OCS Study
BOEM 2016-034

The Identification of Port Modifications and the Environmental and Socioeconomic Consequences

US Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Program

BOEM
Bureau of Ocean Energy Management

OCS Study
BOEM 2016-034

The Identification of Port Modifications and the Environmental and Socioeconomic Consequences

Authors

Payson R. Whitney, III (ESS Group, Inc.)
Stephanie J.K. Wilson (ESS Group, Inc.)
Stephanie Chaston (ESS Group, Inc.)
Chris Elkinton (DNV GL)
Alex Uriate (ICF International)

Prepared under BOEM Contract
M15-PD-00001
by
ESS Group, Inc.
10 Hemingway Drive, 2nd Floor
East Providence, Rhode Island 02915

In association with
DNV GL
ICF Jones & Stokes, Inc.

US Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Program
April 15, 2016

OCS Study
BOEM 2016-034

DISCLAIMER

Study concept, oversight, and funding were provided by the U.S. Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program, Washington, DC under Task Order M15PD00001. This report has been technically reviewed by BOEM and it has been approved for publication. The views and conclusions contained in this document are those of the authors and should not be interpreted as representing the opinions or policies of the U.S. Government, nor does mention of trade names or commercial products constitute an endorsement or recommendation for use.

REPORT AVAILABILITY

To download a PDF file of this Environmental Studies Program report, go to the US Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program Information System (ESPIS) website (http://www.boem.gov/Environmental-Stewardship/Environmental-Studies-Program-Information-System.aspx) and search on OCS Study BOEM 2016-034.

You will be able to obtain this report from BOEM or the National Technical Information Service by writing to the following addresses.

U.S. Department of Interior
Bureau of Ocean Energy Management
Environmental Studies Program
Attn: Chief, Division of Environmental Sciences
45600 Woodland Road
Sterling, Virginia 20166

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, Virginia 22161
Phone: (703) 605-6040
Fax: (703) 605-6900
Email: bookstore@ntis.gov

CITATION

Suggested citation:

ESS Group, Inc. 2016. The Identification of Port Modifications and the Environmental and Socioeconomic Consequences. U.S. Department of the Interior, Bureau of Ocean Energy Management, Washington, DC. OCS Study BOEM 2016-034. 99 pp.

ACKNOWLEDGEMENTS

This report would not have been possible without the research efforts and expert assistance of the following members of the ESS Team:

DNV GL

ICF International

The ESS Team would like to thank the many regulators, owners, and developers of offshore wind facilities and ports who took the time to provide project details and professional insight to help inform this study.

ABOUT THE COVER

Cover image of Liebherr mobile harbor cranes courtesy of Port of Vancouver USA. Source: http://www.portvanusa.com/news/image-library/

Cover image of "The Netherlands: Jumbo Shipping Winner at 2011 TopLift Competition" courtesy of www.offshorewindbiz.com.

All other photographs belong to ESS Group, Inc., were purchased by ESS Group, Inc., or are free for use in the public domain.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

ABBREVIATIONS AND ACRONYMS

AC	Alternating Current
ACS	American Community Survey
AQCR	Air Quality Control Region
BMPs	Best Management Practices
BOEM	Bureau of Ocean Energy Management
CO	Carbon Monoxide
dBA	Decibel A-weighting
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DEP	Department of Environmental Protection
DoD	Department of Defense
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJSCREEN	Environmental Justice Screening and Mapping
ft	Feet
GBS	Gravity Base Structures
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICF	ICF International

in	Inch
kV	Kilovolt
km	Kilometer
Lo-Lo	Lift-On, Lift-Off
m	Meter
MACEC	Massachusetts Clean Energy Center
mg	milligram
MLLW	Mean Lower Low Water
MLW	Mean Low Water
MW	Megawatt
mm	Millimeter
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen oxides
O&M	Operations and Maintenance
OCS	Outer Continental Shelf
OTB	Offshore Terminal Bremerhaven
PAHs	Polyaromatic hydrocarbons
PCBs	Polychlorinated Biphenyls
psf	Pounds per square foot
Ro-Ro	Roll-On, Roll-Off
SPMTs	Self-Propelled Modular Transport Units
T	Tonne
t	Metric ton
t/m2	Ton per square meter
TMDL	Total Maximum Daily Load
TOY	Time of Year
UK	United Kingdom
U.S. DOE	U.S. Department of Energy
U.S. EPA	U.S. Environmental Protection Agency
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VOCs	Volatile Organic Compounds
WTG	Wind Turbine Generator

EXECUTIVE SUMMARY

The Bureau of Ocean Energy Management (BOEM) is responsible for issuing Outer Continental Shelf (OCS) leases as well as monitoring and mitigating impacts that might be associated with offshore wind energy development that would happen on those leases. Although offshore wind is still in its infancy in the United States, it is recognized that port facilities are a critical piece for development and operation of an offshore wind energy facility. Currently, very few ports on the U.S. Atlantic coast are currently capable of fully supporting an offshore wind energy project, however, port modifications are already being implemented or planned to accommodate wind energy facility construction and operations. Traditionally, port development in the U.S. has been focused on commerce by supporting the efficient transport of large quantities of goods and enabling larger and deeper draft ships to access ports as far inland as possible (Cooper and Marrone 2013). Offshore wind energy projects will require specialized equipment, services, and labor not currently available in most U.S. ports. Understanding what will be needed to support both short-term construction and long-term operation and maintenance activities at these ports involves learning from the recent experience of European offshore wind projects, as well as identifying similar services and activities already associated with existing marine industries in the U.S.

Port facilities are anticipated to host three primary activities to support offshore wind energy project development: fabrication and assembly, installation and staging, and operations and maintenance. The primary activities considered for this study are associated with the modification of ports to support the staging and installation of extremely large and heavy components associated with offshore wind energy projects and facilitating access and docking of vessels that transport and install them. Offshore wind staging ports are anticipated to require significant storage and lay-down space, equipment to transport large cargo within the port, cranes with heavy lift capacity to load and unload components from the vessels, sufficient quayside space to accommodate transportation and installation vessels, and sufficient overhead clearance along waterbodies leading to ports to allow these vessels to reach the port. While many of these capabilities are available today in ports along the U.S. Atlantic coastline, the primary exception is the capability of the typical U.S. Atlantic cargo port to handle the weight of the heaviest offshore wind turbine components since the quayside and cranes are configured for lighter load cargo. Therefore, the limiting factors are the quayside bearing capacity as well as the lifting capability of cranes.

This study built upon the U.S. Department of Energy's (U.S. DOE) Assessment of Ports for Offshore Wind Development in the U.S. (DNV GL 2014) and the Port Assessment Tool (DNV GL 2015), and included review of European experiences and studies conducted in the U.S. The study also developed a set of criteria defining the port requirements necessary to support offshore wind construction; identified and classified Atlantic coast ports that could potentially service proposed areas for the offshore wind energy industry; identified potential modifications needed to support the industry at these ports; and summarized potential impact producing factors, potential environmental and socioeconomic impacts, and potential mitigations measures associated with the port modification activities.

Environmental and socioeconomic impacts of port modifications are typically location specific and depend on the magnitude of changes to the impact producing factors relative to local conditions. These impacts may range in severity and depend upon numerous factors, including the impact producing factors, environmental and socioeconomic resources present, location (a primary determinant), time of year, and presence of other factors not associated with the intended port modifications. In general, many of the associated impacts to environmental resources are temporary in nature. Such temporary impacts can be mitigated through regulations and Best Management Practices (BMPs); however, individual, port-specific analyses and/or monitoring are necessary to assess impacts resulting from proposed modifications.

Identifying a minimum set of criteria for selecting a port to support construction of an offshore wind project is a challenging exercise. There are many different ways to make a port facility work for a given project. The wind project can adjust the logistics and equipment to adapt to the available capabilities of the port. For example, as demonstrated by European ports, an air draft restriction may be overcome by utilizing a different configuration of components onboard a vessel. The height of the components may be too high when stored vertically on a vessel, but may be lower when configured differently or stored horizontally. Additionally, some components may be transported in pieces, requiring assembly offshore or at an appropriate location not constrained by height limitations (Cooper and Marrone 2013). A given project may select a port with greater or lesser capabilities depending on the needs of the project, on a cost-benefit review of available port facilities, and the costs and impacts associated with making necessary modifications to the port's facilities.

The financial commitment and investment of time necessary to permit, design, and prepare to modify a port for offshore wind component readiness can be incredibly large and take place over a long period of time. Unforeseen issues, technological advancements, or siting requirements that may not be known at the onset of an offshore wind energy project may have a material effect on the project during the development and permitting stage, and could affect the decision about which port to use or change the types of port modifications necessary to support the offshore wind project. Therefore, flexibility and scalability are important.

Communication is also critical to the successful implementation of port modifications. Offshore wind energy project developers should be communicating early and often with the port authority; federal, state and local authorities; and other key stakeholders, such as fishermen, harbormasters, and other port users in the area of the port(s) they intend to use for their project. It is imperative that these agencies and stakeholders be involved early and often throughout the planning, design and ultimately construction of any project.

The results of this study further confirmed the complexity of these projects, the need for more consistent information about U.S. port characteristics, and emphasized the need for site-specific information and early coordination between various stakeholders as some of the many elements that go into successfully siting, permitting, and preparing a port for an offshore wind energy project.

1.0 INTRODUCTION

1.1 Purpose of the Study

The expansion and modification of existing ports to accommodate proposed commercial wind energy development on the Atlantic OCS was the primary focus of this study. The objectives of this study were to achieve an understanding of:

- Current port capacity, specifically ones that could potentially handle construction activities related to offshore wind energy development, as well as an understanding of the port modifications that could be required to do so;
- Potential environmental and socioeconomic consequences of modifications to ports that may support offshore renewable energy facility construction, as well as the consequences of alterations to port operations; and
- Effectiveness of potential mitigation measures for the environmental and socioeconomic impacts of port modifications to accommodate offshore renewable energy facility construction based on actual experience to date.

The information gathered through existing experiences, a review of the available literature, and input from industry experts served as the basis for this study. This study was conducted to provide BOEM with an understanding of the existing status of Atlantic coast port facilities as well as activities required for port expansion and modification to support proposed Atlantic OCS offshore wind energy development projects. The deliverables were developed to provide documentation to support future National Environmental Policy Act (NEPA) reviews of offshore renewable energy actions and aid in the project specific assessment of potential environmental and socioeconomically impacts associated with the expansion and use of port facilities to support proposed Atlantic OCS offshore wind energy development projects.

1.2 Study Background

In 2005, the Energy Policy Act amended Section 388 of the 1953 Outer Continental Shelf Lands Act, giving the Secretary of Interior discretionary authority to issue leases, easements, or rights-of-way for renewable energy projects on the Federal OCS. Under this authority, BOEM is charged with conducting OCS lease sales as well as monitoring and mitigating unwelcome impacts that might be associated with resource development. BOEM recognizes that new and future uses of the OCS, including renewable energy development, should be managed in a deliberate and responsible manner.

BOEM has opened the door to commercial wind energy development on the OCS in the Mid-Atlantic with the publication of the final environmental assessment for Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore New Jersey, Delaware, Maryland and Virginia and various leasing activities in both the North and Mid-Atlantic.

Port facilities are necessary to facilitate construction, operation, and decommissioning of an offshore wind project. Additionally, larger project components, such as foundations, towers, nacelles, blades, inter-array and export cables, and substation top-sides are typically fabricated at a port-side facility to facilitate transportation to the project site. If current port capabilities cannot support the needs of offshore wind energy projects, it is possible that offshore wind development activities could lead to the expansion or modifications of ports. However, the ability and willingness to carry out significant port expansion or modification will be driven by future offshore wind projects as well as political and economic priorities to support these projects. These priorities will vary from port to port and state to state.

As the offshore wind energy industry develops along the Atlantic coast, it will be important for Federal, state, and local stakeholders to understand the potential environmental and socioeconomic consequences of such development, including the impacts from port expansion/modification and changes in port operations.

The expansion and operation of port facilities can produce a variety of environmental impacts, such as emissions, expansion into undeveloped areas, vessel induced wake erosion, increased dredging, and effects on air and water quality and coastal habitats. In addition, a variety of both positive and negative socioeconomic impacts may occur, such as the increase in construction-related employment and the possible decrease in employment in other fields due to the changing characteristics and use of a port (e.g., a traditional fishing port changing to a wind energy hub).

In addition to BOEM, the U.S. DOE and various state entities and port authorities have been examining criteria for possible improvements to existing port infrastructure. Many reports have indicated modifications will be needed, especially in light of larger proposed turbine sizes. Information from previous studies that analyzed the potential impact of the Panama Canal Expansion and European experiences, namely how ports were altered to accommodate offshore wind energy development, the environmental and socioeconomic impacts resultant from those alterations, and the identification of associated and/or potentially useful mitigation measures, were considered.

Project-specific environmental impact statements (EISs) that evaluate the potential environmental and socioeconomic consequences of wind facility construction will need to be written and will need to account for impacts associated with the expansion/modification and use of port facilities for offshore wind energy development. The information from this study will support these assessments.

