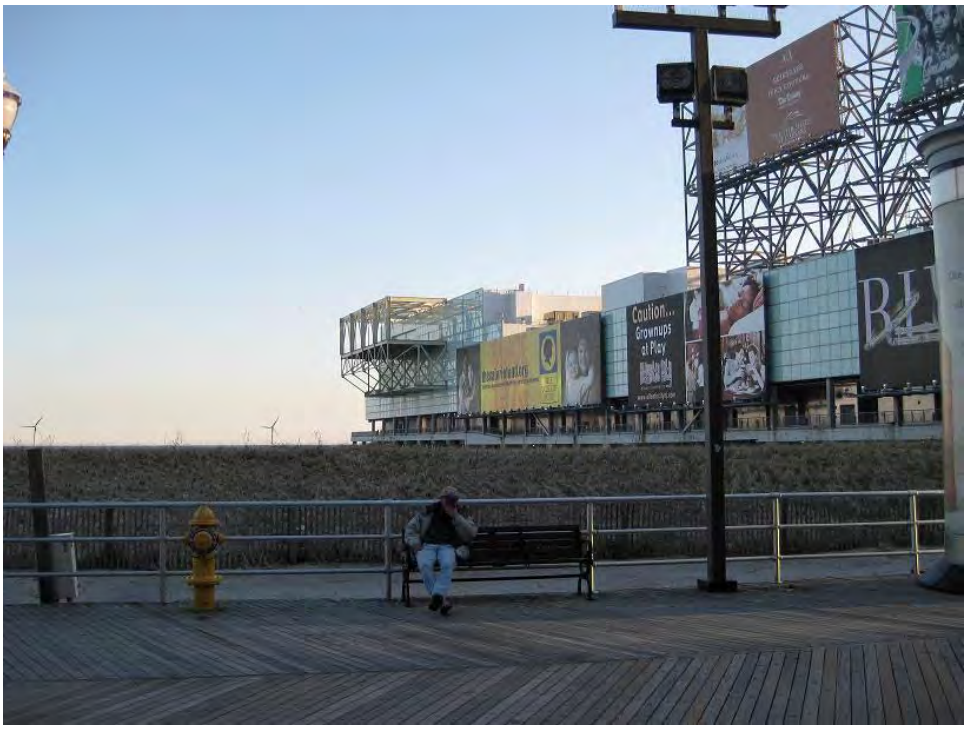


Photo 32 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 33 – Atlantic City, NJ

View from the boardwalk at the base of the Warner Theatre façade - facing SE.

(Façade is now part of the Bally's Hotel and Casino)

N 39.35528
W -074.43387



Photo 34 – Atlantic City, NJ

Same photo as above with turbine position overlay.

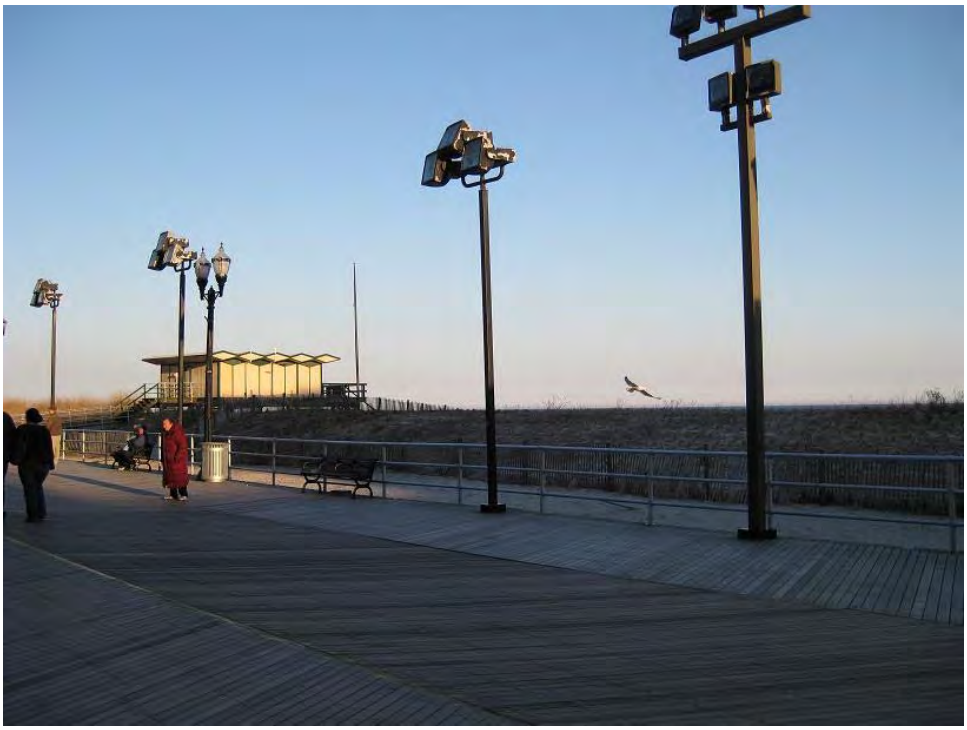


Photo 35 – Atlantic City, NJ

View from the boardwalk at the base of the Warner Theatre façade - facing E.

(Façade is now part of the Bally's Hotel and Casino)

N 39.35528
W -074.43387

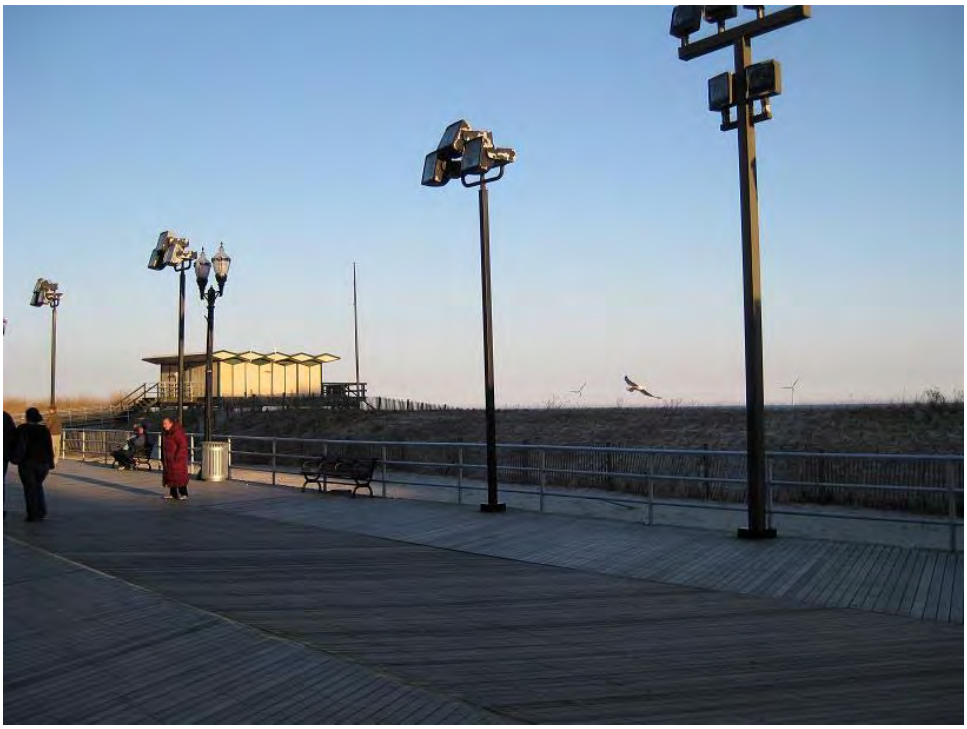


Photo 36 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 37 – Atlantic City, NJ

View from the lookout platform on top of the Absecon Lighthouse - facing S.

N 39.36634
W -074. 41414



Photo 38 – Atlantic City, NJ

Same photo as above with turbine position overlay.

Appendix E

William J. Hughes Public Survey Report

The Richard Stockton College of New Jersey
WILLIAM J. HUGHES CENTER
FOR PUBLIC POLICY

Survey of Residents & Visitors in Four Communities Along the Southern New Jersey Shore

Submitted to:
Fishermen's Energy, LLC

Submitted by:
William J. Hughes Center for Public Policy
The Richard Stockton College of New Jersey

Sharon Schulman, Executive Director
Jason Rivera, Project Manager

August 3, 2009

William J. Hughes Center for Public Policy
Sharon Schulman Executive Director

Ph: 609.626.3542
Fax: 609.626.3480

THE RICHARD STOCKTON COLLEGE OF NEW JERSEY

In preparation for a proposed wind turbine project approximately three miles off the Atlantic City, New Jersey shoreline, Fishermen's Energy, LLC, approached the William J. Hughes Center for Public Policy at The Richard Stockton College of New Jersey and asked that we undertake a statistically significant polling project that would measure attitudes and issues of both residents and visitors to the area. The intent was to:

1. submit a specific project plan to the respondents;
2. observe if there would be any substantial positive or negative impact on the area's tourism industry and/or the quality of life for residents;
3. contrast where applicable the attitudes measured in a 2006 survey undertaken by the State of New Jersey Department of Commerce and note any changes.

Following is a brief summary of the findings:

- 90% of the respondents were aware that electricity could be produced by using offshore wind turbines.
- Support for a wind turbine project three miles off the Atlantic City shore is strong among all subgroups and almost 30 percentage points higher than a similar question asked in 2006.
- Most respondents do not feel that this project would have a negative impact on Atlantic City and the local environment. In fact, 66% thought it would have a positive impact.
- More than three-quarters of the visitors said it would have no effect on whether or not they would visit the Atlantic City area and another 19% said that they would be a little or a lot more likely to visit the area.

The following pages contain findings, analysis, cross tabulations and the survey instrument.

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Table 3. Support/Opposition	9
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Table 5. Effect of Wind Turbine/Windmills on Local Environment*	11

Appendix A: PowerPoint

Appendix B: Cross Tabulations

Appendix C: Survey Instrument

I. Methodology and Sample Characteristics

Methodology

Zogby International was commissioned by the William J. Hughes Center for Public Policy to conduct 1003 intercept interviews in three communities along New Jersey's Atlantic shore. The three communities chosen were Atlantic City/Ventnor, Margate, and Brigantine. Ventnor did not give permission to conduct interviews on their beach, so as a consequence, a lesser amount of interviews were conducted along the Atlantic City/Ventnor border.

The interviews were conducted from July 9 through July 12, 2009. Nine interviewers conducted the interviews over those four days. Interviews were conducted one day along Atlantic City's Boardwalk, while the rest of the interviews were conducted on the beaches in those communities.

The interviews included a 34-question questionnaire and six (6) photographic depictions of what it may look like with windmills off shore. Respondents were asked some basic questions, shown the photographic depictions, then asked specific questions about the depictions.

Sample Characteristics

Sample Characteristics	Frequency	Valid Percent*
Sample size	1003	100
Atlantic City/Ventnor	491	49
Brigantine	260	26
Margate	252	25
Seasonal resident	218	22
Full time resident	241	24
Visitor	544	54
Previously visited shore	506	91
First time visitor	49	9
18-40	299	30
41-60	427	43
Over 60	276	28
Did not answer age	1	--
Less than high school	16	2
High school graduate	201	20
Some college	228	23
College graduate+	546	55
Did not answer education	12	--

Sample Characteristics	Frequency	Valid Percent*
White	874	88
Hispanic	23	2
African American	75	8
Asian/Pacific	17	2
Other/mixed	6	1
Did not answer race	8	--
Married	612	61
Single, never married	221	22
Divorced/widowed/separated	144	14
Civil union/domestic partnership	20	2
Less than $25,000	77	9
$25,000-$34,999	66	8
$35,000-$49,999	104	13
$50,000-$74,999	153	18
$75,000-$99,999	142	17
$100,000 or more	291	35
Did not answer income	170	--
Male	506	51
Female	494	49

*** Numbers have been rounded to the nearest percent and might not total 100.**

II. Narrative Summary

Note: A survey asking about windmills offshore in the Atlantic City area was conducted in 2006 by Lieberman Research. This report will contrast 2009 findings with 2006 data where appropriate.[*]

1. Have you ever heard about producing electricity through the use of Offshore Wind Turbines or Wind Mills? You may have also heard these referred to as Offshore Wind Mills or Wind Farms. Wind Turbines, or Wind Mills are structures that capture wind to produce electricity.

Yes	90%
No	10

Nine in ten respondents say they have heard about producing electricity through the use of offshore wind turbines or windmills, while 10 percent say they have not heard about this.

Vast majorities in all sub-groups have heard about producing electricity using windmills. Those living in Brigantine (95%), respondents over 60 (96%), those who own property along the southern New Jersey shore (93%), and those earning more than $75,000 a year (94%) are the most likely to have heard of this concept.

2. What have you heard about electricity production through the use of Offshore Wind Turbines/Wind Mills?

- Aware of technology (172) 18%
- Good/better for the environment (136) 14
- Clean source of energy (132) 14
- Knowledge of project in Atlantic City (90) 10
- Low cost/cheaper electricity (69) 7
- Alternative source of energy (58) 6
- Good source of energy (57) 6
- Efficient (50) 5
- Cost of construction (33) 3
- Nothing/don't know/no answer (146) 15

Most respondents gave an answer when asked what they have heard about electricity production using windmills or wind turbines. Most of the responses were positive or neutral with a simple awareness of the technology topping the list (18%). The next two most mentioned ideas were “good for the environment” and “a clean source of energy” (both 14%).

[*]**It is difficult to compare the data for the following reasons: question wording is different; photographic depictions are very different; and the sample is different.**

The only possible negative response was the "cost of construction" cited by 3%.

3. On a scale of 1 to 5 where 1 is "not at all familiar" with producing electricity through Offshore Wind Mills and 5 is "extremely familiar", how familiar are you with the idea of producing electricity through Offshore Wind Mills?

Table 1. Familiarity with Offshore Wind Mills

	%
Overall Familiar (5+4)	**27**
5	11
4	16
3	33
Overall Not familiar (2+1)	**40**
2	25
1	14
Not sure	**<0**

A plurality of respondents (40%) say they are not familiar with offshore windmills, while just over one in four (27%) express at least some familiarity, including about one in nine (11%) who are extremely familiar.

Familiarity decreases with age as a majority of those under 40 (50%) are familiar with the concept compared to 31% of those over 60 who are aware and men are more aware than are women (45% vs. 34%)

4. Are you familiar with the 5-turbine wind farm near the Borgata Casino on the way into Atlantic City?

Table 2. Familiarity with 5-Turbine Wind Farm

	%
Overall Familiar (5+4)	**41**
5	31
4	10
3	16
Overall Not familiar (2+1)	**43**
2	22
1	21
Not sure	**<0**

Respondents are closely divided in their familiarity with the Atlantic County Utilities Authority's (ACUA) wind farm near the Borgata Casino – 41% are familiar while 43% are not familiar.

Those in Brigantine (45%) are the most familiar while those surveyed in Atlantic City/Ventnor (37%) are the least familiar. Familiarity increases with age and women are slightly more likely than men to say they are familiar with the wind farm.

5. Are you more likely or less likely to visit Atlantic City because of these five windmills?

More likely	8%
Less likely	2
No difference	89
Not sure	2

Nearly nine in ten (89%) say it will make no difference in their plans whether or not to visit Atlantic City because of the ACUA 5-windmill farm near the Borgata. Eight percent say it will make them more likely to visit Atlantic City and just 2% say it will make them less likely to visit.

Eighty-five percent or more in most sub-groups say it would make no difference in their likelihood of visiting Atlantic City because of the wind farm.

Consideration is being given to building a nine windmill farm three miles off Atlantic City as part of a program designed to provide electricity through clean, renewable and locally generated sources. I'm going to show you some pictures of what the proposed nine Offshore Wind Mills or Wind Farm off Atlantic City might look like from the area and ask you some questions based on the pictures.

6. On a scale of 1 to 5, where 1 is "completely opposed" to this idea and 5 is "completely in favor" of this idea, how do you feel about the idea of the proposed nine windmills three miles off the Atlantic City shore?

Table 3. Support/Opposition*

	2009	2006
Overall In favor (5+4)	**76**	**47**
5	55	--
4	20	--
3	15	31
Overall Oppose (2+1)	**7**	**21**
2	3	--
1	4	--
Not sure**	**3**	**1**

***Question in 2006: Based on this information, please rate your favorability toward the Wind Turbine project using a scale from 1 to 5 where 1 means you are "completely opposed" to this idea and 5 means you are "completely in favor of this idea? Use any number from 1 to 5.**
****Not sure was "no answer" in 2006**

After looking at six photos of what windmills three miles out to sea might look like, three in four (76%) support the idea while just 7% are opposed. A majority (55%) are strongly in support. Three percent are not sure. In 2006, 47% of respondents were in favor of wind turbines offshore, however, it should be noted that the question was worded differently in 2006, and the photographic depictions were different.

Sub-group responses generally mirror the response overall with a majority in most sub-groups saying the strongly support having windmills offshore.

7. What benefits, if any, do you think there might be with what you just looked at?

Table 4. Benefits from Offshore Windmills

2009		2006	
Environmental Issues (Net)	**38%**	**Environmental Issues (Net)**	**40%**
Clean source of energy	18	Clean source of energy	15
Less pollution/clean air	--	Less pollution/clean air	12
Good/better for the environment	15	Good/better for the environment	10
Conserves energy	5	Conserves energy	4
Energy Source (Net)	**18%**	**Energy Source (Net)**	**33%***
Good source of energy	7	Good source of energy	10
Renewable source of energy	6	Renewable source of energy	6
Alternative source of energy	5	Alternative source of energy	4
Cost (Net)	**23%**	**Cost (Net)**	**28%**
Low cost/cheaper electricity	18	Low cost/cheaper electricity	24
Saves Money	5	Saves Money	4
Not Fossil Fuel (Net)	**11%**	**Not Fossil Fuel (Net)**	**7%***
Reduced dependence	6	Reduced dependence	6
Not fossil fuel	5	Not fossil fuel	2
Nothing/don't know/no answer	**9**	**Nothing/don't know/no answer**	**13**

***Totals from previous study.**

When asked top-of-mind what benefits, if any, might be associated with the windmills, there are minor changes. Photographic depictions are different between the two studies which may account for the differences. Environmental issues still top the list of benefits – 38% in 2009, 40% in 2006.

8. What disadvantages, if any, do you think there might be with what you just looked at?

- Ugly/eye sore (169) 17%
- Obstructs ocean view (107) 11
- Harmful to marine life/other wildlife (78) 8
- Cost of construction (59) 6
- Interferes with boats/water traffic (48) 5
- Inefficient (19) 2
- Durability (18) 2
- Noise (17) 2
- No difference (165) 16
- Nothing/don't know/no answer (326) 32

Thinking of disadvantages to having windmills three miles offshore, 17% say they are "ugly" and 11% believe they will obstruct the view of the ocean.

9. Do you think the nine windmills three miles off the Atlantic City shore will have a positive or negative effect on the city of Atlantic City and the local environment?

Table 5. Affect of Wind Turbine/Windmills on Local Environment*

	2009	2006
Positive	66	48
Negative	7	16
No effect	22	32
Not sure**	6	4

***Question in 2006: How do you think Wind Turbines would affect the New Jersey Shore environment? What do you think their overall affect on the environment would be?**
****Not sure was "no answer" in 2006**

Positive	66%
Negative	7
No effect	22
Not sure	6

By three to one (66% vs. 22%), respondents think the windmills will have a positive effect on the city and the local environment rather than having no effect, while 7% believe the overall effect will be negative. Six percent are not sure. By contrast, in 2006, 48% thought the wind turbines would have an overall positive effect, but again, the questions are different.

A majority in every sub-group, but two, say the effect would be positive, including nearly three in four (74%) of those under 40 who think the windmills will have a positive effect, while 56% of seniors over 60 feel that way. Those who have lived on the southern New Jersey shore for three years or more are more likely than those living there less than three years to say the overall effect would be positive.

10. Please tell me why you feel that way?

- Low cost/cheaper electricity (95) 11%
- Good/better for the environment (94) 11
- Clean source of energy (93) 11
- Good source of energy (74) 9
- Atlantic City serves as role model (64) 8
- Looks good (43) 5
- Saves money (37) 4
- Renewable source of energy (36) 4
- No difference (114) 14
- Nothing/don't know/no answer (173) 21

Eleven percent each say the reason they believe the windmills will have a positive effect is because of "cheaper electricity," it's "better for the environment," and it is a "clean source of energy."

(11 and 12 visitors only)
11. If nine windmills were located off the Atlantic City shore, please tell me how likely you would be to visit the Atlantic City area in the future? Would you be…?

A lot more likely	11%
A little more likely	8
Neither more likely nor less likely	77
A little less likely	3
A lot less likely	1
Not sure	<0

Just over three in four (77%) say it would not make a difference to them if nine windmills were located off the Atlantic City shore, while just about one in five (19%) say it would make them more likely to visit the Atlantic City area in the future. Only 4% would be less likely to visit.

Sub-group results reflect overall with results with a significant majority in each sub-group saying they are neither more nor less likely to visit in the future.

12. Do you think you would go elsewhere on the New Jersey Shore or go somewhere other than the Atlantic City area?

Elsewhere on the New Jersey Shore	6%
Somewhere other than the New Jersey Shore	1
Not sure	94

Nearly all of those who said it makes no difference or were less likely to visit the Atlantic City area said they are not sure if they would go, while 6% said they would go

elsewhere on the southern New Jersey shore. Just 1% would go somewhere other than the southern New Jersey shore to vacation.

Ninety percent or more in all sub-groups except one say they are not sure.

(13-15 residents only)
13. If nine windmills were located off the Atlantic City shore, please tell me what affect it would have on people who live in the Atlantic City area?

- No difference (140) 30%
- Low cost/cheaper electricity (57) 12
- Obstructs ocean view (22) 5
- Saves money (16) 3
- Ugly/eye sore (15) 3
- Good/better for the environment (14) 3
- More jobs (13) 3
- Good source of energy (11) 2
- Clean source of energy (8) 2
- Nothing/don't know/no answer (177) 37

About one in three respondents say locating the windmills of the Atlantic City shore would have no effect. Twelve percent say the windmills would lower the cost of electricity.

14. Do you own any rental properties in the Atlantic City area?

Yes	10%
No	89
Not sure	1

Nine in ten (89%) say they do not own any rental properties in the Atlantic City area while 10% do.

Results among sub-groups echo overall results.

15. If nine windmills were located off the Atlantic City shore, do you think it would it make it easier or more difficult to rent your properties or would it have no impact?

Easier	10%
More difficult	13
No impact	76
Not sure	2

Of the 10% who own rental property in the Atlantic City area, three in four (76%) think there would be no impact on their ability to rent their properties if the windmills

were located offshore. Thirteen percent believe it would be more difficult to rent their properties and 10% think it would be easier. Two percent are just not sure.

Totals are too small for sub-group analysis.

(ASK EVERYONE)
16. Would you say the development of renewable energy resources as compared to other issues facing the nation is…

Much more important	24%
Somewhat more important	22
Equally as important	40
Somewhat less important	9
A lot less important	4
Not sure	1

Nearly half (46%) say that the development of renewable energy resources as compared to other issues facing the nation is important, while another 40% say it is equally as important as other issues. Thirteen percent feel that renewable energy is less important than other issues facing the nation.

Younger respondents are more likely than those over 60 to say developing renewable energy resources is equally as important as other issues and men are slightly more likely than women to feel that way.

Those living on the southern New Jersey shore seasonally are more likely than full time residents and visitors to say developing renewable energy resources is equally important as other issues.

17. Would you say that global warming and the reduction of greenhouse gases compared to other issues facing the nation is...

Much more important	27%
Somewhat more important	22
Equally as important	33
Somewhat less important	9
A lot less important	8
Not sure	2

Half (49%) of respondents think global warming and the reduction of greenhouse gases compare to other issues facing the country are more important. One in three (33%) think global warming and reduction of greenhouse gases is equally important and just 17% think these issues are less important than other issues facing the nation. Two percent are not sure.

Generally, sub-group responses mirror responses overall with most of the sub-groups closely divided between saying global warming and the reduction of greenhouse gases is much more important or equally important as other issues facing the country.

Appendix A: Power Point

Opinions on Wind Turbines at the Southern New Jersey Shore

Research by:

Zogby International

&

William J. Hughes Center for Public Policy at the Richard Stockton College of New Jersey

July 2009

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Hughes Center

- Table of contents
- Methodology and survey details
- Summary of findings
- Question analysis

includes comparative analysis from 2006 survey where appropriate

- Sample composition and wind mill pictures

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Methodology

- Results for this survey are based on face-to-face intercept interviews of 1,003 residents and visitors to the Jersey Shore. Interviews were conducted in Atlantic City, Ventnor, Margate, and Brigantine.
- Of the 1,003 interviews, 459 were residents and 544 were visitors. 491 were interviewed in Atlantic City/Ventnor, 252 in Margate, and 260 in Brigantine. Additional demographic details are included in the appendix.
- Margin of error: +/- 3.2 percentage points. Margin of error is higher within subgroups.
- A previous survey using a similar methodology and a sample size of 4,026 residents and visitors to Monmouth, Ocean, Atlantic and Cape May counties was carried out in 2006 under the direction of the Lieberman Research Group. The Atlantic County subsample had 983 respondents. Only those in the Atlantic County subsample are included in the comparative slides of this report.

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Survey details

- All respondents were asked a number of general questions about their awareness of wind turbines and wind power, what they had heard or knew about wind turbines and wind power, whether they were aware of existing wind farms in the area and how they felt about the overall importance of renewable energy and reduction of greenhouse gases.
- All respondents were shown the same set of pictures depicting wind turbines located three miles off of the New Jersey shore. They then answered a series of questions on their support for these wind turbines, what they thought the benefits and disadvantages to these turbines would be, and what the effect would be on the surrounding community.
- Residents and visitors also answered resident and visitor-specific questions related to renting, economic impact, and future vacation plans.
- Demographic information was collected from all respondents.

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Summary of Findings I

- In general, both knowledge and support of wind turbines have risen significantly since 2006.

- Those surveyed claim a relatively high level of awareness and knowledge of wind turbines. 90% of the total sample claims to be aware of wind turbines, with 60% of this group either saying they are very or somewhat knowledgeable about wind turbines. In 2006, 49% of the total sample claimed to be aware of wind turbines, with 70% of this group claiming to be very or somewhat knowledgeable about wind turbines.

- 88% of the sample say their travel plans are unaffected by the existing Atlantic County Utilities Authority (ACUA) wind turbines near the Borgata.

- After being shown the pictures of wind turbines three miles off of the shore, 75% of the sample say they are in favor of these wind turbines. In 2006, only 38% of the sample felt this way.

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Summary of Findings II

- When asked whether the wind turbines would have a positive or negative effect on the city of Atlantic City, 66% of the total sample said these windmills would have a positive effect. In 2006, 30% felt the same way.

- 4% of visitors say the wind turbines would make them less likely to visit Atlantic City in the future. In 2006, 30% felt this way.

- 77% of residents who own rental property believe that wind turbines would have no effect on their ability to rent property. In 2006, 60% felt this way.

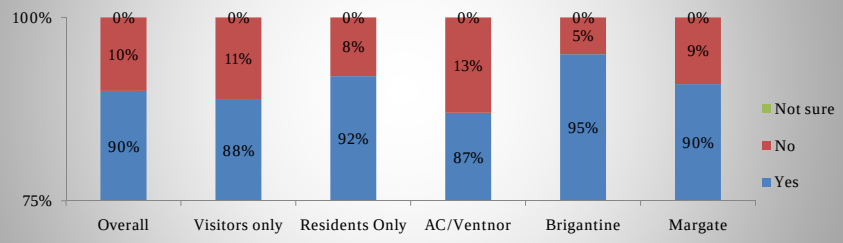
- Differences in 2009 and 2006 in how people view the significance of wind energy, development of renewable resources, and global warming compared to other concerns are generally small in magnitude.

- Note that different pictures of the wind mills at three miles off of the shore were used in 2006 and 2009. This should be kept in mind when analyzing relevant comparative data. The pictures are included in the appendix of this report.

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Familiarity – overall

(Question 1) **Have you ever heard about producing electricity through the use of Offshore Wind Turbines or Wind Mills?**



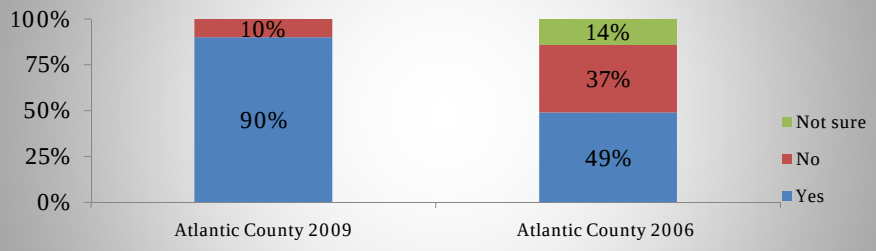
A large majority of both the overall group and all subgroups have heard of producing electricity through wind turbines or wind mills.

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Familiarity – 2009 and 2006

(Question 1) **Have you ever heard about producing electricity through the use of Offshore Wind Turbines or Wind Mills?**



The percentage of people who have heard about producing electricity through wind turbines or wind mills has jumped from 49% in 2006 to 90% in 2009.

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General impressions of Wind Turbines/Wind Mills

(Question 2) **What have you heard about electricity production through the use of Offshore Wind Turbines/Wind Mills?** *(open-ended question)*

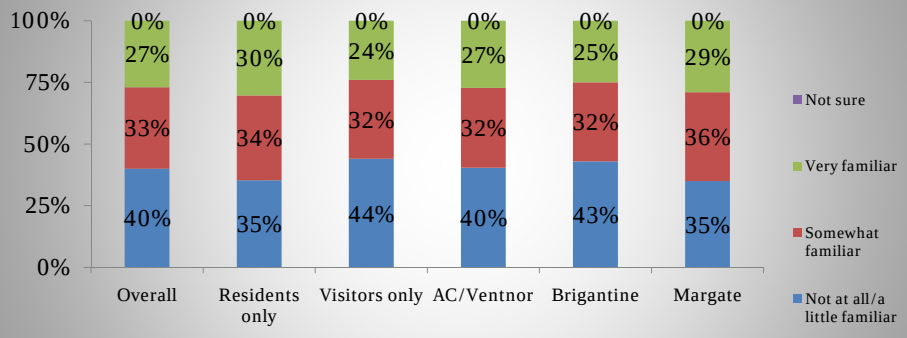
General Category	Frequency mentioned
Aware of technology	172
Nothing/don't know/ no answer	146
Good/better for the environment	136
Clean source of energy	132
Knowledge of project in Atlantic City	90
Low cost/cheaper electricity	69
Alternative source of energy	58
Good source of energy	57
Efficient	50
Cost of construction	33

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Familiarity - Scale

(Question 3) On a scale of 1 (low) to 5 (high), how familiar are you with the idea of producing electricity through offshore wind mills?



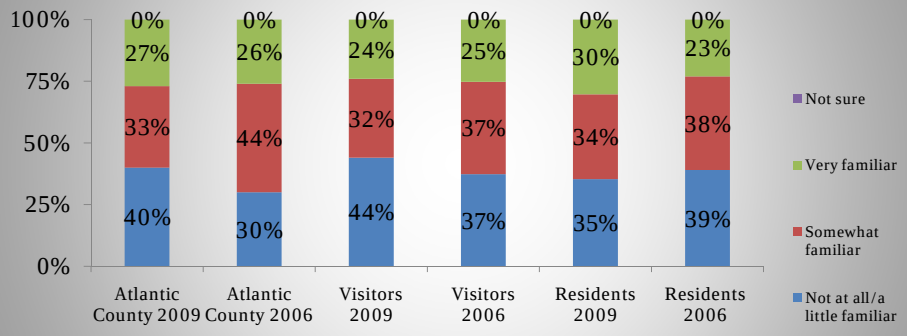
Residents (30%) are more likely than visitors (24%) to say they are very familiar with the idea of producing electricity through wind mills.

Note: Those who answered 1 or 2 are "not at all/a little familiar"; those who answered 3 are "somewhat familiar"; those who answered 4 or 5 are "very familiar".

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Familiarity - Scale

(Question 3) On a scale of 1 (low) to 5 (high), how familiar are you with the idea of producing electricity through offshore wind mills?



The percentage of residents saying they are "very familiar" has jumped from 23% in 2006 to 30% in 2009.

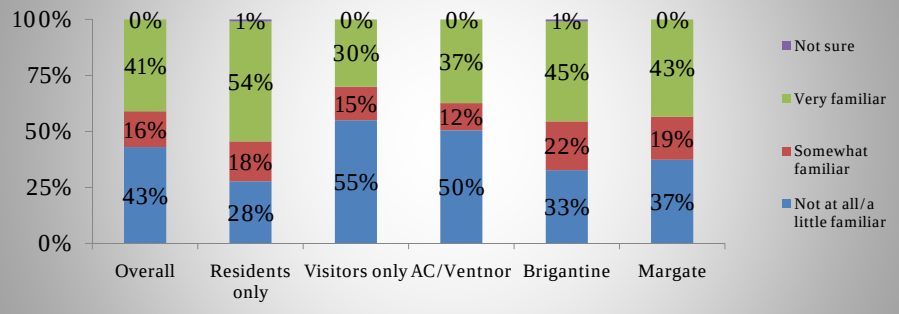
Note: Those who answered 1 or 2 are "not at all/a little familiar"; those who answered 3 are "somewhat familiar"; those who answered 4 or 5 are "very familiar".

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Familiarity - ACUA wind farm near Borgata

(Question 4) On a scale of 1 (not at all familiar) to 5(extremely familiar), are you familiar with the 5-turbine wind farm near the Borgata Casino on the way into Atlantic City?



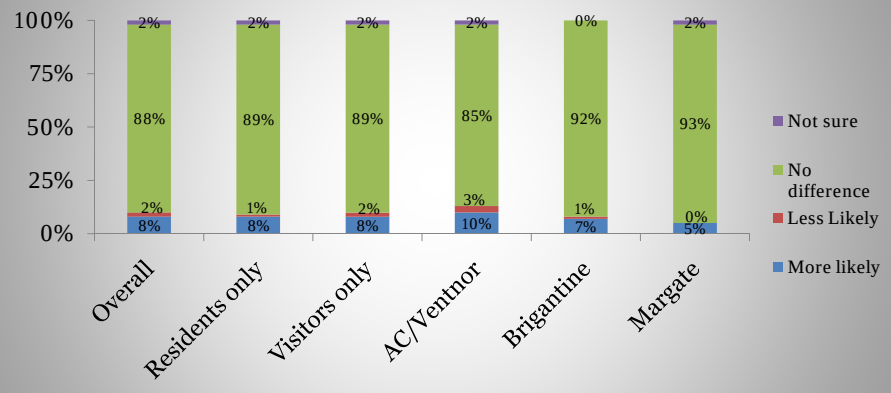
A majority (54%) of residents claim to be "very familiar" with the ACUA wind farm near the Borgata Casino, while a majority (55%) of visitors are "not at all/a little familiar".

Note: Those who answered 1 or 2 are "not at all/a little familiar"; those who answered 3 are "somewhat familiar"; those who answered 4 or 5 are "very familiar".

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Effect on travel plans - ACUA wind farms near Borgata

(Question 5) Are you more or less likely to visit Atlantic City because of these five wind mills?



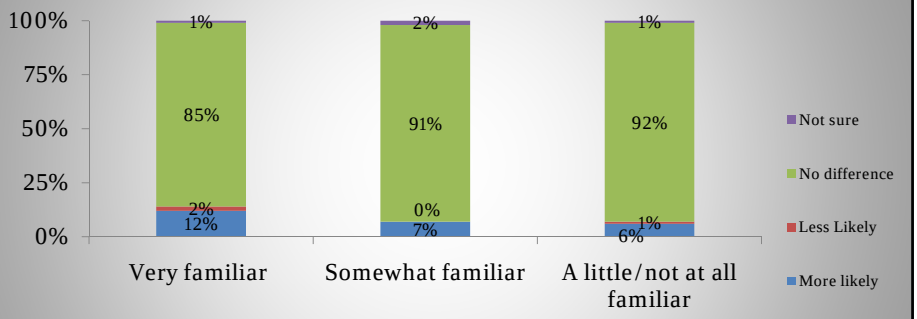
The vast majority of people in all groups say the ACUA wind farm near the Borgata makes no difference in their travel plans.

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Effect on travel plans/familiarity with windmills

(Question 5) Are you more or less likely to visit Atlantic City because of these five windmills?

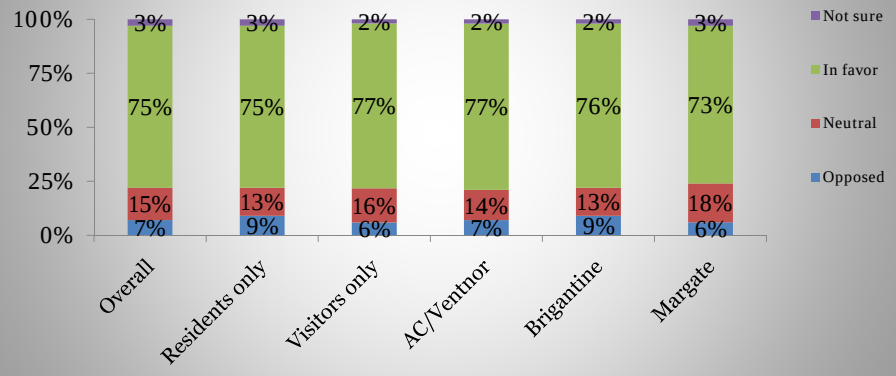


Those who claim to be "very familiar" with windmills are the most likely to say the ACUA windmills near the Borgata make them "more likely" to visit Atlantic City, though a large majority of all groups say the windmills make no difference.

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Feelings towards Atlantic City windmills

- *(Question 6 – after viewing pictures of windmills)* On a scale of 1 to 5, where 1 is "completely opposed" to this idea and 5 is "completely in favor" of this idea, how do you feel about the idea of the proposed nine wind mills three miles off the Atlantic City shore?



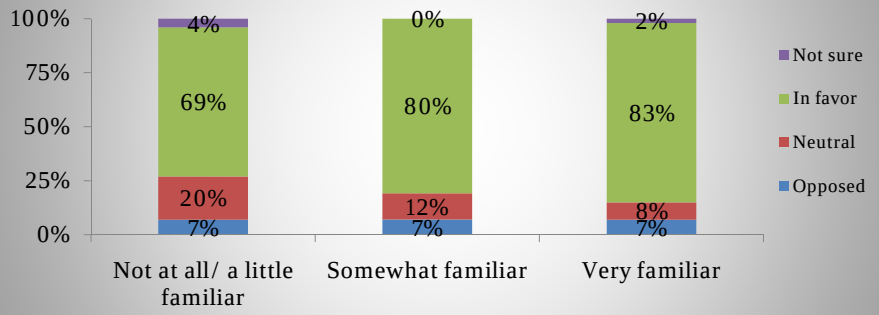
Large majorities of all groups are "in favor" of nine wind mills three miles off of the Atlantic City shore.

Note: Those who answered 1 or 2 are "opposed"; those who answered 3 are "neutral"; those who answered 4 or 5 are "in favor".

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Feelings towards Atlantic City wind mills by windmill familiarity

- *(Question 6)* On a scale of 1 to 5, where 1 is "completely opposed" to this idea and 5 is "completely in favor" of this idea, how do you feel about the idea of the proposed nine wind mills three miles off the Atlantic City shore?



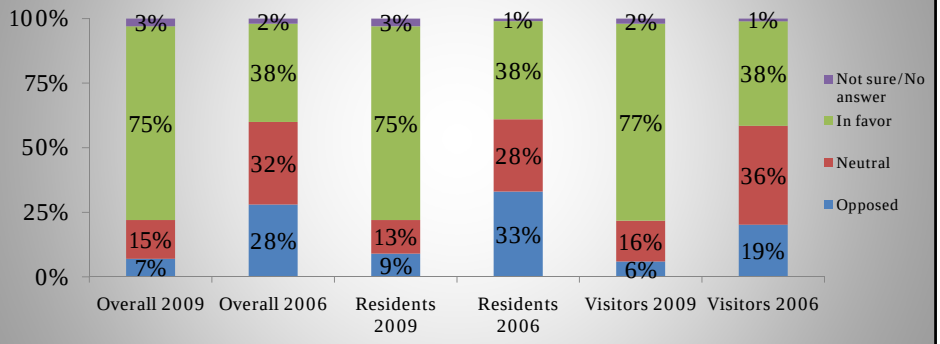
Those who are more familiar with windmills tend to be more in favor of placing wind mills off of the Atlantic City shore, although a majority at all levels of familiarity are still in favor of the wind mills.

Note: Those who answered 1 or 2 are "opposed"; those who answered 3 are "neutral"; those who answered 4 or 5 are "In favor".

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Feelings towards Atlantic City windmills

- *(Question 6)* On a scale of 1 to 5, where 1 is "completely opposed" to this idea and 5 is "completely in favor" of this idea, how do you feel about the idea of the proposed nine wind mills three miles off the Atlantic City shore?



The percentage of those in favor of the wind mills at three miles off of the shore has increased dramatically among both visitors and residents.

Note: Those who answered 1 or 2 are "opposed"; those who answered 3 are "neutral"; those who answered 4 or 5 are "in favor".
Note 2: Only 2006 data related to windmills at 3 miles out was included in this analysis

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Benefits of Atlantic City Windmills

(Question 7) **What benefits, if any, do you think there might be with what you just looked at?** *(open-ended question)*

General Category	Frequency mentioned
Clean source of energy	180
Low cost/cheaper electricity	178
Good/better for the environment	155
Nothing/don't know/no answer	91
Good source of energy	71
Renewable source of energy	63
Reduces dependence	61
Alternative source of energy	54
Not fossil fuel	54
Conserves energy	50
Saves money	47

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Disadvantages of Atlantic City Windmills

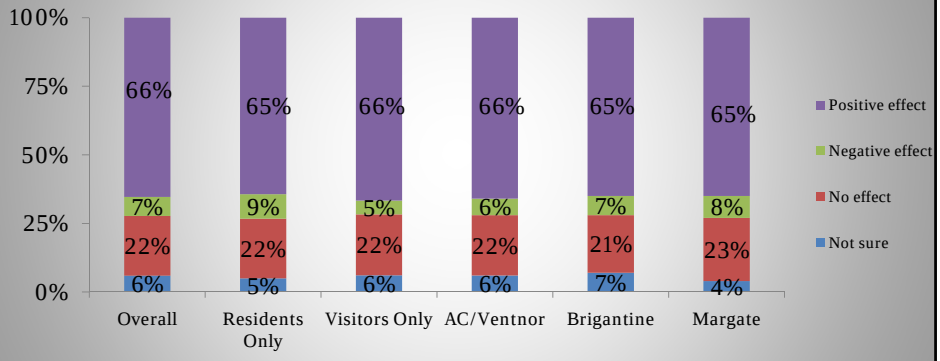
(Question 8) **What disadvantages, if any, do you think there might be with what you just looked at?** *(open-ended question)*

General Category	Frequency mentioned
Nothing/don't know/no answer	326
Ugly/eye sore	169
No difference	165
Obstructs ocean view	107
Harmful to marine life/other wildlife	78
Cost of construction	59
Interferes with boats/water traffic	48
Inefficient	19
Durability	18
Noise	17

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Effect of Windmills

- *(Question 9)* Do you think nine Wind Mills three miles off the Atlantic City shore will have a positive or negative effect on the city of Atlantic City and the local environment?

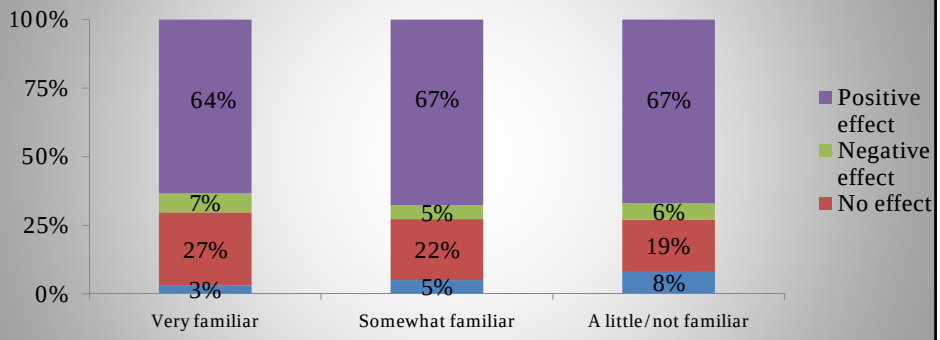


A majority of all groups felt the wind mills would have positive effects on Atlantic City and the local environment.

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Effect of Windmills by familiarity

- *(Question 9)* Do you think nine wind mills three miles off the Atlantic City shore will have a positive or negative effect on the city of Atlantic City and the local environment?



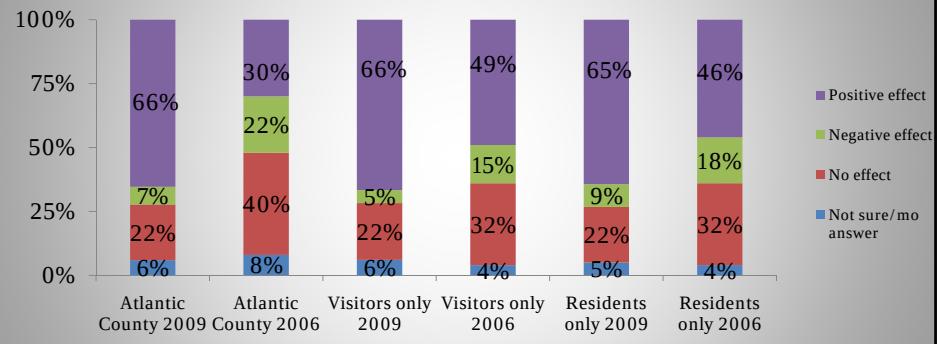
All groups are very likely to believe that wind mills nine miles off of the AC shore would have a positive effect on the city of Atlantic City and the local environment.

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Effect of Windmills

- *(Question 9)* Do you think nine wind mills three miles off the Atlantic City shore will have a positive or negative effect on the city of Atlantic City and the local environment?



The percentage of those surveyed in Atlantic County who feel the wind mills would have a positive effect has increased from 30% in 2006 to 66% in 2009.

Note: 2006 question asked "How do you think wind turbines would affect the New Jersey Shore environment? What do you think their overall effect on the environment would be?"
Note 2: Only 2006 data related to windmills at 3 miles out was included in this analysis

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Effect of Atlantic City Windmills

(Question 10) **Please tell me why you feel this way?** *(open-ended question)*

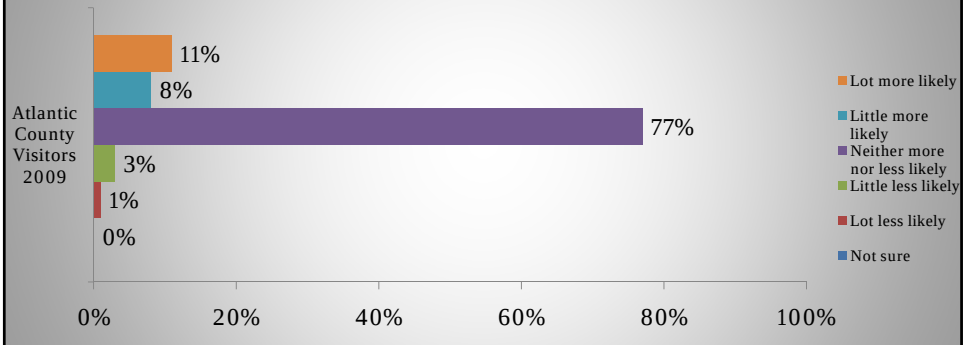
General Category	Frequency mentioned
Nothing/don't know/no answer	173
No difference	114
Low cost/cheaper electricity	95
Good/better for the environment	94
Clean source of energy	93
Good source of energy	74
Atlantic City serves as a role model	64
Looks good	43
Saves money	37
Renewable source of energy	36

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Windmills and future travel plans

(Question 11 – asked of visitors only) If nine wind mills were located off the Atlantic City shore, please tell me how likely you would be to visit the Atlantic City area in the future?



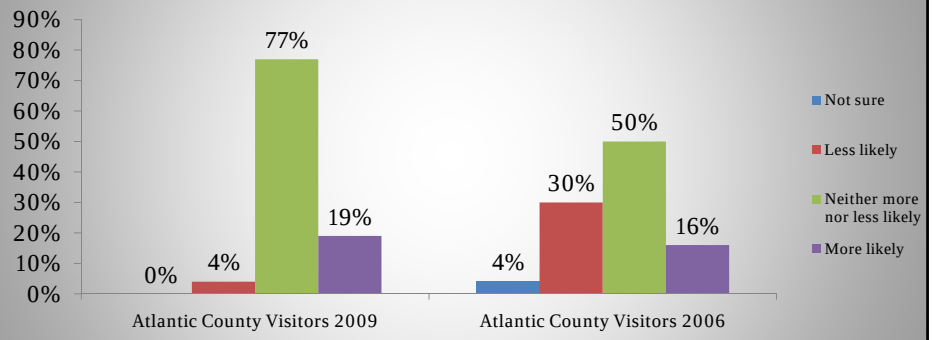
A majority of visitors say the wind mills would make them neither more nor less likely to visit the AC area in the future.

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Windmills and future travel plans

(Question 11 – asked of visitors only) If nine wind mills were located off the Atlantic City shore, please tell me how likely you would be to visit the Atlantic City area in the future?



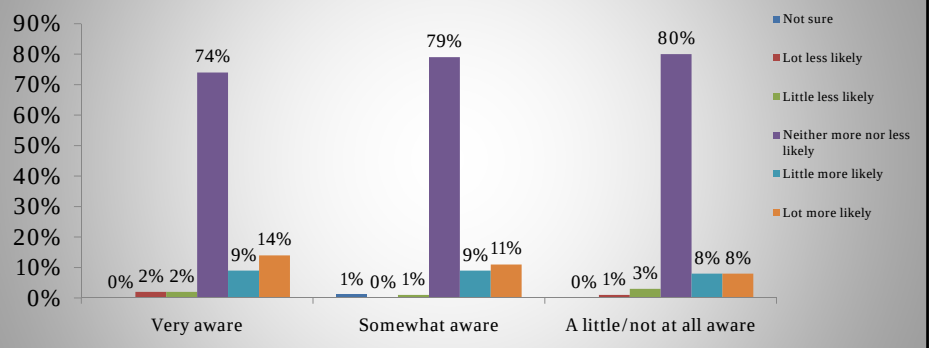
Only 3% of Atlantic City visitors in 2009 say the wind mills would make them less likely to visit Atlantic City in the future, down from 30% of Atlantic City visitors who said the same in 2006.

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Windmills and future travel plans by windmill awareness

(Question 11 – asked of visitors only) If nine wind mills were located off the Atlantic City shore, please tell me how likely you would be to visit the Atlantic City area in the future?

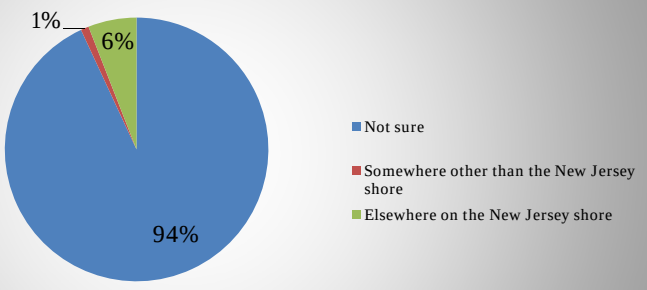


Visitors who are very aware are slightly more likely to say the windmills would make them more likely to visit the AC area in the future, though a majority of all groups say the windmills would make no difference in their future travel plans.

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Windmills and Future Travel Plans

(Question 12 – asked of visitors only) Do you think you would go elsewhere on the New Jersey shore or go somewhere other than the Atlantic City area?



Only 7% of visitors would either go elsewhere on the New Jersey shore or someplace other than the New Jersey shore. The large percentage answering "not sure" is probably due the large percentage in the previous question answering that the windmills would have no effect or a positive effect on their future travel plans.

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Windmills and Atlantic City Residents

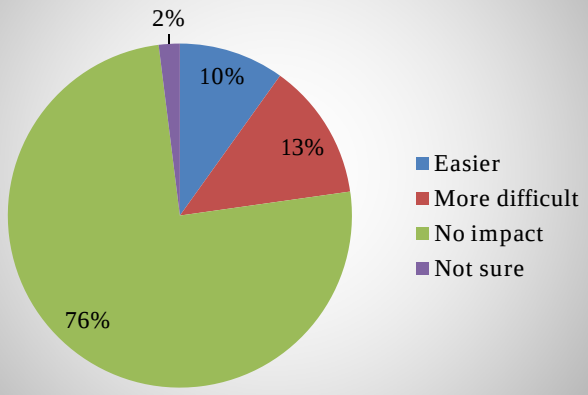
(Question 13- asked of residents only) If nine wind mills were located three miles off the Atlantic City shore, please tell me what effect it would have on people who live in the Atlantic City area? *(open-ended question)*

General Category	Frequency mentioned
Nothing/don't know/ no answer	177
No difference	140
Low cost/cheaper electricity	57
Obstructs ocean view	22
Saves money	16
Ugly/eyesore	15
Good/better for the environment	14
More jobs	13
Good source of energy	11
Clean source of energy	8

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Wind Mills and Rentals

(Question 15 – asked of residents who own rental properties) If nine wind mills were located off the Atlantic City shore, do you think it would make it easier or more difficult to rent your properties or would it have no impact?



76% of those who own rental properties believe the windmills would have no impact on renting their properties.

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Wind Mills and Rentals

(Question 15 – asked of residents who own rental properties) If nine wind mills were located off the Atlantic City shore, do you think it would make it easier or more difficult to rent your properties or would it have no impact?

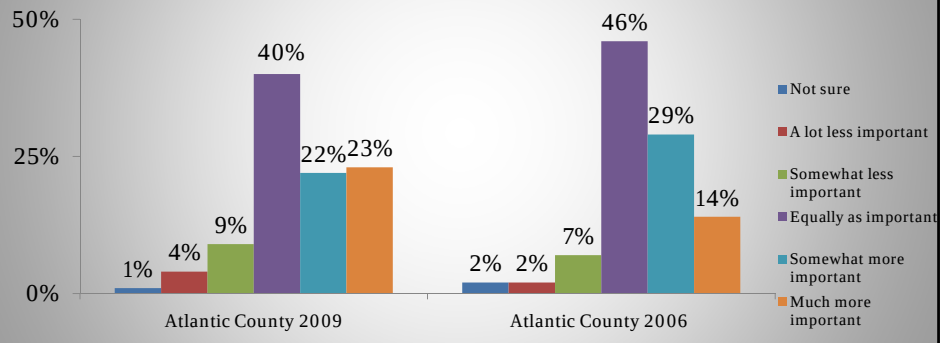


The number of residents who feel windmills would make it more difficult to rent their properties has decreased from 30% in 2006 to 13% in 2009, but the sample size is very small and this data should be interpreted cautiously.

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Wind Mills and Policy

- *(Question 17) Would you say the development of renewable energy resources as compared to other issues facing the nation is much more important, somewhat more important, equally as important, somewhat less important, or a lot less important?*

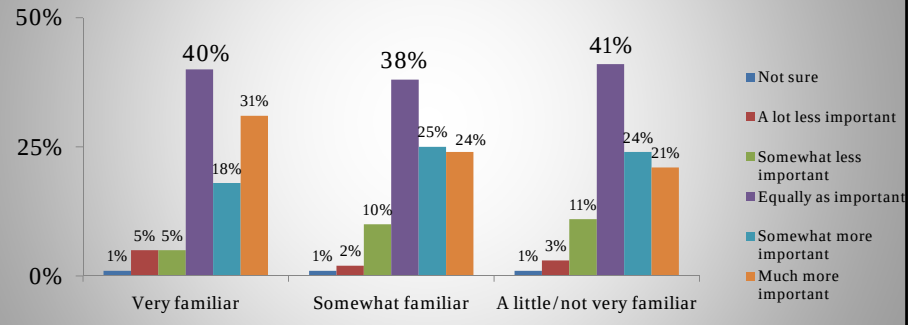


The percentage saying the development of renewable energy resources is somewhat or much more important has stayed stable from 2006 (43%) to 2009 (45%).

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Wind Mills and Policy by Wind Mill Familiarity

- *(Question 17) Would you say the development of renewable energy resources as compared to other issues facing the nation is much more important, somewhat more important, equally as important, somewhat less important, or a lot less important?*

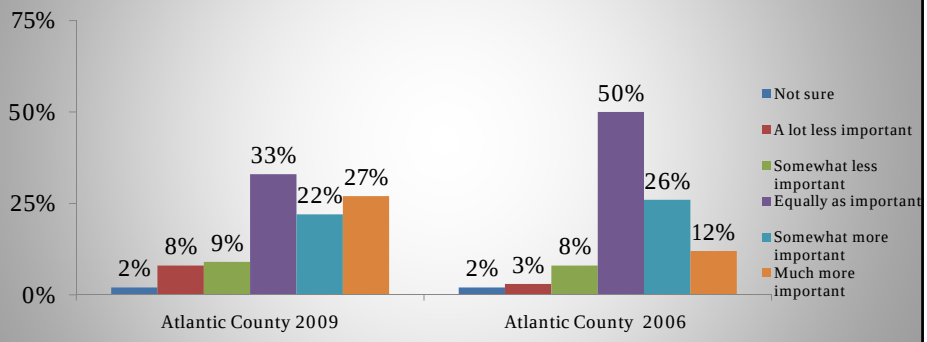


Those who are “very familiar” with windmills are the most likely to say the development of renewable energy resources is “much more important” compared to other issues facing the nation.

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Global Warming and Policy

- *(Question 18) Would you say that global warming and the reduction of greenhouse gases compared to other issues facing the nation is much more important, somewhat more important, equally as important, somewhat less important, a lot less important?*



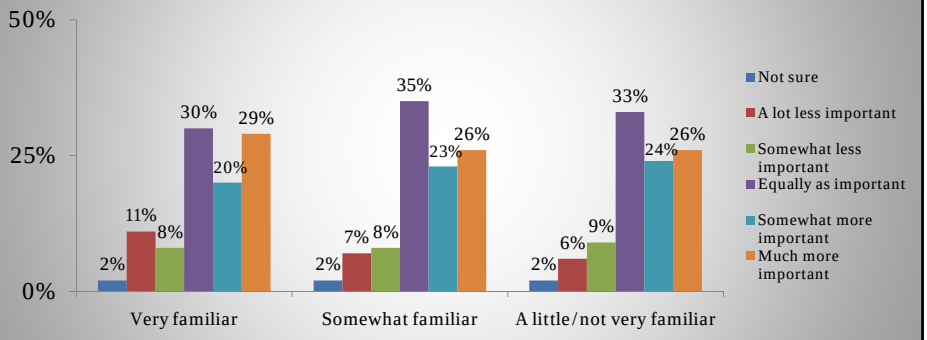
The percentage saying global warming and reduction of greenhouse gases is much more important or somewhat more important than other issues facing the nation has risen from 38% in 2006 to 49% in 2009.

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Global Warming by Familiarity

- *(Question 18) Would you say that global warming and the reduction of greenhouse gases compared to other issues facing the nation is much more important, somewhat more important, equally as important, somewhat less important, a lot less important?*



Percentages are similar across all groups.

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Sample Characteristics I

	Frequency	Valid Percent
Total Sample	1003	100%
visitors	544	54%
residents	459	46%
Atlantic City/Ventnor	491	49% within sample
visitors	352	35% within sample 72% within Atlantic
residents	139	14% within sample 28% within Atlantic
Brigantine	260	26% within sample
visitors	111	11% within sample 43% within Brigantine
residents	149	15% within sample 57% within Brigantine
Margate	252	25% within sample
visitors	81	8% within sample 32% within Margate
residents	171	17% within sample 68% within Margate

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Sample Characteristics II

	Frequency	Valid Percent
Married	612	61%
Single and never married	221	22%
Widowed, separated or divorced	144	14%
Civil union/living together/partnership	20	2%
Less than a HS education	16	2%
HS grad	201	20%
Some college	228	23%
College grad or more	546	55%
>$25k/year in household income	77	9%
$25-35k/year in household income	66	8%
$35-50k/year in household income	104	13%
$50-75k/year in household income	153	18%
$75k-100k/year in household income	142	17%
$100k+/year in household income	291	35%

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Sample Characteristics III

	Frequency	Valid Percent
White/Caucasian	874	88%
Black/African American	75	8%
Hispanic/Latino	23	2%
Asian/Pacific Islander	17	2%
Other/not sure	6	1%
Female	494	49%
Male	506	51%

Note: race of respondent is based on interviewer observation.

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Sample Characteristics IV - visitors only

	Frequency	Valid Percent
Day trip to shore	186	34% of visitors
Vacationing at shore and staying at a friend's home	97	18% of visitors
Vacationing at the shore and staying at a hotel/motel, bed and breakfast, condo-tel	212	38% of visitors
Vacationing at the shore and renting a house, apartment or condo	56	10% of visitors
First trip to shore	64	12% of visitors
Not first trip to shore	476	87% of visitors
Visiting from another part of NJ	161	29% of visitors
Visiting from another state	379	69% of visitors
Visiting from outside US	13	2% of visitors

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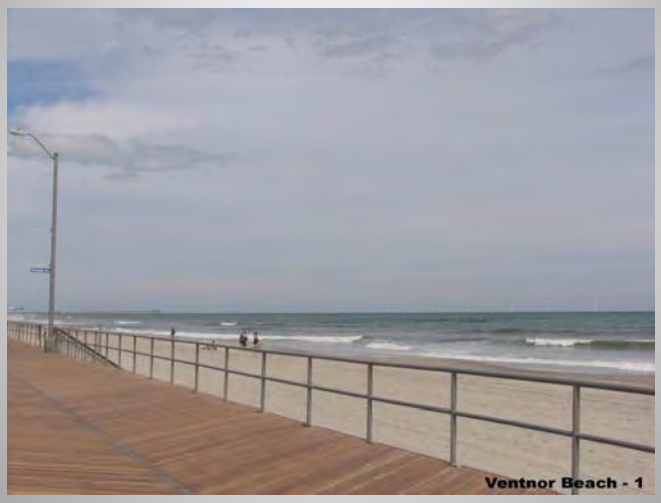
Sample Characteristics V - residents only

	Frequency	Valid Percent
Own their residence	335	79% of residents
Rent their residence	78	18% of residents
Lived on Jersey Shore less than 1 year	11	2% of residents
Lived on Jersey shore 1-3 years	21	5% of residents
Lived on Jersey shore 3-5 years	26	6% of residents
Lived on Jersey shore 5-10 years	51	11% of residents
Lived on Jersey shore 10 years or more	336	75% of residents

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2009 Picture – Wind Mill at 3 Miles at Ventnor Beach



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2009 Picture – Wind Mill at 3 Miles at Ventnor Fishing Pier



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2009 Picture – Wind Mill at 3 Miles at Atlantic City Boardwalk



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2009 Picture – Wind Mill at 3 Miles at Atlantic City Boardwalk Korean War Memorial



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2009 Picture – Wind Mill at 3 Miles at Brigantine Beach



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2009 Picture – Wind Mill at 3 Miles at Brigantine Inlet



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Thank you

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Appendix B: Cross Tabulations

V5. Are you here for a ...

	Total		Region: AC/Ventnor		Region: Brigantine		Region: Margate		Age: 18-40		Age: 41-60		Age: Over 60		S3. Seasonal		S3. Full Time		S3. Visitor		Gender: Male		Gender: Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Day trip to the shore	186	33.5	133	37.6	27	23.7	26	29.9	65	33.9	70	31.5	51	36.2	1	9.1	2	100.0	183	33.8	101	35.2	84	31.6
Vacationing at the shore and staying at a friend's home	97	17.5	16	4.5	38	33.3	43	49.4	46	24.0	38	17.1	13	9.2	2	18.2			95	17.5	51	17.8	45	16.9
Vacationing at the shore and staying at a hotel/motel, bed and breakfast, condo-tel	212	38.2	195	55.1	11	9.6	6	6.9	59	30.7	88	39.6	65	46.1					212	39.1	98	34.1	114	42.9
Vacationing at the shore and renting a house, apartment, or condo	56	10.1	9	2.5	38	33.3	9	10.3	20	10.4	25	11.3	11	7.8	8	72.7			48	8.9	35	12.2	21	7.9
Not Sure	4	.7	1	.3			3	3.4	2	1.0	1	.5	1	.7					4	.7	2	.7	2	.8
Total	555	100.0	354	100.0	114	100.0	87	100.0	192	100.0	222	100.0	141	100.0	11	100.0	2	100.0	542	100.0	287	100.0	266	100.0

	D1. Total		D1. Long time visitor		D1. First time		D1. Not sure/ Refuse		D2. Another part of NJ		D2. Another state		D2. Outside of the US		D4. 1 year to less than 3 years		D4. 3 years to less than 5 years		D4. 5 years to less than 10 years		D4. 10 years or more	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Day trip to the shore	181	33.4	168	35.9	12	18.8	1	10.0	74	46.5	105	28.1	3	23.1							2	33.3
Vacationing at the shore and staying at a friend's home	97	17.9	87	18.6	8	12.5	2	20.0	25	15.7	70	18.7	2	15.4					1	50.0		
Vacationing at the shore and staying at a hotel/motel, bed and breakfast, condo-tel	210	38.7	173	37.0	34	53.1	3	30.0	51	32.1	153	40.9	7	53.8								
Vacationing at the shore and renting a house, apartment, or condo	50	9.2	38	8.1	9	14.1	3	30.0	8	5.0	44	11.8			1	100.0	2	100.0	1	50.0	4	66.7
Not Sure	4	.7	2	.4	1	1.6	1	10.0	1	.6	2	.5	1	7.7								
Total	542	100.0	468	100.0	64	100.0	10	100.0	159	100.0	374	100.0	13	100.0	1	100.0	2	100.0	2	100.0	6	100.0

V5. Are you here for a ...

	D5. Do you currently own or rent your residence on the New Jersey Shore?						Status								Education							
	Total		Own		Rent		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Day trip to the shore	3	27.3	3	30.0			85	25.2	58	45.3	40	52.6	2	18.2	1	12.5	50	40.7	50	35.5	78	28.6
Vacationing at the shore and staying at a friend's home	1	9.1	1	10.0			65	19.3	23	18.0	7	9.2	2	18.2	2	25.0	8	6.5	25	17.7	61	22.3
Vacationing at the shore and staying at a hotel/motel, bed and breakfast, condo-tel							145	43.0	36	28.1	25	32.9	6	54.5	4	50.0	60	48.8	52	36.9	94	34.4
Vacationing at the shore and renting a house, apartment, or condo	7	63.6	6	60.0	1	100.0	39	11.6	11	8.6	3	3.9	1	9.1			5	4.1	14	9.9	37	13.6
Not Sure							3	.9			1	1.3			1	12.5					3	1.1
Total	11	100.0	10	100.0	1	100.0	337	100.0	128	100.0	76	100.0	11	100.0	8	100.0	123	100.0	141	100.0	273	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Day trip to the shore	184	33.3	143	31.3	9	52.9	26	39.4	4	57.1	2	40.0	18	40.0	13	28.9	35	46.1	36	41.4	26	29.5	21	16.2
Vacationing at the shore and staying at a friend's home	96	17.4	89	19.5	2	11.8	5	7.6					8	17.8	5	11.1	9	11.8	6	6.9	16	18.2	39	30.0
Vacationing at the shore and staying at a hotel/motel, bed and breakfast, condo-tel	212	38.4	169	37.0	6	35.3	31	47.0	3	42.9	3	60.0	15	33.3	25	55.6	25	32.9	38	43.7	32	36.4	52	40.0
Vacationing at the shore and renting a house, apartment, or condo	56	10.1	52	11.4			4	6.1					4	8.9	2	4.4	7	9.2	7	8.0	14	15.9	14	10.8
Not Sure	4	.7	4	.9																			4	3.1
Total	552	100.0	457	100.0	17	100.0	66	100.0	7	100.0	5	100.0	45	100.0	45	100.0	76	100.0	87	100.0	88	100.0	130	100.0

V6. Have you come to the shore before?

	Total		Region: AC/Ventnor		Region: Brigantine		Region: Margate		Age: 18-40		Age: 41-60		Age: Over 60		S3. Seasonal		S3. Full Time		S3. Visitor		Gender: Male		Gender: Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes, I've been here before	506	91.2	321	90.4	103	89.6	82	96.5	166	86.0	204	92.7	136	95.8	12	100.0	4	100.0	490	90.9	263	91.3	241	90.9
No, this is my first time	49	8.8	34	9.6	12	10.4	3	3.5	27	14.0	16	7.3	6	4.2					49	9.1	25	8.7	24	9.1
Not Sure																								
Total	555	100.0	355	100.0	115	100.0	85	100.0	193	100.0	220	100.0	142	100.0	12	100.0	4	100.0	539	100.0	288	100.0	265	100.0

	D1. Longtime visitor or first time here? Total		Long time visitor		First time		Not sure/ Refuse		D2. Another part of NJ		Another state		Outside of the US		D4. 1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes, I've been here before	490	90.9	463	99.4	17	27.0	10	100.0	149	95.5	338	90.6	6	46.2	2	100.0	2	100.0	2	100.0	8	100.0
No, this is my first time	49	9.1	3	.6	46	73.0			7	4.5	35	9.4	7	53.8								
Not Sure																						
Total	539	100.0	466	100.0	63	100.0	10	100.0	156	100.0	373	100.0	13	100.0	2	100.0	2	100.0	2	100.0	8	100.0

	D5. Own or rent your residence on the New Jersey Shore? Total		Own		Rent		Status: Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Education: <HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes, I've been here before	14	100.0	12	100.0	2	100.0	313	92.6	114	89.1	67	88.2	11	100.0	6	75.0	111	90.2	129	91.5	251	91.6
No, this is my first time							25	7.4	14	10.9	9	11.8			2	25.0	12	9.8	12	8.5	23	8.4
Not Sure																						
Total	14	100.0	12	100.0	2	100.0	338	100.0	128	100.0	76	100.0	11	100.0	8	100.0	123	100.0	141	100.0	274	100.0

V6. Have you come to the shore before?

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes, I've been here before	503	91.1	418	91.7	15	93.8	60	89.6	7	87.5	3	60.0	33	75.0	40	90.9	66	88.0	78	89.7	82	93.2	128	95.5
No, this is my first time	49	8.9	38	8.3	1	6.3	7	10.4	1	12.5	2	40.0	11	25.0	4	9.1	9	12.0	9	10.3	6	6.8	6	4.5
Not Sure																								
Total	552	100.0	456	100.0	16	100.0	67	100.0	8	100.0	5	100.0	44	100.0	44	100.0	75	100.0	87	100.0	88	100.0	134	100.0

1. Have you ever heard about producing electricity through the use of Offshore Wind Turbines or Wind Mills? You may have also heard these referred to as Offshore Wind Mills or Wind Farms. Wind Turbines, or Wind Mills are structures that capture wind to produce electricity.

	Region								Age						S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)						Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Seasonal		Full Time		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	899	89.9	427	87.0	247	95.0	225	90.4	245	82.2	390	91.5	263	95.6	199	91.3	219	92.0	481	88.4	454	90.3	442	89.5
No	98	9.8	62	12.6	13	5.0	23	9.2	52	17.4	35	8.2	11	4.0	18	8.3	19	8.0	61	11.2	48	9.5	50	10.1
Not Sure	3	.3	2	.4			1	.4	1	.3	1	.2	1	.4	1	.5			2	.4	1	.2	2	.4
Total	1000	100.0	491	100.0	260	100.0	249	100.0	298	100.0	426	100.0	275	100.0	218	100.0	238	100.0	544	100.0	503	100.0	494	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?						D4. How long have you lived on the New Jersey Shore? Would you say you've lived here...?											
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US		Less than 1 year		1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more		Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	485	88.2	421	88.4	54	84.4	10	100.0	145	90.1	333	87.9	11	84.6	9	81.8	18	85.7	24	92.3	47	94.0	309	92.5	5	100.0
No	62	11.3	52	10.9	10	15.6			15	9.3	45	11.9	2	15.4	2	18.2	3	14.3	2	7.7	3	6.0	25	7.5		
Not Sure	3	.5	3	.6					1	.6	1	.3														
Total	550	100.0	476	100.0	64	100.0	10	100.0	161	100.0	379	100.0	13	100.0	11	100.0	21	100.0	26	100.0	50	100.0	334	100.0	5	100.0

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status								Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Not sure/ Refuse		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	387	91.5	311	93.4	65	83.3	11	91.7	571	93.6	170	77.3	133	92.4	19	95.0	1	100.0	13	81.3	166	82.6	205	90.3	504	92.6
No	35	8.3	21	6.3	13	16.7	1	8.3	39	6.4	48	21.8	10	6.9	1	5.0			3	18.8	33	16.4	22	9.7	39	7.2
Not Sure	1	.2	1	.3							2	.9	1	.7							2	1.0			1	.2
Total	423	100.0	333	100.0	78	100.0	12	100.0	610	100.0	220	100.0	144	100.0	20	100.0	1	100.0	16	100.0	201	100.0	227	100.0	544	100.0

1. Have you ever heard about producing electricity through the use of Offshore Wind Turbines or Wind Mills? You may have also heard these referred to as Offshore Wind Mills or Wind Farms. Wind Turbines, or Wind Mills are structures that capture wind to produce electricity.

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	891	89.8	800	91.8	18	78.3	57	76.0	12	70.6	4	66.7	59	77.6	56	84.8	91	87.5	135	88.8	134	94.4	271	93.4
No	98	9.9	70	8.0	5	21.7	16	21.3	5	29.4	2	33.3	17	22.4	9	13.6	12	11.5	17	11.2	7	4.9	19	6.6
Not Sure	3	.3	1	.1			2	2.7							1	1.5	1	1.0			1	.7		
Total	992	100.0	871	100.0	23	100.0	75	100.0	17	100.0	6	100.0	76	100.0	66	100.0	104	100.0	152	100.0	142	100.0	290	100.0

3. On a scale of 1 to 5 where 1 is 'not at all familiar' with producing electricity through Offshore Wind Mills and 5 is 'extremely familiar', how familiar are you with the idea of producing electricity through Offshore Wind Mills?

	Region								Age						S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)						Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Seasonal		Full Time		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all	129	14.4	68	16.1	38	15.4	23	10.2	41	16.8	53	13.7	35	13.4	27	13.6	26	12.1	76	15.8	85	18.8	44	10.0
2	226	25.3	102	24.1	68	27.6	56	24.9	81	33.2	100	25.8	45	17.2	50	25.1	43	20.0	133	27.7	120	26.5	105	24.0
3	294	32.9	135	31.9	79	32.1	80	35.6	71	29.1	133	34.4	90	34.4	64	32.2	77	35.8	153	31.9	144	31.8	149	34.0
4	146	16.3	64	15.1	40	16.3	42	18.7	32	13.1	62	16.0	52	19.8	36	18.1	36	16.7	74	15.4	65	14.3	80	18.3
Extremely	97	10.9	52	12.3	21	8.5	24	10.7	19	7.8	39	10.1	38	14.5	22	11.1	32	14.9	43	9.0	38	8.4	59	13.5
Not Sure	2	.2	2	.5									2	.8			1	.5	1	.2	1	.2	1	.2
Total	894	100.0	423	100.0	246	100.0	225	100.0	244	100.0	387	100.0	262	100.0	199	100.0	215	100.0	480	100.0	453	100.0	438	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?						D4. How long have you lived on the New Jersey Shore? Would you say you've lived here...?											
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US		Less than 1 year		1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more		Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all	78	16.1	64	15.3	12	22.2	2	20.0	20	13.8	57	17.1	1	10.0	1	11.1	3	17.6	5	20.8	7	14.9	35	11.4		
2	135	28.0	120	28.6	14	25.9	1	10.0	40	27.6	95	28.5	1	10.0	2	22.2	3	17.6	3	12.5	15	31.9	68	22.2	2	40.0
3	150	31.1	127	30.3	18	33.3	5	50.0	46	31.7	106	31.8	2	20.0	2	22.2	8	47.1	9	37.5	15	31.9	102	33.3	3	60.0
4	77	15.9	68	16.2	7	13.0	2	20.0	24	16.6	48	14.4	5	50.0	1	11.1	2	11.8	5	20.8	5	10.6	57	18.6		
Extremely	42	8.7	39	9.3	3	5.6			15	10.3	26	7.8	1	10.0	3	33.3	1	5.9	2	8.3	5	10.6	43	14.1		
Not Sure	1	.2	1	.2							1	.3											1	.3		
Total	483	100.0	419	100.0	54	100.0	10	100.0	145	100.0	333	100.0	10	100.0	9	100.0	17	100.0	24	100.0	47	100.0	306	100.0	5	100.0

3. On a scale of 1 to 5 where 1 is 'not at all familiar' with producing electricity through Offshore Wind Mills and 5 is 'extremely familiar', how familiar are you with the idea of producing electricity through Offshore Wind Mills?

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status								Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all	48	12.5	37	11.9	11	17.5			80	14.1	26	15.4	21	15.8	2	10.5	4	30.8	32	19.4	30	14.7	60	12.0
2	87	22.7	71	22.9	12	19.0	4	40.0	141	24.8	53	31.4	27	20.3	4	21.1	3	23.1	40	24.2	48	23.5	133	26.5
3	128	33.4	103	33.2	23	36.5	2	20.0	184	32.4	54	32.0	45	33.8	9	47.4	2	15.4	56	33.9	72	35.3	162	32.3
4	69	18.0	57	18.4	10	15.9	2	20.0	104	18.3	19	11.2	20	15.0	2	10.5	1	7.7	21	12.7	32	15.7	89	17.8
Extremely	50	13.1	41	13.2	7	11.1	2	20.0	58	10.2	17	10.1	19	14.3	2	10.5	3	23.1	15	9.1	22	10.8	56	11.2
Not Sure	1	.3	1	.3					1	.2			1	.8					1	.6			1	.2
Total	383	100.0	310	100.0	63	100.0	10	100.0	568	100.0	169	100.0	133	100.0	19	100.0	13	100.0	165	100.0	204	100.0	501	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all	128	14.4	118	14.8	1	5.6	7	12.5	1	8.3	1	25.0	17	29.3	7	12.5	9	10.0	17	12.6	18	13.4	33	12.3
2	225	25.4	208	26.1	3	16.7	11	19.6	1	8.3	2	50.0	10	17.2	13	23.2	25	27.8	38	28.1	26	19.4	76	28.3
3	290	32.7	254	31.9	6	33.3	23	41.1	7	58.3			20	34.5	17	30.4	34	37.8	44	32.6	55	41.0	83	30.9
4	145	16.4	130	16.3	3	16.7	10	17.9	1	8.3	1	25.0	8	13.8	12	21.4	12	13.3	22	16.3	16	11.9	44	16.4
Extremely	96	10.8	84	10.6	5	27.8	5	8.9	2	16.7			3	5.2	7	12.5	10	11.1	13	9.6	19	14.2	32	11.9
Not Sure	2	.2	2	.3															1	.7			1	.4
Total	886	100.0	796	100.0	18	100.0	56	100.0	12	100.0	4	100.0	58	100.0	56	100.0	90	100.0	135	100.0	134	100.0	269	100.0

4. Are you familiar with the 5-turbine wind farm near the Borgata Casino on the way into Atlantic City?

	Total		Region: AC/Ventnor		Region: Brigantine		Region: Margate		Age: 18-40		Age: 41-60		Age: Over 60		S3. Seasonal		S3. Full Time		S3. Visitor		Gender: Male		Gender: Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all familiar	208	20.8	144	29.4	23	8.8	41	16.3	88	29.5	69	16.2	51	18.5	21	9.6	17	7.1	170	31.3	112	22.1	96	19.5
2	218	21.8	103	21.0	62	23.8	53	21.0	73	24.5	98	23.0	47	17.0	49	22.5	39	16.2	130	23.9	115	22.7	102	20.7
3	164	16.4	58	11.8	57	21.9	49	19.4	46	15.4	79	18.5	38	13.8	45	20.6	38	15.8	81	14.9	77	15.2	87	17.6
4	101	10.1	46	9.4	27	10.4	28	11.1	26	8.7	42	9.8	33	12.0	22	10.1	35	14.5	44	8.1	50	9.9	51	10.3
Extremely familiar'	307	30.6	137	28.0	89	34.2	81	32.1	64	21.5	137	32.1	106	38.4	80	36.7	110	45.6	117	21.5	149	29.4	156	31.6
Not Sure	4	.4	2	.4	2	.8			1	.3	2	.5	1	.4	1	.5	2	.8	1	.2	3	.6	1	.2
Total	1002	100.0	490	100.0	260	100.0	252	100.0	298	100.0	427	100.0	276	100.0	218	100.0	241	100.0	543	100.0	506	100.0	493	100.0

	D1. Total		D1. Long time visitor		D1. First time		D1. Not sure/ Refuse		D2. Another part of NJ		D2. Another state		D2. Outside of the US		D4. Less than 1 year		D4. 1 year to less than 3 years		D4. 3 years to less than 5 years		D4. 5 years to less than 10 years		D4. 10 years or more		D4. Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all familiar	168	30.6	133	27.9	31	49.2	4	40.0	26	16.1	135	35.7	7	53.8	3	27.3	5	23.8			7	13.7	21	6.3	1	20.0
2	133	24.2	113	23.7	16	25.4	4	40.0	37	23.0	93	24.6	3	23.1	2	18.2	2	9.5	4	15.4	17	33.3	61	18.2		
3	82	14.9	73	15.3	8	12.7	1	10.0	33	20.5	47	12.4	2	15.4	1	9.1	8	38.1	5	19.2	6	11.8	62	18.5		
4	45	8.2	41	8.6	4	6.3			14	8.7	33	8.7	1	7.7					2	7.7	8	15.7	43	12.8	2	40.0
Extremely familiar'	120	21.9	115	24.2	4	6.3	1	10.0	51	31.7	69	18.3			5	45.5	6	28.6	15	57.7	13	25.5	147	43.8	1	20.0
Not Sure	1	.2	1	.2							1	.3											2	.6	1	20.0
Total	549	100.0	476	100.0	63	100.0	10	100.0	161	100.0	378	100.0	13	100.0	11	100.0	21	100.0	26	100.0	51	100.0	336	100.0	5	100.0

4. Are you familiar with the 5-turbine wind farm near the Borgata Casino on the way into Atlantic City?

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status										Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Not sure/ Refuse		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all familiar	36	8.5	19	5.7	15	19.2	2	16.7	120	19.6	57	25.9	26	18.1	4	20.0			4	25.0	56	27.9	53	23.2	91	16.7
2	83	19.5	68	20.3	14	17.9	1	8.3	136	22.2	53	24.1	24	16.7	4	20.0			3	18.8	37	18.4	47	20.6	129	23.7
3	79	18.6	64	19.1	10	12.8	5	41.7	113	18.5	36	16.4	10	6.9	3	15.0	1	100.0			28	13.9	31	13.6	102	18.7
4	51	12.0	44	13.1	6	7.7	1	8.3	54	8.8	24	10.9	21	14.6	2	10.0			2	12.5	22	10.9	22	9.6	55	10.1
Extremely familiar'	173	40.7	138	41.2	32	41.0	3	25.0	188	30.7	49	22.3	61	42.4	7	35.0			7	43.8	57	28.4	73	32.0	167	30.6
Not Sure	3	.7	2	.6	1	1.3			1	.2	1	.5	2	1.4							1	.5	2	.9	1	.2
Total	425	100.0	335	100.0	78	100.0	12	100.0	612	100.0	220	100.0	144	100.0	20	100.0	1	100.0	16	100.0	201	100.0	228	100.0	545	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Not at all familiar	207	20.8	157	18.0	7	30.4	32	42.7	7	41.2	4	66.7	30	39.0	20	30.3	30	29.1	31	20.3	21	14.8	45	15.5
2	217	21.8	200	22.9	4	17.4	9	12.0	3	17.6	1	16.7	14	18.2	9	13.6	17	16.5	30	19.6	32	22.5	75	25.8
3	164	16.5	147	16.8	4	17.4	11	14.7	2	11.8			3	3.9	10	15.2	16	15.5	21	13.7	24	16.9	63	21.6
4	100	10.1	89	10.2	4	17.4	5	6.7	2	11.8			8	10.4	9	13.6	17	16.5	15	9.8	14	9.9	22	7.6
Extremely familiar'	303	30.5	277	31.7	4	17.4	18	24.0	3	17.6	1	16.7	21	27.3	18	27.3	23	22.3	56	36.6	50	35.2	84	28.9
Not Sure	3	.3	3	.3									1	1.3							1	.7	2	.7
Total	994	100.0	873	100.0	23	100.0	75	100.0	17	100.0	6	100.0	77	100.0	66	100.0	103	100.0	153	100.0	142	100.0	291	100.0

5. Are you more likely or less likely to visit Atlantic City because of these five windmills?

	Region								Age						S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)						Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Seasonal		Full Time		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
More likely	78	7.9	48	9.9	17	6.6	13	5.2	25	8.5	39	9.2	14	5.1	11	5.1	26	11.0	41	7.6	28	5.6	49	10.0
Less likely	15	1.5	12	2.5	3	1.2			4	1.4	8	1.9	3	1.1	2	.9	2	.8	11	2.0	10	2.0	5	1.0
No difference	883	88.9	416	85.4	237	91.9	230	92.7	260	88.1	369	87.0	253	92.7	198	91.2	205	86.9	480	88.9	455	90.8	426	87.1
NS	17	1.7	11	2.3	1	.4	5	2.0	6	2.0	8	1.9	3	1.1	6	2.8	3	1.3	8	1.5	8	1.6	9	1.8
Total	993	100.0	487	100.0	258	100.0	248	100.0	295	100.0	424	100.0	273	100.0	217	100.0	236	100.0	540	100.0	501	100.0	489	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?						D4. How long have you lived on the New Jersey Shore? Would you say you've lived here...?											
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US		Less than 1 year		1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more		Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
More likely	44	8.1	38	8.0	6	9.5			15	9.5	28	7.4			1	10.0	3	14.3	3	11.5	3	5.9	25	7.6		
Less likely	11	2.0	7	1.5	3	4.8	1	10.0	4	2.5	7	1.9			1	10.0	1	4.8			1	2.0	1	.3		
No difference	483	88.5	420	88.8	54	85.7	9	90.0	138	87.3	336	88.9	13	100.0	7	70.0	15	71.4	23	88.5	46	90.2	301	90.9	4	80.0
NS	8	1.5	8	1.7					1	.6	7	1.9			1	10.0	2	9.5			1	2.0	4	1.2	1	20.0
Total	546	100.0	473	100.0	63	100.0	10	100.0	158	100.0	378	100.0	13	100.0	10	100.0	21	100.0	26	100.0	51	100.0	331	100.0	5	100.0

5. Are you more likely or less likely to visit Atlantic City because of these five windmills?

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status										Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Not sure/ Refuse		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
More likely	30	7.2	25	7.6	4	5.3	1	8.3	35	5.8	27	12.3	15	10.7	1	5.0					12	6.1	23	10.2	43	7.9
Less likely	4	1.0	2	.6	2	2.6			9	1.5	6	2.7									6	3.0	3	1.3	6	1.1
No difference	377	90.0	302	91.2	65	85.5	10	83.3	554	91.1	182	83.1	123	87.9	18	90.0	1	100.0	16	100.0	173	87.8	196	87.1	486	89.5
NS	8	1.9	2	.6	5	6.6	1	8.3	10	1.6	4	1.8	2	1.4	1	5.0					6	3.0	3	1.3	8	1.5
Total	419	100.0	331	100.0	76	100.0	12	100.0	608	100.0	219	100.0	140	100.0	20	100.0	1	100.0	16	100.0	197	100.0	225	100.0	543	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
More likely	75	7.6	58	6.7	4	17.4	10	13.3	2	11.8	1	16.7	9	11.8	3	4.6	8	7.8	13	8.7	13	9.2	24	8.3
Less likely	15	1.5	11	1.3			2	2.7	2	11.8			1	1.3	1	1.5	2	2.0	4	2.7	3	2.1	4	1.4
No difference	878	89.1	782	90.5	19	82.6	60	80.0	12	70.6	5	83.3	62	81.6	60	92.3	90	88.2	131	87.3	125	88.0	258	89.0
NS	17	1.7	13	1.5			3	4.0	1	5.9			4	5.3	1	1.5	2	2.0	2	1.3	1	.7	4	1.4
Total	985	100.0	864	100.0	23	100.0	75	100.0	17	100.0	6	100.0	76	100.0	65	100.0	102	100.0	150	100.0	142	100.0	290	100.0

6. On a scale of 1 to 5, where 1 is 'completely opposed' to this idea and 5 is 'completely in favor' of this idea, how do you feel about the idea of the proposed nine wind mills three miles off the Atlantic City shore?

	Total		Region						Age						S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)						Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Seasonal		Full Time		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Completely opposed	41	4.1	20	4.1	13	5.0	8	3.2	8	2.7	20	4.7	13	4.7	15	6.9	8	3.3	18	3.3	17	3.4	23	4.7
2	32	3.2	16	3.3	9	3.5	7	2.8	8	2.7	12	2.8	12	4.4	6	2.8	14	5.8	12	2.2	9	1.8	23	4.7
3	145	14.5	66	13.5	34	13.1	45	17.9	58	19.4	57	13.4	30	10.9	32	14.7	28	11.7	85	15.7	72	14.3	73	14.8
4	202	20.2	87	17.8	61	23.6	54	21.5	59	19.7	90	21.2	53	19.3	49	22.5	47	19.6	106	19.6	105	20.8	97	19.7
Completely in favor	554	55.4	289	59.0	136	52.5	129	51.4	160	53.5	232	54.6	161	58.5	109	50.0	136	56.7	309	57.0	282	56.0	270	54.8
Not Sure	26	2.6	12	2.4	6	2.3	8	3.2	6	2.0	14	3.3	6	2.2	7	3.2	7	2.9	12	2.2	19	3.8	7	1.4
Total	1000	100.0	490	100.0	259	100.0	251	100.0	299	100.0	425	100.0	275	100.0	218	100.0	240	100.0	542	100.0	504	100.0	493	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?						D4. How long have you lived on the New Jersey Shore? Would you say you've lived here...?									
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US		Less than 1 year		1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more		Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Completely opposed	19	3.5	15	3.2	4	6.3			6	3.7	13	3.4			1	9.1	2	9.5			1	2.0	16	4.8	2	40.0
2	12	2.2	10	2.1	2	3.1			4	2.5	8	2.1					2	9.5			2	3.9	16	4.8		
3	86	15.7	72	15.2	13	20.3	1	10.0	20	12.4	63	16.7	3	23.1			4	19.0	4	15.4	9	17.6	42	12.5		
4	110	20.1	100	21.1	8	12.5	2	20.0	31	19.3	78	20.7	3	23.1	4	36.4	6	28.6	4	15.4	11	21.6	66	19.7	1	20.0
Completely in favor	309	56.4	267	56.3	35	54.7	7	70.0	96	59.6	206	54.6	7	53.8	5	45.5	6	28.6	16	61.5	26	51.0	187	55.8	2	40.0
Not Sure	12	2.2	10	2.1	2	3.1			4	2.5	9	2.4			1	9.1	1	4.8	2	7.7	2	3.9	8	2.4		
Total	548	100.0	474	100.0	64	100.0	10	100.0	161	100.0	377	100.0	13	100.0	11	100.0	21	100.0	26	100.0	51	100.0	335	100.0	5	100.0

6. On a scale of 1 to 5, where 1 is 'completely opposed' to this idea and 5 is 'completely in favor' of this idea, how do you feel about the idea of the proposed nine wind mills three miles off the Atlantic City shore?