2.0 REQUIRED PORT CHARACTERISTICS

To identify the required port characteristics, the ESS Team built on its existing experience, conducted a review of the available literature, and sought input from industry experts. This section describes the port characteristics required to accommodate activities associated with offshore wind energy facility construction on the Atlantic OCS. Identification of these port characteristics is important to identify and understand the port modifications that could be needed to support the offshore wind industry in the Atlantic OCS. This section will also summarize port modifications that have already been implemented or are being planned along the U.S. Atlantic coast to accommodate Panama Canal expansion or wind energy facility construction; as well as potential activity and use conflicts.

This section builds upon the U.S. DOE’s Assessment of Ports for Offshore Wind Development in the U.S. (DNV GL 2014) and the Port Assessment Tool (DNV GL 2015), which involved a review of the current capability of U.S. ports to support offshore wind project development and assessment of the challenges and opportunities related to upgrading this capability to support the growth of as many as 54 gigawatts of offshore wind installed in U.S. waters by 2030. The resulting Ports Assessment Tool was designed to aid decision-makers in making informed decisions regarding the types of investments that would be required to make individual port facilities suitable to serve offshore wind manufacturing, installation, and/or operations. While this section similarly describes the port characteristics required to accommodate offshore wind energy facility development, the following sections further consider the environment and socioeconomic impacts associated with port modifications, as they relate to the NEPA process. In addition to the U.S. DOE report, port readiness was evaluated relative to the offshore wind industry in general (ICF 2012; Cooper & Marrone 2013), as well as to specific ports (Kinetik 2011; TetraTech 2010).

2.1 Introduction to Offshore Wind

BOEM is responsible for issuing OCS lease sales as well as monitoring and mitigating impacts that might be associated with offshore wind energy development that would happen on those leases. Although offshore wind is still in its infancy in the U.S., it is recognized that port facilities are a critical piece in the development and operation of an offshore wind energy facility. Currently, very few ports exist on the Atlantic coast that are capable of fully supporting an offshore wind energy project; however, port modifications are already being implemented or planned to accommodate wind energy facility construction and operations.

Based on European experiences and studies conducted in the U.S., port characteristics critical to supporting offshore wind energy development include:

- Vessel access (channel width and depth; turning capacity; overhead draft);
- Lifting capabilities given the weight and height of components (crane types, height restrictions);
- Bearing capacity of the quayside and storage area;
- Number of berths and storage area;
- Available transportation infrastructure (haul route width and capacity; component load out; road/rail access); and
- Location (e.g., distance from wind energy areas, construction areas, and staging/storage areas, skilled work force).

A note on nomenclature: the term quayside (pronounced “key-side”) is used throughout this report in place of the equivalent terms wharf or pier. While wharf and pier are both more commonly used in the U.S., quayside is the standard term within the offshore wind industry.

Section 2.2 provides an overview of the intended uses of ports for offshore wind construction, including installation/staging, manufacturing, crew transport, operations and maintenance, and storage. Sections 2.3 and 2.4 provide an overview of the components needed for a wind facility and the activities that would take place at the port, respectively. Section 2.5 provides a summary of the port requirements necessary to support offshore wind, by both component and activity, and Section 2.6 provides a summary of implemented and planned port expansions with a discussion of the potential port activity uses and conflicts.

2.2 Overview of Offshore Wind Port Uses

Port facilities are necessary to facilitate construction, operation, and decommissioning of an offshore wind project. Additionally, larger project components are typically fabricated at a port-side facility to facilitate transportation to the project site. The following section summarizes the ways in which ports are used to support offshore wind projects.

2.2.1 Manufacturing and Fabrication

Large offshore wind components, such as foundations, towers, nacelles, blades, inter-array and export cables, and substation top-sides, are typically manufactured in a facility located on the water. This allows these components to be loaded directly onto a vessel and transported to the project’s staging port or to the project site itself. This transportation-based approach is especially necessary when the component is too large or too heavy to be transported by road or rail. For example, a 6 megawatt (MW) turbine nacelle is too large to be readily transported by road due to its width and height. While a large nacelle could be delivered to the staging port in pieces for final assembly, it is typically preferable to complete final assembly in the controlled environment of the manufacturer’s factory.

If the manufacturing facility is located relatively close to the project site, the project may choose to deploy that component directly to the site for installation, rather than staging the component elsewhere. In the U.S. market, where few component manufacturing facilities exist currently, this approach is not expected to be commonplace.

2.2.2 Installation and Staging

During the construction phase of an offshore wind farm, historically, the most common alternative has been to identify a staging port adjacent to the wind farm site, then to transport all major components from the manufacturer's factory to the port facility. By building up a sufficient buffer stock of components, the construction management team can ensure that the expensive installation spread has adequate supplies of each component, at all stages of the construction program, to complete the installation with maximum efficiency. Staging ports are also referred as marshalling ports or construction ports.

The main reason for this approach (as far as wind turbines are concerned) has been that the locations of turbine manufacturers in Northern Europe, which were generally onshore turbine manufacturers branching out into a new marketplace, were rarely adjacent to the offshore development areas. Also, it is common for different specialist facilities or sub-contractors to manufacture only one type of component, so blades may be made in one location, towers in another, and the nacelle elsewhere. The installation vessel would then have to visit several ports, to build up a set of complete turbines onboard for transport to the project site. It therefore made sense to draw all the components together in one place, and use of a staging port adjacent to the construction site became a sensible option.

As the distance between the offshore site and the multiple collection points at widely distributed manufacturers increases, the voyage times for the costly main installation vessel increases pro-rata, and there comes a point when it becomes more economical to carry out the long distance heavy transport with rapid, cheap cargo vessels and barges. Even when factoring in the additional crane and port fees associated with a staging facility, it is expected that there is still a net saving against the additional voyage costs of the main installation vessel. This is common practice in Europe and is expected to be the practice in the U.S., as well.

The unit costs of the main installation vessel's voyage cycle are central to the decision whether to utilize a staging port. Two factors of critical importance are:

- The transit speed of the installation vessel; and
- The vessel's carrying capacity for the components being installed.

Both these parameters strongly influence the unit voyage costs, and have led to a rapid evolution of larger, faster vessels across the wind turbine installation fleet.

Most of the early offshore wind farms were built using towed jack-up barges, with transit speeds of 4 or 5 knots that could carry one or two foundations or turbines. The newly built fleet of Wind Turbine Installation Vessels is generally capable of speeds of approximately 12 knots and has carrying capacities of several units per voyage. This is far slower than cargo vessels, which routinely transit at 15-20 knots; however, it is fast enough to make transportation directly from manufacturers located significantly farther away, rather than to a staging port, the most economical option in many cases.

The other significant factor is the carrying capacity of the installation vessel. If twice as many foundations can be carried per installation cycle, the additional cost per foundation of these long voyages is effectively halved and the balance is tipped against a staging port being an economic option. A secondary consideration has always been that if the installation vessel is cycling large distances, the cycle time per voyage will increase and the installation rate will decrease accordingly. If the installation rate decreases markedly, the vessel may not be capable of carrying out the full season's installation program within the good weather window for the site. This would make a staging port a sensible option, as it would ensure that the installation was carried out during the optimum season, and the cost savings of the additional weather windows may well exceed the costs of a staging port.

2.2.3 Crew Transport

To date, most existing offshore wind projects utilize onshore bases and typically use work boats to transport technicians from port to the offshore site. In more advanced strategies, the uses of specialized vessels or helicopters are emerging for some existing and planned projects. Furthermore, as projects begin to be based further offshore, work boats may also operate from fixed offshore bases, 'floatels' or motherships to substantially reduce the time required for transiting crew to and from site. Such offshore-based approaches require technicians to live for some or all of the year on offshore accommodations near the vicinity of the wind farm, whether fixed or floating, in a similar manner to the approach adopted in offshore oil and gas.

A wide range of conventional and specialized vessels are currently available to provide frequent personnel transportation and access to offshore wind farm developments from an onshore location. These vessels vary in capacity, speed, and significant wave height (Hs)[1] transferring capabilities and include:

- Quick response vessels (e.g., Rigid Inflatable Boats);
- Work boats (traditional catamarans);
- Small Water-plane Area Twin Hull vessels; and
- Hovercrafts or amphibious vehicles (for ice or inter-tidal conditions).

A review of these vessels is provided in the following sub-sections.

2.2.3.1 Quick Response Vessels

There are a range of Rigid Inflatable Boats and other lightweight vessels currently available for offshore wind farm operations. These vessels are small and designed for light work and quick response during installation and operation activities offshore. The vessels are typically in the range of 5 to 15 meters (m) (16 to 49 feet [ft]) length and capable of transferring up to 12 technicians and achieving speeds of approximately 35 knots, well in excess of those attained by most aluminum catamarans and larger work boats.

Although these vessels offer greatly reduced transit times, they are unsuitable for personnel transport over large distances and/or in unfavorable sea conditions. They may, however, offer advantages over work boats for some operations, such as when quick fault diagnosis and subsequent turbine restart is possible without the need for substantial spare parts or additional equipment, for use as supplementary transfer vessels when a greater number of service crews are present for a particular maintenance campaign, and for in-field transfers, particularly in sheltered sites in the summer months when sea conditions are relatively calm. Such vessels may also be

[1] Significant wave height is defined as the average height of the one-third highest waves of a given wave group.

utilized as “daughter crafts” in conjunction with floating offshore-based operations (e.g., motherships). Quick response vessels are capable of transferring technicians onto offshore structures in sea conditions with wave heights between 0.75 and 1.5 meters (m) (2.5 to 5 ft), depending on their size and hull design as well as the profile, frequency, and direction of the waves. 2.2-1 shows an example of these vessels.

Source: www.windcatworkboats.com

Figure 2.2-1. WindSpeed Quick Access Vessel by Windcat

2.2.3.2 Work Boats

Work boats form an integral part of Operations and Maintenance (O&M) strategies for currently operational projects and are typically larger and more comfortable than the Quick Response Vessels. Their purpose is generally to transfer personnel and moderately-sized parts to near-shore projects in support of both scheduled and unscheduled maintenance activities. In some cases, work boats may also operate from fixed offshore bases, floatels, or motherships.

Work boats are typically designed with large foredecks to allow plenty of space and flexibility for transporting components and equipment. This arrangement also means that all items are located underneath the turbine davit or nacelle crane when the vessel is in position against the boat landing. The maximum size of parts, tools, and consumables that may be transported is usually governed more by the lifting capacity of the davit or nacelle crane on the turbines than by the deck capacity of the work boat.

Industry-quoted figures suggest that work boats may typically be used to transfer technicians to offshore structures in significant wave height conditions of up to approximately 1.5 to 1.8 m (5 to 6 ft); however, operating experience suggests that this is often not achievable, especially for smaller vessels.

2.2.4 Operations and Maintenance (O&M)

The operation and maintenance activities of an offshore wind farm can be divided into two main tasks:

- Monitoring, controlling, and coordinating the wind farm operations; and

- Maintenance activities, which are typically sub-categorized into scheduled and unscheduled maintenance of the turbines and the balance of plant.

Currently, developments in advanced control and monitoring systems enable operators to undertake routine checks of operational data and to control the turbines from a remote onshore location, while scheduled and unscheduled maintenance works require the transportation and transfer of technicians to the offshore structures.

2.2.4.1 Scheduled Maintenance / Inspection

This maintenance category comprises any task which is pre-planned at the design stage and normally requires the turbine to be temporarily stopped for maintenance work to be performed. Offshore scheduled maintenance intervals of one year are emerging as the normal practice in contrast to the quarterly or bi-annual approach typically witnessed onshore. This reflects the greater expense, risk, and effort associated with offshore access. These tasks can be performed by trained technicians who are transported to the turbines via marine vessels or helicopters and who then perform the maintenance services equipped with basic tools and consumables.

Such scheduled tasks are often conducted on a seasonal basis, with the bulk of work being carried out in the summer to maximize the probability of access and minimize lost production. This approach may lead to the need for additional resources (vessels, equipment, and technicians) to be brought in during these campaigns.

2.2.4.2 Unscheduled Maintenance

Any unplanned maintenance activities resulting from a failure of a system, sub-system, or component fall within this maintenance category. The level of corrective action, and the impact of the unscheduled maintenance upon the wind farm availability, depends on the severity of the failure. Most failures occur within the wind turbine generator systems and only affect the output of individual turbines, while failure events within the substations or cables occur far less frequently but can have a greater impact on the number of turbines affected depending upon their location. These tasks are performed by trained technicians who are transported to the turbines via marine vessels or helicopters and who then perform the maintenance services equipped with basic tools and consumables; however, some unscheduled maintenance activities could require the use of larger vessels.

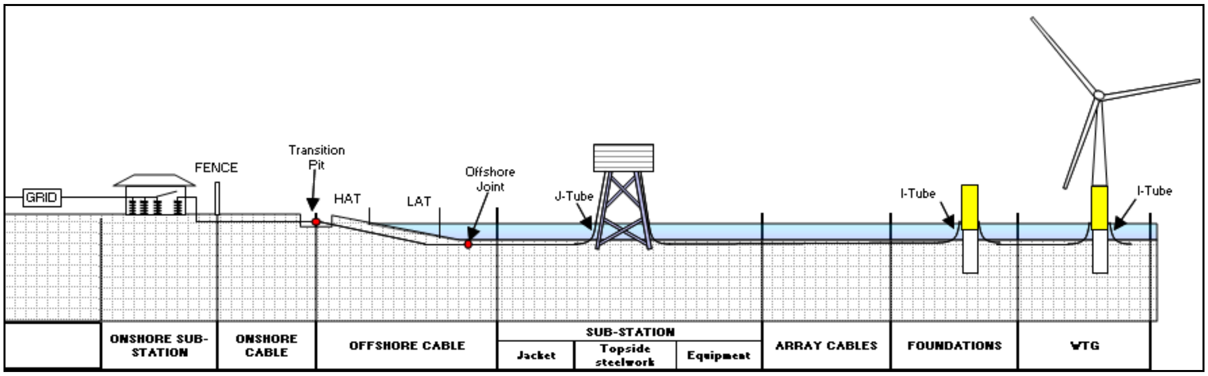
2.2.5 Spare Parts Storage

Ongoing maintenance of any wind project requires a supply of spare parts including major replacement parts (e.g., blades), minor replacement parts (e.g., hydraulic units), and consumables (e.g., lubricants, air filters). Typically, the most frequently used spare parts are stored at a port facility that is located near the project. This port also typically serves as the O&M base of operations and may also house offices and workshops for the project. Larger spare parts may be stored at this same port or at a different port if the vessel access or crane capacity at the O&M port is insufficient to handle the larger parts. Major spare parts, such as blades, are normally delivered directly from the supplier, as needed, and unlikely to be maintained in spare parts storage at the port.

An offshore wind farm also requires storage of spare lengths of inter-array cable and export cable at a port facility. These lengths of cable (typically a minimum 1,000 m (3,281 ft) for each cable type) must be stored near the water or in an area with crane availability so the cable can be loaded on to a cable repair vessel when needed. Spare cable is typically stored in a large horizontally laid coil that is inside a structure that protects the cable from light and mechanical damage. This cable storage requires an area within the port that can be dedicated to long-term storage of the cable without interference with other port uses.

2.3 Overview of Wind Facility Components

Figure 2.3-1 presents a diagrammatic representation of an offshore wind farm. Equipment is split between the offshore and onshore environments, with the installation, commissioning, and operation of the former requiring specialist vessels that are required to operate out of port facilities.



HAT = Highest Astronomical Tide
LAT = Lowest Astronomical Tide

Source: DNV GL (2014)

Figure 2.3-1. Components of an Offshore Wind Project

For further information on the weights and dimensions of specific components, see DNV GL (2014).

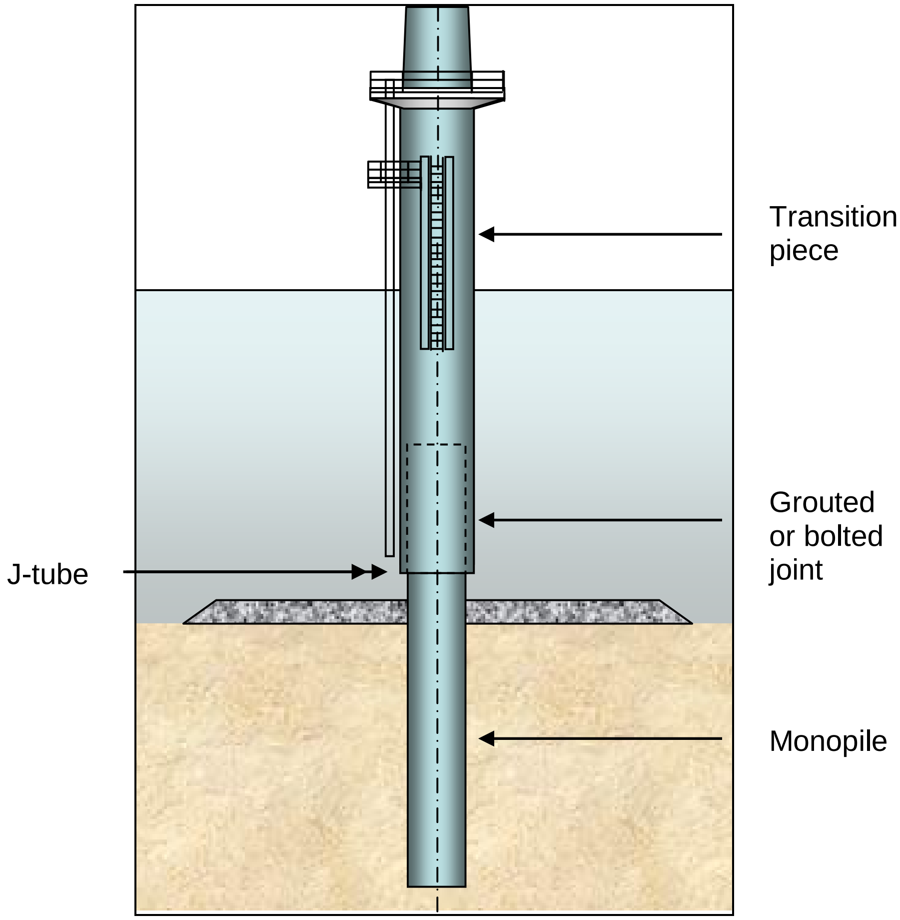
2.3.1 Foundations

The offshore wind farm market is now entering its third decade. Although several types of foundations have been proposed, the foundation types described below represent the technologies commonly used today and include steel monopile structures, gravity base structures, and jacket structures. In some cases, foundation type is the controlling factor relative to quayside bearing capacities and crane lifting capabilities; however, at other times, it could be the Wind Turbine Generators (WTGs). This is largely dependent on WTG size, as a monopile foundation is currently unable to support an 8 MW WTG; however, future technology improvements, such as XL monopiles, may allow for monopile support of 8 MW WTGs.

2.3.1.1 Steel Monopile Structures

Monopile structures have been proven as economic solutions in Europe across various soil conditions and water depths. Steel monopile foundations are used in about 79% of all operational offshore projects, and will be used in the majority of the projects currently under construction or contracted. Hence, steel monopiles offer a well understood design solution. Solutions to the recent industry-wide issues surrounding grouted joint design of new build monopile foundations have been approved so it is likely that monopiles will provide an economic and efficient solution in the future.

A monopile foundation consists of a single steel pile, which is embedded into the seabed. Figure 2.3-2 shows a typical monopile foundation design. The depth of pile penetration into the seabed and the pile diameter and wall thickness are determined principally by the maximum water depth, seabed soil conditions, and rated capacity of the wind turbine. The maximum water depth corresponds to the highest probable combination of high tide and storm surge.



Source: DNV GL (2014)

Figure 2.3-2. Windy Turbine Substructure Concept - Monopile

Typically, the turbine tower is mounted onto the foundation via a transition piece, which itself is fixed onto the pile using a specialized grouted joint. The purpose of the grouted joint is to take up any misalignment tolerances that inevitably occur during installation of the monopile, and provide continuity of structural load transfer between the monopile and the turbine tower. Recently, bolted connections have also been utilized at this joint.

The level of the top of the transition piece, or more specifically the level of the platform, is determined by the necessity to maintain adequate clearance over the crests of waves during storm conditions. On exposed sites with high tidal ranges this can place the platform up to 20 m (66 ft) or more above the water level shown on navigation charts.

The J-tube, illustrated in Figure 2.3-2 above, is an externally or internally mounted steel tube at the base of the foundation that protects the electrical cable leading between the seabed and the structure top-side. An I-tube (shown in Figure 2.3-1) provides the same function as a J-tube; however, it is a vertical tube rather than a J-shaped tube (GL Noble Denton and DNV 2015).

The J-tube and other more delicate attachments – such as railings, walkways, and electrical switchgear that would be damaged during pile-driving activities – are pre-installed (often at the staging port) on the transition piece instead of on the monopile itself. Monopile weights vary with water depth and turbine size, as well as wave climate severity, and soil strengths, and have typically ranged between 250 and 800 metric tons (t) (276 and 882 tonnes [T]) to date. Heavier monopiles (“XL monopiles”) in excess of 1000 t (1,102 T) have recently been ordered.

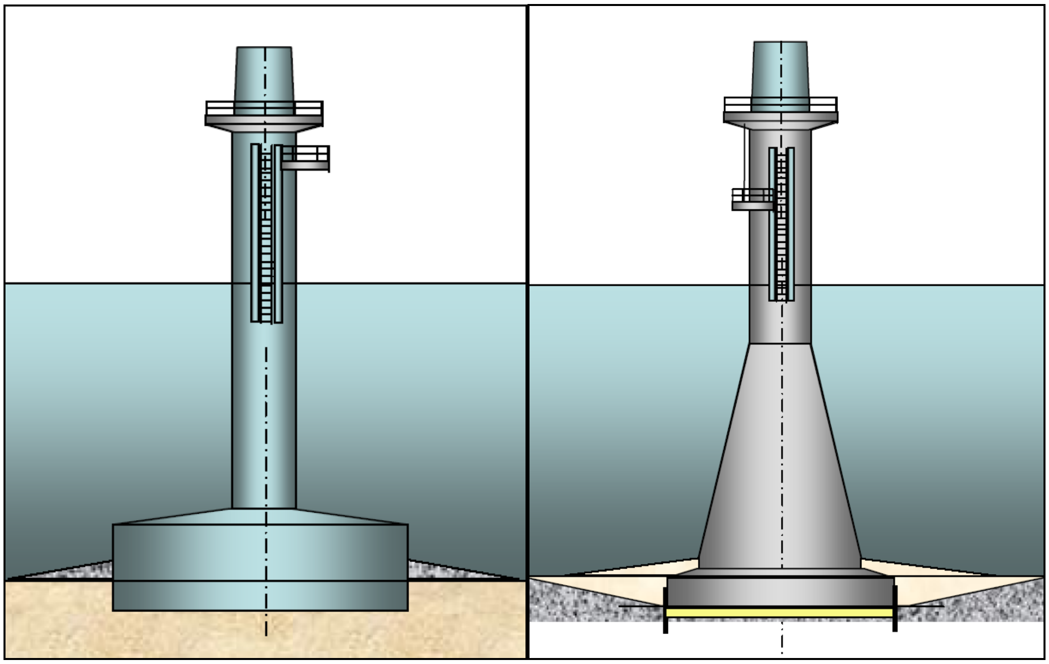
2.3.1.2 Gravity Base Structures

Gravity Base Structures (GBS) typically take one of the two forms illustrated in Figure 2.3-3. Although steel GBS foundations have been proposed, those which have been deployed to date have been made of concrete, for reasons of fabrication cost. Hence, this type of structure is sometimes termed a Concrete Gravity Structure or Concrete Gravity Base Structure.

Concrete gravity bases of both narrow shaft and conical form have been used on a number of offshore wind farms in Northern Europe, with approximately 168 installed and 90 being planned for construction as of mid-2015. Most of these foundations have been of the narrow shaft form, with six foundations at the Belgian Thornton Bank Project being of the conical design. The base of the GBS foundations are typically filled with ballast, consisting of sand, rock, or even water, which serves to anchor the foundation to the seabed and can be adjusted to suit the soil conditions. The ballast can partly be installed in the fabrication yard and partly at the final position; all depending on the capacity of the construction yard, the available draft during sea transport and the availability of ballast materials (DNV 2010).

To date, all GBS foundations for wind turbines, except those of Thornton Bank (consisting of just six turbines at approximately 25 m (82 ft) of water depth), have been installed in rather shallow waters. As a result, the required lifting capacity has been well below 2,000 t (2,205 T), ensuring that the transport and installation of the foundation could be executed using inexpensive barges customized for the installation process. For some projects, such as Middelgrunden just outside Copenhagen (Denmark), the foundations were manufactured in a dry dock and transported to the site partly submerged, thus reducing the required lifting capacity.

Based on available information from the Thornton Bank project, it is evident that new methods must be considered to ensure relatively swift and continuous transport and installation processes. These processes need to be more independent of wave height and frequencies.