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status										Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Not sure/ Refuse		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Completely opposed	22	5.2	17	5.1	4	5.1	1	8.3	23	3.8	9	4.1	7	4.9	1	5.0			1	6.7	8	4.0	8	3.5	23	4.2
2	20	4.7	14	4.2	6	7.7			18	3.0	8	3.6	4	2.8	2	10.0					4	2.0	8	3.5	19	3.5
3	57	13.4	43	12.8	11	14.1	3	25.0	91	14.9	33	15.0	16	11.1	4	20.0			3	20.0	25	12.4	27	11.9	86	15.8
4	88	20.7	73	21.8	13	16.7	2	16.7	125	20.5	48	21.8	27	18.8	2	10.0					37	18.4	51	22.5	112	20.6
Completely in favor	224	52.7	177	52.8	41	52.6	6	50.0	334	54.8	117	53.2	88	61.1	11	55.0	1	100.0	11	73.3	120	59.7	130	57.3	289	53.0
Not Sure	14	3.3	11	3.3	3	3.8			19	3.1	5	2.3	2	1.4							7	3.5	3	1.3	16	2.9
Total	425	100.0	335	100.0	78	100.0	12	100.0	610	100.0	220	100.0	144	100.0	20	100.0	1	100.0	15	100.0	201	100.0	227	100.0	545	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Completely opposed	39	3.9	36	4.1			3	4.0					3	3.9	2	3.1	1	1.0	7	4.6	5	3.5	13	4.5
2	31	3.1	24	2.8	1	4.5	4	5.3	2	11.8			2	2.6	1	1.5	4	3.8	3	2.0	2	1.4	13	4.5
3	145	14.6	132	15.1	5	22.7	7	9.3			1	16.7	17	22.1	9	13.8	21	20.2	14	9.2	15	10.6	49	16.9
4	202	20.4	178	20.4	2	9.1	16	21.3	4	23.5	2	33.3	9	11.7	16	24.6	18	17.3	47	30.7	28	19.7	57	19.7
Completely in favor	549	55.3	480	55.0	14	63.6	42	56.0	10	58.8	3	50.0	44	57.1	36	55.4	56	53.8	78	51.0	89	62.7	153	52.8
Not Sure	26	2.6	22	2.5			3	4.0	1	5.9			2	2.6	1	1.5	4	3.8	4	2.6	3	2.1	5	1.7
Total	992	100.0	872	100.0	22	100.0	75	100.0	17	100.0	6	100.0	77	100.0	65	100.0	104	100.0	153	100.0	142	100.0	290	100.0

9. Do you think nine Wind Mills three miles off the Atlantic City shore will have a positive or negative effect on the city of Atlantic City and the local environment?

	Region								Age						S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)						Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Seasonal		Full Time		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Positive	657	65.6	324	66.0	169	65.3	164	65.1	220	73.6	281	66.0	155	56.2	132	60.8	166	68.9	359	66.0	343	67.9	313	63.4
Negative	68	6.8	30	6.1	19	7.3	19	7.5	17	5.7	31	7.3	20	7.2	23	10.6	17	7.1	28	5.1	30	5.9	37	7.5
No effect	221	22.1	110	22.4	53	20.5	58	23.0	44	14.7	92	21.6	85	30.8	51	23.5	48	19.9	122	22.4	99	19.6	121	24.5
Not sure	56	5.6	27	5.5	18	6.9	11	4.4	18	6.0	22	5.2	16	5.8	11	5.1	10	4.1	35	6.4	33	6.5	23	4.7
Total	1002	100.0	491	100.0	259	100.0	252	100.0	299	100.0	426	100.0	276	100.0	217	100.0	241	100.0	544	100.0	505	100.0	494	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?						D4. How long have you lived on the New Jersey Shore? Would you say you've lived here...?									
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US		Less than 1 year		1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more		Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Positive	363	66.0	314	66.0	43	67.2	6	60.0	99	61.5	256	67.5	8	61.5	5	45.5	8	40.0	21	80.8	29	56.9	230	68.5	1	20.0
Negative	29	5.3	23	4.8	6	9.4			8	5.0	20	5.3	1	7.7	1	9.1	5	25.0	2	7.7	4	7.8	27	8.0		
No effect	125	22.7	110	23.1	11	17.2	4	40.0	42	26.1	80	21.1	4	30.8	3	27.3	5	25.0	2	7.7	17	33.3	65	19.3	3	60.0
Not sure	33	6.0	29	6.1	4	6.3			12	7.5	23	6.1			2	18.2	2	10.0	1	3.8	1	2.0	14	4.2	1	20.0
Total	550	100.0	476	100.0	64	100.0	10	100.0	161	100.0	379	100.0	13	100.0	11	100.0	20	100.0	26	100.0	51	100.0	336	100.0	5	100.0

9. Do you think nine Wind Mills three miles off the Atlantic City shore will have a positive or negative effect on the city of Atlantic City and the local environment?

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status										Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Not sure/ Refuse		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Positive	275	64.9	216	64.7	51	65.4	8	66.7	373	61.0	170	76.9	97	67.4	12	60.0	1	100.0	10	62.5	133	66.2	156	68.4	355	65.1
Negative	38	9.0	31	9.3	5	6.4	2	16.7	45	7.4	14	6.3	8	5.6							10	5.0	14	6.1	42	7.7
No effect	90	21.2	71	21.3	18	23.1	1	8.3	157	25.7	27	12.2	33	22.9	4	20.0			5	31.3	46	22.9	51	22.4	112	20.6
Not sure	21	5.0	16	4.8	4	5.1	1	8.3	36	5.9	10	4.5	6	4.2	4	20.0			1	6.3	12	6.0	7	3.1	36	6.6
Total	424	100.0	334	100.0	78	100.0	12	100.0	611	100.0	221	100.0	144	100.0	20	100.0	1	100.0	16	100.0	201	100.0	228	100.0	545	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Positive	653	65.7	565	64.7	18	78.3	55	73.3	10	58.8	5	83.3	55	71.4	46	69.7	71	68.3	106	69.3	102	71.8	184	63.4
Negative	66	6.6	58	6.6	1	4.3	6	8.0			1	16.7	6	7.8	3	4.5	5	4.8	10	6.5	8	5.6	21	7.2
No effect	220	22.1	203	23.3	4	17.4	9	12.0	4	23.5			13	16.9	16	24.2	18	17.3	30	19.6	26	18.3	67	23.1
Not sure	55	5.5	47	5.4			5	6.7	3	17.6			3	3.9	1	1.5	10	9.6	7	4.6	6	4.2	18	6.2
Total	994	100.0	873	100.0	23	100.0	75	100.0	17	100.0	6	100.0	77	100.0	66	100.0	104	100.0	153	100.0	142	100.0	290	100.0

11. If nine Wind Mills were located off the Atlantic City shore, please tell me how likely you would be to visit the Atlantic City area in the future? Would you be...?

	Total		Region						Age						S3. Are you a seasonal or full time resident of the New Visitor		Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60				Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
A lot more likely	60	11.1	53	15.1	3	2.7	4	4.9	28	15.1	20	9.2	12	8.6	60	11.1	36	12.9	24	9.2
A little more likely	43	7.9	30	8.6	7	6.3	6	7.4	17	9.1	19	8.8	7	5.0	43	7.9	22	7.9	21	8.1
Neither more likely nor less likely	418	77.1	253	72.3	95	85.6	70	86.4	134	72.0	169	77.9	115	82.7	418	77.1	211	75.4	205	78.8
A little less likely	14	2.6	11	3.1	2	1.8	1	1.2	5	2.7	6	2.8	3	2.2	14	2.6	4	1.4	10	3.8
A lot less likely	5	.9	2	.6	3	2.7			1	.5	3	1.4	1	.7	5	.9	5	1.8		
Not Sure	2	.4	1	.3	1	.9			1	.5			1	.7	2	.4	2	.7		
Total	542	100.0	350	100.0	111	100.0	81	100.0	186	100.0	217	100.0	139	100.0	542	100.0	280	100.0	260	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?					
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
A lot more likely	60	11.2	48	10.4	12	18.8			14	8.9	44	11.9	2	15.4
A little more likely	43	8.0	35	7.6	7	10.9	1	10.0	13	8.2	29	7.9	1	7.7
Neither more likely nor less likely	413	76.9	364	78.6	40	62.5	9	90.0	127	80.4	280	75.9	9	69.2
A little less likely	14	2.6	10	2.2	4	6.3			3	1.9	10	2.7	1	7.7
A lot less likely	5	.9	4	.9	1	1.6			1	.6	4	1.1		
Not Sure	2	.4	2	.4							2	.5		
Total	537	100.0	463	100.0	64	100.0	10	100.0	158	100.0	369	100.0	13	100.0

11. If nine Wind Mills were located off the Atlantic City shore, please tell me how likely you would be to visit the Atlantic City area in the future? Would you be...?

	Status								Education							
	Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
A lot more likely	21	6.3	25	20.5	14	18.7			1	12.5	12	9.9	23	16.7	24	9.1
A little more likely	26	7.9	12	9.8	4	5.3					14	11.6	11	8.0	16	6.0
Neither more likely nor less likely	268	81.0	80	65.6	57	76.0	11	100.0	7	87.5	91	75.2	100	72.5	212	80.0
A little less likely	10	3.0	4	3.3							2	1.7	3	2.2	9	3.4
A lot less likely	4	1.2	1	.8							1	.8	1	.7	3	1.1
Not Sure	2	.6									1	.8			1	.4
Total	331	100.0	122	100.0	75	100.0	11	100.0	8	100.0	121	100.0	138	100.0	265	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
A lot more likely	60	11.1	39	8.8	1	5.9	17	26.2			3	60.0	6	13.3	13	30.2	10	13.9	12	14.1	8	9.2	7	5.5
A little more likely	43	8.0	32	7.2	3	17.6	8	12.3					5	11.1	2	4.7	9	12.5	7	8.2	10	11.5	6	4.7
Neither more likely nor less likely	415	77.0	359	80.7	12	70.6	36	55.4	6	85.7	2	40.0	33	73.3	27	62.8	50	69.4	60	70.6	66	75.9	109	85.2
A little less likely	14	2.6	8	1.8	1	5.9	4	6.2	1	14.3			1	2.2			2	2.8	4	4.7	2	2.3	4	3.1
A lot less likely	5	.9	5	1.1											1	2.3	1	1.4	1	1.2			2	1.6
Not Sure	2	.4	2	.4															1	1.2	1	1.1		
Total	539	100.0	445	100.0	17	100.0	65	100.0	7	100.0	5	100.0	45	100.0	43	100.0	72	100.0	85	100.0	87	100.0	128	100.0

12. Do you think you would go elsewhere on the New Jersey Shore or go somewhere other than the Atlantic City area?

	Total		Region						Age						S3. Are you a seasonal or full time resident of the New		Gender			
			AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Elsewhere on the New Jersey Shore	28	5.5	23	7.0	5	4.6			8	4.7	15	7.3	5	3.7	28	5.5	14	5.3	14	5.6
Somewhere other than the New Jersey Shore	5	1.0	5	1.5					1	.6	2	1.0	2	1.5	5	1.0	2	.8	3	1.2
Not Sure	479	93.6	301	91.5	104	95.4	74	100.0	163	94.8	189	91.7	127	94.8	479	93.6	246	93.9	231	93.1
Total	512	100.0	329	100.0	109	100.0	74	100.0	172	100.0	206	100.0	134	100.0	512	100.0	262	100.0	248	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?					
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Elsewhere on the New Jersey Shore	28	5.5	21	4.8	7	11.9			9	6.2	19	5.4		
Somewhere other than the New Jersey Shore	5	1.0	3	.7	2	3.4			1	.7	4	1.1		
Not Sure	474	93.5	414	94.5	50	84.7	10	100.0	136	93.2	328	93.4	13	100.0
Total	507	100.0	438	100.0	59	100.0	10	100.0	146	100.0	351	100.0	13	100.0

	Status								Education							
	Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Elsewhere on the New Jersey Shore	16	5.0	10	9.1	2	2.9					8	6.8	8	6.3	12	4.8
Somewhere other than the New Jersey Shore	4	1.2			1	1.5							1	.8	4	1.6
Not Sure	301	93.8	100	90.9	65	95.6	11	100.0	8	100.0	109	93.2	118	92.9	234	93.6
Total	321	100.0	110	100.0	68	100.0	11	100.0	8	100.0	117	100.0	127	100.0	250	100.0

12. Do you think you would go elsewhere on the New Jersey Shore or go somewhere other than the Atlantic City area?

			Race										Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Elsewhere on the New Jersey Shore	28	5.5	23	5.5	1	6.3	4	6.5					2	4.8	2	5.0	2	3.1	7	8.6	7	8.4	7	5.6
Somewhere other than the New Jersey Shore	5	1.0	3	.7			1	1.6			1	20.0							1	1.2	1	1.2	3	2.4
Not Sure	476	93.5	393	93.8	15	93.8	57	91.9	7	100.0	4	80.0	40	95.2	38	95.0	62	96.9	73	90.1	75	90.4	114	91.9
Total	509	100.0	419	100.0	16	100.0	62	100.0	7	100.0	5	100.0	42	100.0	40	100.0	64	100.0	81	100.0	83	100.0	124	100.0

14. Do you own any rental properties in the Atlantic City area?

	Total		Region: AC/Ventnor		Region: Brigantine		Region: Margate		Age: 18-40		Age: 41-60		Age: Over 60		S3. Seasonal		S3. Full Time		S3. Visitor		Gender: Male		Gender: Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	45	10.0	9	6.6	18	12.3	18	10.7	7	6.4	24	11.5	14	10.6	29	13.7	15	6.3	1	50.0	25	11.4	20	8.7
No	403	89.4	128	93.4	126	86.3	149	88.7	102	92.7	183	88.0	117	88.6	179	84.8	223	93.7	1	50.0	193	87.7	210	90.9
Not Sure	3	.7			2	1.4	1	.6	1	.9	1	.5	1	.8	3	1.4					2	.9	1	.4
Total	451	100.0	137	100.0	146	100.0	168	100.0	110	100.0	208	100.0	132	100.0	211	100.0	238	100.0	2	100.0	220	100.0	231	100.0

	D1. Are you a longtime visitor or is this your first time here? Total		D1. Long time visitor		D2. Another part of NJ		D2. Another state		D4. Less than 1 year		D4. 1 year to less than 3 years		D4. 3 years to less than 5 years		D4. 5 years to less than 10 years		D4. 10 years or more		D4. Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	1	11.1	1	11.1			1	12.5			3	14.3	2	8.0	6	11.8	33	9.9		
No	8	88.9	8	88.9	2	100.0	7	87.5	11	100.0	18	85.7	23	92.0	45	88.2	300	89.6	3	75.0
Not Sure																	2	.6	1	25.0
Total	9	100.0	9	100.0	2	100.0	8	100.0	11	100.0	21	100.0	25	100.0	51	100.0	335	100.0	4	100.0

	D5. Do you currently own or rent your residence on the New Jersey Shore? Total		D5. Own		D5. Rent		D5. Not sure/ Refuse		Status: Married		Status: Single, never married		Status: Widowed, separated, divorced		Status: Civil union/living together/partnership		Status: Not sure/ Refuse		Education: <HS		Education: HSGrad		Education: SomeCol		Education: Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	38	9.0	35	10.5	3	3.9			38	13.8	4	4.2	3	4.4							2	2.6	10	11.2	33	12.0
No	379	90.2	296	89.2	72	94.7	11	91.7	237	85.9	91	94.8	64	94.1	9	100.0	1	100.0	8	100.0	75	97.4	79	88.8	240	87.0
Not Sure	3	.7	1	.3	1	1.3	1	8.3	1	.4	1	1.0	1	1.5											3	1.1
Total	420	100.0	332	100.0	76	100.0	12	100.0	276	100.0	96	100.0	68	100.0	9	100.0	1	100.0	8	100.0	77	100.0	89	100.0	276	100.0

14. Do you own any rental properties in the Atlantic City area?

			Race										Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Yes	45	10.1	43	10.2			1	11.1	1	10.0					1	4.8	2	6.9	2	2.9	8	14.0	24	15.0
No	399	89.3	374	89.0	7	100.0	8	88.9	9	90.0	1	100.0	32	100.0	20	95.2	27	93.1	64	94.1	49	86.0	135	84.4
Not Sure	3	.7	3	.7															2	2.9			1	.6
Total	447	100.0	420	100.0	7	100.0	9	100.0	10	100.0	1	100.0	32	100.0	21	100.0	29	100.0	68	100.0	57	100.0	160	100.0

15. If nine Wind Mills were located off the Atlantic City shore, do you think it would it make it easier or more difficult to rent your properties or would it have no impact?

	Region								Age						S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)						Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Seasonal		Full Time		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Easier	6	9.5	4	17.4			2	9.1	1	11.1	2	6.1	3	14.3	2	5.7	4	14.8					6	18.8
More difficult	8	12.7	5	21.7			3	13.6			6	18.2	2	9.5	3	8.6	5	18.5			6	19.4	2	6.3
No impact	48	76.2	14	60.9	18	100.0	16	72.7	7	77.8	25	75.8	16	76.2	29	82.9	18	66.7	1	100.0	25	80.6	23	71.9
Not sure	1	1.6					1	4.5	1	11.1					1	2.9							1	3.1
Total	63	100.0	23	100.0	18	100.0	22	100.0	9	100.0	33	100.0	21	100.0	35	100.0	27	100.0	1	100.0	31	100.0	32	100.0

	D1. Are you a longtime visitor or is this your first time here?				D2. Are you visiting		D4. How long have you lived on the New Jersey Shore? Would you say you've lived here...?							
	Total		Long time visitor		Another state		1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Easier													6	13.3
More difficult	1	33.3	1	33.3					1	33.3	1	11.1	5	11.1
No impact	2	66.7	2	66.7	1	100.0	4	100.0	2	66.7	7	77.8	34	75.6
Not sure											1	11.1		
Total	3	100.0	3	100.0	1	100.0	4	100.0	3	100.0	9	100.0	45	100.0

15. If nine Wind Mills were located off the Atlantic City shore, do you think it would it make it easier or more difficult to rent your properties or would it have no impact?

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status						Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Easier	5	9.1	4	8.2	1	20.0			2	4.3	2	28.6	2	22.2					1	8.3	5	10.9
More difficult	6	10.9	6	12.2					6	12.8	1	14.3	1	11.1			1	25.0	1	8.3	6	13.0
No impact	43	78.2	38	77.6	4	80.0	1	100.0	38	80.9	4	57.1	6	66.7	1	100.0	3	75.0	10	83.3	34	73.9
Not sure	1	1.8	1	2.0					1	2.1											1	2.2
Total	55	100.0	49	100.0	5	100.0	1	100.0	47	100.0	7	100.0	9	100.0	1	100.0	4	100.0	12	100.0	46	100.0

	Race								Income											
	Total		White		AfrAmer		Asian		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Easier	6	9.5	6	10.0													3	30.0	2	6.7
More difficult	8	12.7	6	10.0	2	100.0					1	25.0			2	50.0			4	13.3
No impact	48	76.2	47	78.3			1	100.0	2	100.0	3	75.0	2	100.0	2	50.0	7	70.0	23	76.7
Not sure	1	1.6	1	1.7															1	3.3
Total	63	100.0	60	100.0	2	100.0	1	100.0	2	100.0	4	100.0	2	100.0	4	100.0	10	100.0	30	100.0

17. Would you say the development of renewable energy resources as compared to other issues facing the nation is.....

	Total		Region: AC/Ventnor		Region: Brigantine		Region: Margate		Age: 18-40		Age: 41-60		Age: Over 60		S3. Seasonal		S3. Full Time		S3. Visitor		Gender: Male		Gender: Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	234	23.5	118	24.2	58	22.5	58	23.4	68	23.0	97	22.9	69	25.3	43	19.8	62	25.8	129	24.0	100	19.9	134	27.3
Somewhat more important	222	22.3	103	21.1	62	24.0	57	23.0	66	22.3	93	21.9	62	22.7	47	21.7	47	19.6	128	23.8	117	23.3	105	21.4
Equally as important	396	39.8	189	38.7	109	42.2	98	39.5	129	43.6	176	41.5	91	33.3	94	43.3	91	37.9	211	39.3	212	42.2	182	37.1
Somewhat less important	91	9.2	43	8.8	22	8.5	26	10.5	22	7.4	39	9.2	30	11.0	22	10.1	24	10.0	45	8.4	51	10.2	40	8.2
A lot less important	37	3.7	22	4.5	6	2.3	9	3.6	6	2.0	14	3.3	17	6.2	9	4.1	10	4.2	18	3.4	14	2.8	23	4.7
Not sure	14	1.4	13	2.7	1	.4			5	1.7	5	1.2	4	1.5	2	.9	6	2.5	6	1.1	8	1.6	6	1.2
Total	994	100.0	488	100.0	258	100.0	248	100.0	296	100.0	424	100.0	273	100.0	217	100.0	240	100.0	537	100.0	502	100.0	490	100.0

	D1. Total		D1. Long time visitor		D1. First time		D1. Not sure/ Refuse		D2. Another part of NJ		D2. Another state		D2. Outside of the US		D4. Less than 1 year		D4. 1 year to less than 3 years		D4. 3 years to less than 5 years		D4. 5 years to less than 10 years		D4. 10 years or more		D4. Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	131	24.1	112	23.7	18	29.5	1	10.0	42	26.3	86	23.1	2	15.4	2	18.2	5	23.8	5	19.2	7	13.7	83	24.8	1	20.0
Somewhat more important	128	23.5	109	23.0	17	27.9	2	20.0	28	17.5	95	25.5	5	38.5	1	9.1	4	19.0	5	19.2	16	31.4	67	20.0	1	20.0
Equally as important	215	39.5	189	40.0	20	32.8	6	60.0	63	39.4	148	39.7	5	38.5	4	36.4	11	52.4	10	38.5	20	39.2	132	39.4	3	60.0
Somewhat less important	46	8.5	40	8.5	5	8.2	1	10.0	18	11.3	29	7.8	1	7.7	4	36.4			3	11.5	6	11.8	32	9.6		
A lot less important	18	3.3	18	3.8					7	4.4	11	2.9							1	3.8	1	2.0	17	5.1		
Not sure	6	1.1	5	1.1	1	1.6			2	1.3	4	1.1					1	4.8	2	7.7	1	2.0	4	1.2		
Total	544	100.0	473	100.0	61	100.0	10	100.0	160	100.0	373	100.0	13	100.0	11	100.0	21	100.0	26	100.0	51	100.0	335	100.0	5	100.0

17. Would you say the development of renewable energy resources as compared to other issues facing the nation is.....

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status										Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Not sure/ Refuse		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	91	21.5	73	21.9	17	21.8	1	8.3	144	23.7	52	23.5	30	21.1	7	35.0			3	18.8	44	21.9	58	25.7	127	23.5
Somewhat more important	87	20.5	75	22.5	10	12.8	2	16.7	142	23.4	45	20.4	29	20.4	5	25.0			1	6.3	41	20.4	46	20.4	129	23.9
Equally as important	175	41.3	138	41.3	32	41.0	5	41.7	237	39.0	96	43.4	55	38.7	8	40.0			10	62.5	88	43.8	90	39.8	206	38.1
Somewhat less important	45	10.6	29	8.7	12	15.4	4	33.3	54	8.9	19	8.6	16	11.3			1	100.0			13	6.5	22	9.7	55	10.2
A lot less important	18	4.2	14	4.2	4	5.1			23	3.8	5	2.3	9	6.3					2	12.5	8	4.0	8	3.5	18	3.3
Not sure	8	1.9	5	1.5	3	3.8			7	1.2	4	1.8	3	2.1							7	3.5	2	.9	5	.9
Total	424	100.0	334	100.0	78	100.0	12	100.0	607	100.0	221	100.0	142	100.0	20	100.0	1	100.0	16	100.0	201	100.0	226	100.0	540	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	232	23.5	201	23.2	4	17.4	23	31.1	4	25.0			14	18.2	17	25.8	25	24.0	36	23.8	34	24.1	66	22.8
Somewhat more important	220	22.3	198	22.8	4	17.4	12	16.2	3	18.8	3	50.0	22	28.6	16	24.2	20	19.2	33	21.9	36	25.5	60	20.8
Equally as important	393	39.8	343	39.5	13	56.5	29	39.2	5	31.3	3	50.0	34	44.2	24	36.4	48	46.2	56	37.1	57	40.4	119	41.2
Somewhat less important	91	9.2	79	9.1	2	8.7	7	9.5	3	18.8			3	3.9	5	7.6	9	8.7	17	11.3	6	4.3	32	11.1
A lot less important	37	3.7	36	4.1			1	1.4					2	2.6	2	3.0	1	1.0	5	3.3	7	5.0	11	3.8
Not sure	14	1.4	11	1.3			2	2.7	1	6.3			2	2.6	2	3.0	1	1.0	4	2.6	1	.7	1	.3
Total	987	100.0	868	100.0	23	100.0	74	100.0	16	100.0	6	100.0	77	100.0	66	100.0	104	100.0	151	100.0	141	100.0	289	100.0

18. Would you say that global warming and the reduction of greenhouse gases compared to other issues facing the nation is..

	Total		Region						Age						S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)						Gender			
	Total		AC/Ventnor		Brigantine		Margate		18-40		41-60		Over 60		Seasonal		Full Time		Visitor		Male		Female	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	266	26.8	154	31.6	57	22.2	55	22.1	79	26.7	115	27.1	72	26.5	41	19.0	69	28.8	156	29.1	119	23.7	147	30.1
Somewhat more important	221	22.3	88	18.1	62	24.1	71	28.5	79	26.7	93	21.9	48	17.6	55	25.5	53	22.1	113	21.0	113	22.5	107	21.9
Equally as important	323	32.5	150	30.8	87	33.9	86	34.5	98	33.1	147	34.7	78	28.7	76	35.2	64	26.7	183	34.1	188	37.4	134	27.5
Somewhat less important	84	8.5	36	7.4	26	10.1	22	8.8	17	5.7	36	8.5	31	11.4	25	11.6	19	7.9	40	7.4	35	7.0	49	10.0
A lot less important	78	7.9	47	9.7	20	7.8	11	4.4	17	5.7	24	5.7	37	13.6	17	7.9	25	10.4	36	6.7	36	7.2	42	8.6
Not sure	21	2.1	12	2.5	5	1.9	4	1.6	6	2.0	9	2.1	6	2.2	2	.9	10	4.2	9	1.7	12	2.4	9	1.8
Total	993	100.0	487	100.0	257	100.0	249	100.0	296	100.0	424	100.0	272	100.0	216	100.0	240	100.0	537	100.0	503	100.0	488	100.0

	D1. Are you a longtime visitor or is this your first time here?								D2. Are you visiting from...?						D4. How long have you lived on the New Jersey Shore? Would you say you've lived here...?									
	Total		Long time visitor		First time		Not sure/ Refuse		Another part of NJ		Another state		Outside of the US		Less than 1 year		1 year to less than 3 years		3 years to less than 5 years		5 years to less than 10 years		10 years or more		Not sure	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	158	29.0	144	30.4	12	19.7	2	20.0	46	28.8	106	28.4	4	30.8	1	9.1	4	19.0	6	23.1	13	25.5	83	24.9	1	20.0
Somewhat more important	114	21.0	99	20.9	12	19.7	3	30.0	27	16.9	85	22.8	4	30.8	2	18.2	4	19.0	6	23.1	14	27.5	80	24.0		
Equally as important	186	34.2	155	32.8	27	44.3	4	40.0	57	35.6	126	33.8	4	30.8	3	27.3	11	52.4	9	34.6	14	27.5	96	28.7	3	60.0
Somewhat less important	40	7.4	32	6.8	8	13.1			12	7.5	28	7.5	1	7.7	2	18.2	2	9.5	1	3.8	6	11.8	32	9.6	1	20.0
A lot less important	37	6.8	34	7.2	2	3.3	1	10.0	14	8.8	23	6.2			3	27.3			2	7.7	2	3.9	35	10.5		
Not sure	9	1.7	9	1.9					4	2.5	5	1.3							2	7.7	2	3.9	8	2.4		
Total	544	100.0	473	100.0	61	100.0	10	100.0	160	100.0	373	100.0	13	100.0	11	100.0	21	100.0	26	100.0	51	100.0	334	100.0	5	100.0

18. Would you say that global warming and the reduction of greenhouse gases compared to other issues facing the nation is..

	D5. Do you currently own or rent your residence on the New Jersey Shore?								Status										Education							
	Total		Own		Rent		Not sure/ Refuse		Married		Single, never married		Widowed, separated, divorced		Civil union/living together/partnership		Not sure/ Refuse		<HS		HSGrad		SomeCol		Col+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	101	23.9	81	24.3	20	25.6			157	26.0	68	30.8	35	24.5	6	30.0			5	31.3	66	32.8	69	30.5	123	22.8
Somewhat more important	99	23.4	79	23.7	17	21.8	3	25.0	132	21.8	50	22.6	29	20.3	8	40.0	1	100.0	1	6.3	30	14.9	50	22.1	136	25.2
Equally as important	131	31.0	102	30.6	24	30.8	5	41.7	196	32.4	71	32.1	52	36.4	3	15.0			6	37.5	67	33.3	68	30.1	180	33.4
Somewhat less important	42	9.9	34	10.2	5	6.4	3	25.0	58	9.6	14	6.3	10	7.0	1	5.0			3	18.8	14	7.0	18	8.0	48	8.9
A lot less important	39	9.2	30	9.0	9	11.5			51	8.4	14	6.3	11	7.7	2	10.0			1	6.3	18	9.0	17	7.5	42	7.8
Not sure	11	2.6	7	2.1	3	3.8	1	8.3	11	1.8	4	1.8	6	4.2							6	3.0	4	1.8	10	1.9
Total	423	100.0	333	100.0	78	100.0	12	100.0	605	100.0	221	100.0	143	100.0	20	100.0	1	100.0	16	100.0	201	100.0	226	100.0	539	100.0

	Race												Income											
	Total		White		Hisp		AfrAmer		Asian		Other		< $25K		$25-35K		$35-50K		$50-75K		$75-100K		$100+	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Much more important	264	26.8	213	24.6	12	52.2	32	43.2	6	37.5	1	16.7	28	36.4	22	33.3	36	34.6	54	35.8	36	25.7	55	19.1
Somewhat more important	220	22.3	202	23.3	2	8.7	12	16.2	2	12.5	2	33.3	15	19.5	15	22.7	18	17.3	27	17.9	36	25.7	74	25.7
Equally as important	320	32.5	283	32.6	7	30.4	24	32.4	3	18.8	3	50.0	24	31.2	18	27.3	37	35.6	46	30.5	49	35.0	96	33.3
Somewhat less important	84	8.5	78	9.0	2	8.7	4	5.4					5	6.5	5	7.6	6	5.8	8	5.3	5	3.6	36	12.5
A lot less important	78	7.9	73	8.4			1	1.4	4	25.0			2	2.6	4	6.1	4	3.8	15	9.9	12	8.6	22	7.6
Not sure	20	2.0	18	2.1			1	1.4	1	6.3			3	3.9	2	3.0	3	2.9	1	.7	2	1.4	5	1.7
Total	986	100.0	867	100.0	23	100.0	74	100.0	16	100.0	6	100.0	77	100.0	66	100.0	104	100.0	151	100.0	140	100.0	288	100.0

Appendix C: Survey Instrument

Hello, I'm _____ from Zogby International and we are working for the Hughes Center of Public Policy at Stockton College, this is a survey on opinions about the Atlantic City Area. Do you have a few minutes?

Screening Questions

S1. Do you work in the tourism industry, as a seasonal business employee on the New Jersey Shore, for the state of New Jersey, for a public utility or for an environmental organization?

1. Yes (End) 2. No 3. Not sure (End)

701. Is your age group 18-40 41-60 Over 60

S3. Are you a seasonal or full time resident of the New Jersey Shore community or a visitor (meaning any community within 3 miles of the ocean or bay?)

1. Seasonal **(RESIDENT)(GO to Q1)**
2. Full Time **(RESIDENT) (GO to Q1)**
3. **(VISITOR) (Go to V5)**

V5. Are you here for a …

1. Day trip to the shore
2. Vacationing at the shore and staying at a friend's home
3. Vacationing at the shore and staying at a hotel/motel, bed and breakfast, condo-tel
4. Vacationing at the shore and renting a house, apartment or condo
5. Not sure **(Do not read)**

V6. Have you come to the shore before?

1. Yes, I've been here before 2. No, this is my first time 3. Not sure **(Do not read)**

(ASK EVERYONE) **Main Questionnaire**

1. Have you ever heard about producing electricity through the use of Offshore Wind Turbines or Wind Mills? You may have also heard these referred to as Offshore Wind Mills or Wind Farms. Wind Turbines, or Wind Mills are structures that capture wind to produce electricity.

1. Yes (To 2 and 3) **2. No (To Q4)** **3. Not sure (To Q4)**

2. What have you heard about electricity production through the use of Offshore Wind Turbines/Wind Mills? **(RECORD VERBATIM) (PROBE)** Anything else**?**_____

_____

_____

_____

_____

_____

3. On a scale of 1 to 5 where 1 is "not at all familiar" with producing electricity through Offshore Wind Mills and 5 is "extremely familiar", how familiar are you with the idea of producing electricity through Offshore Wind Mills?

1 **Not at all** 2 3 4 5 **Extremely** 6. Not sure **(Do not read)**

4. Are you familiar with the 5-turbine wind farm near the Borgata Casino on the way into Atlantic City?

1 **Not at all familiar** 2 3 4 **5 Extremely familiar**
6. Not sure **(Do not read)**

5. Are you more likely or less likely to visit Atlantic City because of these five windmills?

1. More likely 2. Less likely 3. No difference
4. Not Sure**(Do not read)**

CONCEPT TEST - Consideration is being given to building a nine windmill farm three miles off Atlantic City as part of a program designed to provide electricity through clean, renewable and locally generated sources.

I'm going to show you some pictures of what the proposed nine Offshore Wind Mills or Wind Farm off Atlantic City might look like from the area and ask you some questions based on the pictures.
(Interviewer note: Show Pictures-Visitors and Residents see the same pictures)

6. On a scale of 1 to 5, where 1 is "completely opposed" to this idea and 5 is "completely in favor" of this idea, how do you feel about the idea of the proposed nine wind mills three miles off the Atlantic City shore?

1 **Completely opposed** 2 3 4 5 **Completely in favor**
6. Not sure **(Do not read)**

7. What benefits, if any, do you think there might be with what you just looked at? (RECORD VERBATIM) (PROBE) Any others?

_____
_____
_____
_____

8. What **disadvantages**, if any, do you think there might be with what you just looked at? **(RECORD VERBATIM) (PROBE)** Any others?_____
_____
_____
_____

9. Do you think nine Wind Mills three miles off the Atlantic City shore will have a positive or negative effect on the city of Atlantic City and the local environment?

1. Positive 2. Negative 3. No effect 4. Not sure **(Do not read)**

10. Please tell me why you feel that way? **(RECORD VERBATIM) (PROBE)** Any other reasons?

_____
_____
_____
_____

(ASK Q11-12 <u>VISITORS only</u>)

11. If nine Wind Mills were located off the Atlantic City shore, please tell me how likely you would be to visit the Atlantic City area in the future? Would you be…? **(READ ANSWERS)**

1. A lot more likely **(To 17)**
2. A little more likely **(To 17)**
3. Neither more likely nor less likely **(To 12)**
4. A little less likely **(To 12)**
5. A lot less likely **(To 12)**
6. Not sure **(Do not read) (To 12)**

12. Do you think you would go elsewhere on the New Jersey Shore or go somewhere other than the Atlantic City area?

1. Elsewhere on the New Jersey Shore
2. Somewhere other than the New Jersey Shore
3. Not sure **(Do not read)**

(ASK Q13 – Q15 RESIDENT only)

13. If nine Wind Mills were located three miles off the Atlantic City shore, please tell me what affect it would have on people who live in the Atlantic City area?

_____
_____
_____

14. Do you own any rental properties in the Atlantic City area?

1. Yes **(Ask 15) What City_____** 2. No **(To 17)**
3. Not sure **(To 17)**

15. If nine Wind Mills were located off the Atlantic City shore, do you think it would it make it easier or more difficult to rent your properties or would it have no impact?

1. Easier 2. More difficult 3. No impact 4. Not sure **(Do not read)**

(ASK EVERYONE)

17. Would you say the development of renewable energy resources as compared to other issues facing the nation is..

1. Much more important 2. Somewhat more important
3. Equally as important
4. Somewhat less important 5. A lot less important
6. Not sure **(Do not read)**

18. Would you say that global warming and the reduction of greenhouse gases compared to other issues facing the nation is**..**

1. Much more important 2. Somewhat more important
3. Equally as important
4. Somewhat less important 5. A lot less important
6. Not sure **(Do not read)**

DEMOGRAPHICS

The following questions are for classification purposes only.

(ASK QD1 – QD3 VISITORS only)

D1. Are you a longtime visitor or is this your first time here?

1. Long time visitor 2. First time 3. Not sure/Refuse **(Do not read)**

D2. Are you visiting from…?

1. Another part of New Jersey 2. Another state (**Record)_____**
3. Outside of the US 4. Not sure/Refuse **(Do not read)**

D3. Please select the reason or reasons that you chose the New Jersey

Shore for this trip? **(ALLOW MULTIPLE RESPONSES)**

1. Convenient to where I live
2. Come here all the time
3. Beautiful beaches
4. Fun for the family
5. Tourist attraction
6. Variety of destinations and things to see
7. Has gambling
8. Relaxing
9. Other **(Record)**_____

(ASK QD4 – QD5 for RESIDENT only)

D4. How long have you lived on the New Jersey Shore? Would you say you've lived here…? **(READ ANSWERS)**

1. Less than 1 year
2. 1 year to less than 3 years
3. 3 years to less than 5 years
4. 5 years to less than 10 years
5. 10 years or more
6. Not sure **(Do not read)**

D5. Do you currently own or rent your residence on the New Jersey Shore? 1. Own 2. Rent 3. Not sure/Refuse

(ASK EVERYONE)

D6. Which of the following best describes your marital status? Are you…? **(READ ANSWERS)**

1. Married
2. Single, never married
3. Widowed, separated, divorced
4. Civil union/living together/partnership
5. Not sure/Refuse **(Do not read)**

903. Which of the following best describes your highest level of education?

1. Less than h.s. graduate 2. H.S. graduate 3. Some college
4. College graduate or more 0. Refuse **(Do not read)**

921. Which of the following best represents your household income last year before taxes?

1. Less than $25,000 2. $25,000-$34,999
3. $35,000-$49,999 4. $50,000-$74,999
5. $75,000-$99,999 6. $100,000 or more 0. Refuse **(Do not read)**

9. **ETHNIC BACKGROUND**. **DO NOT READ. VISUAL ONLY**

1. White/Caucasian
2. Black/African American
3. Hispanic/Latino
4. Asian/Pacific Islander
5. Other **(Record)**_____
6. Not sure

D10. Do you consider yourself to be Hispanic?

1. Yes 2. No 3. Not sure/Refuse **(Do not read)**

S7. **RECORD RESPONDENT'S GENDER**

1. Female 2. Male

Thank you very much for your help.
Your opinions are greatly appreciated!

Department of Energy
Golden Field Office
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February 17, 2015

Jesse Bergevin
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2037 Dream Catcher Plaza
Oneida, NY 13421

SUBJECT: DOE and USACE Request for Re-Initiation of Section 106 Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Mr. Bergevin:

I am contacting you to re-open the consultation process with regards to an offshore wind project that is within your Tribal area of interest. Pursuant to Section 106 of the *National Historic Preservation Act* of 1966 (NHPA) as amended, the U.S. Department of Energy (DOE) is initiating the consultation process to determine any potential effects on Tribal properties of traditional religious and cultural significance.

DOE is proposing to provide funding to Fishermen's Atlantic City Windfarm, LLC (project proponent) to support the development of an offshore wind renewable energy facility (Proposed Project) located approximately 2.8 miles off the New Jersey coast from Atlantic City. The Proposed Project would consist of the construction, operation, maintenance, and eventual decommissioning of up to six wind turbine generators that would generate a maximum of approximately 25 megawatts (MW) of electricity, a 33-kilovolt (kV) alternating current (AC) submarine cable interconnecting the turbines, a 33-kV AC submarine transmission cable (export cable), and a 33-kV AC underground cable (onshore interconnection cable) that would connect the project with existing onshore infrastructure in Atlantic City, New Jersey.

The U.S. Army Corps of Engineers, Philadelphia District (USACE) previously contacted you about permitting of the Proposed Project pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. Enclosed is a copy of the USACE correspondence dated March 4, 2011 for your use (Enclosure 1). Since March 2011, the following changes have occurred:

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To streamline the consultation process and to avoid redundancy, DOE and USACE have decided to jointly re-initiate consultation with you. Our goal is to avoid inadvertently impacting traditional cultural properties, burials, and lands with significance to the Tribe(s) and Nation(s), pursuant to Section 106 of the NHPA.

To inform the consultation process, attached for your use is a detailed project description (Enclosure 3) which includes the proposed changes to the project since the USACE contacted you in March 2011. Also enclosed are excerpts from a viewshed analysis report that has been completed for the project (Enclosure 4).

DOE and USACE are inquiring if the Tribe has any concerns with regards to resources of religious and cultural significance (e.g. traditional cultural properties) that could be impacted by the Proposed Project?

If you have any questions or require additional information, please contact Lori Gray at (720)356-1568 or lori.gray@ee.doe.gov or Nicole Minnichbach, USACE at 215-656-6556 or Nicole.C.Minnichbach@usace.army.mil.

Please provide your response to this inquiry within 30 days of receipt of this letter to help us move the process forward. Correspondence should be directed to:

U.S. Department of Energy
Golden Field Office
Attn: Ms. Lori Gray
NEPA Division Director
15013 Denver West Parkway
Golden, CO 80401

U.S. Army Corps of Engineers
Regulatory Branch, Philadelphia District
Attn: Ms. Nicole Minnichbach
Cultural Resource Specialist/Tribal Liaison
Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107-3390

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addressing any concerns your Tribe may have related to the Fishermen's Atlantic City Windfarm.

Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

Electronic cc:
Lori Gray, DOE
Michael Hahn, DOE
Roak Parker, DOE
Nicole Cooper Minnichbach, USACE
Lawrence M Slavitter, USACE

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 17, 2015

Nekole Alligood
Cultural Preservation Director
The Delaware Nation
31064 State Highway 281
P.O. Box 825
Anadarko, Oklahoma 73005

SUBJECT: DOE and USACE Request for Re-Initiation of Section 106 Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Ms. Alligood:

I am contacting you to re-open the consultation process with regards to an offshore wind project that is within your Tribal area of interest. Pursuant to Section 106 of the *National Historic Preservation Act* of 1966 (NHPA) as amended, the U.S. Department of Energy (DOE) is initiating the consultation process to determine any potential effects on Tribal properties of traditional religious and cultural significance.

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Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

Electronic cc:
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Michael Hahn, DOE
Roak Parker, DOE
Nicole Cooper Minnichbach, USACE
Lawrence M Slavitter, USACE

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 17, 2015

Brice Obermeyer, PhD
Tribal Historic Preservation Officer
The Delaware Tribe
1200 Commercial Street
Roosevelt Hall, Room 212
Emporia State University
Emporia, KS 66801

SUBJECT: DOE and USACE Request for Re-Initiation of Section 106 Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Dr. Obermeyer:

I am contacting you to re-open the consultation process with regards to an offshore wind project that is within your Tribal area of interest. Pursuant to Section 106 of the *National Historic Preservation Act* of 1966 (NHPA) as amended, the U.S. Department of Energy (DOE) is initiating the consultation process to determine any potential effects on Tribal properties of traditional religious and cultural significance.

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Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

Electronic cc:
Lori Gray, DOE
Michael Hahn, DOE
Roak Parker, DOE
Nicole Cooper Minnichbach, USACE
Lawrence M Slavitter, USACE

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 17, 2015

Robin Dushane
Cultural Preservation Director
The Eastern Shawnee Tribe of Oklahoma
12705 S. 705 Road
Wyandotte, Oklahoma 74370

SUBJECT: DOE and USACE Request for Re-Initiation of Section 106 Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Ms. Dushane:

I am contacting you to re-open the consultation process with regards to an offshore wind project that is within your Tribal area of interest. Pursuant to Section 106 of the *National Historic Preservation Act* of 1966 (NHPA) as amended, the U.S. Department of Energy (DOE) is initiating the consultation process to determine any potential effects on Tribal properties of traditional religious and cultural significance.

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Sincerely,

Timothy Meeks
Acting Director

Enclosures: as stated

Electronic cc:
Lori Gray, DOE
Michael Hahn, DOE
Roak Parker, DOE
Nicole Cooper Minnichbach, USACE
Lawrence M Slavitter, USACE

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 17, 2015

Sherry White
Tribal Historic Preservation Officer
Stockbridge-Munsee Community of Mohican Indians
W13447 Camp 14 Road
P.O. Box 70
Bowler, Wisconsin 54416

SUBJECT: DOE and USACE Request for Re-Initiation of Section 106 Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Ms. White:

I am contacting you to re-open the consultation process with regards to an offshore wind project that is within your Tribal area of interest. Pursuant to Section 106 of the *National Historic Preservation Act* of 1966 (NHPA) as amended, the U.S. Department of Energy (DOE) is initiating the consultation process to determine any potential effects on Tribal properties of traditional religious and cultural significance.