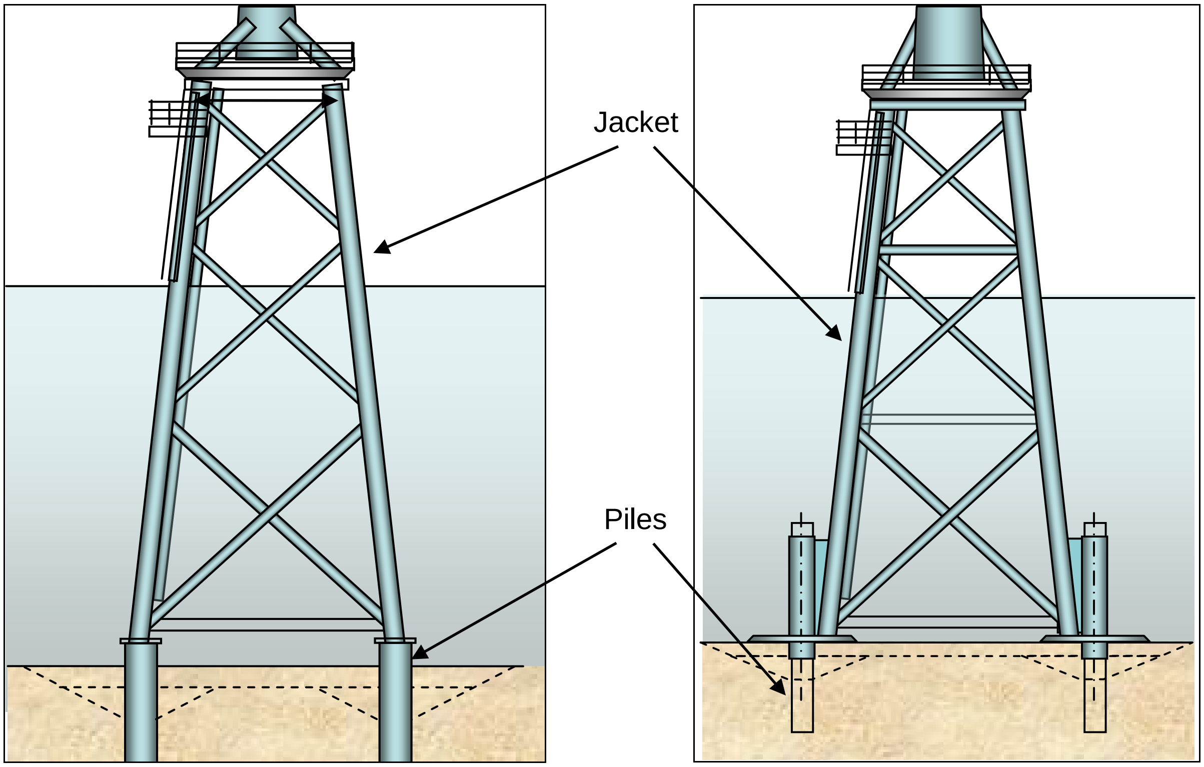
Source: DNV GL (2014)

Figure 2.3-3. Wind Turbine Substructure Concept – Gravity Base Structure

2.3.1.3 Jacket Structures

A general jacket foundation form is illustrated in Figure 2.3-4. Jacket structures appear to be favored for the support of wind turbines in the 5 MW to 7 MW range. Fabrication complexity, especially at the interface with the tower, is a specific issue that needs to be resolved, though several forms of simplified transition structure are in development, which avoids this complexity. Alternative forms of transition structure are also often dictated by design for natural frequency limits.

In recent years, jacket structures have been developed to support REpower 5M wind turbines at the Beatrice demonstrator site off northeastern Scotland, at the Alpha Ventus wind farm in the German North Sea, and at the Ormonde wind farm in the Irish Sea. These deployments cover a wide range of water depths, from approximately 20 m (66 ft) at Ormonde, to 30 m (98 ft) at Alpha Ventus, to 45 m (148 ft) at the Beatrice demonstration site. Together, these three sites indicate that jacket foundations are viable options for larger wind turbines, such as the RE5M, in a fairly broad range of water depths.



Source: DNV GL (2014)

Figure 2.3-4. Wind Turbine Substructure Concept – Jacket (pre-piled & post-piled)

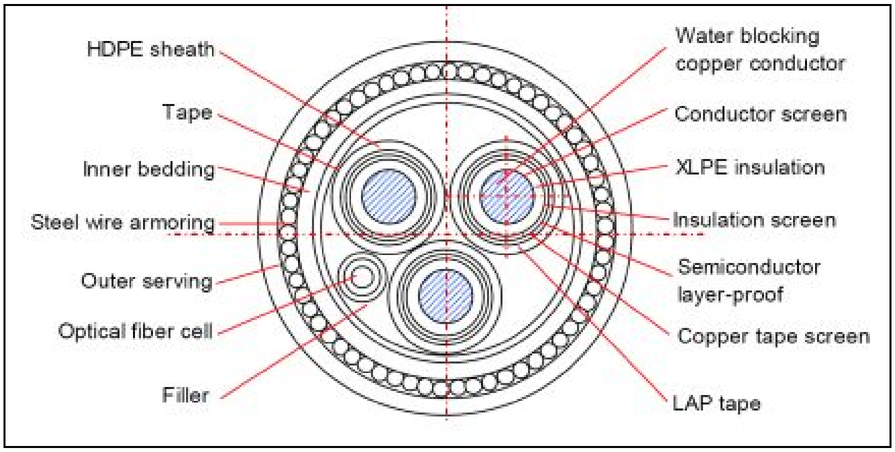
The nature of the jacket concept lends itself to a considerable number of variant geometries. These include shortened jackets that do not emerge above sea level, 3- and 4-legged jackets, jackets which might be piled in-leg, and alternative leg inclination angles, among others.

Secondary steelwork such as boat landings and working and intermediate access platforms are mounted on the main lattice and would be entirely pre-installed at the fabrication yard. J-tubes are generally mounted to the brace members and are enclosed within the lattice.

2.3.2 Cables

2.3.2.1 Inter-Array Cables

The inter-array cables connect the wind turbines into strings and then connect the strings to the offshore substation platform(s). The cables between adjacent wind turbines are relatively short in length and depend on the wind farm layout. The cables between the offshore substation and the wind turbine strings are typically longer. At present, inter-array cables in Europe are typically operated at a voltage level of 33 kilovolt (kV); in the U.S., 33 kV or 34.5 kV is expected to be the norm. Typical conductor diameters range from 120 square millimeters (mm^2) to 630 mm^2 (0.186 square inches [in^2] to 0.977 in^2) depending on usage and capacity; this range of cable could carry between approximately 20 MW and 35 MW. In the future, it is expected that cables will be operated at around 66 kV, which would enable savings through the use of fewer wind farm array circuits. These cable sizes are consistent with those used in the offshore electric submarine cable industry (ORTC, 2011; PMSS, 2014). Figure 2.3-5 below shows a typical cross-section of a 3-core cable with fiber optic communications medium. The steel wire outer armoring provides mechanical protection for the cable.

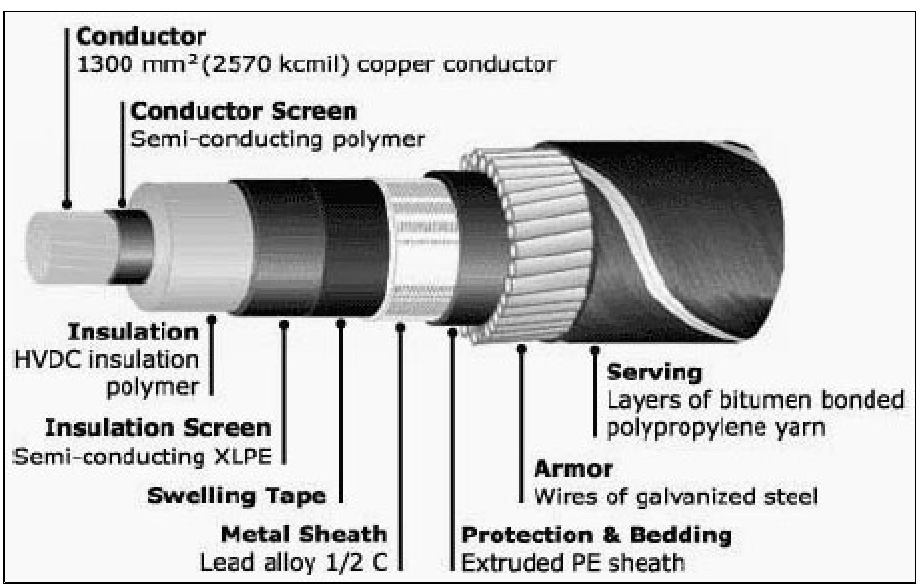


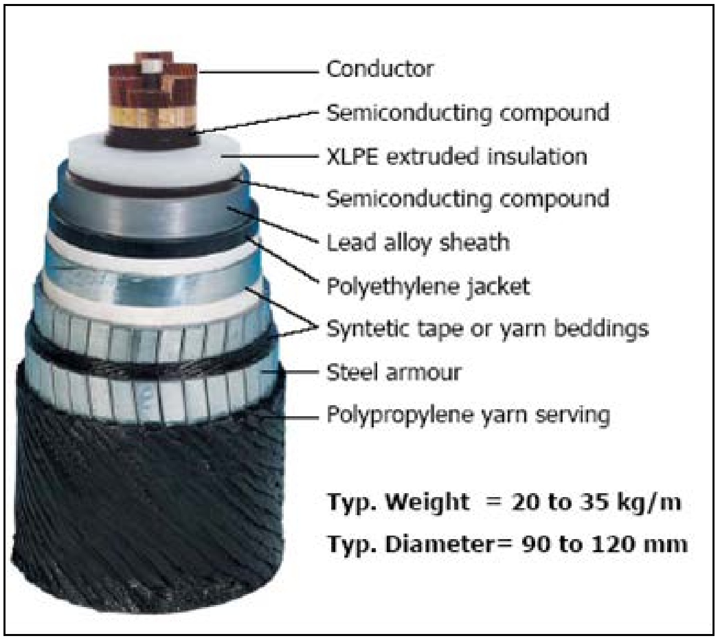
Source: http://www.zttcable.com.hk/en/submarine.htm

Figure 2.3-5. Cross-Section of Inter-array Cable

2.3.2.2 Export Cables

The export cables transmit the electricity from the offshore substation(s) to the designated onshore landfall point. Two types of cables are currently available for use: Alternating Current (AC) or High Voltage Direct Current (HVDC). AC export cables are similar to the array cables, although the insulation requirements are more significant. Therefore, the dimensions of a 132 kV 500 mm^2 (0.775 in^2) cable are greater than those of a 33 kV 500 mm^2 (0.775 in^2) cable. HVDC cables are much simpler, as shown in Figure 2.3-6 below, although in most cases two will be required: a send and return or positive and negative. The two HVDC cables are typically bundled together and installed in a single trench.



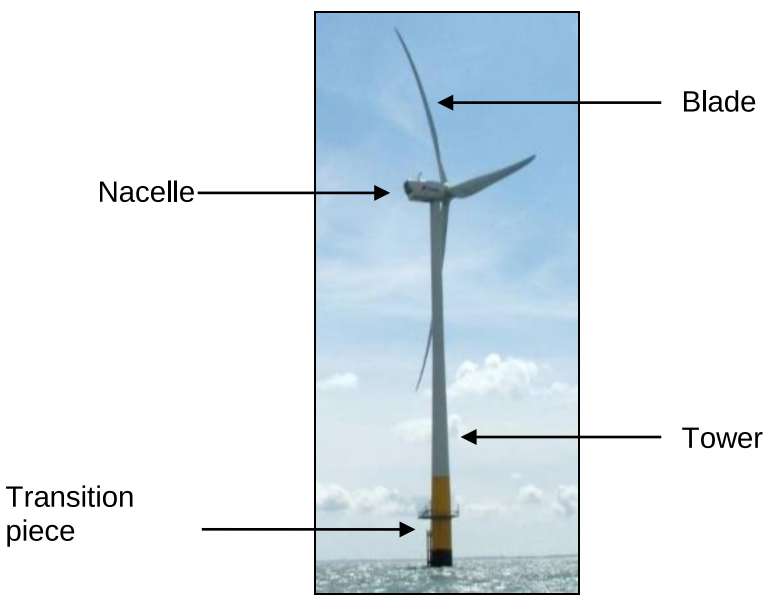


Source: electrical-engineering-portal.com/offshore-wind-farms-transmission-cables

Figure 2.3-6. Components of a HVDC Export Cable

2.3.3 Turbines

This study considers wind turbines with power ratings ranging between 4 MW and 8 MW, which is the likely range of turbine sizes that would be principally used in the U.S. in the short- and medium-term. Figure 2.3-7 presents a typical upwind offshore wind turbine. The primary components of an offshore wind turbine are labeled.



Source: DNV GL (2014)

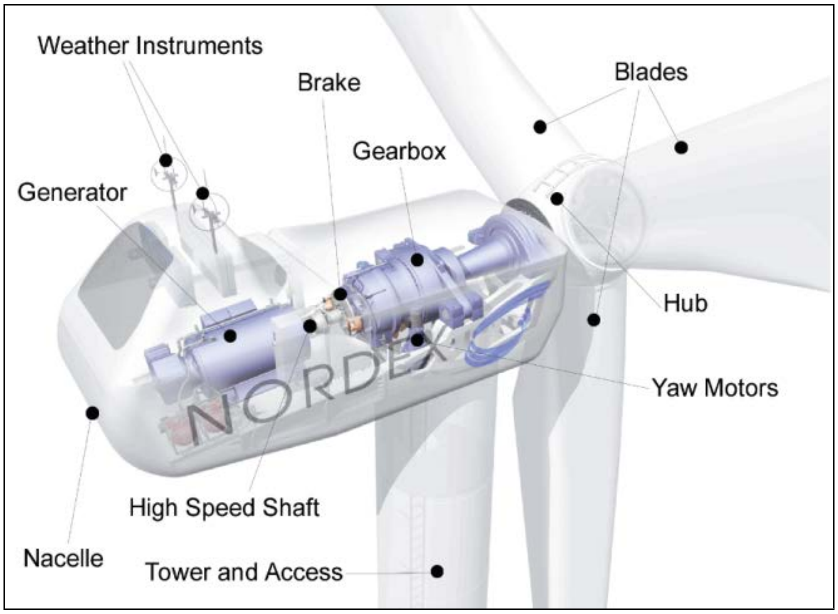
Figure 2.3-7. Principal Components of an Offshore Wind Turbine

2.3.3.1 Wind Turbine Tower

The tower structure is usually a lightly tapering tubular section, which connects the flanged connection at the top of the foundation unit or transition piece to the nacelle. The tower structure is likely to consist of up to four tapering steel tubular sections, which are lifted into place and bolted together.