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Sincerely,

Timothy Meeks
Acting Director

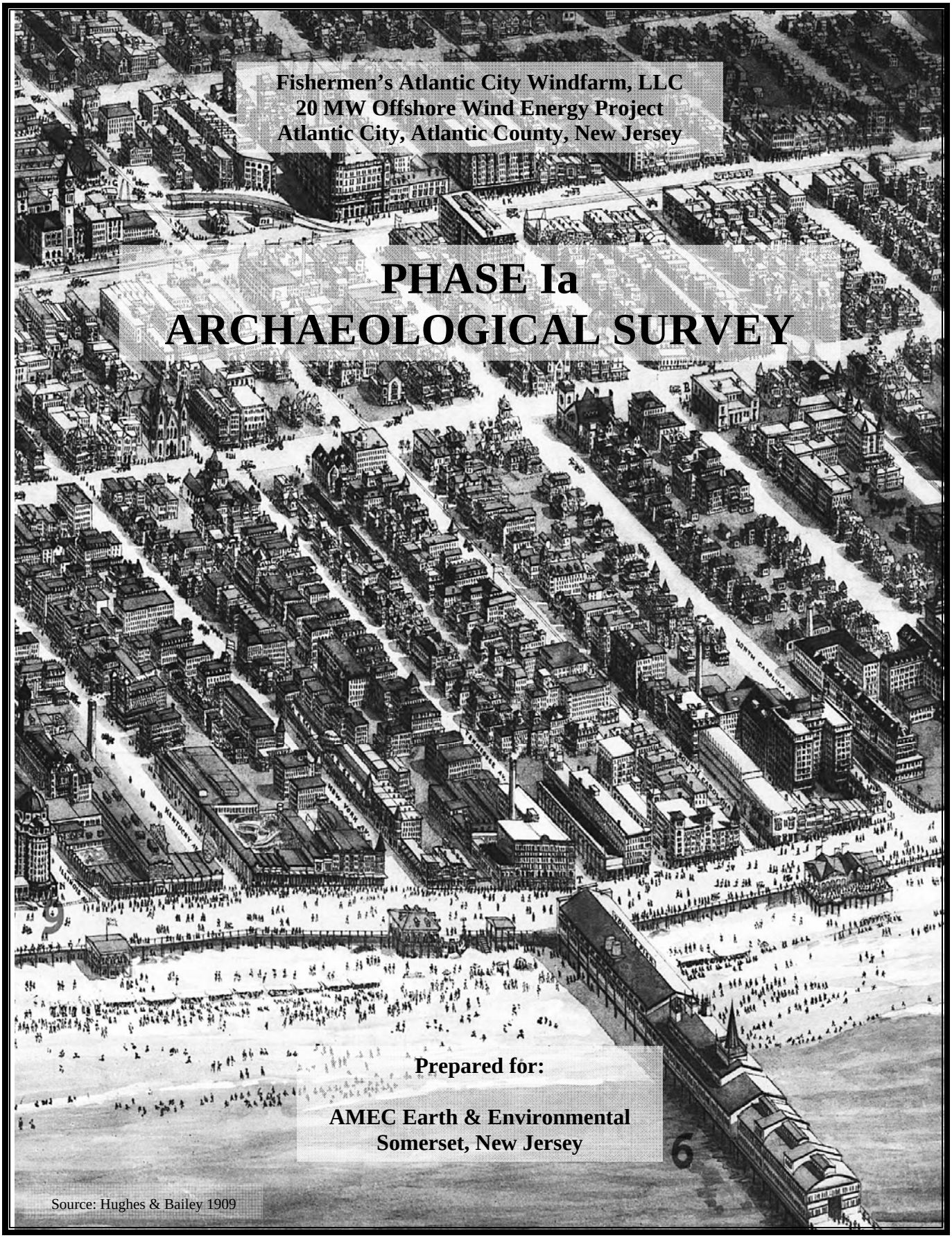
Enclosures: as stated

Electronic cc:
Lori Gray, DOE
Michael Hahn, DOE
Roak Parker, DOE
Nicole Cooper Minnichbach, USACE
Lawrence M Slavitter, USACE

Enclosure 2

Fishermen's Atlantic City Windfarm, LLC
20 MW Offshore Wind Energy Project
Atlantic City, Atlantic County, New Jersey

PHASE Ia
ARCHAEOLOGICAL SURVEY



Prepared for:

AMEC Earth & Environmental
Somerset, New Jersey

Source: Hughes & Bailey 1909

Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project
Atlantic City, Atlantic County, New Jersey

PHASE Ia ARCHAEOLOGICAL SURVEY

by

Kenneth J. Basalik, Ph.D.

and

Philip Ruth

Cultural Heritage Research Services, Inc.
Lansdale, Pennsylvania

Prepared for

AMEC Earth & Environmental
Somerset, New Jersey

July 2011

ABSTRACT

This report documents the results of a Phase Ia Archaeological Survey performed for AMEC Earth & Environmental as part of the Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project in Atlantic City, Atlantic County, New Jersey. The Area of Potential Effect (APE) for the project is located in the Coastal Plain Physiographic Province. The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

Research performed for the Phase Ia Archaeological Survey indicates that there is no prehistoric archaeological potential within the APE due to disturbances associated with utility and building construction. Historical research indicates that the APE is under existing roadways. No historic buildings or structures were formerly present within the APE. There is no historic archaeological potential. No additional archaeological research is recommended.

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INTRODUCTION

This report documents the results of a Phase Ia Archaeological Survey performed for AMEC Earth & Environmental as part of the Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project in Atlantic City, Atlantic County, New Jersey (Figure 1; USGS 1994, 1995). The Area of Potential Effect (APE) for the project is located in the Coastal Plain Physiographic Province. The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

This Phase Ia Archaeological Survey was conducted in accordance with federal and state laws that protect significant cultural resources, including historic and archaeological sites. Federal and state mandates for cultural resources protection include: the National Historic Preservation Act of 1966; the National Environmental Policy Act of 1969; Executive Order 11593; the Archaeological and Historic Preservation Act of 1974; and New Jersey State Act No. 7:22-10. All work was performed in compliance with 36 CFR §800; and the New Jersey Historic Preservation Office's (NJHPO) guidelines as outlined in "Guidelines for Phase I Archaeological Investigations: Identification of Archaeological Resources" (New Jersey Historic Preservation Office 1996).

The Phase Ia Archaeological Survey was undertaken in May and June of 2011. The work was performed by Cultural Heritage Research Services, Inc. (CHRS) of Lansdale, Pennsylvania. Kenneth J. Basalik, Ph.D. was the project's Principal Investigator. Historical research was conducted by Philip Ruth. Graphics for the report were prepared by Crystal Hall. Editorial work was undertaken by Kevin Quigg and Maria Rossi of the CHRS staff (Appendix A). The Phase Ia Archaeological Survey report was prepared under contract to AMEC Earth & Environmental of Somerset, New Jersey.

PROJECT DESCRIPTION

Fishermen's Atlantic City Windfarm, LLC (FISHERMEN'S) is proposing the development of a nominal 20 megawatt (MW) offshore wind renewable energy facility (the Project). The in-water portion of the Project would be located within State waters, with the turbines located approximately 2.8 miles off the coast of Atlantic City. The upland portion of the project consists of an underground transmission cable extending from where the submarine cable makes landfall to the existing Huron Substation. The path of this underground cable is roughly coincident with the line created by Tennessee Avenue.

The project proposes the construction and operation of six, 3.6 MW Siemens turbines, oriented in one row, for a total of approximately 20 MW (net). The total ocean area considered as the project area is approximately 170 acres (calculated as the perimeter around the group of six turbines [approximately 200 feet in each direction] plus a 5 foot width along the length of the cable route from the turbines to the shore); however, the actual portion of the area that will be physically



AREA OF POTENTIAL EFFECT

	SCALE	SOURCE
N	0ft 2000ft 0m 609.6m Prepared by CHRS, Inc.	USGS 1994 ATLANTIC CITY, NJ USGS 1995 OCEANVILLE, NJ

PROJECT LOCATION MAP | **FIGURE 1**

disturbed by the placement of the turbines and cables is approximately 2 acres. A review of the National Oceanic and Atmospheric Administration (NOAA) nautical charts indicates that the proposed cable and turbines for the in-water portion of the Project would be located in water depths of approximately 24 to 39 feet below mean lower low water (MLLW). Power output from the turbines will be transmitted via a 34.5 kilovolt (kV) submarine cable to access the shore. The submarine transmission cable will continue underground to the existing Huron Substation, along a route that is roughly coincident with Tennessee Avenue.

BACKGROUND RESEARCH

Introduction

Background research was conducted in order to identify and provide a context for evaluating cultural resources within and immediately adjacent to the Area of Potential Effect (APE). Institutions and repository records consulted include those associated with the New Jersey State Museum; the New Jersey Historic Preservation Office; the Free Library of Philadelphia; and the Coastal and Hydraulics Laboratory, Engineer Research and Development Center (Table 1). A variety of source materials were consulted, including regional and municipal histories, historical and archaeological resource files, as well as environmental, geological, archaeological, and other pertinent studies. Historic maps and aerial photographs were consulted in an attempt to identify and pinpoint the locations of historic structures within and immediately adjacent to the APE.

TABLE 1

INSTITUTIONS AND REPOSITORY RECORDS CONSULTED

Fisherman's Energy Project, Tennessee Avenue Underground Cable Routing
Atlantic City, New Jersey
Phase Ia Archaeological Survey

Institution/Repository	Records Consulted
New Jersey State Museum	Archaeological site survey files
New Jersey Historic Preservation Office	Archaeological site/Historic Resources Survey forms and maps
Free Library of Philadelphia	Historic maps
Coastal and Hydraulics Laboratory, Engineer Research and Development Center	Historic aerial photographs

The initial background research work was a file search at the New Jersey State Museum and the New Jersey Historic Preservation Office. The file search revealed that no archaeological sites have been recorded along South and North Tennessee Avenues in or adjacent to the project's APE. No historic districts are located within or adjacent to the APE. Only one historic property adjoining either South or North Tennessee Avenues has been determined eligible for listing in either the New Jersey Register of Historic Places or the National Register of Historic Places. Identified as the St. Nicholas of Tolentine Church, the property stands at 1409-1421 Pacific Avenue, on the northwest

corner of that avenue's intersection with South Tennessee Avenue. The property was listed in the New Jersey Register of Historic Places in 2000, and in the National Register the following year. No project-related surface-level or above-ground impacts are anticipated within 1,000 feet of this resource.

Environment

New Jersey has undergone substantial environmental changes in the last 40,000 years as several ice ages changed the climate and topography of the state. Sixteen-thousand years ago, the last ice sheet, called the Wisconsin Stage, began to form as the climate cooled in the Quaternary Period (Wolfe 1977). This ice sheet advanced no further than northern New Jersey. One of the most dramatic effects of the ice sheet was the lowering of ocean levels worldwide as sea water was frozen and trapped in glaciers and continental ice sheets. Along the Atlantic continental shelf sea levels 30,000 to 35,000 years ago were close to those at present (Milliman and Emery 1968). Sea levels dropped subsequently as much as 130 meters during the final Wisconsinan glacial advance around 16,000 years ago. Along the Atlantic coast, ocean beaches during this period lay at the edge of the modern continental shelf, perhaps 100 kilometers east of the modern New Jersey coastline. Belknap and Kraft (1977) question the maximum depth of sea level drop, but agree with the overall pattern. Disagreement exists over the extent of the cooling and the type of vegetation that survived. The area may have consisted of treeless vegetation similar to that found in the Arctic or Canada, or the vegetation may have been that of a more temperate environment.

Climatic patterns changed subsequent to the retreat of the ice sheets. Sea levels rose as a result of the release of water from melting ice sheets. As the sea level rose, it began to cover what is now the Atlantic continental shelf. The sea level rise began around 14,000 years ago and proceeded rapidly until around 7,000 years ago (Milliman and Emery 1968). As temperatures warmed, open grassy environments were replaced by boreal evergreen forests and then by deciduous forests (Robichaud and Buell 1973). As the continental shelf was covered by rising sea levels, the environment shifted from inland forest to tidal salt marshes (ca. 5,000 years ago) to lagoons or to coastal sand barriers (ca. 3,000 years ago) (Dolan Research Inc. and Hunter Research Inc. 1997). Climatic conditions were warm and somewhat moister than in the preceding Boreal phase with oak and hemlock as dominant vegetation species and with pine persisting in coastal areas (Dent 1979).

The late Pleistocene-early Holocene witnessed the extinction of large mammals such as the mastodon (Robichaud and Buell 1973; Wolfe 1977). This might be related to activities of Native Americans (Wolfe 1977), who destroyed local environments as well as modifying their composition. Recent ethnohistoric studies demonstrated that Native American deforestation had a considerable impact on settlement and subsistence systems prior to European entry into North America (Heidenreich 1971). The Lenape Indians, for example, cleared land for the construction of villages and crops, and modified the composition of the forest by setting fires to drive game and make travel easier by creating paths (Robichaud and Buell 1973). Gathering wood for fuel, tools, and building materials depleted forest resources and often necessitated the relocation of entire communities to areas of more abundant assets. Large populations of transplanted Europeans intensified the deforestation process through their search for fuel, lumber, and for agricultural purposes. Similarly, faunal resources (elk, deer, bear, wolf, fox, rabbit, hare, beaver, turkey, partridge, pigeon, and other fowl) were exploited by the Amerind populations, but their habitats

were largely destroyed by European settlement, causing severe population depletion. Europeans specifically changed the environment of the uplands in the Inner Coastal Plain by clearing land, again destroying parts of the forest and modifying its composition (Robichaud and Buell 1973).

Prehistory

Evidence from prehistoric sites in the eastern United States indicates a number of successive regional cultural traditions. Although the exact number and nature of these traditions, which varied locally, remains the subject of debate, three major cultural periods can be defined: Paleo-Indian, Archaic, and Woodland. These traditions are best viewed as responses to changing social and environmental conditions.

The Paleo-Indian Tradition, 11,500–8,000 years ago: The earliest, widely recognized tradition in the northeastern United States is the Paleo-Indian. This tradition is believed to have been characterized by small hunter-gatherer groups subsisting mainly on large mammals, many of which are now extinct or no longer present in the area (woolly mammoth, mastodon, and caribou). The artifact distinctive to this tradition is the fluted projectile point, which is lanceolate-shaped with a central flake removed from both faces along its longitudinal axis. This and related tools have been found in association with various floral and faunal resources in sites across the eastern United States (Funk 1969; Gardner 1974; Adovasio 1977; Dent and Kauffman 1978). This evidence suggests that the Paleo-Indian population exploited a wide variety of terrestrial, subsistence resources. The Paleo-Indian Period is marked by specific cultural ecological adaptations to the Pleistocene and Early Holocene environments. Custer (1984, 1985) has outlined the expected site types for the Paleo-Indian Period, which include the following: quarry, quarry reduction, base camps, base camp maintenance stations, and hunting sites. The larger sites or base camps are quarry-related (i.e., lithic resource focus) and located near major waterways (Gardner 1976; Custer 1984).

The number of Paleo-Indian sites found in undisturbed contexts is very low throughout New Jersey. Approximately 200 fluted points have been found, primarily as surface finds throughout the state (Marshall 1982). The largest concentration of these artifacts has been recovered in the vicinity of the Delaware River drainage (Marshall 1982). Three Paleo-Indian sites are located in the far-extended vicinity of the study area: the Plenge Site (Kraft 1973), Turkey Swamp (Cavallo 1981), and Port Mobil (Kraft 1977). The majority of Paleo-Indian and Archaic sites found to date onshore in New Jersey have been situated in upland locations of major river terraces, often at confluences, overlooking wide expanses of land. This distribution of sites suggests a preference for high, well-drained ground, near streams or wetlands, offering vantage points for observing game. Paleo-Indian sites have been documented in rockshelters, near lithic source areas, and on boulder and cobble-edged coastal plain meltwater drainages, which provided raw materials for chipped stone tool industries. It is probable that many Paleo-Indian sites were situated on the now inundated continental shelf, and that the margins of its formerly exposed river mouths, bays, estuaries, and salt marshes all provided settings that would have been attractive to humans for settlement and/or exploitation. Edwards and Emery (1977) provide a reconstruction of the land area of the Middle Atlantic coast around 10,000 to 12,000 years ago. The current site of the South Jersey coastline was covered by inland forest, probably with surface water locations. Any evidence of Paleo-Indian occupation in the vicinity of the current shoreline would not relate directly to coastal environments but to exploitation of inland forest/riverine habitats (Dolan Research, Inc. and Hunter Research Inc.

1997). Documented submerged archaeological sites along the New Jersey coast are few. Lanceolate points have been recovered from dredge spoils out on the continental shelf (Edwards and Emery 1977). Sixteen sites are listed by Grossman-Bailey (2001).

The Archaic Tradition, 8,000–3,000 years ago: The Archaic Tradition emerged from the Paleo-Indian with a more generalized subsistence strategy in response to changing environmental and, perhaps, social conditions. Approximately 10,000 years ago, as glacial conditions slowly gave way to the warmer Holocene climate, hardwood forests gradually replaced the tundra-like vegetation (Sirkin 1977:214). The socio-cultural response to the climatic amelioration and resultant environmental diversification was one of resource exploitative expansion in terms of biotic and lithic consumption. The Early Archaic settlement pattern for the Coastal Plain has been theorized to contain a wide variety of sites including base camps. These notions are predicated upon models of resource optimization.

The period of time that signals the cultural adaptation to the fully emergent Holocene milieu is the Middle Archaic division. Settlement patterns on the Coastal Plain are anticipated to contain a more diverse array of site types based upon the high productivity rating for this environment. The foci for base camps in this province are projected to be the extensive swamp lands (Custer and Wallace 1982:34) and the relict periglacial features (Bonfiglio and Cresson 1978, 1982). Changes in habitat are reflected in cultural artifacts by the presence of new tool types (Bryan 1977:363).

Evidence suggests that Archaic people lived in small nomadic groups (Cushman 1981:9). The resources exploited varied on the basis of local availability. This factor, coupled with the types and quantities of the lithic materials employed in toolmaking, results in different artifact assemblages at different sites. It is therefore difficult to characterize a typical regional Archaic tool assemblage. Archaic assemblages are, however, clearly distinguished from those of the preceding Paleo-Indian Tradition by the replacement of fluted points with smaller points of cruder materials and the emergence of grinding and ground stone tool (axes, chisels, and gouges) technologies. In general, tool assemblages from this tradition are marked by increasing diversification and specialization through time.

The increased number of sites which date to the Archaic is evidence that population density was greater during the Archaic than it was during the Paleo-Indian Tradition. This increase in population density was possible because, as climatic fluctuations stabilized and hardwood forests became established, the carrying capacity of the environment increased. In addition, the warming trend caused a rise in the sea level, which allowed for the formation of extensive marshes and estuaries along the Delaware River. As resources became more abundant in and around major waterways and marshes, settlement was increasingly focused along them (Kraft 1977; Gardner 1980). Despite this trend, there is evidence of continued seasonal nomadism based on a resource-scheduling strategy (Cushman 1981:12).

During the Late Transitional Archaic, trade—particularly in non-local lithic material—expanded, and new artifact forms, such as steatite (soapstone) vessels, were used. The large number of sites and the more diverse cultural assemblages found in the region from this cultural period point towards this increased trade and artifact creation. A larger population with more diverse procurement activities is likely to have increased the importance of upland areas in the region

during this period. Custer (1985), feeling a continuity in resource exploitation, combines the traditional Late Archaic, Early Woodland, and Middle Woodland Periods together under the term "Woodland I." This division is marked by the following items: "focus on the highest productivity settings, an intensified use of certain resources, appearance of large semi-sedentary macro-band base camps, development of storage and processing facilities, extensive use of a wide range of environments, development and maintenance of trade and exchange networks, and the appearance of incipient ranked societies" (Custer 1985:36-37).

Also notable towards the end of the Archaic is the appearance of several prominent cultural traditions, including the Small Stemmed Point Tradition (probably an in situ development) and the Susquehanna Tradition (which originated in the southeast) (Kraft and Mounier 1982a:81-82). The Small Stemmed Point Tradition occurs in the mid-Atlantic coast, with some penetration into upland areas and along major rivers, and is characterized in part by small stemmed projectile points, ground stone woodworking tools, and paintstones, often of hematite or graphite (Kraft and Mounier 1982a:81). The Susquehanna Tradition in New Jersey is exemplified by the Koens-Crispin Complex, which is characterized in part by stone vessels, woodworking tools, implements fashioned from broken points, and a complex mortuary technology (Kraft and Mounier 1982a:82).

Settlement location patterns during the Archaic Period for the Coastal Plain are depicted as a diverse array of site types occupying a multitude of suitable micro-environs. These attractive settings or micro-environs would include the well-drained soils and land juxtaposed to the flood plains, swamps, and/or marshes (Custer and Wallace 1982; Custer 1985). Early Archaic sites have been identified in numerous locations on New Jersey's Coastal Plain, although it is commonly believed that many Early Archaic sites may be buried under river sand or slope wash, or at former coastal locations that have been submerged by rising sea levels (Grossman-Bailey 2001). As a result, the present understanding of the social and technological adaptations of Early Archaic indigenous peoples is limited. Recorded sites in the coastal plain of New Jersey are located primarily along rivers, near confluences of smaller waterways and headwaters. For the coastal plain of New Jersey, Grossman-Bailey (2001) lists 166 sites believed to represent the Late Archaic Period. The majority of these sites are located in the interior.

The Woodland Tradition, 3,000 to 500 years ago: The beginning of the Woodland Tradition in this region is marked by the introduction of ceramics (Gardner 1980:3) and by two major trends: increasing sedentism and the development of extensive agriculture (Curry and Custer 1982:4; Cushman 1981:14). During the Woodland Tradition permanent or semi-permanent settlements replaced the seasonal base camp. Settlement patterns derived from sites which date to this period are focused on major waterways (Curry and Custer 1982:1), where the exploitable biomass was the greatest. The harvesting of various plants, waterfowl, fish and shellfish would have provided a more than adequate supply of food. These waterways supplied relatively easy transportation, facilitating trade and increasing the range and quantity of resources that could be exploited. The Late Woodland Period (Custer's "Woodland II") is generally characterized by the introduction of maize and squash cultigens and the appearance of sedentary villages. These developments were neither unilateral nor temporally concomitant throughout the Mid-Atlantic region.

The Late Woodland Period reflects a continuation of similar land use patterns and settlement location of the earlier Late Archaic/Early Woodland through Middle Woodland Periods. The major

difference appears as an "increasing use of floodplain settings for relatively large semi-sedentary communities and the habitation-utilization of certain levees along major drainages" (Custer and Wallace 1982:159). As one might expect, it appears that the primary determinant of prehistoric settlement pattern distributions, excluding mortuary or ceremonial sites, is the location of water resources (Stewart 1981; Custer and Wallace 1982; Gardner 1987). The Abbott Farm Site complex located near Trenton, New Jersey, was the locus of a substantial Woodland Period occupation which was investigated over the years by numerous researchers, notably Cross (1956), Cavallo (1987) and Stewart (1986, 1987, 1998).

Sites with Early Woodland components are relatively scarce in comparison to the number of Transitional, Late, and Middle Archaic sites. Most of the known Early Woodland Period sites in the region occur in coastal or estuarine zones, and are less frequently found along major rivers and lakes. This suggests that coastal resources became an increasingly significant part of the subsistence collecting activities and diets of the region's indigenous peoples. The Late Woodland sites represent more sedentary lifestyles with year-round base camps located on the fertile flood plains of major rivers, while smaller, temporary seasonal camp sites are numerous along tributaries and natural springs.

The Contact Period, AD 1500–1700: The Late Woodland Period ended with European contact, which appears in the archaeological record as an intrusion of European artifacts into Late Woodland assemblages. At the time of Native American/European contact, relations between the two groups took various forms, usually beginning as trade interactions and religious proselytization. Relations then often proceeded to armed conflict, ultimately leading to the displacement of Native populations. At the time of European contact, New Jersey was occupied by the Unami branch of the Lenape (Kraft 1986).

Previous Regional Archaeological Research: A Brief Summary

No archaeological sites have been recorded along or adjacent to the project's Area of Potential Effect (APE), although sites have been found in the general region. The first statewide survey to inventory prehistoric resources was sponsored by the New Jersey legislature and was undertaken by Skinner and Schrabisch (1913). The survey recorded about 1,000 sites including several sites in Pleasantville. During the Depression years of the 1930s, a more intensive survey of New Jersey was conducted under the auspices of the Works Project Administration (WPA) (Cross 1941). During the 1950s, Kier, an avocational archaeologist, conducted a number of surveys in the Outer Coastal Plain along parts of the Necochaque Creek, Mullica Creek, and Batsto River. He was successful in locating 19 prehistoric sites (Cavallo and Mounier 1980:37). During the late 1960s and early 1970s, Regensburg conducted investigations within the Pinelands. His work resulted in the discovery of several prehistoric site locations including Savich Farm, an Early Archaic to Late Woodland site which contains a substantial Late Archaic component and an associated cemetery (Regensburg 1971).

Mounier (1972, 1974, 1975) conducted a series of excavations and surveys in the Maurice and Great Egg Harbor Rivers, and Rancocas Creek drainages which allowed him to define a number of archaeological complexes and begin examining the nature of regional prehistoric settlement patterns (Mounier 1978; Kraft and Mounier 1982a, 1982b). Mounier (1978:62) found that "the distribution

of aboriginal sites in the Rancocas Valley section of Burlington County shows a pattern of closely spaced units forming nearly continuous bands of occupation along the main branches and tributaries." He also observed that "site placement, size, and function appear not to correlate directly with stream order within the Inner Coastal Plain possibly as a function of general environmental resource distribution" (Mounier 1978:65).

Cavallo and Mounier completed a survey of prehistoric aboriginal sites in the New Jersey Pinelands in 1980. Their research utilized data collected from archival sources, publications and interviews from professional and avocational archaeologists, as well as artifact collectors. This endeavor resulted in the listing of 1,046 sites which were then analyzed for co-relating variables of environmental attributes (Cavallo and Mounier 1980).

Temple University, under the direction of Ranere and Hansell, initiated research into the prehistoric occupation of the Outer Coastal Plain of New Jersey in 1980. Their investigations during the summer field seasons of 1980-81 focused on the large, multi-component campsite of Gravelly Run along the Great Egg Harbor River. During the following years of 1982, 1984, 1986 and 1987, Temple University was engaged in a systematic survey of the Lower Great Egg Harbor River watershed (Ranere and Hansell 1984a, 1984b, 1985, 1989). This survey observed that the pattern distribution for the sites in the study sample crosscuts the entire range of temporal periods from the Middle Archaic through the Late Woodland. This phenomenon strongly suggests a case for the ubiquitous presence of ephemerally-based procurement camps through time which were engaged in similar extractive activities, perhaps in response to a similar set of environmental parameters in the Outer Coastal Plain of New Jersey. Few sites other than procurement camps are known in the region.

Investigations by Bonfiglio and Cresson (1978, 1982) in both the Inner and Outer Coastal Plains of New Jersey resulted in a remarkable contribution to regional settlement pattern studies. They found an association between relict periglacial features (i.e., pingos and thermokarst basins) and sites of suspected Paleo-Indian and Early/Middle Archaic Periods. Continual archaeological surveys over the years leading to the present time period have added a substantial amount of data to confirm this landform/cultural association (Jack Cresson, pers. com., June 29, 1998). In fact, some of the sites identified by Cresson have a suspected periglacial component (Jack Cresson, pers. com., June 29, 1998).

Study Area History

The Area of Potential Effect (APE) is located within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues in Atlantic City, New Jersey (Figure 1; USGS 1994, 1995). A historical sketch of Atlantic City, posted on the Atlantic-City-Online.com website (Kozek 2010:n.p.), reads as follows:

> Atlantic City has a long and varied history. Though much has been written about the post 1977 casino years, and the heyday years of the 30's and 40's when the Atlantic City Boardwalk was the in place to be seen, there is a wealth of rich history which dates back over two hundred years before the first dice were thrown or the first jitney hit the

pavement. Let's take a look back into history and discover all the people who helped make Atlantic City, not only what it is today, but what it will be in the future.

The original inhabitants of Absecon Island, on which Atlantic City rests, were the Lenni-Lenape Indians. The Lenni-Lenapes would travel over the Old Indian Trail from the Mainland to the island to spend the summer months. The trail, which was located approximately where Florida Ave. is today, was five miles long over the marshland. The Indians would partake of the abundance the ocean and bay had to offer, along with the varieties of wildlife and flora of the island.

The first recorded owner of Absecon Island was Thomas Budd, an Englishman, who arrived in Atlantic County in [the] late 1670's. Budd was given the island and other acreage as settlement of a claim he had against the holders of the royal grant. His mainland property was then valued at $0.40 an acre, while the beach land [was valued at] a mere $0.04 an acre. That same piece of beach front property today would be worth millions of dollars per acre.

For the next hundred years, the island would be visited by not only the Indians, but also hunters and some of the early mainland settlers. Among these brave soles [*sic*] was Jeremiah Leeds. Leeds, born in Leeds Point in 1754, was the first white man to build a permanent structure on the island in 1785 at what is now Arctic and Arkansas Ave. His grandfather had built a cedar log cabin on Baltic Ave. at the site of the recently demolished bus terminal as early as 1783. Jeremiah and his family were the first official residents of Atlantic City. Their home and farm was called Leeds Plantation, and Leeds grew corn and rye and raised cattle. A year after Leeds [*sic*] death in 1838, his second wife Millicent got a license to operate a tavern called Aunt Millie's Boarding House, located at Baltic and Massachusetts Ave. Thus, the first business in Atlantic City was born.

Several of Jeremiah and Millicent's children were important in their own right. Robert B. Leeds, born in Atlantic City on May 2, 1828, was the city's first postmaster. Another son Chalkey S. Leeds, born in Atlantic City in 1824, became the city's first mayor in 1854.

By the year 1850, there were seven permanent dwellings on the island, all but one [of] which were owned by descendants of Jeremiah Leeds. Dr. Jonathan Pitney, a prominent physician who lived in Absecon, felt that the island had much to offer, and even had ideas of making the island a health resort, but access to the island had to be improved. Pitney, along with a civil engineer from Philadelphia, Richard Osborne, had the idea to bring the railroad to the island. In 1852, construction began on the Camden-Atlantic City Railroad. On July 5, 1854, the first train arrived from Camden after a grueling 2½-hour trip, and the invasion of the tourists had begun.

Osborne has been given credit with naming the city, while his friend Dr. Pitney thought up the plan for the names and placements of the city streets which remains today. Streets running parallel to the ocean would be named after the world's great

bodies of water, Pacific, Atlantic, Baltic, Mediterranean, Adriatic, and Arctic, while the streets which ran east to west would be named after the States.

Visitors to Atlantic City didn't only arrive by train. Atlantic City was becoming a bustling seaport. But along with the increasing number of sailing vessels, came an increasing number of tragic wrecks off the coast. One of the most tragic was the sinking of the Powhattan, a vessel carrying 311 German immigrants, which sank on April 16, 1854. For days, bodies washed up on the shoreline. Because it was impossible to identify the dead, 54 bodies were buried in a mass grave in the cemetery at the Smithville Methodist Church, and 45 bodies were buried in Absecon. At the urging of Dr. Pitney, a lighthouse was erected in 1854, and turned on one year later. The lighthouse, in the Inlet section of the city, was originally at the edge of the ocean, but it now stands over ½-mile from the beach.

The first official road from the mainland to the island was completed in 1870, after 17 years of construction. The road, which ran from Pleasantville, had a $.30 toll. The first free road was Albany Ave., constructed over the meadows from Pleasantville.

By 1878, one railroad couldn't handle all the passengers wanting to go to the Shore, so the Narrow Gauge Line to Philadelphia was constructed. At this point massive hotels like the United States and the Surf House, as well as smaller rooming houses, had sprung up all over town. The first commercial hotel the Belloe House, located at Massachusetts and Atlantic Ave., was built in 1853, and operated till 1902. The United States Hotel took up a full city block between Atlantic, Pacific, Delaware, and Maryland (the current site of the Showboat Parking lot). These grand hotels were not only impressive in size, but featured the most updated amenities, and were considered quite luxurious for the time.

There were beautiful hotels, elegant restaurants, and convenient transportation, but the businessmen of Atlantic City had one big problem to contend with: sand. It was everywhere, from the train cars to the hotel lobbies. In 1870, Alexander Boardman, a conductor on the Atlantic City-Camden Railroad, was asked to think up a way to keep the sand out of the hotels and rail cars. Boardman, along with a hotel owner Jacob Keim, presented an idea to City Council. In 1870, and costing half the towns [*sic*] tax revenue that year, an eight foot wide wooden foot walk was built from the beach into town. This first Boardwalk, which was taken up during the winter, was replaced with another larger structure in 1880. On Sunday September 9, 1889, a devastating hurricane hit the island, destroying the boardwalk. Most of the city was under 6 feet of water, and the ocean met the bay at Georgia Ave. The Boardwalk of today is 60 feet wide, and 6 miles long. Its planks, placed in a herringbone pattern, are laid on a substructure of concrete and steel. Steel railings are in place to keep visitors from falling off to the beach below, and in accordance with an old City Council ordinance, hotels, restaurants and shops are kept on one side of the boards, with amusement piers on the other.

On June 16, 1880, Atlantic City was formally opened. With fanfare the likes [of which] few in the area had seen, a resort was born. By the census of 1900, there were

over 27,000 residents in Atlantic City, up from a mere 250 just 45 years before. The first public school was opened in 1858 at Maryland and Arctic Ave. Before this, mainlanders were sent over to teach the island's children. By 1883, the city had built its first school on Texas Ave., at a cost of $25,000.

The next twenty-five years saw many firsts in the city. The First National Bank of Atlantic City was opened on May 23, 1881, and a little over a year later in July 1882, the first use of electricity, a street light in front of Keuhnles Hall at Atlantic and South Carolina Ave., shown bright. The Atlantic City Beach Patrol opened in August 1881, posting strict 9am to 5pm bathing hours. By the next season, there were 20 guards on duty. The Atlantic City Hospital opened Nov. 30, 1898, while the public library opened Jan. 31, 1900. Trolley service began in the city in 1893, extending out to Ventnor in 1900. The trolleys ran till 1955. Atlantic City's famous jitney service started up in 1915, with a ride around town costing just 5 cents.

The late 1800's were a growth time for the city. Nearly 2/3^{rds} of the city's 6,500 dwellings in 1899 were cottages. These cottages were elaborate 2-3 story private homes, many the summer homes of prominent doctors and businessmen from Philadelphia. Beautifully coifed lawns and magnificently decorated interiors made these homes a symbol of the glory days of the city. At the same time, along the Boardwalk, amusement piers began popping up. With names like Million Dollar, Steel, [and] Iron, the piers of Atlantic City were a major draw. Everyone could find some sort of entertainment to meet their tastes from the Diving Horse, Dr. Couney's Premature Infant Exhibit, marathon dance contests to side show acts. Despite the variety of draws to the city, one issue remained: how to extend the tourist season past summer. That question was answered by a 16-year-old girl from Washington in 1921 who was the first Miss America. The pageant, which was held intermittently from 1930-1935, became synonymous with Atlantic City when it began being held at the Convention Hall in 1940.

Atlantic City became *the* place to go. Entertainers from vaudeville to Hollywood graced the stages of the piers. Glamorous hotels like Haddon Hall, the Traymore, the Shelburne and the Marlborough-Blenheim drew guests from all over the world. Atlantic City's future seemed bright, until World War II. After the war, the public seemed to stop its love affair with The World's Favorite Playground. Possibly because of the public's access to national air travel, the shift of the population westward, the general deterioration of the city, or a shift in the public's taste for more sophisticated entertainment, Atlantic City lost much of its shine; and most of its tourists.

With the passage of the Casino Gambling Referendum in 1976, Atlantic City began an upward battle, not unlike one it had started two hundred years before, to use the glorious resources it has been given by nature, to make it once again a world renown tourist Mecca (Kozek 2010:n.p.)

The Area of Potential Effect (APE) comprises a 20-foot-wide corridor beneath the western (southbound) lane of South and North Tennessee Avenues, except for three locations where the

buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection. The three proposed vault locations are discussed below as Area 1 (southern vault location), Area 2 (central vault location), and Area 3 (northern vault location).

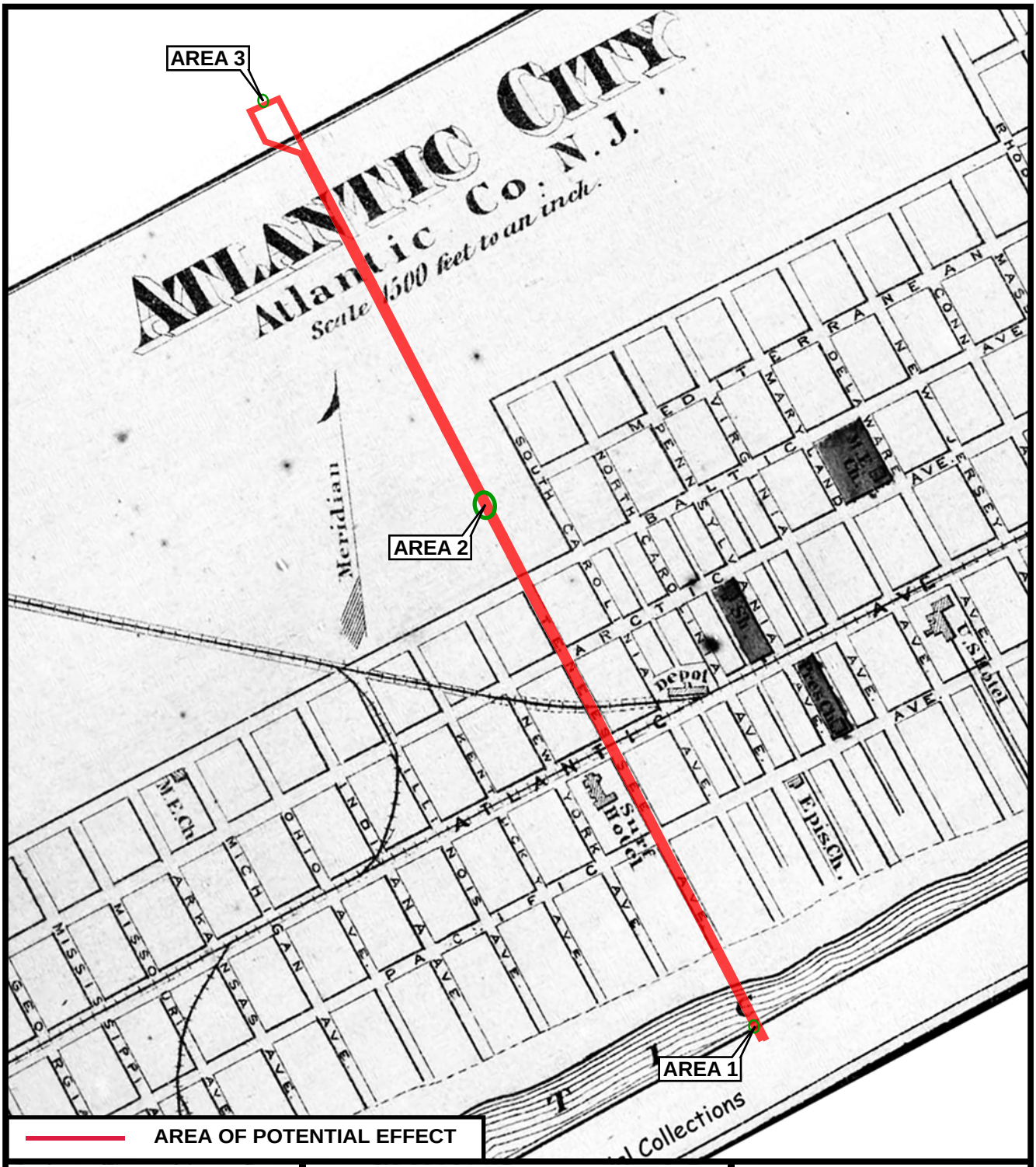
In an effort to identify historical conditions within Areas 1, 2, and 3 of the APE, CHRS, Inc. researchers examined historic maps of Atlantic City and Atlantic County published in 1872 (Beers 1872a [Figure 2]; Beers 1872b), 1878 (Woolman, Rose and Price 1878 [Figure 3]; Rose, Ruff and Woolman 1878), 1886 (Sanborn Map & Publishing Company 1886), 1888 (Geological Survey of New Jersey 1888 [Figure 4]), 1896 (Sanborn-Perris Map Company Limited 1896), 1900 (Mueller 1900 [Figure 5]), 1907 (Sanborn Map Company 1907), 1921 (Sanborn Map Company 1921), 1949 (Sanborn Map Company 1949), 1979 (Sanborn Map Company 1979), 1989 (USGS 1989), and 1990 (Sanborn Map Company 1990), as well as aerial photographs taken in 1920 (Anonymous 1920 [Figure 6]), 1933 (Anonymous 1933 [Figure 7]), 1944 (United States Army 1944 [Figure 8]), 1995 (Google Earth 1995), and 2002 (Google Earth 2002a, 2002b). The results of this historical research for each of the proposed vault locations are discussed below.

Area 1 (Southern Vault Location)

The proposed location of the southern vault (Area 1) is under the pavement of South Tennessee Avenue. The east side of South Tennessee Avenue in the vicinity of Area 1 is currently occupied by the Boardwalk National Arcade Building (a.k.a. the Boardwalk National Bank Building), a 100- by 380-foot multi-use structure built in 1925 (Wilson 1953:xiv; Appendix B, Photographs 1 and 2). The west side of South Tennessee Avenue in this vicinity is occupied by a parking lot, laid over a site formerly occupied by a succession of historic structures (Appendix B, Photograph 3), as will be described in greater detail below.

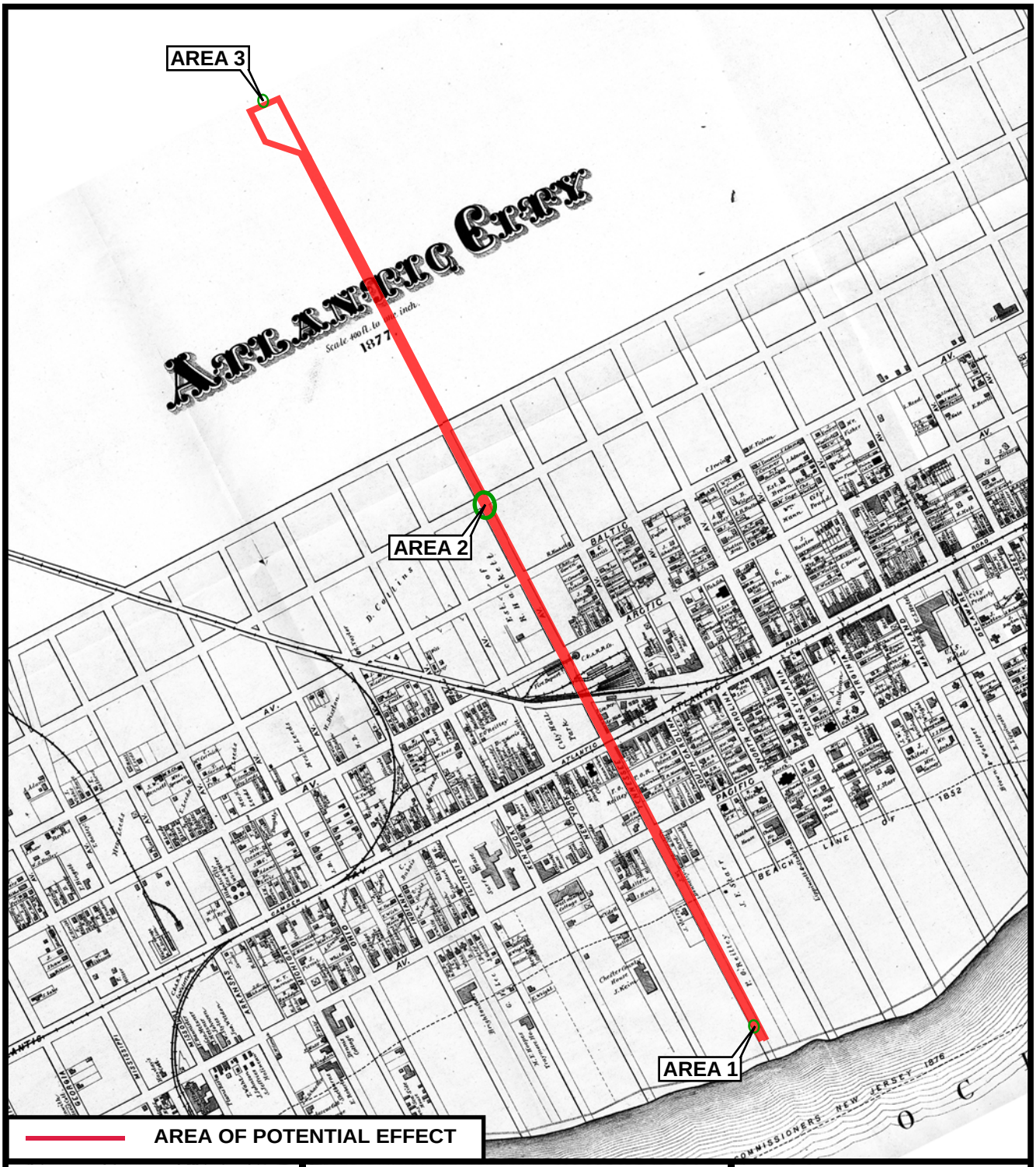
On maps of Atlantic City and Atlantic County published in 1872, Area 1 was located between 80 and 200 meters southeast of the denoted waterline, within the Atlantic Ocean (Beers 1872a [Figure 2]; Beers 1872b). Between 1872 and 1878, fill comprising mainly quartz sand and gravel was imported into this area, creating fill land extending southeastward to a new waterline approximately 150 meters southeast of Area 1 (Woolman, Rose and Price 1878 [Figure 3]; Rose, Ruff, and Woolman 1878). By 1878, Tennessee Avenue had been extended southeastward across this fill land and through Area 1 to the new shoreline. No above-ground structures were denoted on the 1878 Atlantic City maps within 200 meters of Area 1.

South Tennessee Avenue and the Boardwalk were depicted on their current alignments in the vicinity of Area 1 on an insurance map published in 1886 (Sanborn Map & Publishing Company 1886). As noted above, the larger, second Boardwalk had been installed in 1880 (Kozek 2010:n.p.). By 1886, the west side of South Tennessee Avenue was occupied in this vicinity by a one-story structure identified as “Central Baths.” The east side of South Tennessee Avenue was occupied by a one-story office building at the southern end of a long block of one-story “Bath Houses.” No utilities were denoted along South Tennessee Avenue on the 1886 map (Sanborn Map & Publishing Company 1886).



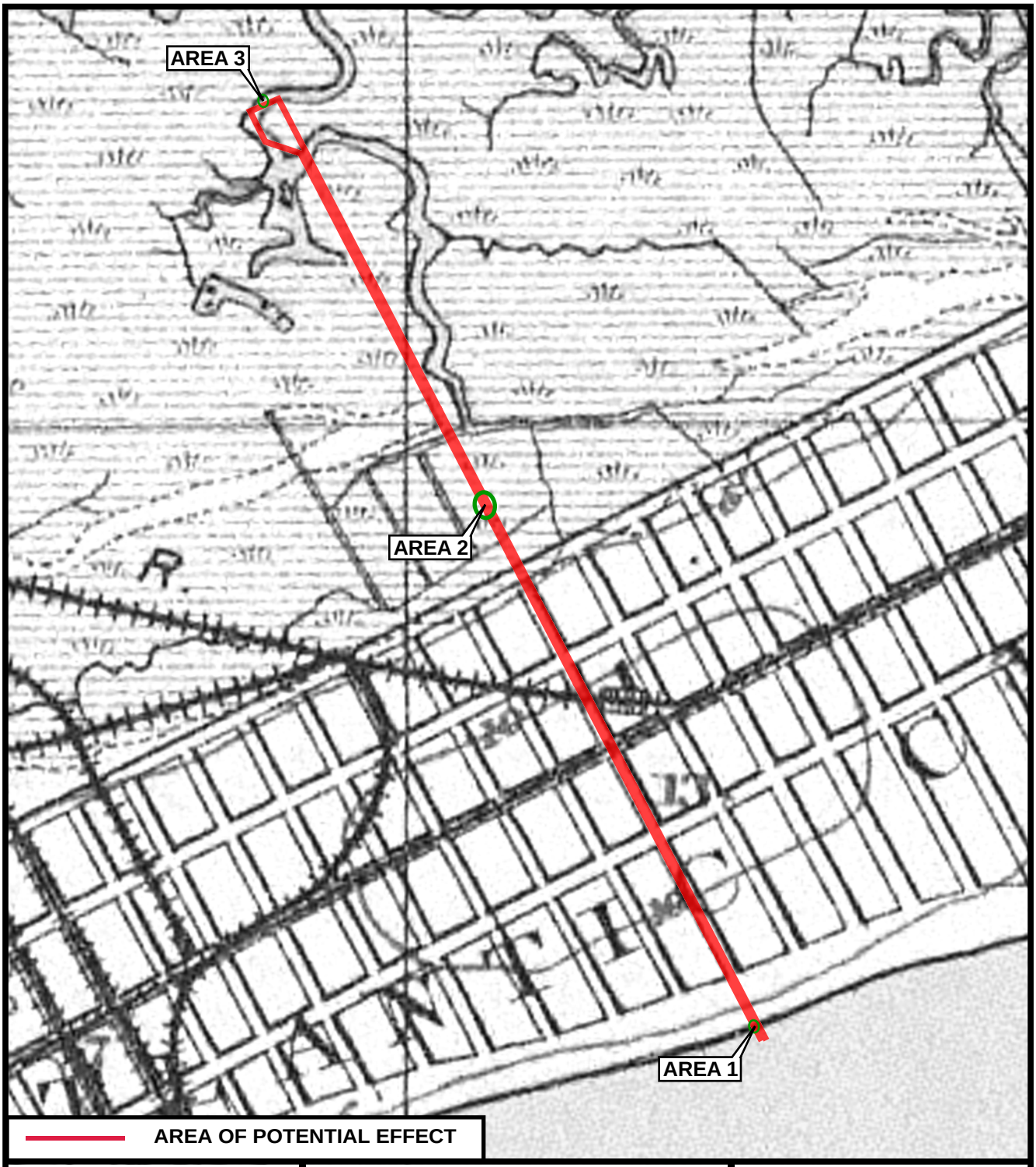
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	BEERS 1872a

PROJECT AREA CIRCA 1872 | **FIGURE 2**



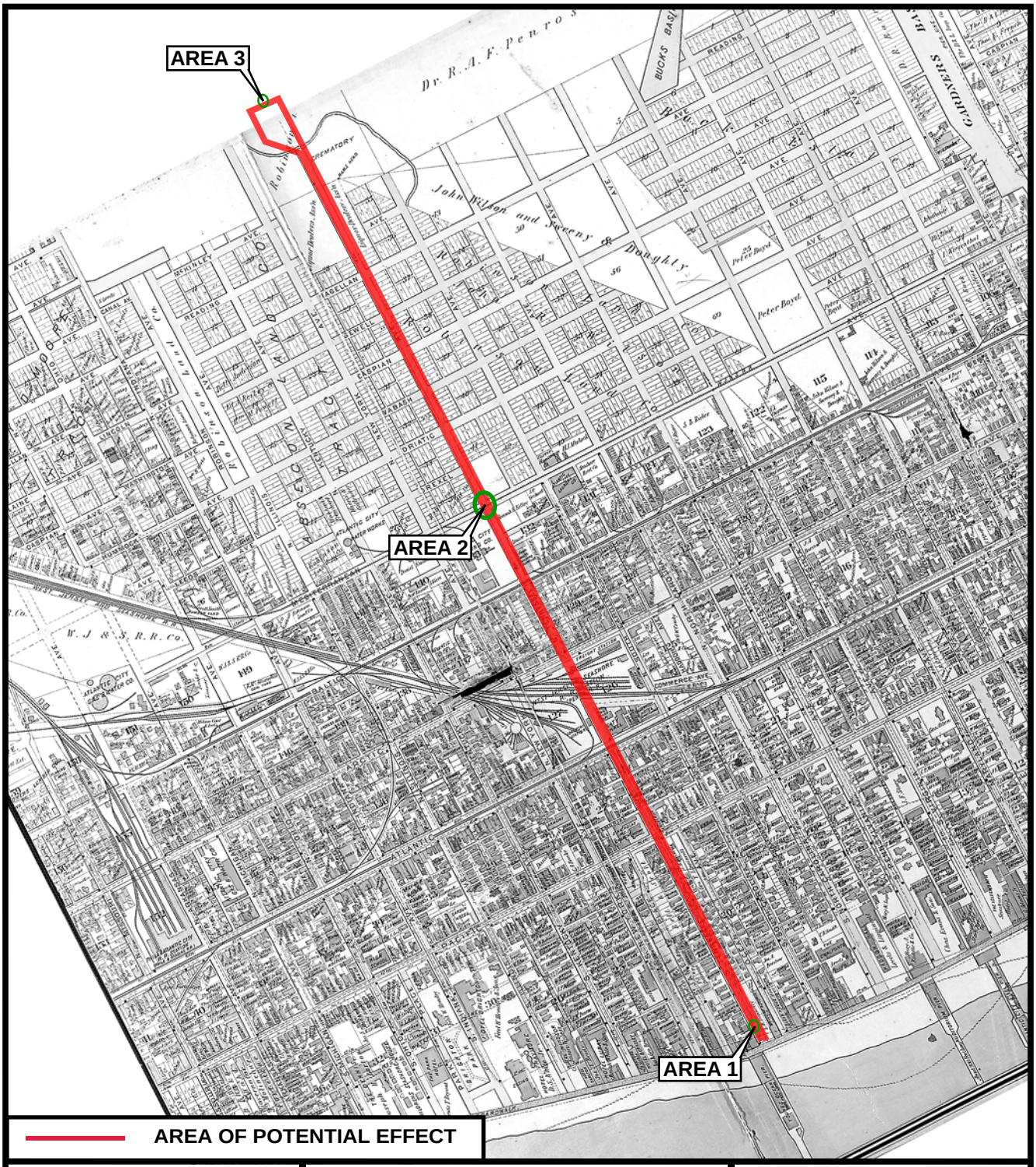
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	WOOLMAN, ROSE AND PRICE 1878

PROJECT AREA CIRCA 1878 | **FIGURE 3**



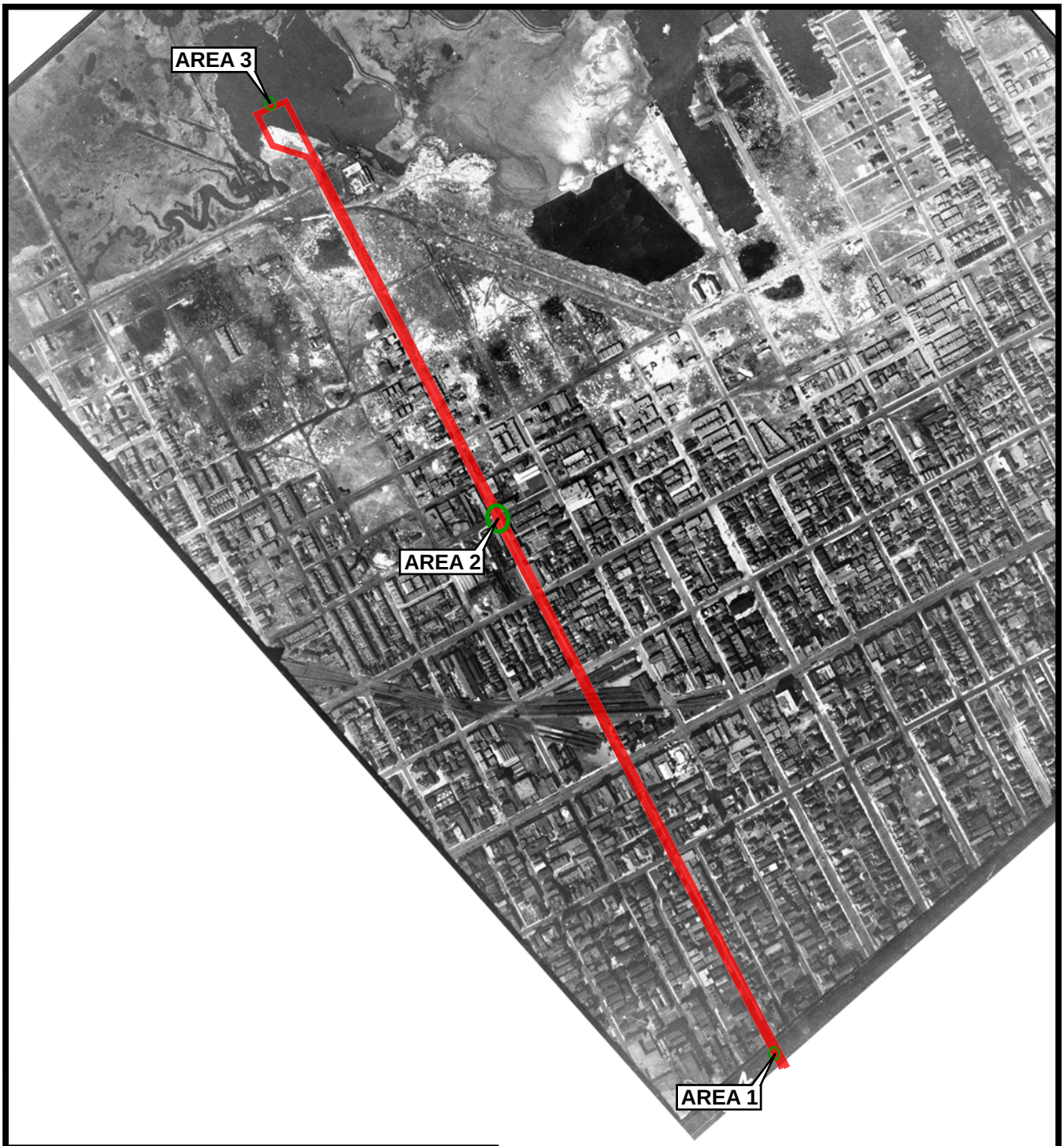
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	GEOLOGICAL SURVEY OF NEW JERSEY 1888

PROJECT AREA CIRCA 1888 | **FIGURE 4**



	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	MUELLER 1900

PROJECT AREA CIRCA 1900 | **FIGURE 5**



AREA OF POTENTIAL EFFECT

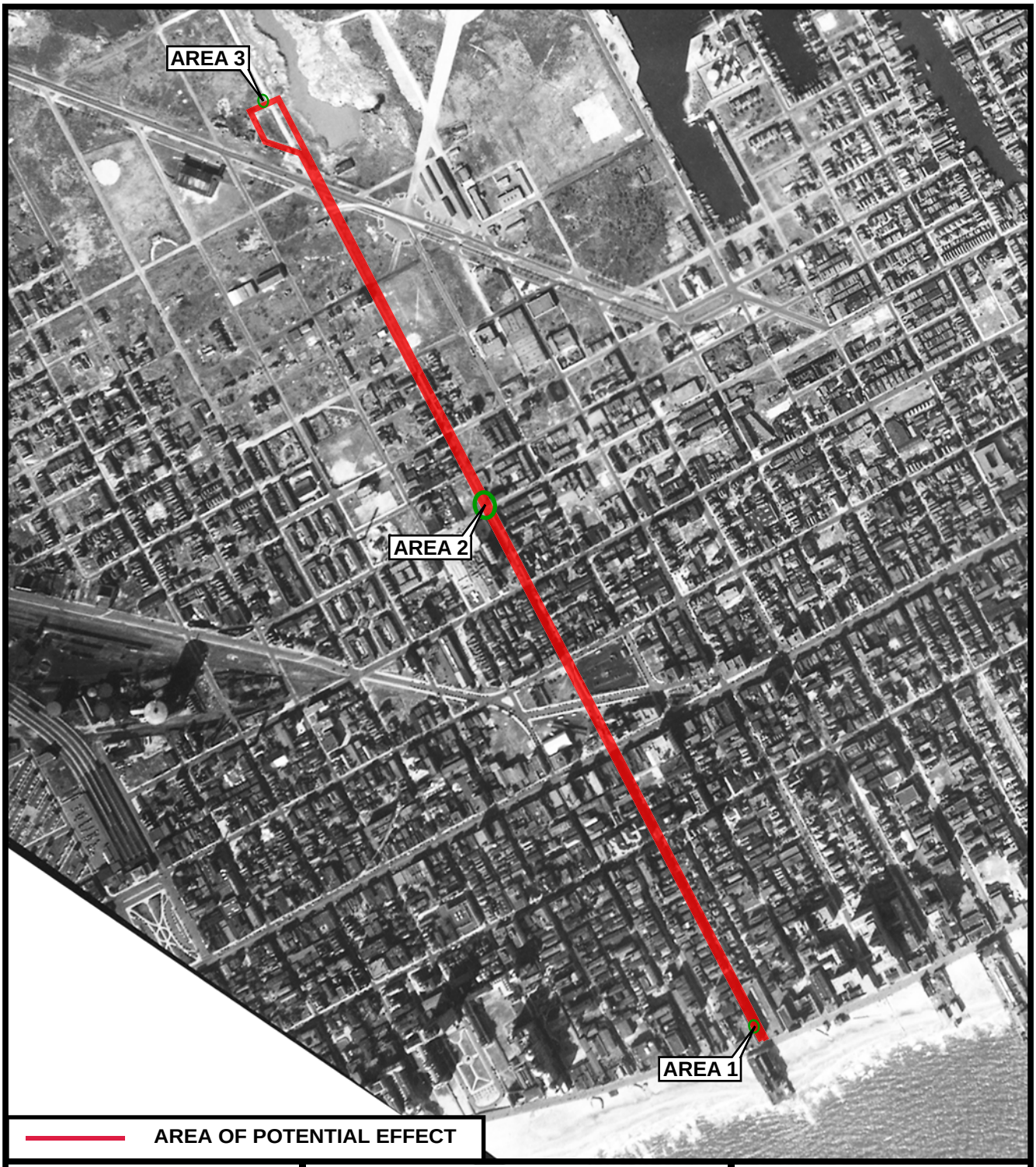
	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	ANONYMOUS 1920

PROJECT AREA CIRCA 1920 | **FIGURE 6**



	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	ANONYMOUS 1933

PROJECT AREA CIRCA 1933 | **FIGURE 7**



	SCALE	SOURCE
N	0ft 1060ft 0m 323.1m Prepared by CHRS, Inc.	UNITED STATES ARMY 1944

PROJECT AREA CIRCA 1944 | **FIGURE 8**

Bathhouses on either side of South Tennessee Avenue in the vicinity of Area 1 were replaced by larger multi-use structures by 1896, as reflected on an insurance map published in that year (Sanborn-Perris Map Company Limited 1896). Both sides of South Tennessee Avenue were lined with three-story recreational multiplexes in 1896. A wooden "incline" had been installed for pedestrian use along the west side of South Tennessee Avenue, extending from the elevated Boardwalk approximately 40 feet northwestward, descending to street level. Along the east side of South Tennessee Avenue, a longer and more elevated "incline" had been installed for use by toboggans. A 12-inch water pipe was denoted beneath the western half of South Tennessee Avenue. As this utility had not been denoted on the 1886 map, it appears to have been installed between 1886 and 1896 (Sanborn Map & Publishing Company 1886; Sanborn-Perris Map Company Limited 1896).

The recreational multiplex on the east side of South Tennessee Avenue in the vicinity of Area 1 was removed between 1896 and 1900, as reflected on a map of Atlantic City published in the latter year (Mueller 1900 [Figure 5]). The lot formerly occupied by that multiplex was depicted on the 1900 map as vacant and owned by L.H. Donnelly. The lot lining the west side of the Avenue was occupied in 1900 by frame structures attributed to John L. Young.

By 1921, the lot adjoining the west side of South Tennessee Avenue in the vicinity of Area 1 was occupied by the six-story, brick Hotel Alamac, as noted on an insurance map published in that year (Sanborn Map Company 1921). The "basement story" of the hotel was located beneath the wooden pedestrian incline extending from the Boardwalk down to street level. The formerly vacant lot on the east side of South Tennessee Avenue was occupied in 1921 by a brick and cement building measuring approximately 50 by 200 feet, housing Child's Restaurant. A subsurface utility is denoted beneath South Tennessee Avenue. The utility was the 12-inch water pipe that had been in place since at least 1896.

In 1925, the Child's Restaurant structure on the east side of South Tennessee Avenue was razed and replaced by a 100 by 380-foot structure known as the Boardwalk National Arcade Building. In addition to accommodating multiple recreational facilities, the Boardwalk National Arcade Building also housed the Boardwalk National Bank of Atlantic City (Wilson 1953:xiv). Still standing today, the structure is also known as the Boardwalk National Bank Building (Appendix B, Photographs 1 and 2).

The large brick structure on the west side of South Tennessee Avenue in the vicinity of Area 1—identified as Hotel Alamac in 1921—was still standing in 1949, as indicated on an insurance map published in that year (Sanborn Map Company 1949). The building was identified in 1949 as the Mayflower Hotel. The Mayflower was still standing in 1978, when it was described in a *Time Magazine* article as "bedraggled" (Anonymous 1978:n.p.). Between 1978 and 1990, the building was razed, leaving a lot along the west side of South Tennessee Avenue that is presently used for parking (Sanborn Map Company 1990; Appendix B, Photograph 3).

Area 2 (Central Vault Location)

The proposed location of the central vault (Area 2) is under the pavement at the intersection of North Tennessee Avenue and Mediterranean Avenue. The northeast corner of this intersection had

been occupied by an early twentieth-century warehouse (as discussed below), but it is currently vacant (Appendix B, Photograph 4). The southeast corner of the intersection is occupied by Atlantic City Townhouse, a high-rise residential facility reportedly erected in 1980 (Appendix B, Photograph 5; Sanborn Map Company 1990). A residence built after 1995 occupies the southwest corner of the intersection, and a wholesale grocery supply building, constructed in 1964, occupies the intersection's northwest corner (Appendix B, Photographs 6 and 7; Sanborn Map Company 1979; Google Earth 1995).

No features were denoted in the vicinity of Area 2 on a map of Atlantic City published in 1872 (Beers 1872a [Figure 2]). Neither Tennessee Avenue nor Mediterranean Avenue extended into this vicinity, which was characterized as marshland on a map of Atlantic County also published in 1872 (Beers 1872b).

Between 1872 and 1877, Tennessee Avenue (or its proposed alignment) was extended northward through Area 2 to an intersection with Adriatic Avenue, as reflected on a map of Atlantic City as it existed in 1877 (; Woolman, Rose and Price 1878 [Figure 3]). During that same period, Mediterranean Avenue (or its proposed alignment) was extended westward so that it crossed Tennessee Avenue in Area 2. No features other than those roadways were depicted in or near Area 2 on this map.

No structures were depicted in or immediately adjacent to Area 2 on maps of Atlantic City published in 1886, 1888, 1896, and 1900 (Sanborn Map & Publishing Company 1886; Geological Survey of New Jersey 1888 [Figure 4]; Sanborn-Perris Map Company Limited 1896; Mueller 1900 [Figure 5]). On the 1888 map, Area 2 and its vicinity were characterized as marshland (Geological Survey of New Jersey 1888 [Figure 4]). Sometime prior to 1896, a single-track railroad was laid down the center of Mediterranean Avenue. On the 1896 map, the tracks were attributed to "W.J. & S.S. R.R." (the West Jersey and Seashore Railroad) (Sanborn-Perris Map Company Limited 1896). In May of that year, the Pennsylvania Railroad Company had consolidated all of its railroads and several smaller properties in southern New Jersey into the West Jersey and Seashore Railroad (Baer 2010:n.p.). Multiple sets of "W.J. & S.S. R.R." tracks were denoted reaching into various corners of Atlantic City by 1896 (Sanborn-Perris Map Company Limited 1896).

Between 1900 and 1906, the first structures were erected on the southeastern and northeastern corners of the North Tennessee-Mediterranean Avenue intersection, near Area 1. These developments were reflected on a 1906 insurance map of Atlantic City, published the following year (Sanborn Map Company 1907). Denoted on the southeastern corner of the intersection was a block of three-story structures, fronting on North Tennessee Avenue, and comprising dwellings, a store, and a saloon. Denoted on the northeastern corner of the intersection was a three-story "Eldredge Storage Ware Ho.," with a warehouse yard (including a railroad siding and multiple wagon sheds) to its immediate north. Four-inch water pipes were depicted running down the centers of both avenues. Mediterranean Avenue was still equipped in 1906 with a single set of West Jersey and Seashore Railroad tracks.

Structures were denoted on all four corners of the North Tennessee-Mediterranean Avenue intersection on an insurance map published in 1921 (Sanborn Map Company 1921). The former Eldridge warehouse on the northeastern corner had been replaced in 1908 (as noted on the map) by

a longer, brick warehouse, owned in 1921 by the "Eldredge Storage & Ware Ho. Co." The block of three-story structures on the southeastern corner of the intersection—six row homes bookended by stores, fronting on North Tennessee Avenue—was still standing in 1921. The southwestern corner of the intersection was occupied by a one-story "Auto[mobile] Ho[use]," flanked by a two-story garage and a one-story wagon shed. The northwestern corner of the intersection was occupied by the one-story factory of Alex E. Bass, manufacturer of children's dresses.

The structures on the southwest and northwest corners of the North Tennessee-Mediterranean Avenue intersection were razed or removed between 1921 and 1949, as reflected on an insurance map published in the latter year (Sanborn Map Company 1949). The structures on the intersection's other corners do not appear to have been significantly altered during that period.

A wholesale grocery supply building was constructed in 1964 on a lot on the northwest corner of the North Tennessee-Mediterranean Avenue intersection (Sanborn Map Company 1979). That structure is still standing in the same location (Appendix B, Photograph 7). No significant changes were effected to structures on the other three corners of the intersection between 1949 and 1979. During the following 11 years, the early twentieth-century Eldredge Warehouse structure on the northeastern corner of the intersection was razed or removed, leaving a vacant lot which currently occupies that location (Appendix B, Photograph 4; Sanborn Map Company 1979, 1990). The block of early twentieth-century dwellings and commercial establishments on the southeastern corner of the intersection was razed or removed around 1979-80, and the present high-rise residential facility known as Atlantic City Townhouse was built in the latter year (Appendix B, Photograph 5; Sanborn Map Company 1979, 1990). A two-story residence was constructed on the southwestern corner of the intersection after April 1995 (Appendix B, Photograph 6; Google Earth 1995).

Area 3 (Northern Vault Location)

The proposed location of the northern vault (Area 3) is located in the northwestern portion of an electrical substation facility bounded on the south by McKinley Avenue, on the west by the Marina Thermal complex, on the north by roadways associated with the Atlantic City Express Brigantine Connector, and on the east by vacated North Tennessee Avenue (Appendix B, Photograph 8).

This area comprised marshland bisected or partly occupied by the eastward meandering South Fork of Clam Creek from at least 1872 through 1920 (Beers 1872a [Figure 2]; Beers 1872b; Woolman, Rose and Price 1878 [Figure 3]; Rose, Ruff and Woolman 1878; Sanborn Map & Publishing Company 1886; Geological Survey of New Jersey 1888 [Figure 4]; Mueller 1900 [Figure 5]; Sanborn Map Company 1907; Anonymous 1920 [Figure 6]). Between 1920 and 1933, the area was at least partially built up on fill (Anonymous 1920 [Figure 6]; Anonymous 1933 [Figure 7]). No structures were visible within 200 feet of Area 3 on aerial photographs taken in 1920, 1933, and 1944, though the latter photograph documented the northward extension of North Tennessee Avenue along the east side of Area 3 (it has since been vacated) (Anonymous 1920 [Figure 6]; Anonymous 1933 [Figure 7]; United States Army 1944 [Figure 8]). No structures were denoted on or within 200 feet of Area 3 on insurance maps published in 1949 and 1979 (Sanborn Map Company 1949, 1979). Between March 25, 2002 and December 30, 2002—as reflected on aerial photographs taken on those two dates—all of the structures on the north side of McKinley

Avenue in the vicinity of Area 3 were razed or removed in preparation for the construction of the present Marina Thermal Building (immediately west of Area 3), roadways associated with the Atlantic City Express Brigantine Connector (immediately north of Area 3), and the present electrical substation facilities (Google Earth 2002a, 2002b).

ARCHAEOLOGICAL POTENTIAL

The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

The proposed location of the southern vault (Area 1) is under the pavement of South Tennessee Avenue. The area is disturbed. This area was filled in and Tennessee Avenue was constructed across the area in the 1870s. Utilities were constructed under Tennessee Avenue in this area beginning in the 1890s. No historic buildings or other structures other than the roadway and subsurface utilities were present that would have resulted in significant archaeological deposits in this area. Area 1 has no prehistoric or historic archaeological potential.

The proposed location of the central vault (Area 2) is under the pavement at the intersection of North Tennessee Avenue and Mediterranean Avenue. The area is disturbed. This area was characterized as a marshland in 1872 and 1888. Tennessee Avenue and Mediterranean Avenue are mapped across the area in 1877, and a railroad was built on Mediterranean Avenue in the 1890s. Buildings were erected along the roadways between 1900 and 1906 as were the first subsurface utilities. No historic buildings or other structures other than the roadway and subsurface utilities were present that would have resulted in significant archaeological deposits in this area. Area 2 has no prehistoric or historic archaeological potential.

The proposed location of the northern vault (Area 3) is located in the northwestern portion of an electrical substation facility bounded on the south by McKinley Avenue, on the west by the Marina Thermal complex, on the north by roadways associated with the Atlantic City Express Brigantine Connector, and on the east by vacated North Tennessee Avenue. The area is disturbed. This area comprised marshland bisected or partly occupied by the eastward meandering South Fork of Clam Creek through 1920 when the marshland was filled in. No historic buildings or other structures other than the roadway and subsurface utilities were present that would have resulted in significant archaeological deposits in this area. Area 3 has no prehistoric or historic archaeological potential.

SUMMARY AND RECOMMENDATIONS

This report documents the results of a Phase Ia Archaeological Survey performed for AMEC Earth & Environmental as part of the Fishermen's Atlantic City Windfarm, LLC 20 MW Offshore Wind Energy Project in Atlantic City, Atlantic County, New Jersey (Figure 1; USGS 1994, 1995). The Area of Potential Effect (APE) for the project is located in the Coastal Plain Physiographic Province. The proposed project entails installation of a 12-inch power cable within a 20-foot-wide easement beneath an approximate 6,500-foot section of the western (southbound) lane of South and North Tennessee Avenues using HDD (Horizontal Directional Drilling), trenchless technology. At three locations, the buried cable will be brought to the surface in order to connect with existing utilities. In these three locations (at the termini and the midpoint of the APE), subsurface vaults will be constructed to house the points of connection.

Research performed for the Phase Ia Archaeological Survey indicates that there is no prehistoric archaeological potential within the APE due to disturbances associated with utility and building construction. Historical research indicates that the APE is under existing roadways. No historic buildings or structures were formerly present within the APE. There is no historic archaeological potential. No additional archaeological research is recommended.

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APPENDIX A

QUALIFICATIONS OF RESEARCHERS

QUALIFICATIONS OF RESEARCHERS

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	B.A. Anthropology, University of Pennsylvania
Project Responsibility:	Administration, report writing and review

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	B.A. English, Goshen College
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Professional Experience:	2 years
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	Social Services, Bucks County Community College
Project Responsibility:	Graphics preparation

Editor:	Kevin Quigg
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	B.A. Communications, Temple University
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Editor:	Maria Rossi
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Project Responsibility	Report editing

APPENDIX B

PHOTOGRAPHS



Photograph 1: Northward view of the front of the Boardwalk National Arcade Building, on the northeast corner of the intersection of South Tennessee Avenue and the Boardwalk.



Photograph 2: Southeastward view of the Boardwalk National Arcade Building. South Tennessee Avenue is in the foreground. Area 1 (southern vault location) is located in the lower right-hand corner of this view.



Photograph 3: Southward view of Area 1 (southern vault location) and vicinity. The Boardwalk National Arcade Building is on the left. The area west (to the right) of the visible sidewalk is occupied by a parking lot.



Photograph 4: Northeastward view of Area 2 (central vault location) and the vacant lot on the northeast corner of the North Tennessee-Mediterranean Avenue intersection.



Photograph 5: Southeastward view of Area 2 (central vault location) and the Atlantic City Townhouse (built in 1980) on the southeast corner of the North Tennessee-Mediterranean Avenue intersection.



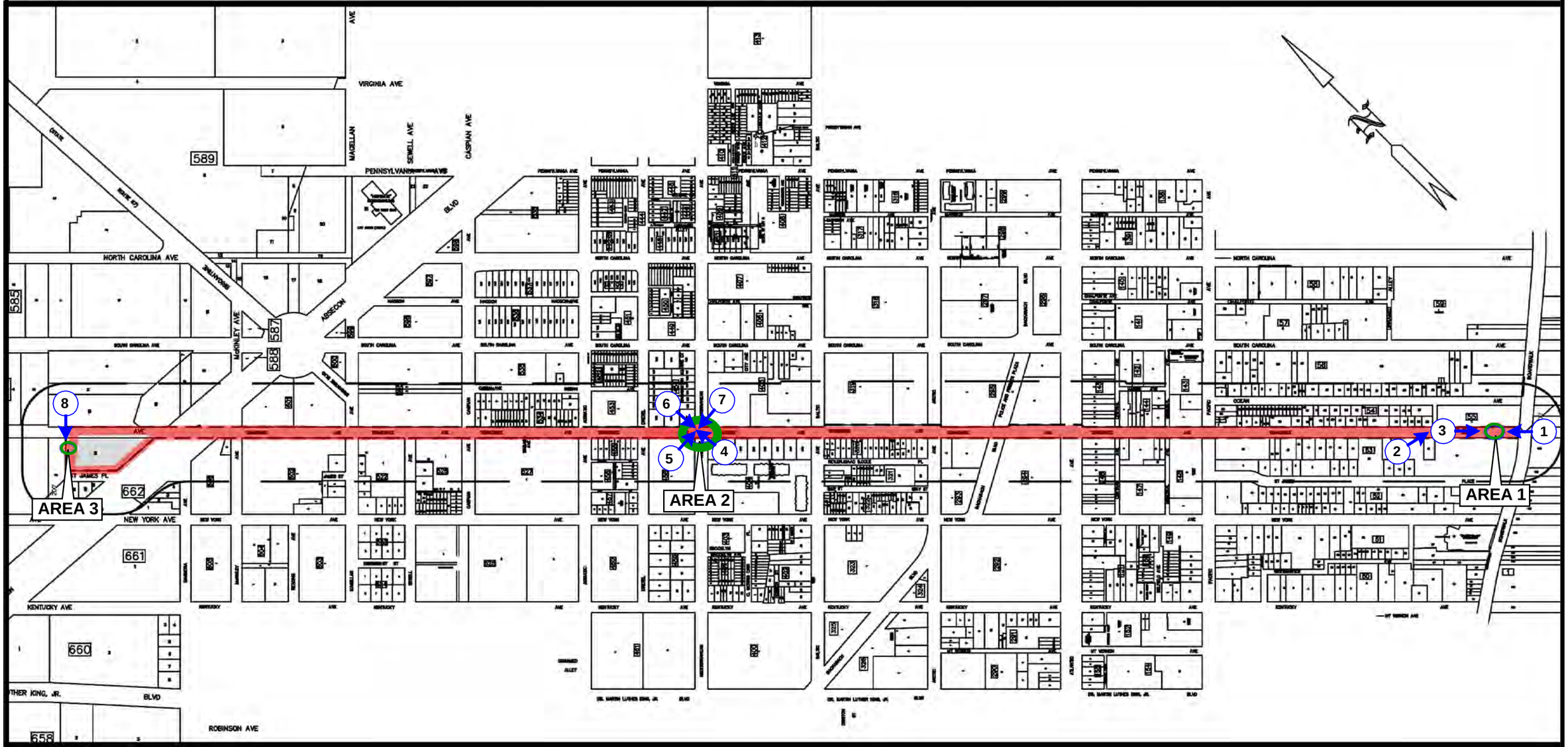
Photograph 6: Southwestward view of Area 2 (central vault location) and the dwelling built after April 1995 on the southwest corner of the North Tennessee-Mediterranean Avenue intersection.



Photograph 7: Northwestward view of Area 2 (central vault location) and the wholesale grocery supply building constructed in 1964 on the northwest corner of the North Tennessee-Mediterranean Avenue intersection.



Photograph 8: Westward view of Area 3 (northern vault location) and vicinity. The large brick building is the Marina Thermal Building, constructed in 2002 along with the electrical substation facilities visible on the left.



	SCALE	SOURCE
N	0ft 467ft 0m 142.3m *Prepared by CHRS, Inc.*	ATLANTIC CITY TAX PARCEL

AREA OF POTENTIAL EFFECT

PHOTO LOCATION

PHOTOGRAPH LOCATION MAP

Description of the Proposed Project

Changes to the Project Description (PD) that were previously submitted during consultation are highlighted in yellow and the change is explained in the accompanying footnote.

The Proposed Project consists of the construction, operation, maintenance, and eventual decommissioning[1] of a nominal 25 MW[2] offshore wind renewable energy facility, consisting of up to six turbines[3], a 33-kiloVolt (kV)[4] alternating current (AC) submarine cable interconnecting the turbines (inter-array cable), a 33-kV[4] AC submarine transmission cable (export cable), and a 33-kV[4] AC underground cable (onshore interconnection cable) that would connect the Proposed Project with existing onshore infrastructure located in Atlantic City, New Jersey.

The offshore components of the Proposed Project, including the turbines and the inter-array cable, would be located in state waters approximately 2.8 nautical miles from Atlantic City, New Jersey. The export cable would traverse state waters to shore. The onshore components, including the onshore interconnection cable, fiber optic cable, and interconnection facilities would be located in Atlantic City, New Jersey. Construction would be supported by a construction staging area(s) and a construction port. Onshore support facilities would be located at existing waterfront industrial or commercial sites in the cities of Camden and Atlantic City, New Jersey.

All remaining aspects of the project, including staging sites, vessel traffic, color and labeling of the turbines, seasonal restriction and maintenance schedules remain the same and are not impacted by the proposed project changes.

Annual net electricity production for this Project is anticipated to be approximately 80,000 MW-hours[5] (MWh). The total ocean area considered as the project area is approximately 170 acres (calculated as the perimeter around the group of six turbines, approximately 200 feet in each direction) plus a 5 foot width along the length of the export cable route from the turbines to the shore); however the actual portion of the area that would be physically disturbed by the placement of the turbines and cables is approximately 2 acres. The cable and turbines would be located in water depths of 26 to 40 feet below mean lower low water (MLLW).

Wind Turbine and Foundation Design

The offshore turbine assemblies would each be composed of three primary elements, a foundation, tower, and three blade turbine. The nacelle houses the major mechanical components of each turbine. Each tower would be approximately 16.5 feet in diameter at the base and taper to a diameter of 12.5 feet at the top.

[1] Previous PD did not include operation, maintenance, and eventual decommissioning of the Proposed Project
[2] Previous PD stated “20 MW (net)”
[3] Previous PD stated “six offshore wind turbines”
[4] Previous PD stated “34.5 kv”
[5] Previous PD stated “75,000 MWh”

Each turbine would have a name plate capacity of no more than 5 MW[6] and a blade rotor diameter of no more than 427 feet[7]. Each of the three (3) blades would be two hundred thirteen (213) feet long[8]. The blade at its lowest point would be located 80 feet above mean high water and 506.4 feet above mean high water at its highest point[9].

The turbine array would be oriented in one row parallel to the coastline running northeast to southwest. Spacing between the turbines would be approximately 3,543 feet. Each of the wind turbines would be supported by an Inward Battered Guide Structure (IBGS) jacket-type foundation[10] driven into the seabed (**Figure 1**). The IBGS jacket-type foundation consists of four legs, with each leg being a hollow steel pipe with an approximate outer diameter of 84 inches. The triangular structure has 90-inch diameter pile sleeves for each leg and bracing elements of the foundation will measure approximately 22 feet in length and 72 inches in diameter. At the mudline, each side of the foundation will measure approximately 53 feet from the center point of each leg. The IBGS extends upward from below the seabed, through the water column to exposure at the surface, then tapers to approximately 50 feet above mean lower low water. The structural braces for the towers would be seventy two (72) inches in diameter and would be located laterally along the entire foundation[11].

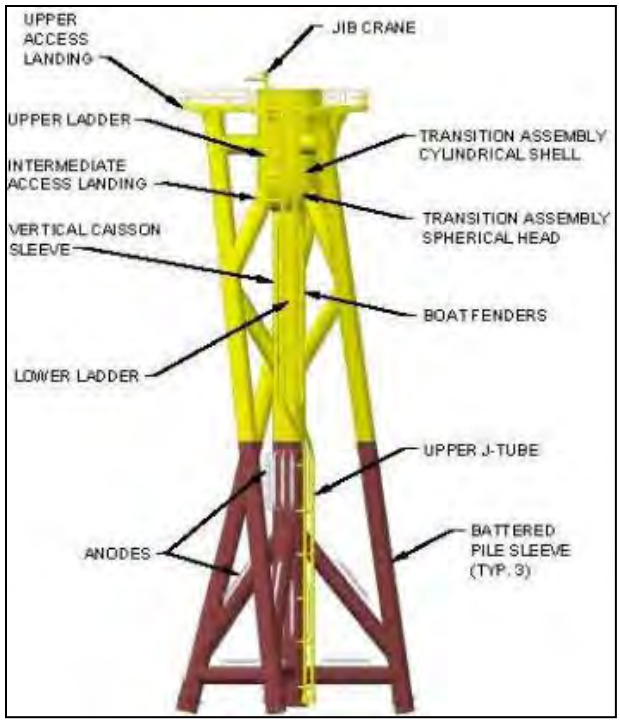


Figure 1. Foundation Design for the Proposed Project.

[6] Previous PD stated "3.6 MW"
[7] Previous PD stated "394 feet"
[8] Previous PD stated "approximately 192 foot long"
[9] Previous PD stated "blade at its lowest point would be located approximately 100 feet above the surface of the water and approximately 500 feet above the surface of the water at its highest point at mean high water"
[10] Previous PD referenced "monopole foundation"
[11] Previous PD did not reference these specifications since the tower was originally intended to be a monopole foundation

Engineering analyses have determined that the base of each foundation will no longer require a scour protection mat or rock scour protection around each foundation pile[12].

Installation of Turbines and Foundations

Fishermen's Atlantic City Windfarm, LLC (FACW) the project proponent, has thoroughly investigated vessel and port availability, and is currently in negotiations with multiple third parties to provide equipment and expertise in the installation of the turbine foundations and turbines. FACW has identified suitable existing US Jones Act-compliant vessels capable of installing the turbines in the 40 foot water depths at the project site. Specialty contractors would be required for delivery and installation of foundations, turbines and the subsea electrical cabling. Installing the array of turbines will require the ability to lift, place, and connect foundations, pilings nacelles, blades and heavy electrical equipment. These components can weigh well in excess of 200 tons each, and can only be lifted with specialized jack up barges or vessel-mounted cranes offering a stable, safe work platform.

FACW currently has a Memorandum of Understanding with the South Jersey Port Corporation for materials staging and preparation. The turbines and associated major components are envisioned to be delivered to the Beckett Street Marine Terminal in Camden, New Jersey. Up to 6 months before the scheduled installation, the turbines would be transported from the manufacturer to the Beckett Street Marine Terminal via barge, rail, and/or truck depending upon their origin. Existing waterfront bulkheads, cranes and laydown areas at Beckett Street would be used to support the staging for this project. At the facility, final turbine assembly including generator mounting and electrical hookups would be performed to minimize work performed offshore. At that point, the turbine manufacturer would lead the final assembly and configuration for the wind turbine generator components to be delivered by vessel to the offshore array field.

The steel turbine towers would be manufactured domestically and transported to the staging area at Beckett Street Marine Terminal via barge, rail, and/or truck. Each tower is approximately 250 feet in length (comprised of bolted segments) and is secured to the foundation by bolting to a transition piece (or flange) at the top of the foundation.

The foundations would be fabricated at a Gulf of Mexico facility and then transported by barge to the staging area at Beckett Street Marine Terminal. Once assembly is completed, the foundations would be loaded onto ABS class ocean deck barges that would carry three jackets per barge. It is anticipated that the two barges would be transported by two tugs directly to the project site. A floating crane barge or specialized jack-up barge or barge equipped with a high capacity crane pile handling frame and pile driving equipment would perform structure installations (**Figure 2**). The installation vessel would position itself near to each of the turbine installations. The vessel would then jack itself up out of the water to provide a stable platform in which to carry out the installation activities. Offshore experience has shown that it normally takes approximately 24 hours in fair weather conditions to position and anchor the

[12] Previous PD stated "scour mats and/or rock protection will be installed to prevent ocean currents from eroding the seabed around the foundation base".

installation vessel. Once the installation vessel is in the turbine array field, it would be moved as minimally as possible, but would, out of necessity, move from one turbine location to the next.



Figure 2. Typical heavy jackup vessel used for offshore wind turbine installations

To secure the foundation in place, steel pipe pilings 7 feet in diameter would be inserted down through the piling sleeves, and then driven to a depth of approximately 140 feet below the seabed using impact hammer methods. The jacket foundations would require the installation of four (4) eighty four (84) inch piles that would be driven inside, down and through the length of each of the ninety (90) inch diameter sleeves of the foundation for each turbine[13]. The anchoring piles would be driven to a depth of approximately 150 feet below the mudline. The maximum sound generation for each pile would be approximately 199 dB (re 1 uPa) at the source.

Each foundation would also be fitted with a ladder extending from the water surface up to a working deck to allow personnel access from vessels. Electrical power generated by the turbine would be cabled down through the structure to emerge from a J-Tube below the seabed.

The Proposed Project would be constructed using the following approach which has been successfully employed in Europe:

- All foundations are installed first;
- The submarine cable is installed next and energized to provide electricity from the grid to assist in turbine installation;
- Turbine towers are installed on the foundations;

[13] Previous PD stated "pile driving of eighteen (18) forty eight (48) inch diameter pipes placed in the openings on the three ends of the foundation structure"

- The turbines are installed on each tower; and
- Lastly the turbines are commissioned and made operational.

The complete wind turbine structure requires a series of main lifts for full assembly. The foundation center caisson (i.e., a watertight retaining structure) would be driven to the required depth using impact methods. The guide structure would then be lifted onto the caisson and secured. Each of the three pilings would then be lifted into the sleeves on the guide structure and hammered to the required depth below the seabed. The turbine tower would then be lifted and secured onto the foundation. Lastly the turbine components including the nacelle and turbine blades would be lifted to the tower top and installed.

Turbine system installations are anticipated to require four to seven fair weather days to complete. In order to minimize the complexity and duration of offshore operations, components of the turbines would be pre-assembled to the extent possible prior to transportation offshore.

Cable Route and Installation

Cables would be manufactured in Seymour, Connecticut and transported by rail to a staging pier in Port Elizabeth, New Jersey. The cable reels would be placed on a special cable laying barge and transported to the project site for installation.

Power output from the turbines would be transmitted via a 33 kV AC submarine cable (export cable) to access the shore. The inter-array transmission cable from each turbine structure would be linked to the export cable that would make landfall at a point in Atlantic City, at the base (southeast terminus) of Tennessee Avenue in Atlantic City. The cable would then continue northwest for 1.2 miles underground to the existing Huron Substation, located along Absecon Avenue. The path of this underground cable is roughly coincident with the line created by Tennessee Avenue. The submarine transmission cable route was selected after evaluations of alternative routes and landfall locations which included bringing the cable to shore through the Absecon Inlet. The route ultimately selected proved to present the least environmental impacts identified during the permitting process and was most acceptable to the USCG.

Offshore, the submarine export and inter-array cables would be arranged in a single string array. An additional fiber-optic cable bundle would also be included within the export cable for telecommunication purposes. At each turbine location, the power and telecommunication cables would extend down from the turbine within the tower structure, and then emerge through a J-tube just above the seabed where it would be connected to the adjacent turbine.

Jet plowing technology would be used to bury the export and inter-array cables to a target depth of 6 feet[14] below the seabed. The export cable would originate at Turbine #3. During this process the installation vessel slowly travels along the planned cable route while towing a weighted sled fitted with a trenching device (plow) and a nozzle which jets water into the bottom to create a narrow trench. The cable is simultaneously fed out from the vessel and laid into the trench. Blades at the back of the sled scrape bottom material over the trench to backfill. The cable would be buried in this manner to

[14] Previous PD stated “9 feet”

approximately 1,800 feet from the shoreline. The depth of the cable below the project along the Atlantic City Beach will be 20 feet. The cable that would run from the turbines to the shore would be five (5) inches in diameter[15].

Beginning at a distance approximately 1,800 feet from the shoreline, the cable would be routed through a lined conduit installed using Horizontal Directional Drilling (HDD) methods.[16] The installation of this HDD conduit would be performed from the landside. At the base of Tennessee Avenue (approximately 500 feet inland of the high water line), a concrete vault approximately 8 feet by 8 feet by 7 feet would be installed below roadway grade using typical upland excavation equipment. HDD equipment would then drill a 6-inch diameter cable-way 25 feet below the street level, underneath the boardwalk and beach, and emerge at the jet plow end point 1,800 feet from shore. While drilling, the cable-way would be lined with polyvinyl chloride (PVC) conduit to prevent collapse and to protect the cable after it has been installed. Soil material removed from the bored hole (approximately 13 cubic yards) would be removed from the site. All construction-related soil and debris would be appropriately disposed of depending upon the characteristics of the material, in accordance with relevant New Jersey Department of Environmental Protection (NJDEP) regulations. Once HDD is completed, the cable would be pulled from the offshore vessel through the conduit to emerge at the shore end vault, where the offshore cable would be connected.

A similar cable to that used offshore, but designed specifically for land applications would be used for the remaining 1.2 mile run below the Tennessee Avenue street level to the Huron substation. Again HDD methods would be used to route the cable 25 feet below street level. This burial depth was selected after a review of existing below grade infrastructure along this route. At 25 feet, the cable would be below all existing infrastructure. Soil material removed from the bored hole (approximately 46 cubic yards) would be removed from the site and properly disposed as described above. At the Huron substation facility, a breaker system, and other minor electrical components specific to the Proposed Project would need to be installed for connection of the export cable and to the power grid.

The following sections were not part of the original project description.

Operations and Maintenance

Upon completion of the construction activities, FAWC would conduct several weeks of commissioning activities that would entail the testing of the turbines as well as the offshore and onshore transmission systems. The project would begin operations approximately in October 2017 and continue until the end of the 25-year expected operational life of the facility.

Operation of the turbines would require continuous remote (shore-based) monitoring and control, scheduled onsite maintenance, and unscheduled responses to faults or damage. Additionally, the

[15] Previous PD stated “8 inches in diameter”

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

- Remote monitoring and supervision of the wind turbines and associated equipment 24 hours a day, 7 days a week using the wind power supervisory control and data acquisition system;
- Initiation of any required corrective action;
- Operation of the Turbine Condition Monitoring (TCM) system;
- Performing diagnostic assessment of data from the TCM;
- Managing the inventory of spare parts, including performing any maintenance of these spare parts;
- Scheduling and logistics planning of maintenance activities; and
- Performing daily communication with the facility operator.