2.3.3.2 Nacelle and Blades

The nacelle typically houses the drivetrain and many of the power electronic and control components of the turbine. The general architecture of a typical gear-driven wind turbine nacelle is illustrated in Figure 2.3-8. The nacelle is usually installed at the site as a single unit, with the hub pre-installed. The wind turbine blades are then bolted onto the hub. Depending on the capabilities of the installation vessel and the assembly space available in the staging port, some turbines are erected using a full rotor installation, which comprises the hub and blades being preassembled onshore and installed on the nacelle offshore.



Source: www.nordex.dk

Figure 2.3-8. Wind Turbine Nacelle and Rotor

2.3.4 Substations

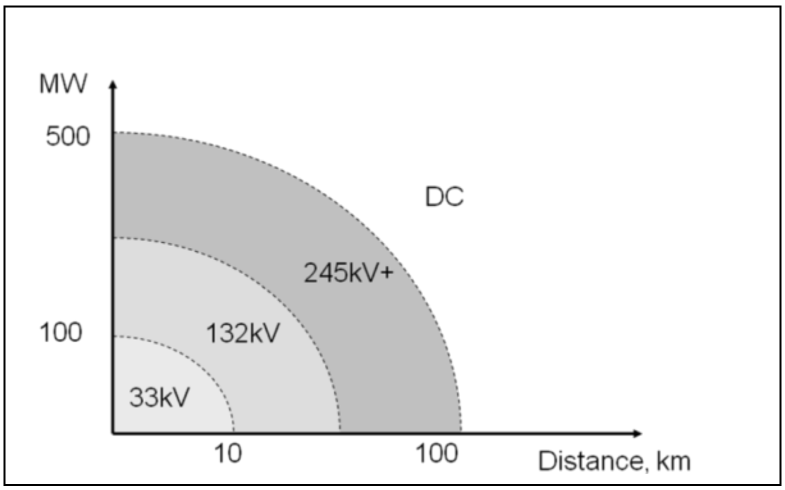
Whether an offshore wind farm has an offshore or onshore substation depends primarily on the size of the wind farm, distance from shore, and distance from the grid connection point. Typically, wind farms farther than approximately 10 kilometers (km) (6.2 miles) from land have substations offshore. The substation accommodates the transformers required to increase the distribution voltage (33 kV or above) of the inter-array cables to a higher voltage of typically 110 – 245 kV. From the offshore substation, the export cables then carry the power to the landfall location.

As wind farm capacities increase and move farther offshore, there is a requirement for increased electrical equipment ratings and hence, for larger substations. When wind farms are located at substantial distances from shore, the losses in the electrical system can become significant. To minimize losses as far as possible, voltages are stepped up, for example from 33 kV to 115 kV.

2.3.4.1 Power Export Technology: HVAC or HVDC

Eventually, when distances are large, transporting power with reasonable losses using High-Voltage Alternating Current (HVAC) becomes technically challenging and may justify the use of HVDC technology, which is a step change in the size of the required electrical infrastructure. Figure 2.3-9 presents an approximation for the optimization of the power export technology as a function of the distance from the shore and the capacity of the wind farm.

If the power is to be exported from the wind farm using HVDC, a separate offshore platform may also be installed to house the plant, which converts the AC that is generated by the wind turbines to direct current (DC) for the transmission of power to shore.



Source: DNV GL (2014)

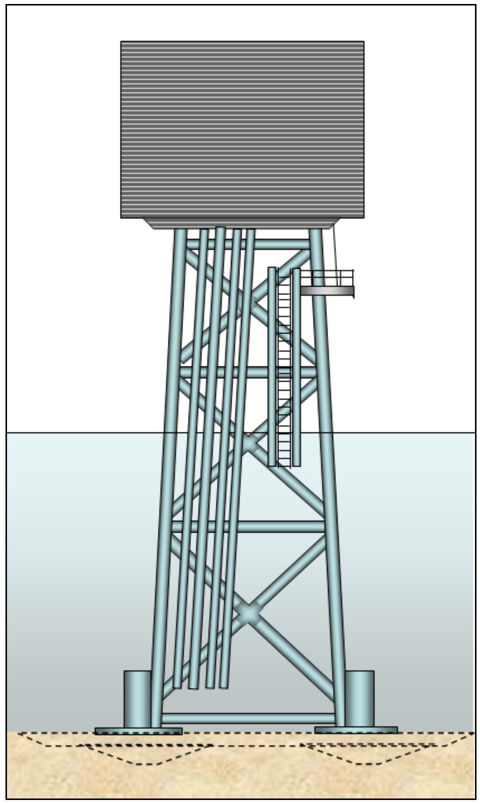
Figure 2.3-9. Export Cable Technology vs. Distance

The approach of utilizing several substations for large projects and for projects with HVDC output is considered to be a likely trend as the European offshore wind industry progresses and projects move farther offshore.

2.3.4.2 Substation Foundation

The substation(s) require foundations on which to place the topside that contains the equipment mentioned above. Options for the foundation design are similar to those for turbine foundations but the topside weights are heavier, requiring significantly larger substation foundations.

The substation foundation unit is likely to use one of the design concepts described above for the wind turbines, most probably a jacket structure. Figure 2.3-10 below shows typical configuration for a jacket mounted offshore substation.



Source: DNV GL (2014)

Figure 2.3-10. Offshore Substation on Jacket Foundation

2.4 Overview of Port Activities

Port facilities supporting offshore wind energy projects typically host three primary activities: fabrication and assembly, installation and staging, and operations and maintenance. Part of each of these activities are a set of typical tasks performed at a port, including loading and unloading components, transporting components, storing components, maintenance of components, and fabrication, and/or final assembly of components. The following sub-sections provide an introduction to each of these tasks.

Large offshore wind project components are generally manufactured, stored, loaded, and unloaded at a port facility before they are deployed to the project site. One exception is jackets, which are generally not unloaded after loadout at the manufacturer's factory and remain on their transportation barge after leaving the fabrication yard, remaining afloat until they are installed.

Port facilities also serve as the best location for fabrication facilities. If a manufacturer happens to be located reasonably close to the offshore wind farm site, this facility may fulfill the dual roles of manufacture and staging port.

2.4.1 Component Loading and Unloading

Historically, wind turbines were manufactured with onshore installation in mind. The remoteness of many onshore project sites was a key driver in determining maximum component sizes and their design for largely road-based transport. Nevertheless, the international scale of the wind turbine market led to the location of many turbine manufacturers on or near coastal, river or estuarine port facilities, placing them in a favorable position for the subsequent offshore wind market.

The increased size of offshore turbines can also restrict many traditional approaches to road-based transport of components. As a result, it is normal practice for components to be transported by sea directly from the manufacturer to a marshaling or staging port before subsequent transport to the offshore site, thus avoiding any significant onshore transport with the exception of general port logistics. In some cases, turbines may even be shipped directly to the site from the manufacturer port facility, limiting onshore handling still further.

In the U.K. and Europe foundations and other offshore components have, by necessity, followed a similar route, with fabricators and suppliers largely based close to a suitable port. Once again, a marshaling or staging port may be adopted as an interim storage facility, depending largely on the transit distance between the site and the fabrication port.

There are various transportation alternatives for moving turbines and foundations from the manufacturer's premises to the offshore wind farm site. The generally applicable alternatives are:

- Loading of components at the manufacturer's port facility and offloading them onto quayside storage areas at the staging port to be collected by a feeder vessel or installation vessel as required on site;
- Loading of components onto a transport vessel or barge at the manufacturer's premises and either anchoring the transport barge or offloading onto a storage barge in a sheltered harbor near the offshore wind farm site while awaiting transfer to the installation vessel;
- Loading of components onto a transport vessel or barge at the manufacturer's premises, and offloading onto the installation craft at the offshore wind farm site – known as feeder vessel duties; or
- Loading of components directly onto the installation craft at the manufacturer's premises for transport and installation at the offshore wind farm site.

The loading of the vessels in ports can be performed in a variety of ways, but currently the most common approaches are the lifting and rolling of components onto the deck or into the holds of the vessel, using techniques known as Lo-Lo and Ro-Ro, respectively. The term Ro-Ro is an abbreviation of the descriptive term: "Roll-on, Roll-off," while Lo-Lo is an abbreviation of "Lift-On, Lift-Off." Both have significant implications, with regard to vessels, port infrastructure, and mechanical plant selection. The practicalities and implications of both techniques will be described in the following sections.

For completeness, other techniques that are used include rollers, grease and air skates, crawler transport units, and skidding techniques, all of which are technically possible, but are generally less favored within the industry.

Due to their size and weight, GBSs are considered a separate case. There are four primary approaches to fabrication of GBSs:

- in a dry dock,
- in a floating dry dock,
- casting on a quayside or
- casting on a barge.

In each case, the GBS needs to be either lifted from a quayside or launched and floated to site. In Europe, heavy-lift crane vessels are used to lift GBSs at the quayside. These vessels are not available to service ports in the U.S., nor are they expected to be available in the near- to medium-term. As such, the most likely scenario for GBS fabrication and deployment will be to cast them directly on the barge. A heavy-lift vessel will still be required to install the GBS, but such a vessel could be brought in from Europe or elsewhere, if needed. Figure 2.4-1 shows 12 GBS foundations on a barge being towed to a project site and four others being fabricated on a second barge.

Source: http://businessguide.offshorewind.biz/profiles/view/jan_de_nul_group

Figure 2.4-1. GBS Foundations Fabrication and Deployment Using Barges

2.4.1.1 Lift-On, Lift-Off

Lo-Lo has traditionally been the most common way to load and unload ships, and port facilities will often have cranes designed to accommodate the most common types of cargo passing through the port. It is important to note that the cranes currently located in ports may not have the lifting capacity to meet the demands of the offshore wind industry.

Lifting operations within a port may be carried out either by land-based cranes on the quayside or by the use of the vessel cranes, if present.

2.4.1.2 Quayside Cranes

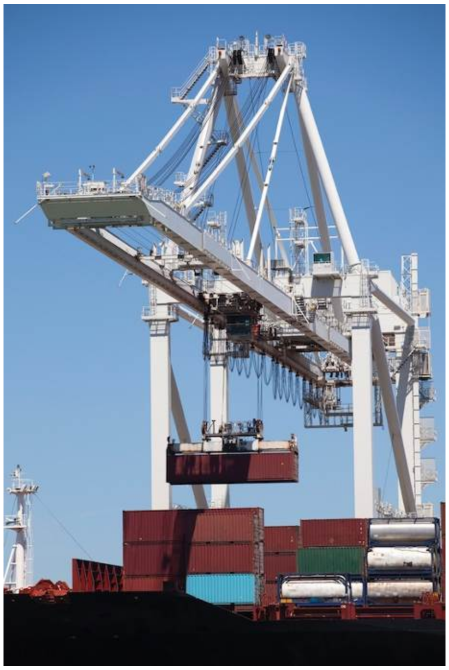
The types of freight which are commonly loaded on and off ships using cranes within port facilities vary dramatically and require very different lifting solutions:

- **Bulk and Granular Material:** Some bulk material cargos require cranes with grabber arms (Figure 2.4-2), or pneumatic transport systems, while some ships may have internal hoppers and conveyor discharge systems built in. These types of arrangements are suitable for rocks, aggregates, other granular materials (like grain or iron ore), traditional solid fuels (like coal) and, increasingly, for wood-chips and pellets for biomass heating systems. Cranes dedicated to this application tend to be highly specialized, with relatively light lift capacities, but fast cycling capability (both hoist speeds and slew-rates). All but the largest of these, operating in tandem, would be unsuitable for lifting heavy turbine or foundation components, but may prove beneficial for loading or unloading rock, gravel, and grout materials during seabed preparation works, grouting works, and burial or scour-protection works.

Source: http://www.portstrategy.com/news101/port-operations/cargo-handling/gift-of-the-grab

Figure 2.4-2. Mobile Crane with Grabber Arm Loading Salt

- **Containerized Freight:** Most “transit” cargos pass inland, through ports, and are therefore “packaged” in such a way as to be suitable for forwarding as either road or rail freight. The most common example of these is container shipping, which has dedicated vessels and port cranes (Figure 2.4-3), most of which are generally inappropriate for offshore wind installation purposes due to their relatively light lift capabilities and “made to order” configuration.



Source: http://www.portstrategy.com/news101/port-operations/cargo-handling/gift-of-the-grab

Figure 2.4-3. Container-Port Crane

- **Specialist and Non-Containerized Break-Bulk Cargo:** Typically located at ports serving large component fabricators, ship builders or other heavy industries, large harbor or gantry cranes are generally the most appropriate permanent quayside cranes for the purposes of offshore foundation and turbine loading and unloading. Ports that do not have such permanent specialist heavy-lift cranes may, however, utilize large mobile, crawler, or ringer cranes as long as sufficient quayside soil bearing strengths exist (or can be constructed). See Figure 2.4-4 for an example. One valuable feature of a crawler crane, as opposed to mobile or ringer cranes, is its ability to pick a load up and to track forward, thereby transporting the load while suspended, an operation which is called "pick and carry." This enables the use of a single crawler crane both to load and to transport turbine components around a marshaling yard, and avoids the additional expense of transporters such as Self-Propelled Modular Transport Units (SPMTs). The cost penalty is that the transit speed of a laden crawler crane is extremely slow; therefore, the time requirement for chartering delivery vessels, and any associated equipment and personnel, will be greatly increased, but it may be cost-effective if pick and carry travel distances can be kept to a minimum.

Image courtesy of Port of Vancouver USA
Source: http://www.portvanusa.com/news/image-library/

Figure 2.4-4. Specialized Mobile Harbor Cranes Lifting Wind Turbine Blade

Many areas adjacent to quays have had rails fitted for tower or gantry cranes (Figure 2.4-5). Generally, these cranes are too small to meet the requirements of offshore wind installation, but the reinforced concrete beams along which the rails run, are often well supported by piles and may well have useful load bearing capacity, either for lifting or as haulage routes.

Source: http://first-tech.com.hk/special.html#t9hit

Figure 2.4-5. Gantry Crane

2.4.1.3 Vessel Cranes for Loading and Unloading

A common solution to loading and unloading wind turbine components in port is to use the onboard vessel cranes. This type of vessel with its own lift-gear is variously called a “geared vessel,” a multi-purpose vessel, or a heavy lift cargo vessel. This option will require adequate onshore transportation facilities (such as SPMTs) and quayside bearing strengths to allow components to be located close enough to the vessel to be within the crane's operating radius.

Vessel cranes are not limited to installation vessels, but may also be present on large cargo vessels that are used to transport components between manufacturers and marshaling ports. Figure 2.4-6 shows two pedestal cranes on a heavy lift cargo vessel used for the transportation and installation of transition pieces at the Greater Gabbard Offshore Wind Project in the United Kingdom (UK). As with other cranes, these vessel-mounted cranes may be used in tandem to increase the overall lifting capacity.

Source: Offshorewind.biz

Figure 2.4-6. Pedestal Cranes on Jumbo Shipping's Jumbo Javelin Used to Install Transition Pieces at the Greater Gabbard Offshore Project

2.4.1.4 Independent Floating Cranes

Another option, to avoid having to use either a vessel fitted with its own crane or land-based cranes, is to use an independent floating crane. There are often lifting requirements in ports where the port's cranes are inadequate to meet the lifting needs of large items, and a large number of ports have floating cranes available to carry out these unusual, intermittent lifts.

One type of floating crane that is ideally suited to heavy lifting is the sheerleg crane. In its simplest form, it is effectively an unpowered (often termed "deck" barge), with a structural steel frame protruding over the forward edge and some form of lifting winch and pulley system.

2.4.1.5 Roll-On, Roll-Off

Ro-Ro is most commonly associated with passenger car ferries and the transport of new vehicles to their port of entry, where vehicles and other wheeled equipment are loaded and unloaded onto the vessel by driving on and off ramps, using a customized port access device called a link-span (Figure 2.4-7).

Many onshore wind turbine components are transported using Ro-Ro ferries, when they are not operating to a commercial timetable. The larger offshore turbines are unlikely to be transported using ferries, as their components are generally larger than even the largest freight transport for which the ferries and link-spans are designed; they are also too large to be road-hauled via infrastructure designed for similarly-sized vehicles. However, this methodology is applicable to loading and unloading turbine components that are transported by barge, and some cargo vessels that have decks that can be used for Ro-Ro cargos.

To determine whether a particular link-span (ramp for loading/unloading components using Ro-Ro) can be used with a particular barge or vessel, and under what particular circumstances (i.e., in terms of ballasting, state of the tide, around timetabled usage of the Ro-Ro, etc.), a separate study by a specialist project cargo freight-forwarding specialist would be required.

While some ports do not have permanent Ro-Ro berths, it is possible to accommodate this facility by using a mobile Ro-Ro ramp. This is a highly specialized piece of equipment, as it enables extension of a port's capability beyond that of its fixed infrastructure.

There are some general cargo vessels and heavy-lift cargo vessels which have aft and/or bow ramps designed for Ro-Ro cargos. Some vessels are designed with reinforced decks, and will only accommodate the Ro-Ro cargos as deck loads, while others have more elaborate arrangements for accommodating the cargo below deck. An example of a Ro-Ro capable vessel is shown in Figure 2.4-7.

The number of Ro-Ro berths, and the category of cargo they are capable of carrying, are important factors to consider in evaluating port capabilities.

Source: www.roll-group.com/projects/windmill-equipment.html

Figure 2.4-7. Ro-Ro Capable Vessel – RollDock

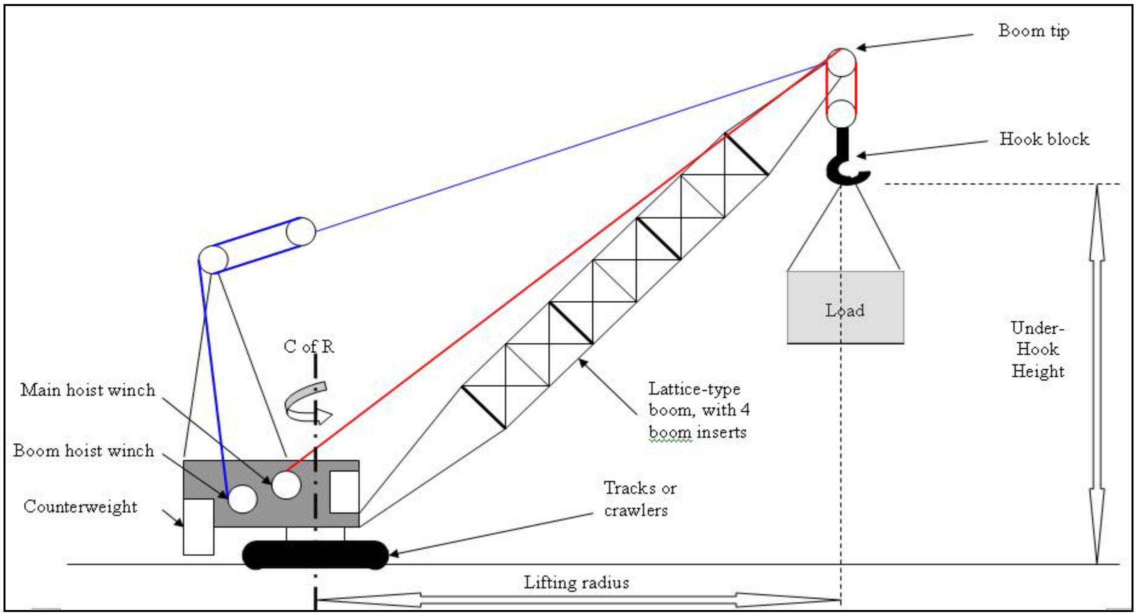
2.4.2 Component Transportation Within the Port

Components are transported within the port facility using a number of different techniques. This section summarizes the primary techniques employed currently.

2.4.2.1 Crawler Cranes

In general, the types of cranes currently found in ports are highly evolved to meet the specific requirements of loading and unloading what can be categorized as "general cargo" from cargo ships. They generally have cabs at high level, to allow the crane driver to see into deep holds easily. They also have relatively low lift capacity, but high operational speeds, to quickly perform small lifts to load the vessel. Some of the largest harbor cranes currently in operation can only lift approximately 200 t (220 T), which is insufficient for most wind turbine components.

Crawler cranes can be used in versatile roles, not only for loading and unloading components but also transporting items from storage around the port (Figure 2.4-8). This can minimize the requirement for SPMTs, although these can prove to be significantly more economical than using a suitable specification crawler crane for all operations.



Source: DNV GL (2014)

Figure 2.4-8. Typical Lattice-boomed Crawler Crane Lifting Arrangement

In general, crawler cranes in the 500-600 t (551-661 T) range have proven to be the most versatile cranes in staging yards in Northern European wind farm developments. However, for handling large nacelles, larger cranes may well be needed.

It is possible to use a 1,000 t (1,102 T) crawler crane in tandem with a smaller crane to place larger components at a distance aboard the vessel.

An alternative option to the lattice-boomed crawler crane is a mobile crane. These are generally self-transporting, and can mobilize quickly. This means that the crane can be brought to and from site in short order, allowing the contractor to minimize the number of days the crane is sitting idle on-site. While day rates for mobile cranes are significantly higher than those for crawler cranes on long-term hire, this could work out to be less costly over the project duration.

A mobile crane stabilizes itself with a set of out-rigger legs, generally four. A major disadvantage is that these concentrate lifted loads into relatively small points, which is inadvisable immediately adjacent to the quayside edge. This condition is known as "super-loading." Most quaysides are of a sheet-piled construction, with a capping beam, and there is a significant danger of the sheet piling failing if large loads are placed too close to the edge.

Another disadvantage of mobile cranes is that they cannot "pick and carry," and can only rotate and place a lifted load within the safe operating radius. This means that SPMTs will also be required to transport components to storage, incurring additional daily costs.

2.4.2.2 Self-Propelled Modular Transporters (SPMTs)

Some wind farms have managed to avoid the need for heavy cranes by loading turbines and foundation components onto SPMTs, and by utilizing Ro-Ro ship-type vessels or transport barges loaded from Ro-Ro link-spans. Common forms of SPMT have individual two-axle units with a load carrying capability of approximately 30t / axle (33 T/ axle), and can be arranged side-by-side or end-to-end in a rolling transporter for extremely large loads (Figure 2.4-9).

Source: DNV GL (2014)

Figure 2.4-9. Self-propelled Modular Transporters

Whether this type of unloading arrangement will be possible will be specific to each port facility and vessel combination, as gentle gradients, large turning radii, and sufficient headroom are often required (often not available in existing port Ro-Ro facilities). Any usage of incorporated roads would require that transportation complies with road haulage regulations for that part of the haulage route.

Specialist heavy transport firms, or project cargo forwarders, can support companies wishing to investigate the suitability of individual port facilities for accepting specific cargos. However, each combination of vessel, port, and component will require individual assessment. If large numbers of components require storage, further assessment of the deck strengths or axle loads of haul routes between the Ro-Ro offloading and storage areas will be required.

Despite the complexities of this transport method, it avoids the need for large cranes, which can result in significant savings. Additional cost may be incurred due to the need for storage frames or equivalent, which allows SPMTs to roll underneath and jack the load on and off.

2.4.3 Component Storage and Preparation

Wind turbine components are large structures, which require significant storage space at ports. This section will describe storage methodologies and describe the assumptions made pertaining to storage.

Source: www.mlm.uk.com

Figure 2.4-10. Nacelle Storage in Port

It is assumed that components will be raised off the ground during storage, as shown in Figure 2.4-10 above. This enables SPMTs to maneuver underneath, jack-up to take the weight of the component, and transit to the quayside for load-out. A sufficient gap must therefore be left for the SPMT beneath the component. The typical method to achieve this is to use short metal columns to raise the component off the ground and baulk timbers to distribute the load to the ground.

It is assumed that blades are stored in stacks of three and the frames are supported by 4 m (13 ft) long blocks at both ends. For nacelles, it is assumed that four columns would support the structure and would rest on timbers the length of half of the nacelle. The transition pieces are assumed to rest on a frame, which rests on four columns, the weight distributed over two pieces of baulk timber as long as the diameter of the transition piece. The monopile foundations are assumed to be stored on ten columns at five points along the foundation, each column resting on a 4 m (13 ft) long piece of baulk timber. Lastly, the jacket foundations are assumed to be stored upright or on their sides, each of the four contact points resting on 12 square meters (m^2) (129 square feet [ft^2]) pallets. It should be noted, however, that it is not recommended for the jackets to be stored at the staging port, but loaded immediately onto a barge from the manufacturing port and kept there until ready for installation. Jacket foundations are particularly fragile and this method avoids double handling and potential damage.

In the early days of U.S. offshore wind development, it is expected that numerous components will be delivered to the staging port from Europe rather than from a local manufacturing facility. This longer transit time will likely result in a requirement to store more components at the staging port in order to provide sufficient buffer during construction. As a result, U.S. ports would need larger storage areas than are common in European staging ports.