Each turbine would undergo scheduled maintenance and inspection as well as a full annual maintenance program as prescribed by the turbine manufacturer. This work would be performed by personnel qualified by the manufacturer. Additionally, inspections of the underwater structures and seabed would be performed at a minimum of once per year.

As access to the turbines can only be achieved by vessel, sea conditions would dictate when service may be performed. Heavy annual work would be scheduled to occur during summer months when conditions for accessing the turbines are typically suitable (waves less than 3 feet). During winter months, accessibility may be limited for extended periods of time.

Service crews would board a dedicated service vessel based in Atlantic City, New Jersey. Personnel would gain access to the turbines via the ladder system incorporated into each foundation. Tools and light parts would be lifted onto the structure using a small crane system provided on the structure working deck. Annual maintenance for each turbine is expected to require 5 to 8 days of onsite work. Turbines would be returned to normal operation at the end of each service day.

No oils or other waste would be discharged during service events. Appropriate measures would be implemented to provide for containment and collection of hazardous material spills should they occur. It is not expected that any painting would be necessary during the life of the turbines, other than to repair damage. The original coating system on the towers is designed to last the lifetime of the structure.

Decommissioning

While the project is presently planned for a 25 year operational period, the potential for equipment upgrades and continued operation would be evaluated throughout the project life. When it is determined that the project is to be decommissioned, all physical elements of the project would be removed and the site would be restored to its original condition. A financial instrument to fund decommissioning activities would be set in place at the start of the project to ensure that sufficient funds are available for removal of the turbines and support infrastructure.

A comprehensive Decommissioning Plan which addresses the engineering, environmental, regulatory, and economic elements of the decommissioning task. The plan addresses state requirements presently in place as well as those established by the Bureau of Ocean Energy Management (BOEM) guidelines described in 30 CFR Parts 250.1700 – 1754. An overview of the Decommissioning Plan is provided below.

Decommissioning of the project would involve the removal of equipment both offshore and onshore and would be performed utilizing similar equipment to that used during the construction process. This equipment may include barges, lift boats, tugs and crew vessels. Deep draft vessels would port at the Beckett Street Terminal in Camden, New Jersey, while smaller crew vessels would operate from Atlantic City. Onshore, trucks, trailers, and cable handing equipment would be used to recover the cable and substation equipment. Removed materials would be refurbished, recycled, or disposed of, as appropriate.

Offshore Equipment Removal

Removal of the offshore equipment would consist of the following tasks:

- Removal of the wind turbines;
- Removal of towers and foundations;
- Removal of inter-array and export cables; and
- Site clearance survey.

The removal processes would be performed with full consideration of environmental and safety compliance. Federal and state permits would be in place as required prior to initiating decommissioning. During decommissioning, safety exclusion zones would be established and marked with buoys and navigational aids to protect the workforce and vessel traffic. FACW would ensure that any subsea obstacles would be adequately marked until they are made safe or removed.

Removal of the turbine equipment would essentially be the reverse of the installation. Using a barge supported heavy lift crane, each rotor and nacelle would be lowered to a transport barge and secured for transit to port. Power cables would be removed from the tower and at the sea bed. The steel turbine tower would be removed as one unit above the transition joint at water level.

Each tower foundation is comprised of three driven pilings, a center caisson and a guide structure. The guide structure would first be removed and loaded onto a barge for recycling. Each of the pilings and the caisson would be cut 15 feet below the seabed and removed. The remaining piling structures (below -15 feet) would be left in place.

Because full removal off all buried cable would cause disturbance to the established sea bed, power cables at each turbine location would be excavated to the 6 foot burial depth, cut and removed. All cabling at or below the 6-foot depth would be left in place undisturbed.

Upon completion of structural decommissioning, a site clearance survey would be performed to ensure that no debris remains within the project area, and to document the physical condition of the seabed. Similar to the geophysical survey performed pre-construction, the clearance survey would employ side

scan sonar for imaging the seabed, a magnetometer to detect ferrous materials, and depth mapping systems. Any objects detected would be investigated and removed as appropriate. Demonstration of clearance would be provided to the appropriate agencies.

Onshore Equipment Removal

Removal of the onshore equipment would consist of the following tasks:

- Removal of sea-to-shore transition cable;
- Abandonment of sea-to-shore directionally drilled conduit;
- Abandonment of the onshore cable vault;
- Removal of land cable; and
- Removal of substation equipment.

After removal of the offshore equipment, the remaining power transmission cable would be pulled back through its HDD conduit to the vault at the base of Tennessee Avenue from where it would be removed for recycling. The 6-inch conduit would be left in place, 25 feet below the boardwalk and beach, and extending offshore to the former transition point.

All equipment would be removed and the vault would be abandoned in accordance with Atlantic City, New Jersey regulations or, at the discretion of the city, the vault would be removed and the excavated site backfilled.

The land based cable extending from the vault to the Huron substation would be removed from its conduit by pulling from the substation end. The cable would be trucked from the location and recycled. The 6-inch buried conduit (approximately 25 feet below grade) would be capped and left in place for future use by the city or other projects.

Switchboxes and other electrical equipment at the substation will be removed in accordance with requirements set by Atlantic County Electric. Any other ancillary equipment would either be removed or left in place as preferred by Atlantic County Electric.

VIEWSHED ANALYSIS REPORT

Fishermen's Atlantic City Windfarm, LLC
20 MW Offshore Wind Energy Project
~2.8 Miles Offshore of Atlantic City, NJ

Prepared for

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July 29, 2010

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1.0 INTRODUCTION

This *Viewshed Analysis Report* has been prepared by AMEC Earth & Environmental, Inc. (AMEC) on behalf of Fishermen's Atlantic City Windfarm, LLC (FISHERMENS). This report summarizes the results of a viewshed analysis whose purpose was to determine if a nominal 20 megawatt (MW) offshore wind renewable energy facility (the "Project") within New Jersey (NJ) State waters would visually impair the viewshed from existing historic resources in the vicinity of the project. The project is the proposed development of on offshore wind farm comprising six electric generating windmills located approximately 2.8 miles off the coast from Atlantic City (see **Figure 1**). The six windmills will be supported by monopile foundations. A submarine electric transmission cable from each windmill will be linked to a single main submarine transmission cable that will make landfall at a point in Atlantic City.

Photographs were taken from various historic locations within Atlantic County NJ from Atlantic City down to Longport. Digital overlays of the precise location and size of the turbines were placed over those photographs in which at least one turbine would be seen, if constructed.

The results of this analysis show that, even from historically sensitive areas, the sight of the turbines nearly 3.0 miles offshore does not have a significant effect on the overall Atlantic County viewscape.

2.0 PROJECT DESCRIPTION AND SETTING

The following sections present an overview of the proposed Project and a general description of the geographic location and existing visual setting surrounding the Project site.

2.1 PROJECT DESCRIPTION

The reference design for this Project is the construction and operation of six, 3.6 MW Siemens turbines, oriented in one row (see **Figure 1**). The total ocean area considered as the Project area is approximately 170 acres (calculated as the perimeter around the group of six turbines (approximately 200 feet in each direction) plus a five foot width along the length of the cable route from the turbines to the shore); however, the actual portion of the area that will be physically disturbed by the placement of the turbines and cables is approximately 2.0 acres.

The six, 3.6 MW, Siemens turbines are each composed of three primary elements, a foundation, transition piece, and nacelle with three blade turbine assembly.

The turbine foundation is the base of the structure and extends from below the seabed to approximately 9 feet above the water surface. Based on geotechnical conditions, environmental loading and economic considerations, monopile foundations have been selected for this project. A single steel pile, with a diameter of approximately 16 feet and wall thickness of 2+ inches will be driven into the bottom to the required depth (approximately 150 feet). The foundation will extend 40 feet through the water column to exposure at the surface.

The transition section extends from the top of foundation (9 feet above sea level) to the turbine at approximately 295 feet. Normally for the type of turbine proposed for this project (Siemens SWT-3.6-107/120), the monopile outer diameter would be approximately 15.4 feet, and the Transition Piece (TP) which is normally connected to the monopile via a grouted connection would be approximately 16.4 feet in diameter. A boat landing for service access is located just above water level, as well as an access door to the structure interior spaces and ladder. The

transition pile interior is also used as the conduit for the electrical cable as it runs from the turbine motor to the seabed where it emerges from a "J-tube" to connection with the cabling network,

The primary wind turbine components are the nacelle, which houses the gearbox and generator, and the rotor works which include the hub and three turbine blades (see **Appendix A**). Each turbine will have a rotor diameter of approximately 394 feet and a center hub height of 295 feet above sea level. The turbines are installed on the transition pile top and will automatically rotate to orient the blades into the wind to most effectively capture energy

In array size, turbine size, and location, FISHERMEN'S believes that this 20 MW windfarm Project is relatively similar to, and can be viewed as an "offshore equivalent" of the successful five-turbine windfarm operating on the grounds of the ACUA in Atlantic City. The five turbines at the ACUA facility are currently considered to be a tourist attraction. FISHERMEN'S believes the presence of the turbines off of Atlantic City will showcase Atlantic City's and New Jersey's commitment to renewable resources and will become a symbol for the City, while located far enough offshore to not be intrusive. Most importantly, the Project will demonstrate the efficacy of the new technology and will propel New Jersey to the forefront of a new green industry.

2.2 PROJECT LOCATION AND VISUAL SETTING

The turbines would be located within State waters, approximately 2.8 miles off the coast of Atlantic City (see **Figure 2**). The proposed turbine locations were selected to maximize wind energy potential while minimizing visual impacts by orienting the turbines parallel to the shore to create a uniform appearance, and by locating them as far offshore as possible, while still remaining within State waters. Table 1.1 below presents the latitude and longitude of the proposed six turbine locations in various units.

Table 1.1
Latitude and Longitude of Major Project Components

Turbine Number/Cable location	Latitude (NAD83) (N)	Longitude (NAD83) (W)	NJ State Plane (ft) (X)	NJ State Plane (ft) (Y)	UTM Zone 18 (X)	UTM Zone 18 (Y)
1	39.2999	-74.4369	509979.27	169929.48	549070	4350509
2	39.3048	-74.4260	513053.18	171713.54	549887	4351013
3	39.3099	-74.4154	516054.26	173590.33	550709	4351518
4	39.3150	-74.4047	519078.95	175427.07	551528	4352023
5	39.3198	-74.3939	522148.68	177193.85	552345	4352526
6	39.3250	-74.3832	525152.27	179097.02	553161	4353029
Waterward extent of submarine cable	39.3250	-74.3832	525152.27	179097.02	553161	4353029

Per N.J.A.C. 7:7E-8.12, scenic resources include the views of the natural and/or built landscape. Large-scale elements of building and site design are defined as the elements that compose the developed landscape such as size, geometry, massing, height, and bulk structures. New coastal development that is visually compatible with its surroundings in terms of building and site design, and enhances scenic resources is encouraged. New coastal development that is not visually compatible with existing scenic resources in terms of large-scale elements of building and site design is discouraged.

The existing visual and aesthetic conditions in the Project area consists of open water punctuated by fishing and other vessels of various sizes. The waters off southern New Jersey are active vessel traffic areas, and the Atlantic City port serves as a hub for a large fleet of both fishing vessels and pleasure craft. The view of the turbines from the shoreline will be unobstructed, with the exception of the occasional passing vessel.

Atlantic City and Ocean City (just south of Atlantic City) are located on barrier beach islands separated from the mainland by estuarine wetlands. The cities are both densely developed, with

some tall buildings. Most of the barrier beach between them (including Chelsea Heights, Ventnor City, Margate City, and Longport), and beyond them to the north (Brigantine) and south (Strathmere), is also developed. This developed barrier beach effectively blocks most views of the ocean from further inland in the vicinity of the Project.

3.0 VIEWSHED SITE SELECTION

AMEC visited the NJ State Historic Preservation Office (SHPO) on January 26, 2010 in order to develop a list of sites that are present on the National and/or State Register of Historic Places from Brigantine, NJ down to Longport, NJ. The sites from that list that finally chosen for inclusion in the viewshed project were selected due to their close proximity to the ocean (within 500 feet) or their public appeal and vantage point of the shore area. The original list of sites included the following:

1) Church of the Redeemer – Longport, NJ (National and State registered)
2) Great Egg Coast Guard Station – Longport, NJ (National and State registered)
3) Lucy the Margate Elephant – Margate City, NJ (National and State registered)
4) John Stafford Historic District – Ventnor City, NJ (National and State registered)
5) Raphael-Gordon House – Atlantic City, NJ (State registered)
6) The Strand and Marine Apartments – Atlantic City, NJ (State registered)
7) Atlantic City Convention Hall – Atlantic City, NJ (National and State registered)
8) Warner Theater (façade) – Atlantic City, New Jersey (State registered)
9) Shelburne Hotel – Atlantic City, New Jersey (National and State registered)
10) Holmhurst Hotel – Atlantic City, NJ (National and State registered)
11) Morton Hotel – Atlantic City, NJ (National and State registered)
12) Absecon Lighthouse – Atlantic City, NJ (National and State registered)

Upon further research into the individual sites, it was discovered that the three hotels in Atlantic City (Shelburne Hotel, Holmhurst Hotel, and Morton Hotel) have all been demolished and are no longer in existence. The Holmhurst Hotel was demolished in March 1985 (see **Appendix B**). No dates of demolition were available for the other two buildings.

Based upon the above information, the field evaluation was limited to the nine places still in existence from the original list (see **Figure 3**).

4.0 VIEWSHED SITE EVALUATIONS

On March 9 and 19, 2010, AMEC visited the nine selected locations based on the SHPO review. At each location, the closest and/or highest vantage point was selected to take photographs facing the direction in which the turbines will be located. At least two or three photos were taken towards the ocean in order to fully cover the entire viewscape in the direction of the turbines.

Each of the photographs was then digitally overlaid with a depiction of the turbines, documenting exactly how they would appear from those vantage points. Once that was completed, it was determined that the following places were the only ones from the original list in which the turbines would be visible:

1) The John Stafford Historic District
2) The Raphael-Gordon House
3) The Strand and Marine Apartments
4) The Atlantic City Convention Hall
5) The Warner Theater (façade); and
6) The Absecon Lighthouse

Details regarding each of these locations are provided in the following sections.

It should be noted that Lucy the Margate Elephant was closed for the season so a photo from the top level (approximately two stories high) could not be taken. However, photos from the base of the elephant and from the snack shop located between Lucy and the ocean were taken. The turbines will be blocked from view at the snack shop by another building located next door, and the view of the turbines from the bottom of the elephant is completely shielded by multiple buildings and other tall structures. Therefore, it was determined that the turbines will most likely not be visible from the top of Lucy the Margate Elephant and this site was not investigated further.

4.1 THE JOHN STAFFORD HISTORIC DISTRICT

The John Stafford Historic District is comprised of four city blocks along the eastern border of Ventnor City, NJ (see **Figure 4**). The streets contained within this district include South Austin Avenue, South Marion Avenue, South Baton Rouge Avenue, and South Vassar Square.



View of S. Baton Rouge Avenue – facing northwest

Although this area is listed as a National and State Historic District, there were no obvious signs along the boardwalk declaring it as such. In addition, the houses within the district appeared to be older homes mixed in with more recent and modern construction. It is not expected that visitors to Atlantic City would be attracted to this area. The only good vantage point of the

ocean within this district is from the boardwalk lining the southeast border. It is from the boardwalk at the end of each of the four streets in which the field photographs were taken.

4. 2 THE RAPHAEL-GORDON HOUSE

This house is located at 118 South Newton Street, just within the western border of Atlantic City, NJ (see **Figure 4**). It is nestled within a residential area with no obvious signage from the street. A small plaque located next to the front door is the only sign indicating the name of the house.



View of the Raphael-Gordon House – facing west

The property is privately owned by the Raphel and Gordon Families. It is not open to the public; however, one of the owners, Murry Raphel, will invite people in for tours if they are interested.

It is unlikely that visitors to Atlantic City would specifically come to visit this house. The only good vantage point of the ocean was from the second story balcony in the southeast corner of the house or from the furthest southeast corner of the property. It is from these two locations in which the field photographs were taken.

4. 3 THE STRAND AND MARINE APARTMENTS

The former Strand and Marine Apartments complex buildings are located at 3821- 3825 Boardwalk Avenue in Atlantic City, NJ (see **Figure 4**). The buildings are currently vacant and boarded up. In addition, a "for sale" sign is hanging in front of one of them.

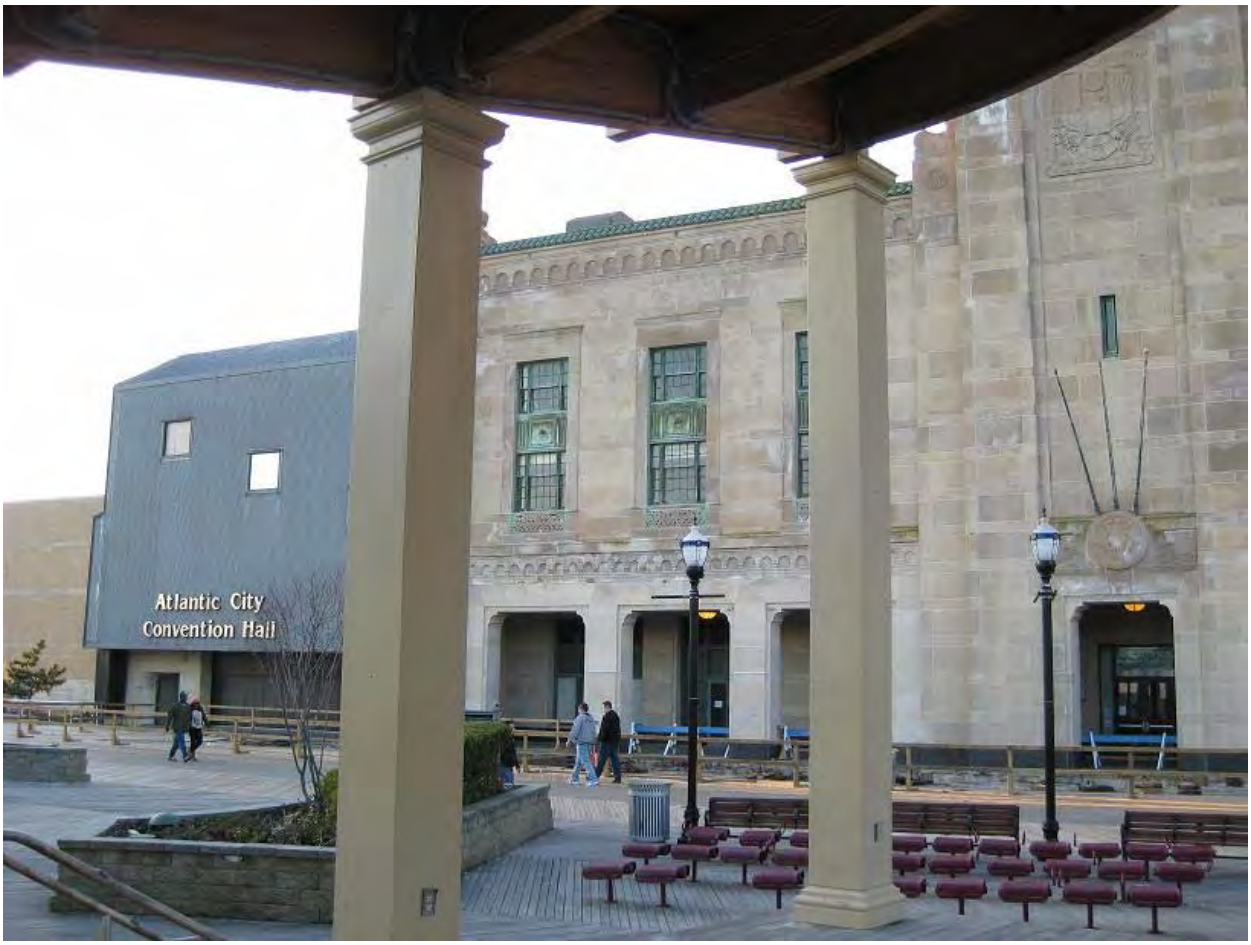


View of the Strand and Marine Apartments – facing north

It is very unlikely that visitors to Atlantic City would be interested in visiting this site. The best vantage point of the ocean that was accessible to the public was from the boardwalk adjacent to the southeast sides of the buildings. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

4.4 THE ATLANTIC CITY CONVENTION HALL

The Atlantic City Convention Hall is located at 2301 Boardwalk, Atlantic City, NJ (see **Figure 5**). The building is no longer being used as a convention hall. It is currently named "Atlantic City Boardwalk Hall" and is the home to various sporting and concert events.



View of the Atlantic City Convention Hall – facing northwest

According to their website *(*www.boardwalkhall.com), approximately 33 million people visit the arena each year, the majority of whom are assumed to be visiting specifically for the entertainment held within the building. The best vantage point of the ocean that was accessible to the public without a ticket to an event was from the open air stage adjacent to the southeast side of the building. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

4.5 THE WARNER THEATER (FAÇADE)

The Warner Theater façade is located along the boardwalk, between Michigan and Arkansas Avenues, Atlantic City, NJ (see **Figure 5**). The outer façade, which used to be the original entrance, is the only existing portion of the former theater. The much larger auditorium was demolished in 1960 (see **Appendix C**).



View of the Warner Theater (façade) – facing northwest

The façade now is part of the Bally's Wild West Casino. It is unlikely that visitors to the casino would specifically come to visit this façade. The ocean was visible from the boardwalk in front of the site. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

4.6 THE ABSECON LIGHTHOUSE

The Absecon Lighthouse is located at 31 South Rhode Island Avenue, Atlantic City, NJ (see **Figure 6**). This is the only historic place on the list that was not located within 500 feet of the ocean. It was chosen due to the fact that the observation deck is available to the public which provides a birds-eye view of the surrounding area.



View of the Absecon Lighthouse – facing southwest

According to their staff, approximately 20,000 people visited the lighthouse last year. They also stated that tourism to the lighthouse has been increasing each year and has nearly doubled in the last five years. The best vantage point of the ocean was from the observation deck over 160 feet in the air along the southern and southeastern sides of the tower. It is from this location in which the field photographs were taken. For more information regarding the history of this site, see **Appendix C.**

5.0 VIEWSHED RESULTS

The following sections summarize the results of the turbine overlays from each of the historical sites in which the turbines would be visible.

5.1 THE JOHN STAFFORD HISTORIC DISTRICT

The viewscape from the boardwalk at the end of all the streets associated with the John Stafford Historic District includes various structures typically seen along the NJ shore. High dunes and dune fencing, boardwalk associated railings and signs, lifeguard stations, and light poles are all visible (see **Appendix D, photos 1, 3, 5, 7, 9, 11, 13, and 15**). The turbines will be visible from the boardwalk at the end of each street, however the size of the turbines that far off the coast will appear to be smaller than many of the surrounding structures, including the life guard stations (see **Appendix D, photos 2, 4, 6, 8, 10, 12, 14, and 16**). In addition, it is believed that the turbines would not be visible from street level within the district; that the only observation point for the turbines is from the boardwalk which is just outside the district boundary.

5.2 THE RAPHAEL-GORDON HOUSE

The viewscape from the second story balcony of the Raphael-Gordon House (which is only accessible to the public upon a request to the owner) includes portions of another two-story building nearby and a large evergreen tree to the east (see **Appendix D, photo 17**). Only two turbines will be visible from the balcony; however, the size of the turbines that far off the coast will appear to be smaller than the surrounding building and tree (see **Appendix D, photo 18**).

The viewscape from the street level at the Raphael-Gordon House includes portions of another two-story building nearby, large evergreen tree trunks, high dunes, a light pole, and the adjacent roadway (see **Appendix D, photo 19**). Although four turbines will be visible from the street, the view of two of them is almost entirely blocked by the high dunes. Again, the size of the turbines

that far off the coast will appear to be smaller than the surrounding building, lightpole, and trees (see **Appendix D, photo 20**).

5.3 THE STRAND AND MARINE APARTMENTS

The viewscape from the boardwalk in front of the former Strand and Marine Apartment complex includes various structures typically seen along the NJ shore. High dunes and dune fencing, boardwalk associated railings, a pavilion, and light poles are all visible (see **Appendix D, photos 21 and 23**). Although the turbines will be visible from the boardwalk in front of the buildings, the majority of the turbine structures will be hidden by the high dunes in that area (see **Appendix D, photos 22 and 24**).

5.4 THE ATLANTIC CITY CONVENTION HALL

The viewscape from the stage in front of the Atlantic City Convention Hall building includes various pillars associate with the roof of the stage and high dunes typically seen along the NJ shore (see **Appendix D, photos 25, 27, and 29**). Although the turbines will be visible from the stage, the size of the turbines that far off the coast will appear to be much smaller than surrounding pillars (see **Appendix D, photos 26, 28, and 30**).

5.5 THE WARNER THEATER (FAÇADE)

The viewscape from the boardwalk in front of the Warner Theater façade includes structures typically seen along the NJ shore. High dunes and dune fencing, boardwalk associated railings and other public structures, a pier with large billboards attached to the side towards the south, light poles, and a life guard station are all visible (see **Appendix D, photos 31, 33, and 35**). Although the turbines will be visible from the boardwalk in front of the façade, the majority of turbine bases will be hidden by the high dunes in that area (see **Appendix D, photos 32, 34, and 36**). In addition, the size of the turbines that far off the coast will appear to be much smaller in comparison to many of the surrounding structures.

5.6 THE ABSECON LIGHTHOUSE

The viewscape from the Absecon Lighthouse public observation deck includes many structures typically seen within Atlantic City, NJ. Many high-rise buildings and smaller housing units, streets, parking lots, and construction equipment are all visible (see **Appendix D, photo 37**). Only one turbine will be visible from the observation deck of the Absecon Lighthouse; however, the size of the turbines that far off the coast will appear to be smaller than the surrounding buildings (see **Appendix D, photo 38**).

6.0 CONCLUSION

Based upon the photographs generated with the overlying depiction of the turbines and their respective size and location in relation to the various historically sensitive areas investigated as a part of this viewshed analysis, the conclusion is that the views of the turbines will not negatively affect the viewscape. The turbines will only be visible from six National and/or State Registered Historic Places between Ventnor City and Atlantic City, NJ. In all of these locations, the turbines in the horizon will appear as structures that will be much smaller in comparison to surrounding structures.

While not associated with the Viewshed Analysis, it is important to note that a public survey conducted by the William J. Hughes Center for Public Policy on behalf of FISHERMEN'S (see **Appendix E**) suggested that the potential view of the proposed project was not seen as an issue by the general public. The executive summary of their report reads as follows:

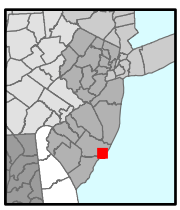
> *In preparation for a proposed wind turbine project approximately three miles off the Atlantic City, New Jersey shoreline, Fishermen's Energy, LLC, approached the William J. Hughes Center for Public Policy at The Richard Stockton College of New Jersey and asked that we undertake a statistically significant polling project that would measure attitudes and issues of both residents and visitors to the area. The intent was to:*
>
> 1. *Submit a specific project plan to the respondents;*
> 2. *Observe if there would be any substantial positive or negative impact on the area's tourism industry and/or the quality of life for residents;*
> 3. *Contrast where applicable the attitudes measured in a 2006 survey undertaken by the State of New Jersey Department of Commerce and note any changes.*
>
> *Following is a brief summary of the findings:*
>
> - *90% of the respondents were aware that electricity could be produced by using offshore wind turbines*

- *Support for a wind turbine project three miles off the Atlantic City shore is strong among all subgroups and almost 30 percentage points higher than a similar question asked in 2006*
- *Most respondents do not feel that this project would have a negative impact on Atlantic City and the local environment. In fact, 66% thought it would have a positive impact.*
- *More than three-quarters of the visitors said it would have no effect on whether or not they would visit the Atlantic City area and another 19% said that they would be a little or a lot more likely to visit the area.*

Based on those results, FISHERMEN'S believes that this 20 MW windfarm Project will be more likely to attract tourists, similar to the effect of the five-turbine windfarm operating on the grounds of the ACUA in Atlantic City. FISHERMEN'S believes the presence of the turbines off of Atlantic City will showcase Atlantic City's and New Jersey's commitment to renewable resources and will become a symbol for the City, while located far enough offshore to not be intrusive.

Figures





0 0.15 0.3 0.6 0.9 1.2 1.5 Miles

Legend

- Proposed cable route
- Proposed turbine locations
- (S) Huron substation

N W E S

DATA SOURCE: United States Geological Survey Quadrangles: Oceanville, New Jersey 1989; Atlantic City, New Jersey 1989

amec Earth & Environmental

Figure 1
Site Location Map
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey

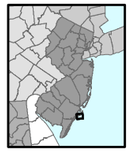
Reviewed By: PP	Contract Number: 7-7523-0002	April 2010

amec Earth & Environmental

Figure 2

Site Plans
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey

Reviewed By: CH	Contract Number: 7-7523-0002	Revised April 2010



Legend

- Proposed turbine locations
- Landfall location
- Huron substation
- Installation changeover point
- Proposed buoy location
- Proposed cable route - Horizontal directional drilling (HDD) installation
- Proposed cable route - Jet-plow installation

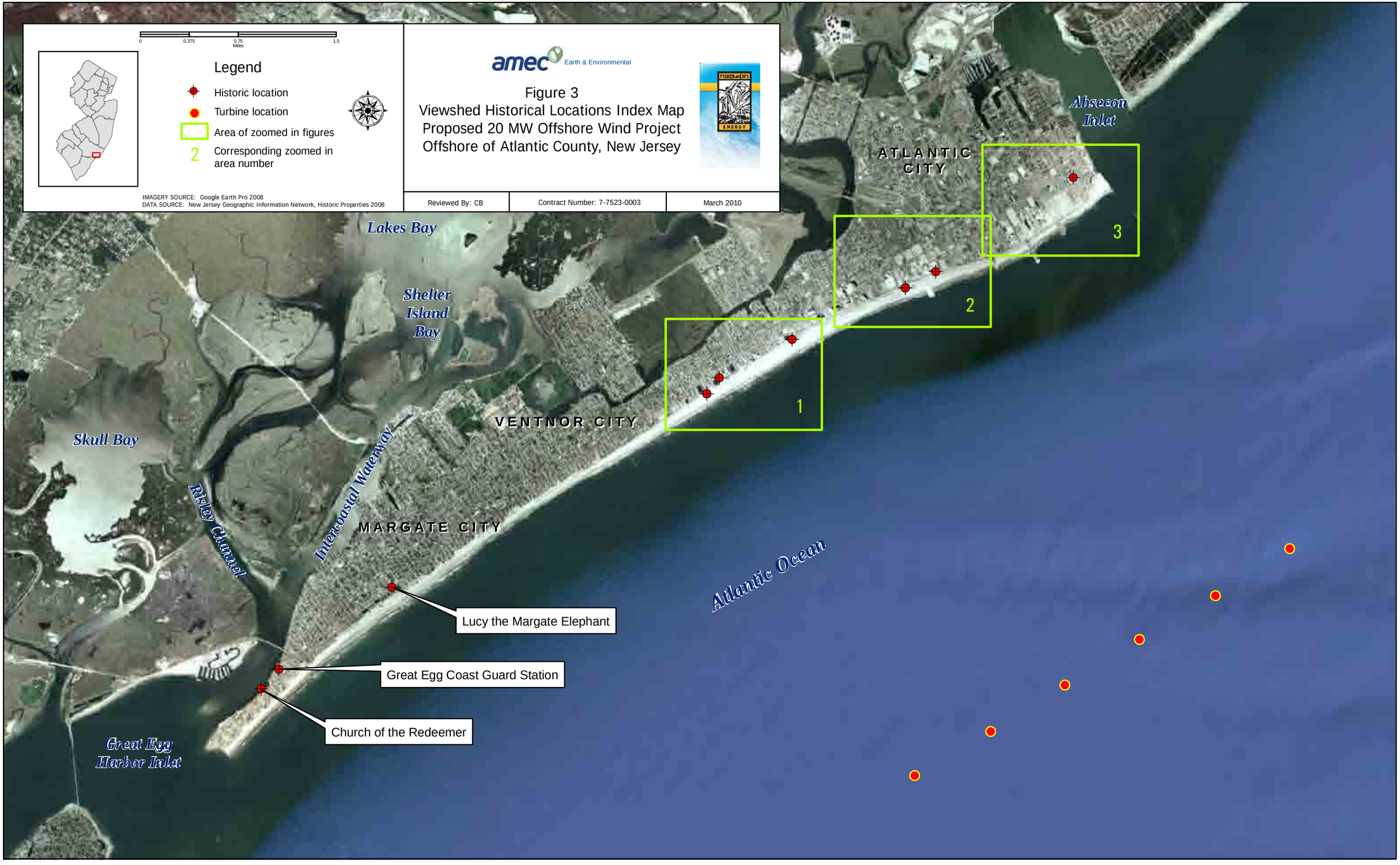
N W E S

Data source: Google Earth Pro 2009; 2009 Digital Globe; United States Geological Survey; United States Department of Agriculture; National Oceanic and Atmospheric Administration 2009.

Feature	Latitude (N)	Longitude (W)	State Plane NJ ft (X)	State Plane NJ ft (Y)	UTM Zone 18 (X)	UTM Zone 18 (Y)
Wind Turbine 1	39.2999	-74.4369	509979.27	169929.48	549070	4350509
Wind Turbine 2	39.3048	-74.4260	513053.18	171713.54	549887	4351013
Wind Turbine 3	39.3099	-74.4154	516054.26	173590.33	550709	4351518
Wind Turbine 4	39.3150	-74.4047	519078.95	175427.07	551528	4352023
Wind Turbine 5	39.3198	-74.3939	522148.68	177193.85	552345	4352526
Wind Turbine 6	39.3250	-74.3832	525152.27	179097.02	553161	4353029
Buoy location	39.3124	-74.4036	519404.95	174472.04	551418	4351610
Landfall location	39.3559	-74.4239	513630.63	190331.03	549631	4356433
Installation changeover location	39.3509	-74.4216	514302.15	188493.92	549839	4355874

Miles 0 0.125 0.25 0.5 0.75 1

Feet 0 1,250 2,500 5,000 7,500 10,000


0
0.375
0.75
Miles
1.5
Legend
Historic location
Turbine location
Area of zoomed in figures
2
Corresponding zoomed in area number
IMAGERY SOURCE: Google Earth Pro 2008
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Figure 3
Viewshed Historical Locations Index Map
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
Reviewed By: CB
Contract Number: 7-7523-0003
March 2010
Absecon Inlet
ATLANTIC CITY
Lakes Bay
Shelter Island Bay
VENTNOR CITY
Skull Bay
Risley Channel
Intercoastal Waterway
MARGATE CITY
Atlantic Ocean
Lucy the Margate Elephant
Great Egg Coast Guard Station
Church of the Redeemer
Great Egg Harbor Inlet
1
2
3


Intercoastal Waterway Inside Thorofare
Atlantic Ocean
WINCHESTER AVE
RALEIGH AVE
BARTRAM PL
KINGSTON AVE
TALLAHASSEE AVE
CLAYHAGY AVE
DELANCY PL
RICHMOND AVE
ELBERON AVE
DOVER AVE
RIDGEWAY AVE
ANNAPOLIS AVE
LINCOLN PL
ROOSEVELT PL
The Strand and Marine Apartments
NEWTON AVE
ABERDEEN PL
ATLANTIC AVE
PLAZA PL
BERKLEY SQ
BOARDWALK
CALLENDER AVE
OAKLAND AVE
HILLSIDE AVE
MARION AVE
AUSTIN AVE
BATON ROUGE AVE
JACKSON AVE
VASSAR SQ
Raphael-Gordon House
John Stafford Historic District
FRANKFORT AVE
WEYMOUTH AVE
LITTLE ROCK AVE
VICTORIA AVE
SURREY AVE
AMHERST AVE
NASHVILLE AVE
OAKLAND AVE
0
250
500
1,000
Feet
Legend
Historic location
Historic district
IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Viewshed Historical Locations - Area 1
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
FISHERMEN ENERGY
Reviewed By: CB
Contract Number: 7-7523-0003
March 2010


Intercoastal Waterway
TURNPIKE RD
NEVADA AVE
ARIZONA AVE
FAIRMOUNT AVE
GEORGIA AVE
ARCTIC AVE
ATLANTIC AVE
CALIFORNIA AVE
TEXAS AVE
BRIGHTON AVE
MORRIS AVE
IOWA AVE
BELMONT AVE
BELLEVUE AVE
FLORIDA AVE
PACIFIC AVE
Atlantic City Convention Hall
MISSISSIPPI AVE
COLUMBIA PL
MISSOURI AVE
ARKANSAS AVE
MICHIGAN AVE
OHIO AVE
INDIANA AVE
DR MARTIN LUTHER KING BLVD
ST JAMES PL
TENNESSEE AVE
OCEAN AVE
Warner Theatre (facade)
BOARDWALK
Atlantic Ocean
0
250
500
1,000
Feet
Legend
Historic location
IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Viewshed Historical Locations - Area 2
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
FISHERMEN'S ENERGY
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March 2010


Absecon Lighthouse
Atlantic Ocean
MASSACHUSETTS AVE
ATLANTIC AVE
PENNSYLVANIA AVE
DEWEY PL
ORIENTAL AVE
VERMONT AVE
RHODE ISLAND AVE
SEASIDE AVE
VICTORIA AVE
METROPOLITAN AVE
CONNECTICUT AVE
NEW JERSEY AVE
DELAWARE AVE
STATES AVE
MARYLAND AVE
VIRGINIA AVE
MANSION AVE
SOUTH CAROLINA AVE
OCEAN AVE
TENNESSEE AVE
ST JAMES PL
0
250
500
1,000
Feet
Legend
Historic location
IMAGERY SOURCE: New Jersey Geographic Information Network 2007
DATA SOURCE: New Jersey Geographic Information Network, Historic Properties 2008
amec Earth & Environmental
Viewshed Historical Locations - Area 3
Proposed 20 MW Offshore Wind Project
Offshore of Atlantic County, New Jersey
FISHERMEN'S ENERGY
Reviewed By: CB
Contract Number: 7-7523-0003
March 2010

Appendix D

Photograph Log and Key Map



Photo 1 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Austin Avenue - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34237
W -074.46662



Photo 2 – Ventnor City, NJ

Same photo as above with turbine position overlay.

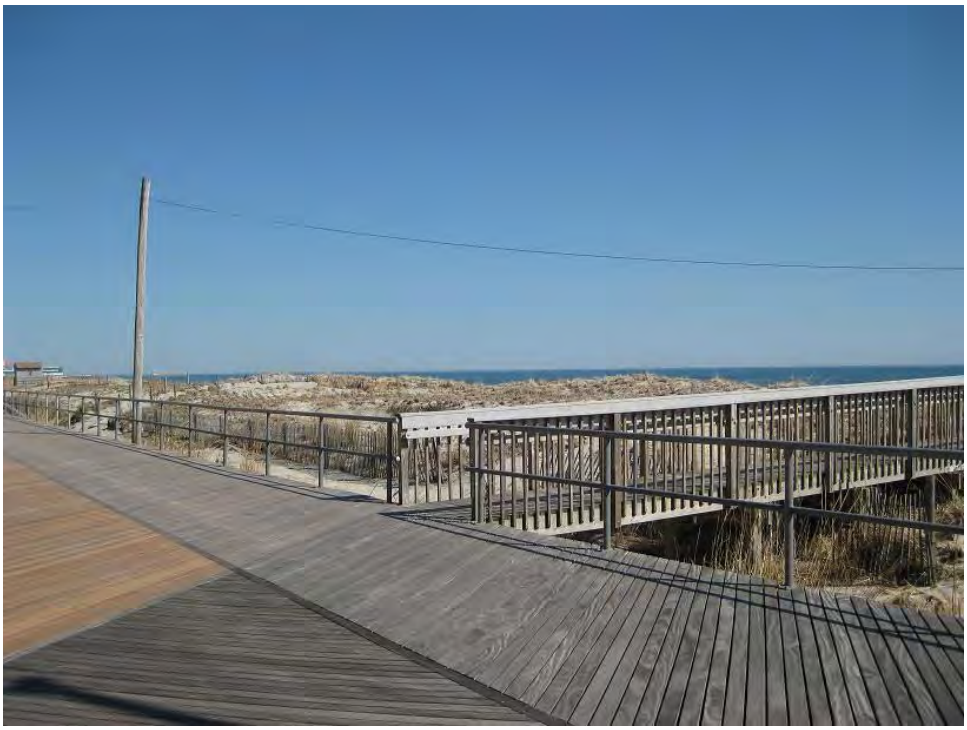


Photo 3 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Austin Avenue - facing E.

(This street is part of the John Stafford Historic District).

N 39.34237
W -074.46662

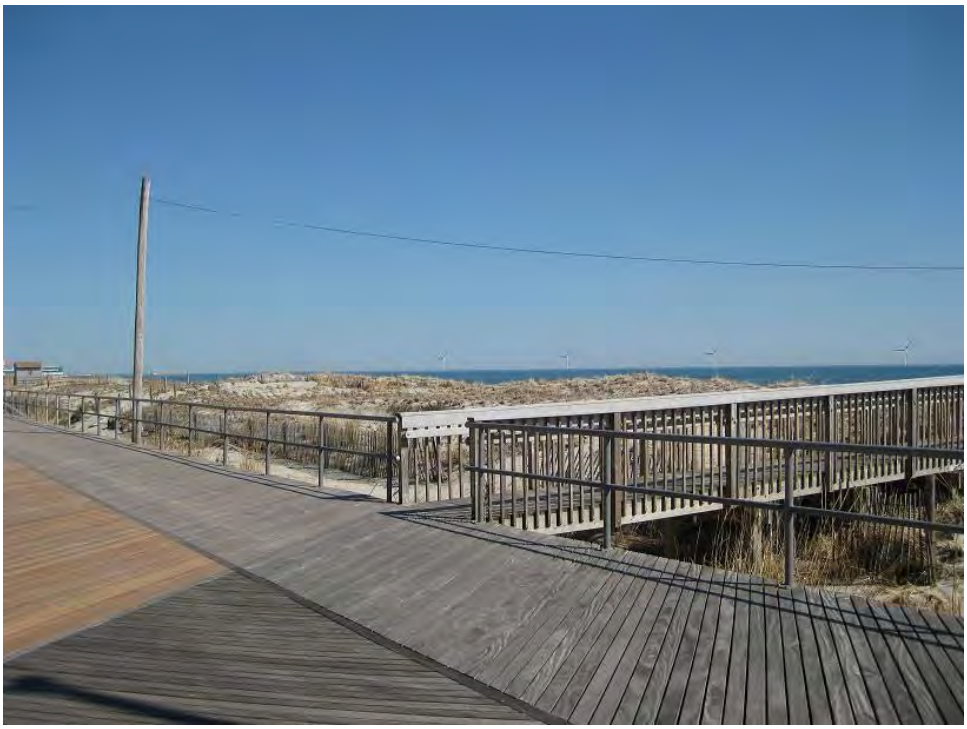


Photo 4 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 5 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Marion Avenue - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34262
W -074.46609



Photo 6 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 7 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Marion Avenue - facing E.

(This street is part of the John Stafford Historic District).

N 39.34262
W -074.46609



Photo 8 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 9 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Baton Rouge Avenue - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34284
W -074.46552



Photo 10 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 11 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Baton Rouge Avenue - facing E.

(This street is part of the John Stafford Historic District).

N 39.34284
W -074.46552



Photo 12 – Ventnor City, NJ

Same photo as above with turbine position overlay.

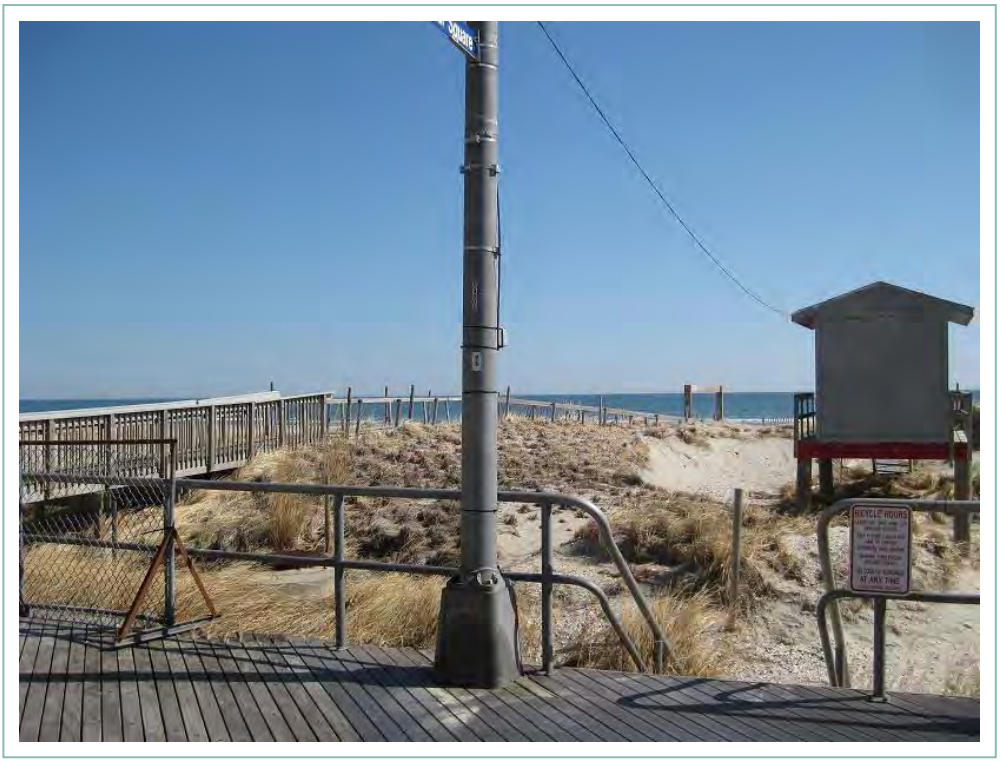


Photo 13 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Vassar Square - facing SE.

(This street is part of the John Stafford Historic District).

N 39.34308
W -074.46505



Photo 14 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 15 – Ventnor City, NJ

View from the boardwalk at the SE end of S. Vassar Square - facing E.

(This street is part of the John Stafford Historic District).

N 39.34308
W -074.46505



Photo 16 – Ventnor City, NJ

Same photo as above with turbine position overlay.



Photo 17 – Atlantic City, NJ

View from the 2nd story balcony of the Raphael-Gordon House - facing SE.

N 39.34409
W -074.46476



Photo 18 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 19 – Atlantic City, NJ

View from the SE corner of the Raphael-Gordon House property - facing SE.

N 39.34408
W -074.46472



Photo 20 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 21 – Atlantic City, NJ

View from the boardwalk at the SE faces of the former Strand and Marine Apartments - facing SE.

N 39.34826
W -074.45434



Photo 22 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 23 – Atlantic City, NJ

View from the boardwalk at the SE faces of the former Strand and Marine Apartments - facing E.

N 39.34826
W -074.45434



Photo 24 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 25 – Atlantic City, NJ

View from the stage in front of the former Atlantic City Convention Hall - facing S.

(The building is now the "Boardwalk Hall" arena)

N 39.35376
W -074.43798



Photo 26 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 27 – Atlantic City, NJ

View from the stage in front of the former Atlantic City Convention Hall - facing SE.

(The building is now the "Boardwalk Hall" arena)

N 39.35376
W -074.43798



Photo 28 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 29 – Atlantic City, NJ

View from the stage in front of the former Atlantic City Convention Hall - facing E.

(The building is now the "Boardwalk Hall" arena)

N 39.35376
W -074.43798



Photo 30 – Atlantic City, NJ

Same photo as above with turbine position overlay.

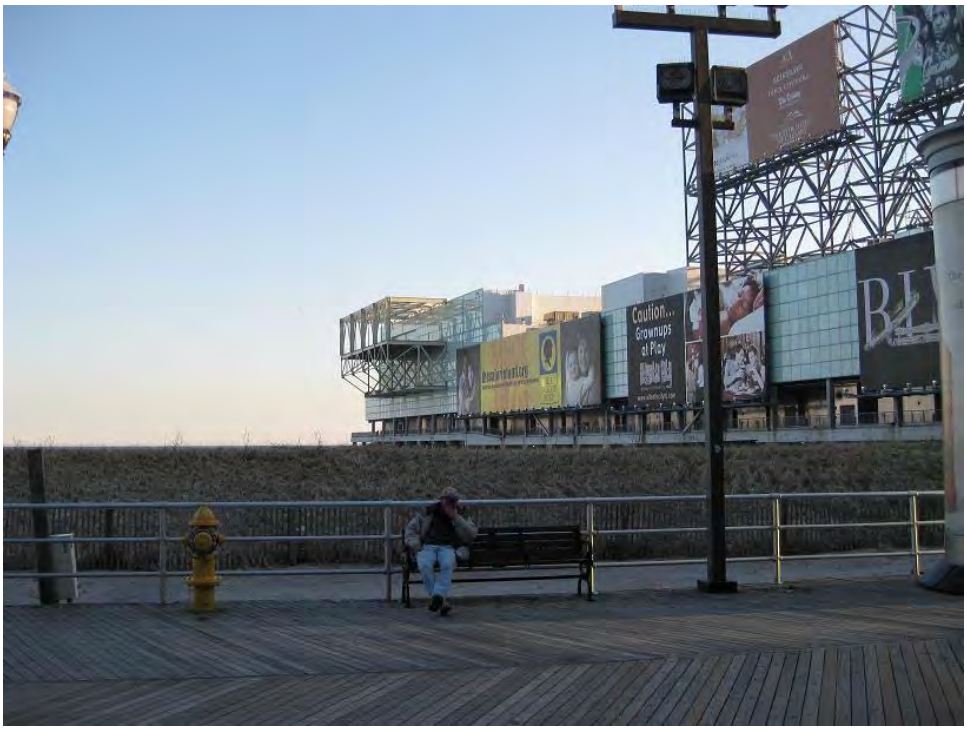


Photo 31 – Atlantic City, NJ

View from the boardwalk at the base of the Warner Theatre façade - facing S.

(Façade is now part of the Bally's Hotel and Casino)

N 39.35528
W -074.43387

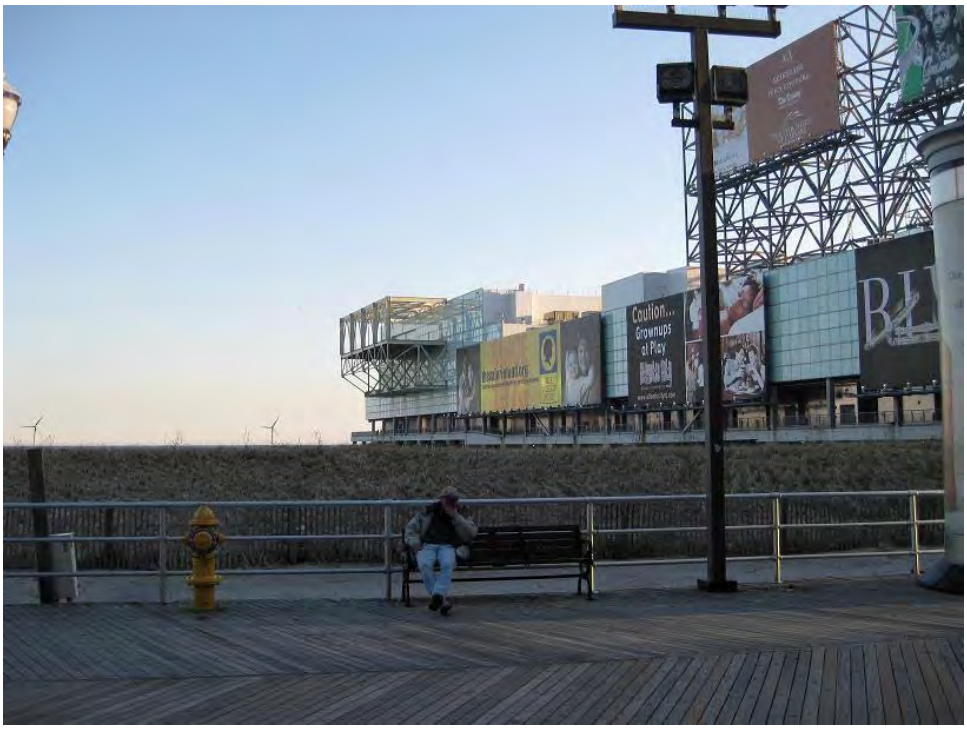


Photo 32 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 33 – Atlantic City, NJ

View from the boardwalk at the base of the Warner Theatre façade - facing SE.

(Façade is now part of the Bally's Hotel and Casino)

N 39.35528
W -074.43387



Photo 34 – Atlantic City, NJ

Same photo as above with turbine position overlay.

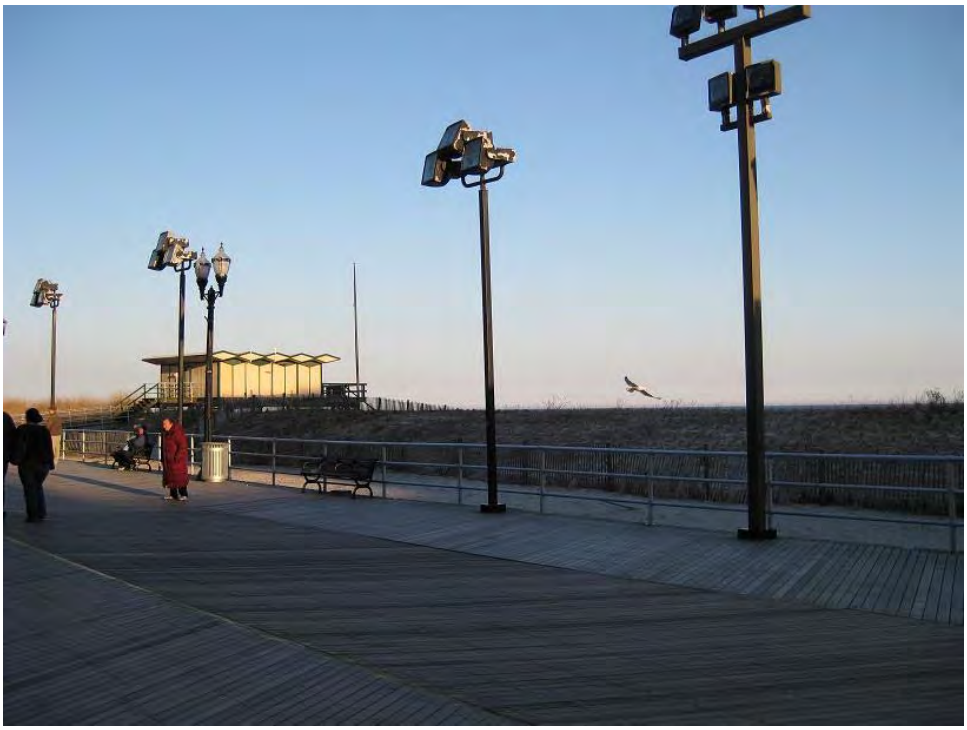


Photo 35 – Atlantic City, NJ

View from the boardwalk at the base of the Warner Theatre façade - facing E.

(Façade is now part of the Bally's Hotel and Casino)

N 39.35528
W -074.43387

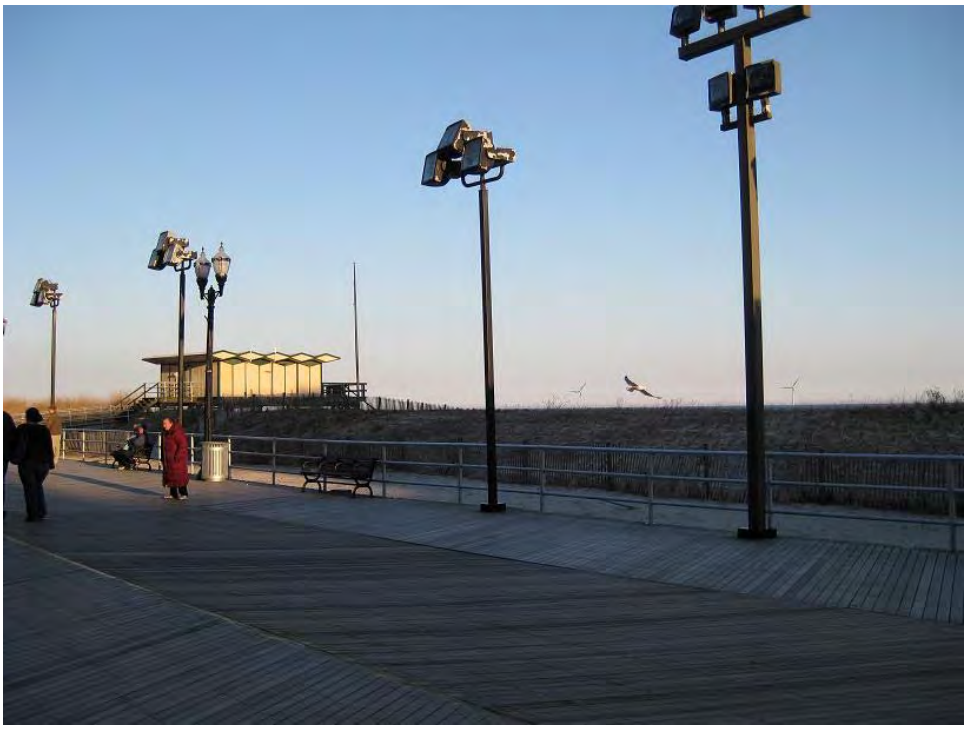


Photo 36 – Atlantic City, NJ

Same photo as above with turbine position overlay.



Photo 37 – Atlantic City, NJ

View from the lookout platform on top of the Absecon Lighthouse - facing S.

N 39.36634
W -074. 41414



Photo 38 – Atlantic City, NJ

Same photo as above with turbine position overlay.

Department of Energy
Golden Field Office
15013 Denver West Parkway
Golden, Colorado 80401

February 23, 2015

Eric Schrading
Field Office Supervisor
U.S. Fish and Wildlife Service
New Jersey Field Office
Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232

SUBJECT: DOE and USACE Request for Re-Initiation of the Section 7 Endangered Species Act Informal Consultation for Fishermen's Atlantic City Windfarm, LLC

Dear Mr. Schrading:

The U.S. Department of Energy (DOE) is proposing to provide funding to Fishermen's Atlantic City Windfarm, LLC (project proponent) to support the development of an offshore wind renewable energy facility (proposed project) within New Jersey state waters, located approximately 2.8 miles off the New Jersey coast from Atlantic City. The U.S. Army Corps of Engineers, Philadelphia District (USACE) has regulatory and permitting authority for this proposed project under Section 404 of the *Clean Water Act* and Section 10 of the *Rivers and Harbors Act of 1899*. The USACE issued Department of the Army Permit CENAP-OP-R-2008-0777-39 for this proposed project on June 14, 2013. Since issuance of the USACE permit, the project plans have been refined and a permit modification package has been submitted to the USACE. The USACE is proposing to process a modification to that permit.

The proposed project would consist of the construction, operation, maintenance, and eventual decommissioning of up to six wind turbine generators that would generate a maximum of approximately 25 megawatts (MW) of electricity, a 33-kilovolt (kV) alternating current (AC) submarine cable interconnecting the turbines, a 33-kV AC submarine transmission cable (export cable), and a 33-kV AC underground cable (onshore interconnection cable) that would connect the proposed project with existing onshore infrastructure in Atlantic City, New Jersey.

The following federally listed species could potentially be impacted by the proposed project: roseate tern (*Sterna dougallii dougallii*) (endangered), piping plover (*Charadrius melodus*) (threatened), red knot (*Calidris canutus rufa*) (threatened), northern long-eared bat (*Myotis septentrionalis*) (candidate) and, seabeach amaranth (*Amaranthus pumilus*) (threatened).

The USACE previously completed consultation pursuant to section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), with your office for permitting of the proposed project and determined that the proposed project is not likely to adversely affect any species listed as threatened or endangered under your jurisdiction. This determination was based on a biological assessment submitted during the consultation process. On April 26, 2012 your office concurred with this determination. A copy of this concurrence is attached (Enclosure 1). Since this concurrence, the following changes have occurred:

- A permit modification package has been submitted to the USACE. The USACE plans to issue a Public Notice to solicit comments and recommendations from the public concerning modification of the Department of the Army permit. The USACE will include your office on the distribution list to be notified when the Public Notice is published.
- The red knot has been listed as threatened and the northern long-eared bat has been listed as a candidate species under the ESA.
- DOE is completing an Environmental Assessment (EA) for the proposed project under the National Environmental Policy Act (NEPA) and the USACE is a cooperating agency. DOE will include your office on the distribution list to be notified when the draft EA is posted for the public comment period.

To streamline the NEPA process and to avoid redundancy, DOE and USACE have decided to jointly re-initiate Section 7 consultation for the proposed project. An *Addendum to the 2009 Avian Risk Assessment for the Fishermen's Energy Wind Project, Atlantic County, New Jersey: Impacts of Rotor Diameter Change to Listed Red Knots and Other Birds* is attached for your use (Enclosure 2). Also attached is *An Evaluation of the Potential for Impact to the Northern Long-Eatred Bat (Myotis septentrionalis)* (Enclosure 3). Both assessments address the modifications to the proposed project that have occurred since the completion of the initial USACE led Section 7 consultation and the potential effects of the proposed project modifications on the listed species.

DOE, as the lead federal agency and USACE, as the permitting agency, have reviewed the proposed project changes and the two assessments and determined that their respective actions of funding and modifying the permit for the proposed project *may affect but is not likely to adversely affect* the following listed species: roseate tern (*Sterna dougallii dougallii*) (endangered), piping plover (*Charadrius melodus*) (threatened), red knot (*Calidris canutus rufa*) (threatened), northern long-eared bat (*Myotis septentrionalis*) (candidate) and, seabeach amaranth (*Amaranthus pumilus*) (threatened) with the inclusion of the Department of the Army special permit conditions 29-33 (Enclosure 4).

DOE and USACE respectfully request your concurrence with their determination. Please send any correspondence to:

U.S. Department of Energy
Golden Field Office
Attn: Ms. Lori Gray
NEPA Division Director
15013 Denver West Parkway
Golden, CO 80401

U.S. Army Corps of Engineers
Regulatory Branch, Philadelphia District
Attn: Mr. Lawrence M. Slavitter
Wanamaker Building
100 Penn Square East
Philadelphia, PA 19107-3390

If you have any questions or require any additional information, please contact me at (720)356-1568 or lori.gray@ee.doe.gov or Larry Slavitter, USACE at 215-655-6734 or Lawrence.M.Slavitter@usace.army.mil.

Sincerely,

Lori Gray

Lori Gray
NEPA Division Director

Enclosures: as stated

Electronic cc:
Wendy Walsh, NJFO
Carlo Popolizio, NJFO
Lori Gray, DOE
Michael Hahn, DOE
Roak Parker, DOE
Lawrence M Slavitter, USACE

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New Jersey Field Office
Ecological Services
927 North Main Street, Building D
Pleasantville, New Jersey 08232
Tel: 609/646 9310
Fax: 609/646 0352
http://www.fws.gov/northeast/njfieldoffice/

In Reply Refer To:
2010-CPA-0267

Frank J. Cianfrani, Chief
Regulatory Branch, Philadelphia District
U.S. Army Corps of Engineers
Wanamaker Building, 100 Penn Square East
Philadelphia, Pennsylvania 19107-3390
ATTN: Mr. Lawrence Slavitter

APR 26 2012

Subject: Conclusion of Endangered Species Act Consultation for the Fishermen's Energy of New Jersey LLC (applicant) proposed wind energy facility approximately 2.8 miles east of Atlantic City, Atlantic County, New Jersey

Dear Mr. Cianfrani:

The U.S. Fish and Wildlife Service (Service) has reviewed your April 11, 2012 letter regarding the subject project. Fishermen's Energy of New Jersey, LLC, has applied to the U.S. Army Corps of Engineers, Philadelphia District (Corps) for a Department of the Army Standard Permit to install six (6) wind turbines, static rock scour protection, and submarine electric transmission cables at a site approximately 2.8 nautical miles east of Atlantic City, Atlantic County, New Jersey. The Corps has Federal jurisdiction over the proposed work under Section 10 of the Rivers and Harbors Act (30 Stat. 1151, as amended; 33 U.S.C. 403 *et seq.*) and Section 404 of the Clean Water Act (33 U.S.C. 1344 *et seq.*). This letter is provided pursuant to Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA). Federally listed and candidate (L/C) species potentially present in the project's action area include roseate tern (*Sterna dougallii dougallii*) (endangered), piping plover (*Charadrius melodus*) (threatened), red knot (*Calidris canutus rufa*) (candidate), and seabeach amaranth (*Amaranthus pumilus*) (threatened).

CONSULTATION HISTORY

August 27, 2010	The Corps issued a Public Notice describing the proposed project.
September 22, 2010	Via letter, the Service provided the Corps with a list of L/C species that may occur in the action area; stated that we could not concur with the Corps' determination that the project was not likely to adversely affect federally listed species; and requested additional information, monitoring, and conservation measures for listed and other avian species.

June 13, 2011	Via email, the Service was provided with a document entitled *Avian Risk Assessment for Fisherman's Energy Atlantic City Offshore Project Atlantic City New Jersey 2008,2009,2010-2011*, dated June 8, 2011.
July 25, 2011	The Corps forwarded a revised proposal submitted by the applicant where the turbines would be constructed using a jacketed foundation as opposed to a monopole foundation.
August 2, 2011	The applicant supplied the Corps and the Service with a document entitled *Avian, Sea Turtle and Marine Mammal Summary Data May 2010 - May 2011*, dated June 7, 2011. This document summarized the findings of a 1-year site-specific study performed by the applicant, and a 2-year study performed by the New Jersey Department of Environmental Protect (NJDEP) concerning avian use of the site.
October 20, 2011	Via letter, the Service recommended that the Corps prepare a Biological Assessment (BA) for this project.
December 19, 2011	The Corps, the Service, and the applicant met to discuss the Service's request for a BA.
February 14, 2012	Via email, the Corps transmitted the final BA, which was prepared by the applicant and dated January 20, 2012.
February 24, 2012	Via letter, the Service indicated that there were some omissions in the BA, but did not recommend that the applicant undertake extensive revisions to the BA. Instead, we recommended that the Corps supplement with BA via letter.
April 11, 2012	Via letter, the Corps provided all the supplemental information requested by the Service, and concluded that the proposed project is not likely to adversely affect any threatened, endangered or candidate species.

SUPPLIMENTAL INFORMATION

Your April 11, 2012 letter notes the Service's concerns that the applicant's and NJDEP's boat-based surveys of the proposed turbine area had a very low probability of detecting L/C bird species. In your letter, the Corps concurred with the Service's view that, while beneficial, the boat-based studies cannot be used to exclude the possibility that L/C species may pass through the turbine area during their spring and fall migrations. Your letter goes on to summarize geolocator and other studies that collectively constitute the best available information regarding the likelihood of L/C bird species passing through the project area and/or being impacted by the turbines. Finally, your letter corrects a few factual errors in the BA. The Service appreciates the Corps' cooperation and effort to fully evaluate project impacts using best available science.

CONSERVATION MEASURES

Your April 11, 2012 letter includes a number of Conservation Measures for L/C species that will be included as permit conditions.

Seabeach Amaranth

If maintenance work is required, between May 15 and November 30 of any year, that would disturb the beach/dune areas east of Tennessee Avenue and landward of mean high water, a survey of the beach/dune area for the presence of seabeach amaranth shall be performed and the results sent to the Corps and the Service for review. No work shall be performed in the beach/dune areas until written approval is received by the permittee from this office.

Roseate Tern, Piping Plover and Red Knot

None of the lighting on the towers shall operate/illuminate in a continuous fashion unless specifically directed by the U.S. Coast Guard and/or the Federal Aviation Administration. Unless required, any continuously operating/illuminating light shall be repaired or replaced within 7 days of being detected.

The windfarm and all related support systems will be monitored and maintained 24/7 by personnel manning the land-based facility control center. On-duty personnel will be responsible for monitoring visibility forecasts distributed by the National Weather Service, as well as data received from the onsite visibility sensing system.

All turbines shall be shut down between March 15 and June 15 and between August 1 and October 31 of any year, if either or both of the following threshold weather conditions occur.

- If visibility in the area is less than 0.6 miles.
- If overcast sky is at or below the top of the turbine rotor sweep (500 feet above mean high water).

Shutdowns will be managed as follows.

- If the forecast for the project area does not anticipate weather conditions to drop below the above-referenced thresholds, but the turbine sensors on site detect poor visibility conditions for more than 2 consecutive hours, the turbines will be shut down until such time that the conditions improve to above-threshold levels for 2 consecutive hours.
- If the forecast for the project area does anticipate weather conditions to drop below the above-referenced conditions for a period of greater than 6 hours, the turbines will be shut down as soon as the sensors on site detect poor visibility conditions at the turbine field. Once site conditions have improved to above-threshold levels for 2 consecutive hours, the turbines may be restarted.

The applicant will schedule yearly meetings every January among the permittee, the Service, and the Corps. The annual meetings will be held for a minimum of 5 years to discuss the requirement for weather-related shutdowns and if the above-referenced protocols should be modified. At least 30 days prior to the meeting, the permittee shall supply both the Corps and the Service detailed logs on when the turbines were shut down, what conditions prompted each shutdown, and how long each shutdown lasted.

Post-construction monitoring of the turbines shall be performed as outlined in the document entitled *Post - Construction Avian, Bat and Marine Mammal Studies Fishermen's Energy State Waters Wind Power Project*, prepared by Geo-Marine Incorporated, Curry and Kerlinger, LLC and North East Ecological Services, dated February 28, 2012. All reports as noted in the document shall be supplied to the Corps, the Service, and the National Marine Fisheries Service for review. The Corps reserves the right to modify the stipulations in this document, including the time frame for acquiring data, based on the information submitted for review. [Please note that the Service has transmitted comments on the revised post-construction monitoring plan via email. A copy of our comments is enclosed.]

CONCLUSION

The Service appreciates the Corps' cooperation and effort to fully evaluate and minimize project impacts. Based on the analysis in your April 11, 2012 letter, background information contained in the BA, and the above Conservation Measures, the Service concurs with your determination that the proposed Fishermen's Energy project is not likely to adversely affect the roseate tern, piping plover, red knot, or seabeach amaranth. Other than these species, no other federally listed or proposed endangered or threatened flora or fauna under Service jurisdiction are known to occur within the vicinity of the proposed project site. If additional information on federally listed species becomes available, or if project plans change, this determination may be reconsidered.

Please contact Wendy Walsh at (609) 383-3938, extension 48, if you have any questions regarding federally listed or candidate species. For other issues and project coordination, please contact Carlo Popolizio, extension 32.

Sincerely,

J. Eric Davis Jr.

J. Eric Davis Jr.
Field Supervisor

EMAIL DISTRIBUTION

SUBJECT:
Fishermen's Energy – Concluding ESA Consultation

TO:
Corps, Sam Reynolds, Samuel.L.Reynolds@usace.army.mil

CC:
Corps, Larry Slavitter, Lawrence.M.Slavitter@usace.army.mil
NJFO, Eric Davis, eric_davis@fws.gov
NJFO, Ron Popowski, ron_popowski@fws.gov
NJFO, Carlo Popolizio, carlo_popolizio@fws.gov
NJFO, Wendy Walsh, wendy_walsh@fws.gov
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RO, Keith Hastie, Keith_Hastie@fws.gov
NEFO, Susi vonOettingen, Susi_vonOettingen@fws.gov
DLUR, Janet Stewart, Janet.Stewart@dep.state.nj.us
ENSP, Christina Davis, ckisiel@hughes.net

Enclosure - U.S. Fish and Wildlife Service Comments on the *Post - Construction Avian, Bat and Marine Mammal Studies Fishermen's Energy State Waters Wind Power Project*, prepared by Geo-Marine Incorporated, Curry and Kerlinger, LLC and North East Ecological Services, dated February 28, 2012
(Previously transmitted via email on March 19, 2012)

Page 6: Acoustic bird data to be collected from the MET buoy will not cover summer use of the project site, although some summer use would be covered by boat surveys. We recommend synchronizing the two data gathering efforts for comparison.

Acoustic bird data to be collected from the MET buoy will not cover the fall migration of piping plovers. At a minimum, data gathering should commence on August 1.

Page 8: Fishermen's Energy presents two alternative thermal imagery techniques: fish eye lens and standard. Fishermen's Energy stated that standard thermal energy cameras would be placed at the northernmost and southernmost turbines, running concurrently. They also stated that the fish eye camera, if implemented, would be placed on the southernmost turbine during spring and the northernmost during fall. Fishermen's Energy needs to clarify whether the fish eye camera would (1) replace the standard camera, (2) be placed along the standard cameras working concurrently, or (3) operate on the northernmost turbine concurrently with standard cameras on the southernmost turbine, and operate on the southernmost turbine concurrently with standard cameras on the northernmost turbine.

Thermal imagery may be the only technique available to document bird collision or close encounter with the turbines at the southern and northern end. Thermal imagery should run year-round or at least also during the summer to document any impacts to resident birds.

Addendum to the 2009 Avian Risk Assessment for the Fishermen's Energy Wind Project, Atlantic County, New Jersey: Impacts of Rotor Diameter Change to Listed Red Knots and Other Birds

February 19, 2015

Prepared by:

Paul Kerlinger, Ph.D.
Curry & Kerlinger, LLC
1734 Susquehannock Drive
McLean, VA 22101

Prepared for:

Fishermen's Energy

Introduction

Fishermen's Energy (FE) has applied for and received permits to construct a small, demonstration wind project in the Atlantic Ocean about 2.8 miles offshore of Atlantic City, Atlantic County, New Jersey. The project is within state waters of New Jersey and will have five or six turbines. For the permitting process, Curry & Kerlinger, LLC provided an avian risk assessment (Kerlinger and Guarnaccia 2009) in which it was concluded that project impacts to birds would be minor and not be biologically significant. It was concluded that while small numbers of birds would be killed or displaced by the construction, the operations of the FE wind plant would not cause significant impacts to the populations of the species involved.

Recently, FE has changed the dimensions and specifications of the turbines that were originally permitted for their project. This addendum was written to answer an inquiry from the U.S. Army Corps of Engineers (USACE) about how the changes in turbine dimensions and specifications will impact newly listed Red Knots (Threatened), as well as updating the 2009 Kerlinger and Guarnaccia risk assessment regarding risk to Red Knots. Specifically the USACE asked: "how the change in height would affect avian species, including the now Federally listed Red Knot" and to "discuss the modification request with respect to potential impacts to avian species." The sections below address or provide answers to these questions and information regarding risk to newly listed Red Knots and birds species that are not listed. They include:

- How turbine number changes and dimension modifications change the original avian risk assessment;
- An update of what has been learned about collision fatalities at wind plants since the 2009 avian risk assessment was prepared;
- A summary of the results of the New Jersey DEP two-year offshore baseline study and the Fishermen's Energy two-year field study;
- An overview of behavior and ecology of during spring and fall migration, with focus on southern New Jersey;
- A summary of the most important threats to this and other species in southern New Jersey;
- A summary update of fatality impacts to non-listed birds; and
- A synthesis of the above with conclusions about risk to Red Knots and other birds.

Turbine Dimension Modifications

Modifications to turbine dimensions and specifications originally permitted are being made by FE. The 2009 Guarnaccia and Kerlinger avian risk assessment was conducted to evaluate the potential for collision fatalities and displacement caused by an offshore wind project consisting of nine turbines with specifications and dimensions as provided in Table 1 as opposed to the six turbines now being proposed.

For the original risk assessment, it was assumed that the towers on which the nacelle and rotors would be mounted would be 80-100 m in height, with a rotor diameter of 90-126 m (Table 1). Thus, the rotor height assumed in the avian risk assessment was between a minimum of about 17 m (55') above the water to a maximum of 163 m (535'). Note that the newly proposed turbine blade height would extend from 80' to 507' above mean high water.

Thus, the specifications and dimensions used for the original analysis were for turbines that could extend to higher above the water and closer to the water than the newly proposed turbines (Table 1). This would be the case if taller towers were used with larger rotors or with shorter towers and longer rotors. In that earlier analysis, we assessed risk for a range of turbine tower heights and rotor diameters to provide a conservative risk assessment for the project.

There is one difference between the turbine dimensions and specifications used in the Guarnaccia and Kerlinger (2009) risk assessment and the new turbine modification. With the original risk assessment the maximum rotor diameter was 413', which is 13' smaller than the new rotor diameter of 426'. This would mean an increase in rotor swept area of 12,469 m^2 to 13,273 m^2, which would be an increase of 804 m^2. Thus, rotor swept area is the only specification or dimension that increases in a way that could potentially increase risk and that increase amounts to about 6.5% greater rotor swept area.

Turbine Specifications	**2009 Avian Risk Assessment Turbine Specifications**	**Existing Permitted Conditions**	**New Turbine Modification**
Hub Height	80-100 m (262-328')	306' above MHW	294' above MHW
Rotor Diameter	90-126 m (295-413')	384'	426'
Blade Length	45-113 m (148-207')	192' above MHW	65 m (213') 213' above MHW
Maximum Height of Blade	152 m (502')	494' above MHW	507' above MHW
Minimum Height of Blade	27 m (89')	117' above MHW	80' above MHW
Number of Turbines	9	6	6

Table 1. Comparison of the modified turbine specifications and dimensions as of January 2015 with turbines used in the Guarnaccia and Kerlinger (2009) avian risk assessment.

Perhaps most important for determining risk with newly modified turbine specifications and dimensions is the fact that the original 2009 (Guarnaccia and Kerlinger) avian risk assessment was for nine turbines and the recent modification included only six turbines. This is a reduction of about 33% in number of obstacles that will be present at the project site. Because absolute numbers of fatalities are most often correlated with number of turbines, risk to Red Knots and other birds would actually be reduced, even with the minor increase in rotor swept area. Thus, the collision risk as assessed in the original risk assessment by Guarnaccia and Kerlinger (2009) is not changed by the turbine modification now being proposed and it is possible that collision risk will be lower because of fewer obstacles.

With respect to displacement by turbines, the fact that there will be a smaller footprint in the ocean resulting from fewer turbines, even with slightly greater rotor swept area, strongly suggests that this type of risk is likely to be less than assessed in the original avian risk assessment.

To conclude, neither collision fatalities nor displacement impacts from turbines with modified dimensions will cause biologically significant impacts to birds. This is in agreement with the original risk assessment by Guarnaccia and Kerlinger (2009).

Update of Literature on Post-construction Fatality Studies

The 2009 risk assessment by Guarnaccia and Kerlinger for the FE wind project summarized both the European and North American literature on impacts to various types of birds, including Red Knot, which was at that time a listed species in New Jersey, but had not yet been listed federally.

Overall, shorebirds have rarely been impacted by wind turbines and we could not find anything that suggests a Red Knot had been killed by a wind turbine anywhere in the United States or Canada. The rates of fatalities at wind turbines have averaged about six birds per turbine per year in the United States as of 2013 (Loss et al. 2013) and about eight birds per year at turbines in Canada as of that year (Zimmerling et al. 2013). These studies examined fatalities at more than 100 different wind turbine facilities in these countries, including sites distributed from the west coast to the east coast.

Unfortunately, neither the Loss et al. nor the Zimmerling et al. papers provide a list of the species killed, although we have perused many of the fatality lists and anecdotally there did not seem to be any Red Knots killed by turbines. However, a consortium of agencies and non-profits have put together a list of birds killed at wind turbines in Canada. That compilation of fatalities was assembled and is updated annually by Bird Studies Canada, Environment Canada (Canadian Wildlife Service), Ontario Ministry of Natural Resources, and the Canadian Wind Energy Association. The database includes all bird carcasses recovered under wind turbines during

fatality studies at 50 different wind projects in that country as of December 2013. Note that Red Knots must traverse various parts of Canada during both spring and fall migration and to do so, they must fly over or near about 40 wind plants in eastern Canada, some of which are situated near the shorelines of the Great Lakes. This is significant because these birds sometimes (rarely) make stopovers on the shores of these lakes.

Unfortunately, there is no comparable database in the U.S. as the U.S. Fish and Wildlife Service, American Wind Energy Association, state wildlife agencies and other agencies simply do not collect such data despite their immense efforts to protect birds by regulating wind energy. Actually, one state agency (Pennsylvania Game Commission) has such a database because post-construction studies are mandatory in that state, but they have made the database confidential. The American Wind Wildlife Institute is currently attempting to assemble a list like the Canadian list.

The Canadian summary includes a list of all fatalities found at the 50 Canadian wind energy sites studied. Each study was conducted during a minimum of one year and some were studied for three years or more. When all years in the database were summed, the total was 86 years of post-construction study. Thus, individual turbine fatality searches probably exceed 75,000. The fatality list included 1,744 carcasses of 144 species. Six projects studied were in Nova Scotia, Prince Edward Island, and Labrador, which have Atlantic coastlines and are within the migration range of Red Knots. There were also six or seven that were conducted at wind turbines along the coastlines of the Great Lakes (turbines within 200 m to 3 km from coastlines). Although Red Knots seldom stopover along those coastlines, other shorebirds do make stopovers in significant numbers along the shorelines of the Great Lakes, as well as in Atlantic coast provinces (listed above).

Of the 1,744 carcasses found, none was a Red Knot. Thus, there is no evidence that this species has been killed by a wind turbine in Canada.

Because of similar behavior during migration and stopovers, *Calidris* (same genus as Red Knot) and other sandpipers may serve as surrogates for Red Knot in a way that might be indicative of the degree of risk to that listed species. Of the 1,744 carcasses found in the Canadian studies, 27 were shorebirds of four species. This does not include American Woodcock and Wilson's Snipe, which are shorebirds, but are found nesting at or near many of the Canadian wind projects, unlike Red Knot and most other sandpipers which nests in the Arctic tundra. Thus, migrant shorebirds similar to Red Knots account for only about 1.5% or less of the fatalities at Canadian wind plants. It is notable that the four sandpiper species make stopovers or nest inland in the vicinity of lakes and ponds that are close to these inland and Great Lakes wind turbines, which Red Knots do not. Overall, the Canadian dataset does not suggest significant or any notable risk to Red Knots at wind turbines.

Three data sets from the United States demonstrate that Red Knots do not appear to be at risk and that shorebirds in general are not at significant risk of colliding with wind turbines. The National Research Council (2007) volume on environmental impacts of wind turbines shows that only about 0.7% of fatalities at wind turbines are shorebirds. This includes woodcock and snipe which nest inland and are often found nesting or foraging near wind turbines, unlike Red Knots.

Although there are very few turbine projects that are situated on or near tidal marshes, there is one, five turbine project on the east coast that is situated in a large set of marshes that include one of the premier stopover sites in eastern North America for migrating shorebirds. The Atlantic County Utilities Authority (ACUA) turbines are within 50 m of tidal areas and are only four miles from the Forsythe National Wildlife Refuge and various state wildlife management areas. In three years of post-construction searches, only two shorebirds were found dead, and only one was a *Calidris* species (same genus as Red Knot). No Red Knots were found dead. Thus, wind turbines built within prime shorebird migratory stopover habitat and close to massive concentration areas for these birds had minimal and not significant impact to the species that used this area.

An unpublished survey of 27 different wind energy facilities in the eastern U.S. and two from Canada, also demonstrates that very few shorebirds are killed by wind turbines. Kerlinger and Guarnacchia (2014 unpublished) assembled a species list from these studies, which totaled nearly 42,000 individual turbine searches, which were conducted during up to three years post-construction at the individual sites. Of the ~1,150 carcasses found in all the studies, four (0.0034%) were Calidris sandpipers and none were Red Knots. Again, the suggestion is that risk to shorebirds is absolutely minimal. There was also no suggestion of risk to Red Knots, which fly over large areas including sites where turbines are located.

In summary, more than 100 empirical studies at onshore wind facilities in the United States and Canada have demonstrated that there have not been significant impacts to shorebirds, nor have Red Knots been impacted. Because there are no offshore facilities or post-construction studies in North America, we have only the onshore studies to rely on. Onshore studies strongly suggest that shorebirds and Red Knots will not be impacted by the FE project, a small, six turbine facility that would be situated nearly 3 miles offshore of New Jersey.

Summary of Preconstruction Studies and Baseline Study in New Jersey

Prior to the permitting of the FE project, two years of baseline avian studies were conducted by GeoMarine Inc. as part of the New Jersey Department of Environmental Protection offshore wind energy study program (GeoMarine Inc. 2010). In addition, another 2-years of baseline study were conducted by FE. The NJ DEP baseline work included a boat survey of a large area of the nearshore and offshore waters of New Jersey. During the baseline study conducted

observers conducted boat surveys to determine species composition and numbers of birds present in the nearshore and offshore waters of New Jersey. In addition, distances from shore of all birds were recorded in an effort to determine whether there were gradients of density going out from the shoreline. From January 2008 until December 2009, observers registered sightings of 176,217 birds along the 18,183 km of surveys. A total of 638 km of surveys were done within the FE project area. In addition to visual studies from boats, the baseline study included marine and NEXRAD radar observations for nearly four migration seasons, along with thermal imaging. Note that Red Knots and other species cannot be identified via remote sensing, so only the direct visual observations from boats may be used to determine potential risk for given species, such as Red Knot.

During the period May 2010 through May 2012, additional boat surveys were conducted, specifically in the area of the FE project and waters close to the site (GeoMarine Inc 2012). The transects extended from the beach out to five miles and six miles up and down (parallel to) the coastline While completing 760 survey transects covering 4950 km observers saw no Red Knots, suggesting use of the project site is minimal to virtually non-existent.

With respect to Red Knots, none were observed during any of the boat surveys conducted over the three years of study. Thus, they were not detected anywhere offshore in New Jersey. Note that very few shorebirds were seen during the four years and 23,000+ kms of boat surveys. This does not mean that they are not present at times in the offshore airspace, but it does strongly suggest that if they are present, they are present in very small numbers and are virtually undetectable. More likely, these birds are present on a fairly regular basis as they migrate over the nearshore and offshore areas, but they fly at such high altitudes they are not easily detectable. (See the section below on migration behavior for information on the altitude of migration for Red Knots and other shorebirds.) Boat surveys conducted in New Jersey waters during four years do not suggest any risk to Red Knots.

Behavior and Ecology of Red Knots during Spring and Fall Migration in Southern New Jersey

Red Knot migration includes some of the longest, non-stop flights among all migrating birds (Niles et al. 2012). Like some other shorebirds, they fly for days nonstop, travelling more than 2,000 miles. The reason for these long flights is the fact that there is little habitat that is suitable between breeding and wintering habitats. In other words, these shorebirds cross large expanses of forest in Canada and the eastern U.S. as well as some farmland. Once they reach the Atlantic Ocean and leave the shoreline bound for South America, there are very few islands that are suitable to make stopovers and knots cannot rest on the water. Thus, they have what is called a jump migration (Baker et al. 2013) in which each jump extends from hundreds to thousands of miles.

Fall migration extends from the arctic across the eastern third of the U.S. and southern maritime Canada to the Atlantic Coast, whereupon these birds fly offshore to the south-southeast and southeast. Most make stops along the east coast and Gulf Coast, but most proceed to coastal Brazil south to southern beaches of South America in a nonstop flight that takes them across the western Atlantic Ocean. A very few birds spend the winter along the east coast from New Jersey south to Florida and along the Gulf Coast.

In spring, these birds fly from eastern South America (Brazil) and continue virtually non-stop over the western Atlantic Ocean to the eastern United States (Baker et al. 2013). Some of these birds arrive to the south of New Jersey and then proceed to the Cape May peninsula, whereas others continue north continue to New England or turn toward the coast of southern New Jersey. Radio tracking (Niles et al. 2012) devices placed on some of these birds have shown remarkable flights, including flights where they have seemingly been blown offshore after which they make sharp turns to return to the New Jersey shore. Some have also been tracked as they navigate around hurricanes.

Once birds arrive offshore of the mid-Atlantic and New Jersey, a larger percentage head for the Delaware Bay of New Jersey and Delaware to make stopovers, forage, and gain weight for their final flight(s) to their arctic nesting sites. These birds would approach the New Jersey coastline from the south, east, and even northeast, if they passed too far to the north. Although we do not know where landfall is for all individuals, some birds have been tracked coming ashore on the Cape May peninsula. The forage and rest along the Delaware Bayshore of New Jersey and Delaware and those that feed on the New Jersey Bayshore often roost on the marshes and beaches of the Atlantic shoreline of Cape May County. Thus, some migrants may pass through the waters near the FE project. At this time, there is a small possibility that they would pass directly over the FE site, although these birds would likely still be flying at heights well above the turbine rotors.

Birds that stopover along Delaware Bayshore beaches spend less than about four weeks during the five to six week migration period. It is then that they foraging on horseshoe crabs on the Delaware Bayshore between North Cape May and Fortescue. Many of these birds, including those that forage on beaches in central and Northern Cape May County make daily flights to and from the Atlantic marshes and beaches where they roost.

The altitude of Red Knot migration, like other shorebirds, appears to proceed at very high altitudes. Kerlinger and Moore (1989) reviewed the literature on flight height of migrants and reported that shorebirds are some of the highest flying migrants, often traveling at more than 1,000-2,000 m above the ground or ocean and shorebirds have been tracked on radar at more than 3,000 m. One study of Red Knot flight behavior showed that they climbed rapidly after takeoff at an average rate of 0.91 mps. Thus, to clear a height of 500 m, the approximate height

of the FE turbines, they would fly for about 5-6 minutes (reference). Thus, aside from a very short time after takeoff and before landing, most of Red Knot migration takes place at heights greater than 1,000 m. This is likely why none were seen during the NJ DEP baseline and FE preconstruction boat surveys.

Burger et al. (2011) reviewed the potential risks to Red Knots during migration. They concluded that there was some risk, but their analysis focused on wind energy development in general rather than a specific project. Thus, there was no evaluation in their paper regarding specific risk to Red Knots that might occur from a project the size and location of the FE project. The present addendum looks specifically at the FE project site, noting that it could be the first wind project in North America and that it occupies a very small percentage of the area discussed by Burger et al.

Summary of Threats to Red Knots in South Jersey. In an effort to determine the relative magnitude of impacts from wind turbines to Red Knots and put the various risks in perspective, we have examined the literature regarding potential bird killers in Cape May, Cumberland, and Atlantic counties. There are three major sources of potential risk to Red Knots during their migration and stopovers through southern New Jersey: oil spills, transmission lines, and communication towers. Examining these potential threats and how they impact birds provides perspective into the relative risk of the FE wind turbines to Red Knots and other birds.

Oil spills are likely to be the most serious potential threat to Red Knots (New York Times, June 5, 2012, quoting NJ DEP biologist Amanda Dey), other shorebirds, and other birds that use the Delaware Bay, marshes in Cumberland, Cape May, and Atlantic counties. These oil spills have occurred in the Delaware Bay and the lower Delaware River previously and there is certainly a potential for a catastrophic oil spill in the future that will cause mass mortality of Red Knots as well as all other shorebirds and non-shorebirds that feed on Delaware Bay beaches. The Delaware River and Bay host one of the largest oil ports in eastern North America. The ship channel, where oil tankers regularly pass or are anchored is only a few miles from Delaware Beaches in Delaware and slightly farther from the beaches of New Jersey. With winds from any direction, spilled oil would reach beaches within a few hours to a day, depending on tide and location of the spill.

Spills have been demonstrated to kill large numbers of birds, including shorebirds of various genera (e.g., Exxon Valdez, BP Gulf, and others). *Calidris* (the genus that includes Red Knots) definitely have been impacted by oil spills. An oil spill in Delaware Bay that results in oil on the beaches could kill or displace a significant portion of the birds that make stopovers on the Delaware Bay in spring. Spills during autumn would be much less risky, although birds stopping over on Atlantic Coast beaches could be impacted. In addition, if the oil killed horseshoe crabs or their eggs, Red Knots might not find enough food to complete their migration and reproduction in that and following years. The reason oil spills are far more risky to Red Knots

and other shorebirds is the wide area that could be impacted. Even a small oil spill can result in greater losses than from wind turbines, both from direct mortality and removal of an important food source for this species.

Electrical transmission (including distribution) lines appear to be the second most important fatality risk to Red Knots, although if oil spills do not occur, they may pose a greater risk. An estimated 130 million birds per year may be killed by collisions with transmission lines (Erickson et al. 2005). These structures extend for long distances and are common on the landscape. They apparently are difficult to see and birds simply collide with them as they engage in low altitude flight. In south Jersey, transmission lines extend along virtually every causeway that extends across the marshes and back bays from the mainland to barrier beaches. They also extend over tidal creeks, pools, and sounds where there are no other obstacles and birds are not expecting any structures that are elevated above the wetlands.

Although there are no estimates as to how many linear miles of transmission lines cross the marshes and back bays, there likely hundreds of miles of lines between Cape May and Atlantic City. It should also be noted that transmission lines of varying heights occur on the mainland of the Cape May peninsula and farther north. Transmission lines that are over land likely pose much less risk because shorebirds tend to fly higher over land than they do over marshes and back bays, where frequently they feed and roost.