2.4.4 Potential Activities and Use Conflicts

Ports that offer the ability to accommodate the activities associated with offshore wind also host a variety of other activities that can aid, conflict, or occur simultaneously with uses related to offshore wind facility development. The activities that are already established at these Atlantic coast ports can affect offshore wind uses both directly and inadvertently (and both positively and negatively) due to the logistics, infrastructure, and benefits of the activity. An example of a positive direct effect is that a port may already have the road systems in place to handle large freight trucks. An example of an inadvertent negative effect is that a port authority may prefer to maintain established relationships with industries they may currently be serving on a consistent basis, and be hesitant to embrace change for what may be considered intermittent or project specific activities. It is common practice for an offshore wind project to lease an entire port or at least an entire terminal, which can serve to minimize vessel conflicts and interference with onshore activities. Below are the major activities and uses currently found at potential offshore wind ports along the Atlantic coast:

- Shipping – the waterborne cargo and associated activities contribute over $600 billion annually, sustaining 13 million jobs (U.S. Department of Transportation Maritime Administration, 2015). Vessels involved in the shipping industry are in the range of a couple hundred meters to several hundred meters (several hundred feet to over 1,000 feet) in length and utilize ports on a daily basis.
- Commercial Fishing – the commercial fishing industry is a $70 billion industry (NOAA, 2010) typically utilizing vessels 9 – 30 m (30 – 100 ft) in length. Commercial activities occur on a daily basis involving on and offshore logistics.
- Cruise lines – the cruise industry is a $20 billion industry (Business Research & Economic Advisors, 2013) utilizing ships a couple hundred meters to several hundred meters (several hundred feet to over 1,000 feet) in length. Cruise ships typically do not visit ports on a daily basis and visit northern U.S. Atlantic coast ports more regularly in warmer months.
- Recreational Boating – the recreational boating industry contributes approximately $18 billion annually (Cicin-Sain and Knecht, 2000). While recreational boaters often navigate the same waterways as large commercial vessels, in most cases, marinas for recreational vessels are not located directly adjacent to port facilities.
- Other activities are conducted by the U.S. Coast Guard, U.S. Navy, passenger ferry services, and marine tourism (i.e., whale watching and scenic tours).

The Table 2.4-1 below compares aspects of current marine industries in ports along the Atlantic and how their specialized infrastructure could possibly compliment or conflict with the requirements needed to build the offshore wind infrastructure.

Table 2.4-1 Summary of Potential Activities and Use Conflicts with Offshore Wind

Industry	Potential Compliments with Offshore Wind	Potential Conflict with Offshore Wind Port Use
Shipping	• Due to the size of shipping vessels, the ports that handle this industry meet the requirements to handle large ships and therefore can handle the barges and vessels required for offshore wind. • The infrastructure on land including warehouses, lifting equipment, roadways, railways, and wharfs are already largely in place to handle most required aspects of the offshore wind industry. • Areas surrounding large ports are already accustomed to the noises and visual impacts associated with the shipping industry at the ports. • The tug and towboat network is established. • The navigational channels are	• Shipping is a source of reliable recurring revenue and some ports may not be accepting of the potential economic risk involved with incorporating a new industry with intermittent needs that could potentially conflict with existing uses. • Possible conflict of usage of existing infrastructure if Port is currently space or equipment constrained. • Current operations may be negatively impacted while necessary modifications for the specialized equipment used with offshore wind are taking place. • Schedules are not flexible and delays can have significant cost implications; however, the high traffic implications will only occur during offshore wind

Industry	Potential Compliments with Offshore Wind	Potential Conflict with Offshore Wind Port Use
	established with appropriate channel depths and widths, in most cases. • Port modifications completed to accommodate offshore wind may open the shipping industry to new commodities. • The communication and safety systems are in place to handle daily vessel traffic.	construction and major maintenance activities. • Cargo ports prefer to enter into long-term (10+ year) contracts, whereas an offshore wind project typically requires a staging port for only 2-3 years.
Commercial Fishing	• The roadway infrastructure is in place for freight trucks; however, not all ports offer the capability to handle oversized freight loads. • The communication and safety systems are in place to handle daily vessel traffic. • Most fishing vessels are smaller in size and have good maneuverability to avoid vessel traffic conflicts. • Commercial fishing vessels are similar in size to any light duty or maintenance vessels; therefore vessel servicing and lift locations are in place. • Does not operate on a fixed schedule.	• Operate year round and on a daily basis which could cause complications with the port operations without proper coordination. • Land-side operations are significantly smaller in scale than offshore wind construction activities with little to no versatility between the industries.
Cruise Lines	• Busiest during the warmer months, limiting vessel traffic complications timeframes. • Ports able to accommodate large cruise lines will also have adequate port and navigational designs required for aspects of offshore wind. • Port modifications completed to accommodate offshore wind may provide additional locations for cruise vessel servicing. • Cruise ships arrive and depart on fixed schedules, which are known in advance and can be planned around for other vessel movements.	• Vessels and their security perimeters are large enough to limit movement of other vessels in constrained locations. • Land-side operations are significantly different than the requirements for offshore wind. • Warm weather construction window for offshore development activity will coincide with highest level of cruise ship activity.
Recreational Boating	• Established marinas can provide docking space for small maintenance vessels and crew transportation vessels, which provides additional revenue to marinas. • Other port industries are accustomed to the recreational boating community and the added vessels to fulfill maintenance trips will not be cumbersome to other industries. • Does not operate on a fixed schedule. • Smaller vessels have excellent maneuverability to avoid traffic conflicts.	• The presence of large marine construction activities or unique vessels becomes a curiosity for the recreational boater, which leads to recreational vessels approaching the work vessels. • Sailboats have limited maneuverability. • During summer months the volume of vessels exponentially increases potentially causing conflicts with offshore wind construction season activities. • A large percentage of recreational boaters do not fully understand or comply with navigational rules, which could lead

Industry	Potential Compliments with Offshore Wind	Potential Conflict with Offshore Wind Port Use
	• Primarily operate in warmer months.	to conflicts.
Other	• Ports with major Naval or Coast Guard facilities will have harbors clear of ice and obstructions year round. • Ports with major Naval or Coast Guard facilities will have adequate channel depths. • Ferries and tourism typically operate only during warmer months of the year.	• Ferries and tourism operate on fixed schedules. • Large naval vessels may cause vessel traffic implications. • Vessels and their security perimeters are large enough to limit movement of other vessels in constrained locations.

Additional concerns of ports, not directly associated with other industries along the Atlantic coast include hurricane barriers limiting vessel sizes, availability of heavy lift cranes for gravity-based structures, and adequate dock bearing limits to support heavy lift cranes. Offshore wind port modifications that may require in-water work, either quayside or in harbor channels, would have the greatest potential to impact the existing Port uses described above.

While there is the potential for conflict between navigating vessels engaged in routine waterborne commerce and those engaged in the offshore wind industry, these type of potential conflicts are well managed and minimized by the marine industry and the U.S. Coast Guard. As part of its mission, the U.S. Coast Guard routinely de-conflicts waterways to maintain marine safety and to allow marine construction activities, specialized vessels, and routine vessel traffic to operate in the same waters with minimal disruption. In addition, professional mariners routinely maintain radio contact with one another when operating close to each other so each vessel's intentions are known and conflicts can be minimized or avoided.

2.5 Summary of Port Requirements to Support Offshore Wind

In this section, the port requirements that are specific to offshore wind are addressed. Overall, the size and weight of offshore wind turbine components makes the ports that support these projects relatively unique when compared with the typical U.S. port (DNV GL, 2014; Cooper and Marrone, 2013; Kinetik, 2011). The seven primary factors that are especially important for ports handling offshore wind components are the following:

- Access
    - Port access channel width and turning capacity
    - Port access maintained and controlling water depths
    - Overhead draft (i.e., bridge clearance, port crane heights)—also known as "air draft"
    - Number of berths
- Quayside
    - Length of the quayside
    - Bearing capacity of the quayside
    - Bearing capacity of the seabed at the quayside
- Storage
    - Bearing capacity of the haul route(s) between the quayside and storage area(s)

- Bearing capacity of the storage area(s)
- Size of storage area

- Roll-On/Roll-Off (Ro-Ro) capability
  - Width and headroom of Ro-Ro berth
  - Bearing capacity of Ro-Ro berth and ramps
- Cranes
  - On-site cranes capabilities
  - Crane height restrictions
- Transportation infrastructure
- Location
  - Vessel transit distance to Wind Energy Areas —more appropriate than straight line distance
  - Availability of skilled workforce

The majority of this section will be spent on staging ports; however, it is worth briefly addressing manufacturing and O&M ports as well.

2.5.1 Manufacturing Ports

Ports that house manufacturing activities will have requirements specific to those activities. The following considerations are important when developing these ports.

- **Vessel access:** Ports that support manufacturing activities for turbine components, foundations, cable, etc., share the same vessel access requirements as staging ports, since components are often transported from the manufacturing facility to the staging port.
- **Specific requirements for manufacturing:** Manufacturing ports may also have specific requirements based on the needs of the manufacturer, for example covered warehouse space, overhead cranes, rail access, heavy lift capacity, indoor and outdoor storage.
- **Lifting capabilities:** It is expected that ports where the heavier components, such as nacelle and foundations, are handled will need strengthening to be able to handle the weight of these components, and may require swept path analysis on bend radii of haul routes to be considered.
- **Specialized vessels:** If special vessels are required to load or offload the component, the manufacturing port must also be able to accommodate these vessels. Examples include jack-up vessels for transporting nacelles, heavy-lift crane vessels for lifting gravity base foundations (these vessels are primarily used in Europe), and cable laying vessels.
- **Location:** Manufacturing ports do not need to be located near the offshore wind project site but are instead typically located for economic and business reasons, such as adjacency to skilled work force and in desirable residential areas.

2.5.2 Operations and Maintenance Ports

The project O&M port will be a port that is close to the project location. Based on the results of DNV GL (2014), most U.S. ports fulfill the requirements for O&M ports with their existing capabilities and with little or no upgrades required. Some considerations relative to O&M ports include their ability to provide 24-hour port facility and navigational access; as well as the identification of tidal restrictions and/or seasonal limitation in certain locations.

- **Crew transfer:** The majority of U.S. ports can serve as crew transfer ports with their existing specifications.
- **Service vessels:** Existing port infrastructure is generally sufficient for maintenance the vessels that will be used for the majority of the routine maintenance on offshore wind turbines. Larger vessels that would be needed for major repairs would need to be deployed out of a port designed to accommodate the required vessel(s) and components. This does not need to be the project's primary O&M port.

2.5.3 Staging Ports

The port readiness study conducted for U.S. DOE (DNV GL, 2014) found that most U.S. ports will require improvements to be able to support staging activities for offshore wind projects. As mentioned above, this is primarily due to the weight of the components, which is greater than most other cargo that passes through most U.S. ports. This finding is also supported by Cooper & Marrone (2013), Kinetic (2011), and TetraTech EC (2010).

The following sections describe the port requirements and important characteristics for specific components and types of port activities necessary to support offshore wind projects. Table 2.5-1 provides some examples of the characteristics that represent the typical "minimum requirements." It is important to keep in mind that this table is an example and may not represent the best solution for a specific project.

In reality, when assessing ports for potential use to support an offshore wind energy project, it may be the case that a facility with significantly lesser characteristics to those listed in Table 2.5-1 may prove to be the preferred option for a given project. As has been the case in Europe, particularly in the UK, if experienced engineers are encouraged to consider adopting some of the myriad of reasonable alternative transportation and installation strategies during the front end engineering design study phase, port facilities with capabilities below the "minimum requirements" can be viable with minimal improvements required. Cost-benefit analyses should always be carried out between utilizing alternative means and methods in existing infrastructure, versus adopting "non-transferrable" construction strategies that require capital investment in enhancing port infrastructure up to what some may be considered to be 'ideal'. In short, identifying a minimum set of requirements is complicated and challenging.

Table 2.5-1. Example of Minimum Requirements to Support Offshore Wind Projects

Requirements	Units	Blades	Nacelles	Towers	Monopiles	GBS	Jackets	Floating
Port access channel width (1,2)	m	22	29	22	29	120 (7)	30	75
Port access turning capacity (1)	t/m^2	160	170	160	170	100	120	n/a
Port access water depths (1)	m	9.5	9.5	9.5	9.5	6.5	6.5	10

Requirements	Units	Blades	Nacelles	Towers	Monopiles	GBS	Jackets	Floating
Overhead draft [3]	m	35	42	35	42	60	75	Unlimited
Number of berths [4]	-	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Quayside bearing capacity	t/m^2	5	10	10	20	15	15	n/a
Quayside length [1]	m	100	170	170	170	n/a	100	n/a
Quayside seabed suitable for jacking	-	Advantage	Advantage	Advantage	Advantage	n/a	Advantage	n/a
Haul route bearing capacity	t/m^2	10	10	10	10	15	10	n/a
Storage area bearing capacity	t/m^2	10	10	10	10	15	10	n/a
Size of storage area [4,5]	m^2	25,000	5,000	20,000	TBD	TBD	TBD	n/a
Roll-On/Roll-Off capability	-	Advantage	Advantage	Advantage	Advantage	Advantage	Advantage	n/a
Width of Ro-Ro berth	m	8	8	8	10	40	25	n/a
Bearing capacity of Ro-Ro berth and ramps	t/m^2	8	8	10	8	40	15	n/a
On-site cranes' capabilities	t	100	600	2 x 250	2 x 600	n/a	2 x 600	n/a
Crane height restrictions	m	50	50	50	50	n/a	50	n/a
Transportation infrastructure	-	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined	Undefined

1 Dependent on vessel selected
2 Minimum channel width is calculated as twice the vessel beam (width)
3 Dependent on project site conditions
4 Dependent on project logistics
5 Dependent on number of turbines
6 Multiple cranes required for heaviest loads
7 Assumes the GBS is transported on a barge

2.5.3.1 Requirements by Component

The following sections address specific port characteristics required to accommodate different types of offshore wind project components.