That most of these transmission lines extend between about 10 m and 50 m above the marshes, mudflats, creeks, and sounds, suggests that they occur in the height zone used by Red Knots, other shorebirds, gulls, terns, waterfowl, Peregrine Falcons, Northern Harriers, and many other species of birds that frequent these areas. There are no studies of transmission line fatalities from these areas, so it is almost impossible to estimate how many birds are impacted. The number could easily be in the thousands per year and Red Knots certainly are at risk from these obstructions. . To determine the real impact of transmission lines to Red Knots and other birds, a fatality study would appear to be a first step toward determining overall risk to these birds, especially in Cape May County.

In Cape May County, the another major threat to Red Knots is from collision with towers. There are also towers in Atlantic and Cumberland County, but Red Knots make multiple crossings of the Cape May Peninsula during their spring stopovers in South Jersey. There is less risk of collision with these structures in Cumberland and Atlantic Counties, as opposed to Cape May County. Also, far fewer knots are found in Atlantic County, so there is less risk there, especially onshore.

Communication towers may be one of the largest killers of birds in Cape May County, with the exception, perhaps, of the Garden State Parkway (Loos and Kerlinger 1994). They are also a

threat to Red Knots. Communication towers are well known as bird killers (Shire et al. 2000). Longcore et al. (2012) demonstrated that some 6.7 million birds are killed by communication towers in North America as opposed to the roughly 250,000 per year for wind turbines (Loss et al. 2013). There are dozens of communication towers in Cape May County and many are located within the potential flight paths of Red Knots as they fly to and from the Delaware Bay to feed and the Atlantic Ocean to rest. Towers such as the guyed Loran and unguyed 380' tall Rescue 21 tower on the U.S. Coast Guard Base may present potential risk to Red Knots. Gehring, Kerlinger, and Manville (2009, 2011) and Kerlinger et al. 2014) demonstrated that unguyed towers of about the same height kill as wind turbines kill about 9 migrating birds annually. In comparison, guyed towers of 400-475 feet in height each kill about 150 birds annually according to Gehring, Kerlinger, and Manville (2011) and Kerlinger et al. (2014).

Systematic studies of the 675 foot tall, multiply guyed Loran tower on the U. S. Coast Guard base in Cape May, have not been conducted. Anecdotal information collected by this author showed that hundreds of birds of various species are likely killed annually. The Coast Guard Loran tower has several additional risk factor, as identified in the U.S. Fish and Wildlife Service guidelines and by the Gehring, Kerlinger, and Manville (2009, 2011) papers. First, guy wires are the most important risk factor on communication towers. The Loran tower has twice as many guy wires as normal communication towers. More guy wires translates to more fatalities. The second factor is related to the importance of Cape May as a migration site and a site that is, in general, far more "birdy" than locations farther inland above the Cape May Peninsula. And, Red Knots (and other federally threatened Piping Plovers) use beaches in the adjacent Cape May National Wildlife Refuge.

Based on the height, guy wires, extra guy wires, and the location of the Loran tower adjacent to the Cape May National Wildlife Refuge, as well as beaches, ponds, and marshes, it could easily kill more birds than towers of similar size inland. Using these factors, the Loran tower could easily kill more than 500 birds per year, including shorebirds. This equates to about 60 times more birds than a single modern wind turbine (Loss et al. 2013, Zimmerling et al. 2014). Finally, Red Knots and many other shorebirds including the threatened Piping Plover, are known to frequent the beaches of the Cape May National Wildlife Refuge, which is only a few hundred meters from the tower.

Because no studies have been required by federal permitting agencies (FCC) or the U.S. Fish and Wildlife Service, we have no information regarding how lethal these structures are to Red Knots, other listed species, or more common birds. That there are dozens of guyed communication towers in south Jersey that are within the daily flight paths of Red Knots (and many other birds), strongly suggests that the risk from these structures is orders of magnitude greater than the risk from the FE wind turbines. And, the 675 foot tall guyed U.S. Coast Guard tower may pose the largest risk of any single structure to Red Knots in southern New Jersey, or perhaps North

America. Note that many of these towers are in habitats and locations where the U.S. Fish and Wildlife Service has recommended that towers not be located (U.S. Fish and Wildlife Service 2000).

In comparison to oil spills, transmission lines, and communication towers in Atlantic, Cape May, and Cumberland counties, the Fishermen's Energy wind turbines pose virtually no risk to Red Knots. Most importantly, these three structures/activities occur within or immediately adjacent to where daily activities of Red Knots (and many other birds) occur, strongly suggesting much greater risk than the FE turbines, which will not be located within the daily flight paths or near foraging and roosting areas of these birds.

Summary Update of Fatality Impacts to Non-listed Birds

Since the 2009 avian risk assessment for FE conducted by Guarnaccia and Kerlinger, dozens more post-construction fatality studies for onshore wind projects have been completed across the U. S. and Canada. In addition, two studies have focused on the biological significance of fatalities on a species by species basis. Their conclusions were similar and consistent across studies and geographic areas. Most importantly, these three meta-analyses strongly suggested that the numbers of birds killed at wind energy facilities, even cumulatively, were not causing populations of the species involved to decline.

In 2013, Environment Canada (Zimmerling et al. 2013) analyzed the results of 50 studies conducted across Canada (33 from Ontario) and concluded that about eight birds were killed per turbine per year. The total fatalities for Canada amounted to about 24,000 birds per year. The authors also examined the biological significance of the fatalities on a species by species basis. They concluded that "< 0.2% of the population of any species is currently affected by mortality or displacement" and that for most species the percentage was smaller. Thus, significant impacts to any species were unlikely.

Also in 2013, biologists from the U.S. Fish and Wildlife Service and the Smithsonian Institution (Loss et al. 2013) published a meta-analysis similar to the Zimmerling et al. study. That study examined wind facilities in the U.S. and concluded that about 6 birds were killed per turbine per year with a total annual mortality of 234,000. In addition, Loss et al. concluded that it was likely that the fatality rates were higher at more modern turbines because of their greater height. This would explain the difference between fatalities at U.S. and Canadian turbines.

Finally, a study published by Erickson et al. (2014) examined the results of 116 different post-construction fatality studies from across North America. They focused on determing whether fatalities would have a cumulative negative impact on the individual species killed by wind turbines. To date, the study is the most thorough and comprehensive examination of its kind and

exceeds any studies (other than hunting harvest studies) done for determining impacts to birds from human activities. Erickson et al. concluded that the impact to individual species from all wind turbines in North America amounted to only 0.008% to 0.038% of their populations. They compared these statistics to impacts from communication towers and concluded that the latter structures kill orders of magnitude more songbirds.

Thus, a voluminous amount of information and analyses have emerged regarding impacts to birds at wind turbine in North America. These data add significantly and agree with the conclusions of the 2009 FE avian risk assessment that impacts to birds caused by wind turbines in general and the FE turbines specifically are not likely to cause significant impacts to any bird species.

Summary and Conclusions

Overall, the five proposed FE turbines do not pose a significant risk to avian species including the Red Knot and it is highly likely that they will have no impact on these birds. With respect to each of the issues discussed above, the following bullets provide a summary and conclusion regarding risk to Red Knots and other birds at the FE turbines.

- Despite the small increased rotor swept area (6.5%) and slight increase in height of the turbines (~4 m), the overall risk to Red Knots and other birds is likely to be lower than reported in the concluded in the original 2009 risk assessment by Guarnaccia and Kerlinger. Because the primary component of absolute risk to birds at wind plants is related to the number of turbines at a given project, a six turbine project would be less risky, even with slightly larger rotors, than the original nine turbine project for which the original.
- A review of studies conducted since the 2009 avian risk report was conducted reveals that the newer studies, including syntheses of more than 100 existing onshore wind farms in the United States and Canada suggest no significant risk to shorebirds. There have also been no Red Knot fatalities registered at any wind plant in Canada or North America despite tens of millions of dollars in studies over the past 15 years. Examining shorebirds as surrogates, it is obvious that very few shorebirds birds collide with turbines, or other tall structures. The empirical literature on impacts at wind turbines provides no evidence that avian species including Red Knots will be impacted by the FE turbines.

- Four years of preconstruction boat surveys were conducted in the waters of New Jersey in which birds were observed from boats. The NJ DEP sponsored two years of study over a large area where offshore wind turbines might be erected in the future (including the FE site) and FE sponsored another 2 years of study, specifically looking at the waters within and surrounding their proposed project. During the three years of study, very few

shorebirds were observed and not a single Red Knot was seen. The likely reasons why these birds were not observed is that they seldom fly over the waters of New Jersey, and the FE project site, except during some migration flights, or that those birds that do migrate through New Jersey waters fly at high altitudes at which they are difficult or impossible to see. Other shorebirds and most night migrants will also fly at altitudes well above turbine rotors. Based on these empirical findings, it is likely that risk to avian species and Red Knots at the FE project will be negligible.

- The behavior and ecology of Red Knots during migration and stopovers in southern New Jersey does not suggest that these birds are at great risk, if any, from the FE turbines. Most importantly, exposure to turbines is absolutely minimal. Very few birds are likely to migrate over the very small area that constitutes the FE project because it is located in a place that is not on any main flyway for knots. The few that might fly over the FE project will likely be migrating at heights of more than 1,000 m above the ocean, thereby virtually eliminating risk to these birds. Also, unlike birds making stopovers on the Delaware Bayshore, migrants do not fly back and forth across the Cape May peninsula where there are far more risks. Once these birds arrive in Cape May and Cumberland Counties, they are also not known to fly out over the Atlantic Ocean. When they complete their stopovers on the Delaware Bayshore, they fly toward the northwest as they initiate their final legs of their migration to arctic nesting locations. During initiation of their "jump" migration, Red Knots climb at a rate that would put them above turbine rotor height within about five to six miles of takeoff. Thus, migratory flight behavior and flight behavior during stopovers in southern New Jersey suggest that risk to these birds from the FE turbines is negligible.

- Overall, the six turbine FE project presents far less risk to birds than other human activities in and around the Cape May Peninsula, as well as Atlantic and Cumberland Counties. Whereas Red Knots almost no time within the FE wind plant area and less time within the rotor swept zone (if any), they are at risk from oil spills in Delaware Bay, transmission lines that transect the marshes, bays, and tidal creeks, as well as uplands of Cape May County, and communication towers that are located both on the mainland and in the back bay marshes. The relative risk to Red Knots during spring migration stopovers from oil spills, transmission lines, and communication towers is likely to be orders of magnitude greater than risk from the FE turbines.

With respect to birds that are not listed as endangered or threatened, three major meta-analyses have appeared in the peer reviewed literature since the 2009 risk assessment was done. These papers analyzed data from upwards of 116 studies and reported that annual fatality rates at wind plants in the U.S. and Canada averaged about 6-8 birds per turbine. The Canadian study specifically stated that it was unlikely that impacts to any bird species was biologically

significant and that annual impacts to species amounted to <0.2% of individuals. Finally, a third study focused on songbirds, the species that are killed most often at wind projects. That study concluded that significant population impacts to songbirds were highly unlikely. All studies suggested that continued monitoring would provide a means of determing whether population level impacts can be expected in the future. Overall, these results strongly suggest that significant impacts to birds pose by the FE facility are highly unlikely.

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Evaluation of the Potential for Impact to the Northern Long-Eared Bat (*Myotis septentrionalis*)

Fishermen's Atlantic City Windfarm, LLC
25 MW Offshore Wind Energy Project
CENAP-OP-R-2008-0777-39
~2.8 Miles Offshore of Atlantic City, NJ

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February 18, 2015

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1.0 INTRODUCTION

Fishermen's Energy (FE) has applied for and received permits through the U.S. Army Corps of Engineers (USACOE) and the New Jersey Department of Environmental Protection (NJDEP) to construct a small, demonstration wind project in the Atlantic Ocean about 2.8 miles offshore of Atlantic City, Atlantic County, New Jersey. The project is within state waters of New Jersey and will have up to 6 turbines.

Recently, FE has changed the dimensions and specifications of the turbines that were originally permitted for their project. As part of the preliminary review of the proposed modifications to the turbines, the USACOE has asked how the changes in turbine dimensions and specifications will potentially impact the northern long-eared bat (*Myotis septentrionalis*). The U.S. Fish & Wildlife Service has proposed listing the long-eared bat as an endangered species under the Endangered Species Act (ESA). The long-eared bat was not a candidate species when the original permit applications for the project were filed in 2009 or when the permit was issued in 2011. Therefore, the USACOE has requested the FE evaluate the potential for adverse impacts to the species based on the proposed modifications to the turbine.

1.1 Turbine Dimension Modifications

Table 1 outlines the proposed changes in the turbines. In general the turbines are located at a greater height, with a wider swept zone, then the original permitted turbines.

Turbine Specifications	Existing Permitted Turbines	Proposed Turbine Modification
Hub Height	306' above MHW	294' above MHW
Rotor Diameter	384'	426'
Blade Length	192' above MHW	213' above MHW
Maximum Height of Blade	494' above MHW	507' above MHW
Lowest Height of Blade	117' above MHW	80' above MHW

1.2 Long-Eared Bat Life History and Habitat Requirements

According to the USFWS, during summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts, using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns and sheds. Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. Specific areas where they hibernate have very high humidity, so much so that droplets of water are often seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible.

Northern long-eared bats emerge at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation. This bat also feeds by gleaning motionless insects from vegetation and water surfaces.

Breeding begins in late summer or early fall when males begin swarming near hibernacula. After copulation, females store sperm during hibernation until spring, when they emerge from their hibernacula, ovulate, and the stored sperm fertilizes an egg. This strategy is called delayed fertilization. After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30 to 60 bats, although larger maternity colonies have been observed. Most females within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Adult northern long-eared bats can live up to 19 years.

2.0 Impact Evaluation

FE does not believe that the Fishermen's Atlantic City Windfarm will have any significant impact to either individual long-eared bats, or to the population of long-eared bats in the Atlantic City area. While FE recognizes that onshore wind turbines have been known to kill bats in general, even the U.S. Fish & Wildlife Service (Northern Long-Eared Bat Fact Sheet; USFWS Midwest Region, 2015) indicates that the number of individual organisms that have been killed to date is small. FE bases its belief on the lack of potential impact on the fact that it is doubtful that long-eared bats would be seen off-shore in the vicinity of the wind turbines.

The Atlantic City area (including the off-shore region where the wind farm will be located), is outside of the normal winter habitat for the long-eared bat. In winter, the species tends to roost in hibernaculia which are located in caves or mines. Information on long-eared bats in New Jersey indicate that hibernaculia for these species are found in northern areas of the state. The geologic and topographic setting for the Atlantic Coastal Plain is not conducive for the establishment of hibernaculia. In the summer, long-eared bats tend to roost in either dead or live trees, and while there are a few records of maternity occurences of the species in Atlantic County, the literature does not suggest that the species occurs extensively in the area. This could be the result of the choice of habitat for the long-eared bat, which is forests that are wet and moist. The physiographic area surrounding Atlantic City has little in the way of those type of forests.

As a part of the pre-construction biological studies conducted by FE as part of the original permitting, bat monitoring studies were conducted in the vicinity of the wind farm. The contractor for FE on the project, North East Ecological Services (NEES), initially used ultrasonic microphones attached to 10.5 meter masts attached to boats to listen for bat calls. NEES then came up with the innovative monitoring approach to sample for the presence of bats by tethering a blimp to a boat, the height of the blimp was equal to hub height of the projected turbines. Under the blimp were acoustic monitors used to listen for bat calls which were recorded for identification. In both instances the boats containing the masts or pulling the blimp made transect runs through the wind farm project area to search for bats.

In 2011, NEES conducted spring and fall migratory monitoring for bat activity using acoustic monitoring equipment (NEES 2011). For the spring monitoring season, NEES relied primarily on

boat transects utilizing ultrasonic microphones attached to masts approximately 10.5 meters (m) above the water surface. During the fall bat migration season, NEES developed and deployed a tethered blimp attached to a commercial fishing boat as the boat surveyed a prescribed route within the project area. The blimp was outfitted with two acoustic monitors and released to nacelle height (84 m - 90 m above sea level).

In the spring 2011 survey, NEES documented four bats during five transect routes across the project area. The four bats were documented on two separate occasions (21 May and 25 May), and were identified as big brown bats and Myotis bats. All four bats were found approximately 3.0 kilometers (km) offshore Margate City, roughly 4.0 km from the nearest turbine location. A single blimp survey conducted 15 June did not detect any bats on the transect route.

For the fall 2011 survey, they conducted 11 blimp transects from 02 August – 06 October. They documented 15 total bats across three separate transect surveys in August and September. The dominant bats identified were the hoary bat (47%) and the red bat (40%). A single silver-haired bat and an unidentified bat were also observed. Most of the hoary bat activity was documented along the coastline from Atlantic City down to Margate City within 1.0 km of the shoreline. The farthest hoary bat from shore was documented 4.5 km from Margate City within 1.0 km of the nearest turbine location. Similarly, most of the red bat activity was documented near the coastline with a single red bat almost 6.0 km from shore within 0.5 km of the nearest turbine location.

The NEES surveys correlate well with the findings of the New Jersey Baseline Study which surveyed bats over the New Jersey Wind Area out to 20 nautical miles. Shipboard surveys were conducted in March, April, May, June, August, September, and October 2009. No bats were detected during the 2009 March, April or June surveys, and one was detected in May. Over eight nights in August, September, and October, 53 bats were detected. Of the total 54 recordings, the eastern red bat was the most common bat detected, but they were detected in the fall offshore along the Delmarva Peninsula while only a few hoary bats and big brown/silverhaired bats were detected in spring and fall. The mean distance from shore was 5.2 nm, with the farthest distance being 10.4 nm.

Appendix A is the Interim Report for Spring 2011 prepared by NEES. Appendix B is the Final Report for the Spring 2012 Migratory Season.

3.0 Conclusion

Based on the findings of the NEES surveys and the expected life history of the long-eared bat, it is not expected that the operation of the Fishermen's Atlantic City Windfarm will have any significant impact on long-eared bats.

Appendix A

Interim Report for the Spring 2011

The Use of Aerial Platform Monitoring to Document Off-Shore Bat Migration for the Fisherman's Atlantic City Windfarm Development Project

Interim Report for the Spring 2011

Prepared for:

Fishermen's Energy of New Jersey, LLC

Prepared by:
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Bow, NH 03304
(603) 228-9308

&

Geo-Marine, Inc.
2201 K Avenue, Suite A2
Plano, Texas 75074

August, 2011

Project Background

In August, 2009, North East Ecological Services was contracted to produce a desktop environmental impact analysis on bats for the Fisherman's Atlantic City Windfarm project. This report highlighted the lack of research on migratory bat behavior across large bodies of water or along coastal corridors, and suggested that this was primarily the result of the technical inability to monitor bat movements over water, particular at high altitude (NEES, 2009). In the Impact Report, NEES highlighted anecdotal data on off-shore bat migration from the historic literature and produced a map identifying the location of all known off-shore bat sightings since 1891. Although all of these sightings were north or east of the Atlantic City project area, they suggested the possibility that migratory bats could travel across the project area as they migrated south through the Atlantic coastal region. This concern was reinforced by the documentation of migratory bat mortality at the Atlantic County Utility Authority (ACUA) wind project during post-construction monitoring in 2007 (NJAS, 2008), and the documentation of bat activity during the New Jersey Ocean/Wind Power Ecological Baseline Surveys conducted in 2009 by Geo-Marine, Inc. (GMI, 2009).

The Technical Manual for Evaluating Wildlife Impacts of Wind Turbines Requiring Coastal Permits ('Technical Manual') produced by the New Jersey Department of Environmental Protection in September 2010 states that wind developers need to conduct habitat evaluations, including species surveys, to establish the movement corridors and distribution of birds, bats, and marine organisms at the project site, and that this information should be collected in the airspace where the turbines will be constructed (NJDEP, 2010). Unfortunately, at the time of the release of the Technical Manual, there was no existing technology that would allow sampling of bat activity in the airspace for an off-shore wind development project. In order to meet the intent of the Technical Manual, GMI and NEES proposed a boat transect to monitor bat activity across the project site during the spring migratory period. Further, NEES proposed to design, construct, and implement bat activity monitoring at rotor swept altitude using a tethered blimp that deployed ultrasonic acoustic monitors. This interim report is a summary of these monitoring results.

Spring 2011 Sampling Effort

During the spring 2011 migratory period, NEES conducted five (5) boat transects across the project site from 05 May through 25 May, 2011. The boat was outfitted with four acoustic monitors (Anabat SD-1: Titley Electronics) mounted on a mast (approximately 10.5m above the water surface) facing forward, backwards, and to both the port and stern sides of the boat. The transects were a sawtooth design that ran both parallel and perpendicular to the shoreline as well as the proposed turbine line (yellow transect, Figure 1). The transects began at least 30 minutes after sunset and continued until completion of the transect approximately three hours later. The transects were conducted in both a southwest and northeast orientation to eliminate directional bias. Wind conditions were generally a light breeze to gentle breeze (less than 12 mph or 2 or 3 on the Beauford Wind Scale) and the sky was generally clear or with scattered clouds. The five survey periods represented a complete spectrum of moonlight conditions.

In addition to the boat transects, NEES conducted one blimp survey on 15 June, 2011. The blimp survey used a modified transect to maximize the period when the acoustic monitors were parallel to the coastline. This was done by travelling southeast from Brigantine, southwest across the turbine line, travelling perpendicular to the coastline, and returning parallel to the turbine line (white line, Figure 1). The blimp was raised to 64 m above the water surface throughout the survey period in a southwesterly wind.

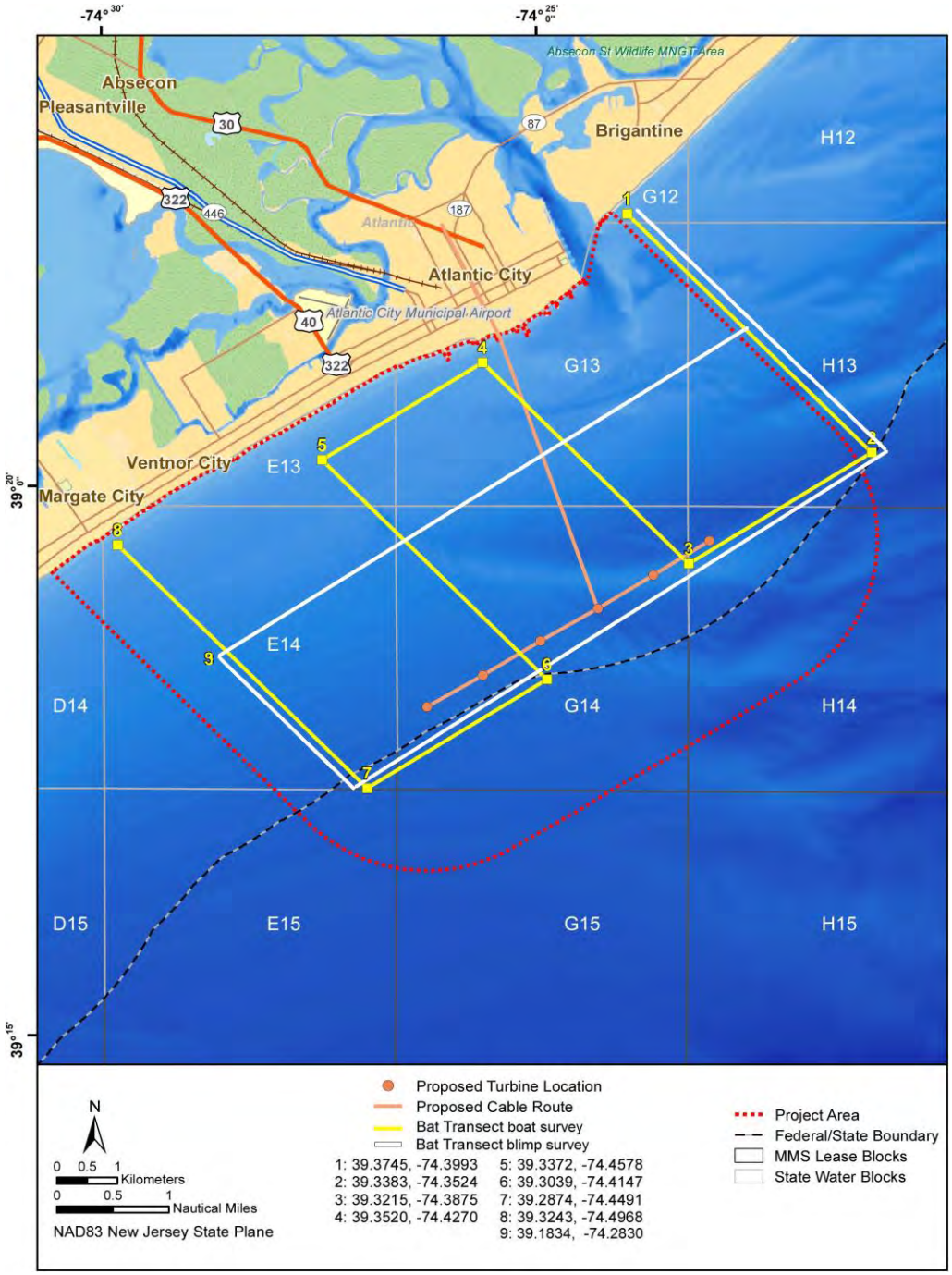


Figure 1. Boat transect and blimp transect paths developed for the Atlantic City Windfarm project.

Spring 2011 Monitoring Results - Boat Transect

Over the course of the five boat transects, a total of 4,140 files were recorded; only four of these files were bat calls, with the remaining files containing mechanical noise from the boat or wind (Table 1). The bat calls were detected during the final two survey periods (1 on 21 May and 3 on 25 May). Bats were heard across each detector orientation except off the back of the boat.

Table 1. Summary of Acoustic Monitoring Data from Boat Transect

	Front	Back	Port	Stern
Total Files	466	1,906	833	935
Bat Calls	2	0	1	1

All the bats were heard west of the project area during the transect route that ran perpendicular to the coastline between points 7 and 8. These bats ranged from 2.5 - 3.0 km from the coastline and were all documented between 22:36 - 22:47 at night.



Figure 2. Bat records documented during boat transects at the Atlantic City Windfarm, Spring 2011

The first bat heard on 21 May was from the big-brown bat/silver-haired bat (Efusc-Lnoct) phonic group and was heard west of the transect line. B02 and B04 were both *Myotis spp*. and were heard in front of the boat and east of the transect line, respectively. The final bat call (B03) was not on sufficient quality for species identification.

Table 2. Bat call files collected during boat transect surveys, Spring 2011

Call ID	Sample Date	Microphone	Species
B01	5/21/2011	Left	Efusc-Lnoct
B02	5/25/2011	Front	Myotis spp.
B03	5/25/2011	Front	Unknown spp.
B04	5/25/2011	Right	Myotis spp.

Spring 2011 Monitoring Results - Blimp Transect

During the spring blimp transect, a total of 157 files were recorded but none of those files contained bat calls (Table 3). The blimp transect survey showed that the blimp is capable of maintaining aloft under variable wind speeds (from 4.3 - 8.4 mph) when the boat was operated at a speed of approximately 5-6 knots.

Table 3. Summary of Acoustic Monitoring Data from Blimp Transect

	Front	**Back**
Total Files	108	49
Bat Calls	0	0

Fall 2011 Sampling Effort

Based on the success of the monitoring during the Spring 2011 migratory season, NEES has continued monitoring bat activity during the Fall 2011 migratory period. The goal is a weekly transect of the project area using the tethered blimp platform. Thus far, NEES has completed four surveys in August and documented bat activity during two of these surveys.

Discussion

The results from the spring migratory survey show that both boat transect surveys and the aerial platform monitoring are viable techniques for monitoring bat migratory activity off-shore. Although no bats were documented during the blimp survey in mid-June, data collected during the Fall 2011 migratory period show that bats are detected at multiple locations over several nights. The Fall sightings to date are presented in Figure 3. The data collected during this study are unique in almost every respect and provide new opportunities for monitoring bat activity over large bodies of water. Given the growth in off-shore wind development, data such as these will be critical for learning more about the migratory behavior of bats and for monitoring the impact of renewable energy on bat populations along coastal North America.



Figure 3. Bat records documented during boat transects at the Atlantic City Windfarm, Spring 2011 and Fall to date. Fall indicated with Fxx and Spring with Spxx.

Literature Cited

[GMI] Geo-Marine, Inc. 2009. Ocean/Wind Power Ecological Baseline Studies – January – December 2008 Revised Interim Report. Submitted to the New Jersey Department of Environmental Protection, Division of Science, Research, and Technology. February 2009, 313 pp.

[NEES] North East Ecological Services, 2009. Potential impact of offshore wind development on bats for the Fisherman's Atlantic City Windfarm, Atlantic County, New Jersey. Report prepared for Fisherman's Energy, LLC, September 2009.

[NJAS] New Jersey Audubon Society, 2008. Post-construction wildlife monitoring at the Atlantic County Utilities Authority – Jersey Atlantic Wind power facility. Report prepared 15 December, 2008. 6 pp.

[NJDEP] New Jersey Department of Environmental Protection, 2010. Technical manual for evaluating wildlife impacts of wind turbines requiring coastal permits, September 2010.

Appendix B

Final Report for the Spring 2012 Migratory Season

Pre-Construction Monitoring of Offshore Bat Migration for the Fishermen's Atlantic City Windfarm Development Project

Final Report for the Spring 2012 Migratory Season

Prepared for:
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&

Geo-Marine, Inc

APRIL 2013

PROJECT BACKGROUND

In August 2009, North East Ecological Services (NEES) was contracted to produce a desktop environmental impact analysis on bats for the Fisherman's Atlantic City Windfarm project. This report highlighted the lack of research on migratory bat behavior across large bodies of water or along coastal corridors, and suggested that this was primarily the result of the technical inability to monitor bat movements over water, particular at high altitude (NEES 2009). In the Impact Report, NEES highlighted anecdotal data on offshore bat migration from the historic literature and produced a map identifying the location of all known offshore bat sightings since 1891. Although all of these sightings were north or east of the Atlantic City project area, they suggested the possibility that migratory bats could travel across the project area as they migrated south through the Atlantic coastal region. This concern was reinforced by the documentation of migratory bat mortality at the Atlantic County Utility Authority (ACUA) wind project during post-construction monitoring in 2007 (NJAS 2008), and the documentation of bat activity during the New Jersey Ocean/Wind Power Ecological Baseline Surveys conducted in 2009 by Geo-Marine, Inc. (GMI 2009).

In 2011, NEES conducted spring and fall migratory monitoring for bat activity off the coast of New Jersey using acoustic monitoring equipment (NEES 2011). For the spring monitoring season, NEES relied primarily on boat transects utilizing ultrasonic microphones attached to masts approximately 10.5 meters (m) above the water surface. During the fall bat migration season, NEES developed and deployed a tethered blimp attached to a commercial fishing boat as the boat surveyed a prescribed route within the project area. The blimp was outfitted with two acoustic monitors and released to nacelle height (84 m - 90 m above sea level). In the spring 2011 survey, NEES documented four bats during five transect routes across the project area. The four bats were documented on two separate occasions (21 May and 25 May), and were identified as big brown bats and Myotis bats. All four bats were found approximately 3.0 kilometers (km) offshore Margate City, roughly 4.0 km from the nearest turbine location. A single blimp survey conducted 15 June did not detect any bats on the transect route. For the fall 2011 survey, we conducted 11 blimp transects from 02 August – 06 October. We documented 15 total bats across three separate transect surveys in August and September. The dominant bats identified were the hoary bat (47%) and the red bat (40%). A single silver-haired bat and an unidentified bat were also identified. Most of the hoary bat activity was documented along the coastline from Atlantic City down to Margate City within 1.0 km of the shoreline. The farthest hoary bat from shore was documented 4.5 km from Margate City within 1.0 km of the nearest turbine location. Similarly, most of the red bat activity was documented near the coastline with a single red bat almost 6.0 km from shore within 0.5 km of the nearest turbine location.

METHODOLOGY

NEES deployed the same tethered blimp using the same protocol developed for the fall 2011 migration season. NEES used a custom 18-foot (ft) inflated dirigible ('blimp') tethered to a commercial fishing boat traveling a transect route at approximately 5-6 knots (kt). A monitoring platform was attached to the belly straps of the blimp to house two Anabat SD-1 acoustic monitors; one monitor faced towards the front of the boat and the other monitor faced towards the back of the boat. The blimp was deployed at sea by slowly releasing the tether line until the sampling altitude was reached; for most surveys, the final sampling altitude was 84 m - 89 m above sea level. Once deployed, the blimp was monitored constantly to confirm operational status and document performance while the boat travelled a modified transect to maximize the period when the acoustic monitors were parallel to the coastline (white transect, **Figure 1**). Generally, this was done by travelling southeast from Brigantine, southwest across the turbine line, travelling perpendicular to the coastline, and returning parallel to the turbine line.

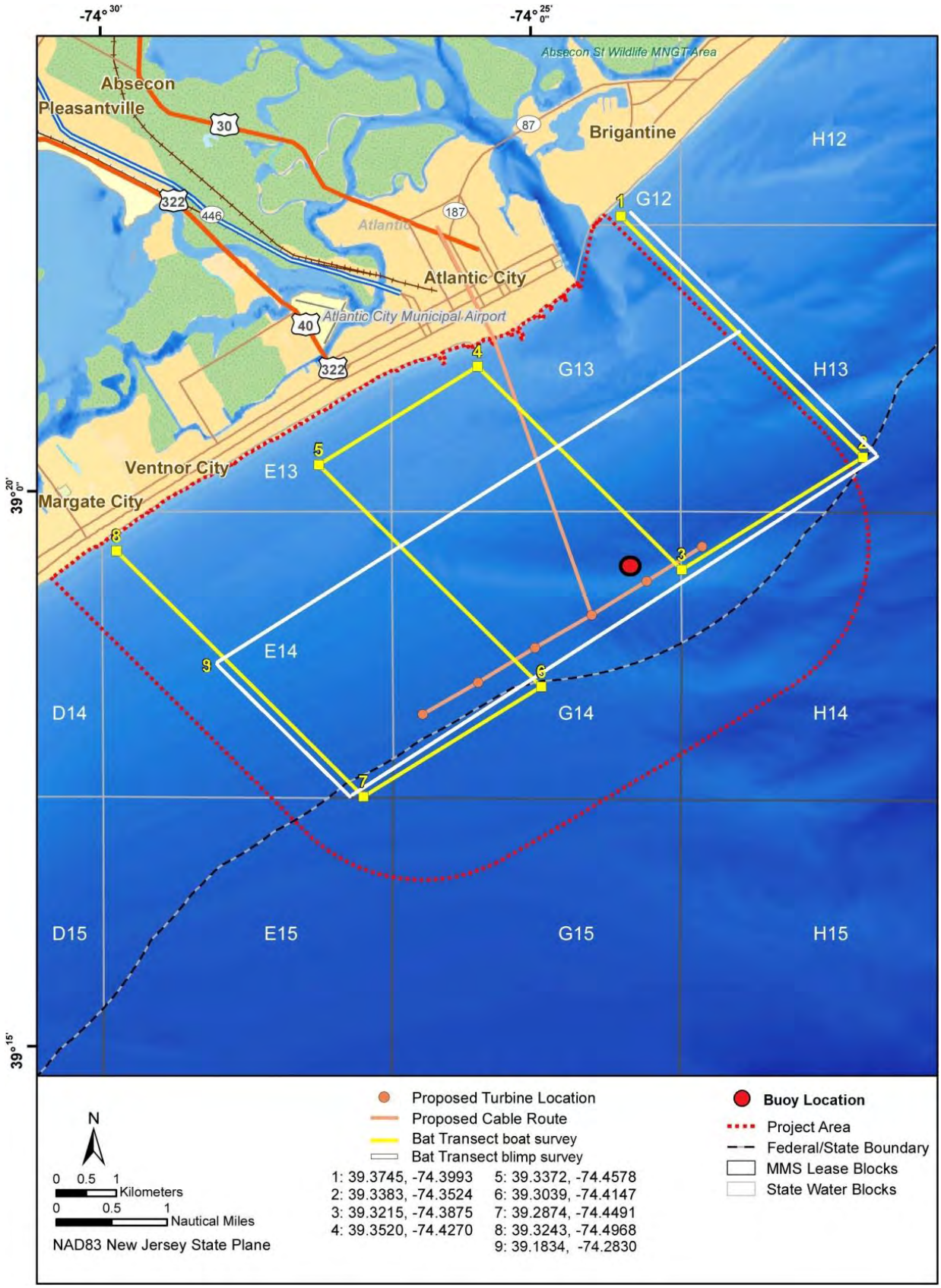

-74° 30'
-74° 25' 0"
Absecon St Wildlife MNGT Area
Absecon
Pleasantville
30
87
Brigantine
H12
322
446
187
Atlantic
G12
1
Atlantic City
Atlantic City Municipal Airport
40
322
4
G13
H13
5
2
Ventnor City
E13
39° 20' 0"
Margate City
8
3
E14
9
6
D14
G14
H14
7
D15
E15
G15
H15
39° 15'
N
0 0.5 1
Kilometers
0 0.5 1
Nautical Miles
NAD83 New Jersey State Plane
Proposed Turbine Location
Proposed Cable Route
Bat Transect boat survey
Bat Transect blimp survey
1: 39.3745, -74.3993
2: 39.3383, -74.3524
3: 39.3215, -74.3875
4: 39.3520, -74.4270
5: 39.3372, -74.4578
6: 39.3039, -74.4147
7: 39.2874, -74.4491
8: 39.3243, -74.4968
9: 39.1834, -74.2830
Buoy Location
Project Area
Federal/State Boundary
MMS Lease Blocks
State Water Blocks

Figure 1. Blimp Transect Path and Stationary Buoy Location for the Atlantic City Windfarm Project.

ACOUSTIC MONITORING RESULTS

During the spring 2012 migratory season, a total of five (5) blimp transects were conducted across the project site. Only one bat (eastern red bat, *Lasiurus borealis*) was recorded across all five sampling periods (**Table 1**). The single red bat was documented on 31 May at approximately 22:00 approximately 2.0 km (1.2 miles [mi]) offshore (**Figure 2**). At the time of observation, the air temperature was approximately 19.7 degrees Celsius (°C) with a 3- to 5-mile per hour (mph; 5- to 8-kilometer per hour [kph]) wind from the south.

Table 1. Summary of Acoustic Monitoring Data from Spring 2012 Blimp Transect.

Sampling Date	Total Files	Hoary Bat	Red Bat	Silver-haired bat	Big Brown Bat	Unknown Bat	Bat Files
17 May 2012	682	0	0	0	0	0	0
30 May 2012	69	0	0	0	0	0	0
31 May 2012	76	0	1	0	0	0	1
06 June 2012	52	0	0	0	0	0	0
21 June 2012	111	0	0	0	0	0	0
Total	**990**	**0**	**1**	**0**	**0**	**0**	**1**



Figure 2. Bat Records documented during Blimp Transects at the Atlantic City Windfarm, Spring 2012.

These data were more similar to the ship-based transects of the spring 2011 migratory season in three major respects. First, both spring migratory sampling periods detected relatively low levels of bat activity. Second, all the bats detected during the spring migratory surveys, across ten different survey dates, were documented in the same area, approximately 1.5 – 2.5 km directly offshore of Margate City. It is unclear why all five bats would have been detected within the same kilometer of transect area given that this area represented less than 4% of the entire transect area. Third, all of the bats documented in the spring migratory period were documented within a 10-day period at the end of May, and all within the same hour (between 22:00 – 23:00) despite using different transect routes and sampling protocols.

DISCUSSION

The Technical Manual for Evaluating Wildlife Impacts of Wind Turbines Requiring Coastal Permits ('Technical Manual') produced by the New Jersey Department of Environmental Protection (NJDEP) in September 2010 states that wind developers need to conduct habitat evaluations, including species surveys, to establish the movement corridors and distribution of birds, bats, and marine organisms at the project site, and that this information should be collected in the airspace where the turbines will be constructed (NJDEP 2010). Unfortunately, at the time of the release of the Technical Manual, there was no existing technology that would allow sampling of bat activity in the airspace for an offshore wind development project. In order to meet the intent of the Technical Manual, NEES proposed a boat transect to monitor bat activity across the project site during the spring migratory period. Further, NEES proposed to design, construct, and implement bat activity monitoring at rotor swept altitude using a tethered blimp that deployed ultrasonic acoustic monitors. The results of this study show that both boat transect surveys and the aerial platform monitoring are viable techniques for monitoring bat migratory activity offshore. Data can be collected from a boat mast under a broader range of environmental conditions but these monitors do not sample within the rotor swept area of the turbines. Data collected from an aerial platform can sample within the rotor swept area, but survey opportunities are more dependent on wind conditions. The blimp used in the present study had no difficulty maintaining loft and bearing under gentle breeze conditions (8 – 12 mph) and the only wind-related problems came from extreme gusts of wind that occurred while the blimp was near the surface. For the present survey, most of the transect routes were in the north-south orientation to collect data on bats migrating from the north; however, using different microphone assemblies and transect routes, one can adjust the direction of the microphone sampling to the site conditions.

There are scant data on the migratory activity of bats off the eastern Atlantic coastline; most of these observations are from fishing vessels operating near the continental shelf up to 200 mi from the shoreline (NEES 2009). It is very difficult to determine migratory phenology or routes from these anecdotal observations. The data collected during this study are unique in the fact that these data are among the only data collected using a systematic approach. The success of this project provides new opportunities for monitoring bat activity over large bodies of water. Given the growth in offshore wind development, data such as these will be critical for learning more about the migratory behavior of bats and for monitoring the impact of renewable energy on bat populations along coastal North America.

LITERATURE CITED

Geo-Marine, Inc. (GMI). 2009. Ocean/Wind Power Ecological Baseline Studies – January – December 2008 Revised Interim Report. Submitted to the New Jersey Department of Environmental Protection, Division of Science, Research, and Technology. February 2009, 313 pp.

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North East Ecological Services (NEES). 2011. The Use of aerial platform monitoring to document off-shore bat migration for the Fisherman's Atlantic City Windfarm Development project. Interim Report for the Spring 2011 migration period. Report prepared for Fisherman's Energy, LLC, August 2011.

New Jersey Audubon Society (NJAS). 2008. Post-construction wildlife monitoring at the Atlantic County Utilities Authority – Jersey Atlantic Wind power facility. Report prepared 15 December 2008. 6 pp.

New Jersey Department of Environmental Protection (NJDEP). 2010. Technical manual for evaluating wildlife impacts of wind turbines requiring coastal permits, September 2010.

project related issues that may be impacting marine mammals and sea turtles. An additional meeting will be held in January for a minimum of 5 years between the permittee, the US Fish and Wildlife Service and the Corps. A minimum of 30 days prior to the meetings, the permittee shall supply both all the Federal agencies with copies of the monitoring reports as specified in the Post Construction Monitoring Plan (see below). The Corps reserves the right to modify/extend the post-construction monitoring based on the results of the above referenced reports.

29. None of the lighting on the towers shall operate/illuminate in a continuous fashion unless specifically directed by the US Coast Guard and/or the Federal Aviation Administration. Unless required, any continuously operating/illuminating light shall be repaired or replaced within 7 days of being detected. This office shall be notified if any of the lights malfunction and confirm repair/replacement of the lighting structure within 30 days of the date of the malfunction.

30. The wind turbines and all related support systems will be monitored and maintained 24/7 by personnel manning the land-based facility control center. On duty personnel will be responsible for monitoring visibility forecasts distributed by the National Weather Service, as well as data received from the onsite visibility sensing system.

31. All turbines shall be shut down between March 15 and June 15, and between August 1 and October 31 of any year, if the following weather conditions are detected:

- If visibility in the area is less than 0.6 miles and/or overcast sky at or below the top of the turbine rotor sweep (500 feet above mean high water).
- If the forecast for the project area does not anticipate weather conditions to drop below the above referenced thresholds, but the turbine sensors on site detect poor visibility conditions for more than 2 consecutive hours, the turbines will be shut down until such time that the conditions improve to above threshold levels for 2 consecutive hours.
- If the forecast for the project area does anticipate weather conditions to drop below the above referenced conditions for a period of greater than 6 hours, the turbines will be shut down once the sensors on site detect poor visibility conditions at the turbine field. Once site conditions have improved to above threshold levels for 2 consecutive hours, the turbines may be restarted.

32. If maintenance work is required, between May 15 and November 30 of any year, that would disturb the beach/dune areas east of Tennessee Avenue and landward of mean high water, a survey of the beach/dune area for the presence of Seabeach Amaranth shall be performed and the results sent to the Corps of Engineers and the US Fish and Wildlife Service for review. No work shall be performed in the beach/dune areas until written approval is received by the permittee from this office.

33. Post construction monitoring of the turbines shall be performed as outlined in the document entitled Post – Construction Avian, Bat and Marine Mammal Studies Fishermen's Energy State Waters Wind Power Project, prepared by Geo-Marine Incorporated, Curry and Kerlinger, LLC and North East Ecological Services, dated March 23, 2012. All reports as noted in the document shall be supplied to this office, the US Fish and Wildlife Service, Pleasantville Field Office and the National Marine Fisheries Service, Gloucester Massachusetts Regional Office for review. This office reserves the right to modify the stipulations in this document, including the time frame for

acquiring data, based on the information submitted to this office for review.

34. The permittee shall notify the Philadelphia District of the Corps at least eighteen (18) months prior to decommissioning of the turbines to discuss what authorizations will be required for the work associated with the removal of the turbines.

FURTHER INFORMATION:

1. Congressional Authorities: You have been authorized to undertake the activity described above pursuant to:

X Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403).

X Section 404 of the Clean Water Act (33 U.S.C. 1344).

☐ Section 103 of the Marine Protection, Research and Sanctuaries Act.

2. Limits of this authorization.

a. This permit does not obviate the need to obtain other Federal, State, or local authorizations required by law.

b. This permit does not grant any property rights or exclusive privileges.

c. This permit does not authorize any injury to the property or rights of others.

d. This permit does not authorize interference with any existing or proposed Federal projects.

3. Limits of Federal Liability. In issuing this permit, the Federal Government does not assume any liability for the following:

a. Damages to the permitted project or uses thereof as a result of other permitted or unpermitted activities or from natural causes.

b. Damages to the permitted project or uses thereof as a result of current or future activities undertaken by or on behalf of the United States in the public interest.

c. Damages to persons, property, or to other permitted or unpermitted activities or structures caused by the activity authorized by this permit.

d. Design or construction deficiencies associated with the permitted work.

e. Damage claims associated with any future modification, suspension, or revocation of this permit.

4. Reliance on Applicant's Data. The determination of this office that issuance of this permit is