Wind Turbines

If the turbine is installed in port, a crane capable of lifting the heavy nacelle and rotor to hub height will be required. One or more cranes will be used for this operation. For a large wind project that requires assembly or final assembly of the turbines in port, sufficient quayside space and berth space will also be required.

Blades

Wind turbine blades are long and require specialized rigging to load and unload, but at 18-40 t (20-44 T), are within the typical weight limits of other break-bulk cargo handled at U.S. ports. As such, the bearing capacities of the quayside and storage areas of typical U.S. ports are sufficient to support these components without modifications. The size of the blades requires the port to have sufficient space on the quayside during loading and unloading of transportation and installation vessels. In the storage area, the blades can usually be stacked 2 or 3 units tall, which minimizes the storage area required. Haul routes between storage and load-out quays must have gentle bend radii to allow the telescopic-trailer haulage to pass freely.

Ro-Ro loading and unloading is a viable option for blades.

Nacelles

Offshore turbine nacelles can weigh 160-450 t (176-496 T) and are heavier than typical break-bulk cargo. Therefore, 10 t/m^2 (2,048 pounds per square foot [psf]) is the recommended minimum bearing capacity in these areas to support nacelles. Improvements to ground bearing capacities of the quayside, haul routes, and storage areas at U.S. ports is anticipated to be required. If a heavy lift crane is used to load and unload the nacelles from the transportation vessel, the quayside will need to be strengthened to support these lifts since such lifts can impart point loads from the cargo or the counterweights under the front or back of the crane. Transportation is typically accomplished using SPMTs to distribute the weight.

The turbine supplier may require that the vessel be jacked up at the quayside when loading or unloading nacelles. This means that the bearing capacity of the seabed at the quayside must be capable of supporting a jack-up vessel. The DNV GL port readiness study (2014) found that U.S. ports did not typically comply with this requirement. Guidance on determining the required seabed bearing capacity is available from the Society of Naval Architects and Marine Engineers (2008).

Ro-Ro loading and unloading is a viable option for nacelles.

Towers

Towers for offshore wind turbines can range in weight from 185 to 310 t (204 to 342 T). Therefore, 10 t/m^2 (2,048 psf) is the recommended minimum bearing capacity in these areas to support towers. Improvements to ground bearing capacities at the quayside, haul routes, and storage area can be expected to be required at U.S. ports to load/unload, transport, and store these components.

Ro-Ro loading and unloading is a viable option for towers.

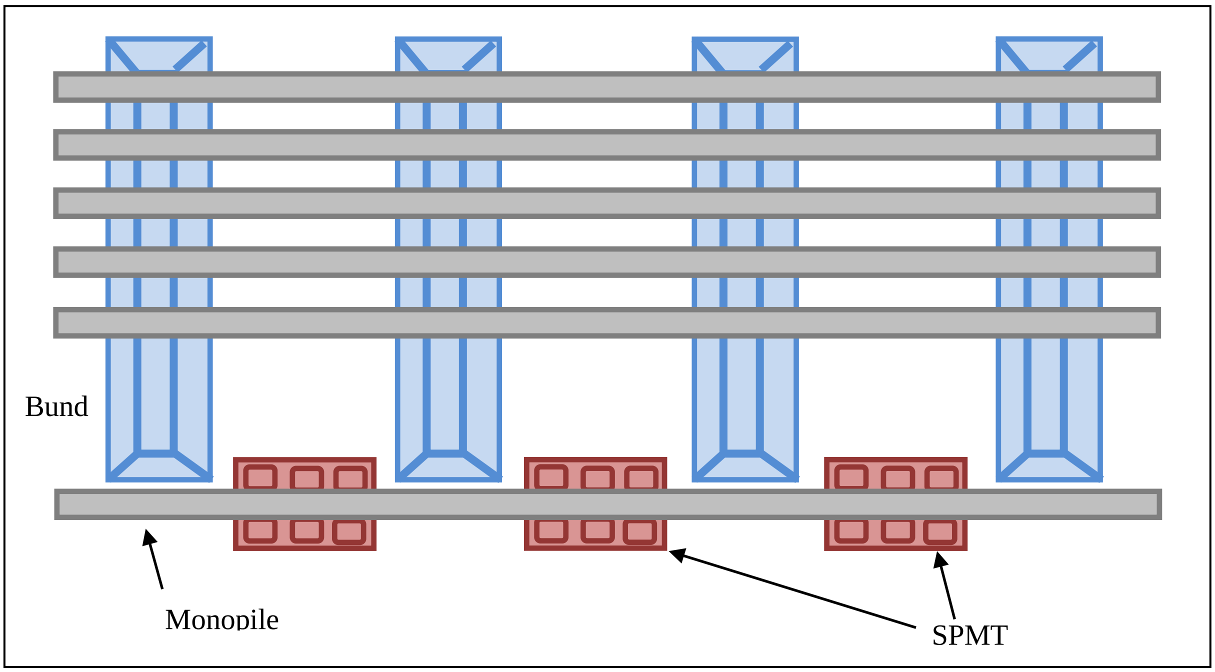
Foundations

Offshore wind turbine foundations are much heavier than most other cargo stored or staged at U.S. ports. As such, specific load-spreading provisions and ground strength modifications must be made to accommodate these components.

Monopiles

Monopiles can weigh in the range of 500-1,000 t (551-1,102 T) or more. As such, ground bearing strength improvements will often be required at U.S. ports to handle this type of cargo at the quayside, along the haul routes, and in the storage area. Ground bearing capacities on the order of 15-20 t/m^2 (3,072-4,096 psf) are recommended, depending on the size of the component, although this can be reduced if additional load spreading is utilized (e.g., additional axles on the SPMTs). It is expected that additional lifting capacity (e.g., multiple cranes) will be required to load and unload these components as these weights are beyond the capacities of typical harbor cranes. Monopiles are typically transported within the port using SPMTs.

Some sites lay parallel bunds of granular material of approximately 1.4 m (5 ft) height and with gaps to allow SPMT units to pass in between, as shown in Figure 2.5-1 below.



Source: DNV GL (2014)

Figure 2.5-1. Monopiles Stored on Bunds

Transition pieces weigh approximately half of what a monopile weighs and are typically transported and stored vertically using cranes or horizontally by SPMTs (prior to equipment fit out). Ideally, they should be stored adjacent to quaysides, to minimize transport distances.

Gravity Base Structures

GBS foundations are the heaviest offshore wind component, weighing between 2,500 and 10,000 t (2,756 and 11,023 T) and heavier GBSs are currently being developed. Therefore, 15-20 t/m^2 (3,072-4,096 psf) is the recommended minimum bearing capacity to support GBS foundations, especially if transportation within the port is required. If GBSs are to be fabricated on the quayside, the quayside will most likely need to undergo significant ground bearing strength improvements to be able to support this weight.

Other options for GBS fabrication are in a dry dock facility and on a barge. GBSs built in a dry dock would be buoyant and would be floated and towed to site. The dry dock needs to be wide enough to support the full GBS diameter plus a buffer; 45-60 m (148-197 ft) width is recommended but this will depend on the specific GBS design. Similarly, the barge would need to be of sufficient size to accommodate the GBS and supporting fixtures and activities. The port will likely need to be able to support multiple GBS construction barges simultaneously, so the quayside length and number of berths become important.

GBS foundations may well benefit from the widening of the Panama Canal, which will allow GBSs for 6-7 MW turbines to be transported through the Canal to projects on the Atlantic coast of the U.S. Currently, the width restrictions for of the Canal do not accommodate these structures.

A tower crane is often used during the construction of large GBS foundations, and has its own ground bearing strength requirements.

SPMTs can be used to transport GBSs within the port. If SPMTs are used to deliver the GBS to the quayside for load-out, additional reinforcement of the quayside will be required.

Lifting of GBS structures in Europe is done using heavy lift vessels. These vessels are not expected to be available in the U.S. in the near future, so construction on a barge is the most likely scenario. The barge will dictate the required harbor channel width. Overhead clearance will need to accommodate the full height of the GBS and the barge. If construction is done on barges, the installation vessel is not required to interact with the port.

Jackets

Jacket structures for offshore wind turbines are typically manufactured and delivered directly to the wind farm site using deck barges. If storage at a staging port is required, transport is typically done using barges with the jackets oriented vertically. The overhead clearance will be determined by the height of the jacket. In general, it is recommended that ports with unrestricted headroom be considered for handling jackets.

Based on their weight, which is estimated to be 600-850 t (661-937 T), port facilities accommodating jackets will require ground improvements such that bearing capacities on the order of 13-17 t/m^2 (2,663-3,482 psf) are achieved. The actual bearing capacity required will depend on the type of lifting equipment used, the type of transportation available, and the load spreading techniques used.

Alternatively, jackets can be stored on barges in the harbor, provided that sufficient harbor storage area is available.

Suction Bucket

Like the other types of foundations described herein, suction bucket foundations will exceed the weight thresholds of most U.S. ports. As such, ground improvements will be required at the quayside, along the haul route, and in the storage area, and additional lifting capacity at the quayside will likely be required.

Suction buckets can be fitted to both monopiles and jackets, and while the latter will require similar logistics to piled jackets, suction buckets on monopiles will need modified transport frames on SPMTs and greatly increased headroom over their conventional counterparts.

Floating

Floating foundations will likely be deployed from a staging port and have specific requirements for the port facility. If the turbine is fully installed on the foundation in the port, either in a dry dock or at the quayside, then towed to the project site, the port will need to have unlimited overhead clearance both within the port and along the access channels to the sea to accommodate the tower and rotor. Water depth is not anticipated to be a driving factor in the harbor as the floating foundations currently in development all have the ability to add buoyancy and float higher in the water during construction and transportation.

Cable

It is common for inter-array (collection) cables to be transported individually on cable reels and stored at a staging port; the project export (transmission) cable is more likely to be delivered directly from the cable supplier to the project site. To accommodate reels (or drums) of array cables, the port must have the ability to lift the fully loaded reels onto the quayside. This typically requires a heavy lift crane. Alternatively, the vessel crane may be able to complete this task if it is of sufficient capacity. Sufficient storage space is required to house the cable drums.

As described above, there is also a requirement to store spare lengths of inter-array and export cable in port facilities for use should a cable repair become necessary. This long-term storage typically takes place in drums or carousels that are placed in an area where the cable can be transferred to the cable repair vessel when needed.

Ground bearing capacity improvements to support cable storage during installation or for long-term spare cable storage are less likely to be needed in U.S. ports since the weights of the loaded drums and carousels would be within the range of the weights of cargo typically handled at U.S. ports. Some port modifications may be required on a case-by-case basis to support this use.

Substation

Substation foundations are assumed to be either similar to the wind turbine foundations for the project, or a jacket foundation. As such, the same storage and handling requirements described above apply to this foundation.

Substation topsides are extremely heavy items and as such tend to pose similar port requirements as GBS foundations due to their size. Due to the difficulty of handling large substations, they will typically be installed directly from the manufacturing port. If the topside is stored at the port, the quayside will need to have sufficient bearing capacity to carry the weight. It is noted that if the topside is offloaded at the port, it is expected to be stored on a reinforced section of quayside to await deployment to the project site; topsides are unlikely to be transported or stored elsewhere in the port. A heavy lift crane would be required on the quayside to load the topside onto the transportation vessel. The quayside will need to be strengthened to accommodate this lift.

2.5.3.2 Requirements by Activity

The following sections address specific port characteristics required to accommodate the primary activities conducted in port during the construction of an offshore wind project. As indicated above, the weight of the various components is a critical factor that needs to be accommodated for in each of the activities addressed below.

Loading and Unloading

The loading and unloading of components requires sufficient berth space, crane capacity, and area on or adjacent to the quayside to temporarily store the components. This quayside and temporary storage area must have sufficient ground bearing strength to accommodate the components. When nacelles are loaded or unloaded, the turbine supplier may require that the vessel be jacked up at the quayside. This means that the bearing capacity of the seabed at the quayside must also be capable of supporting a jack-up vessel. The DNV GL port readiness study (2014) found that U.S. ports did not typically comply with this requirement.

A staging port during project construction is a busy place, with vessels coming and going at all times. The port needs to be large enough to support this level of vessel activity without constraint to the offshore wind staging operation or any other activities in the port (it is noted that an offshore wind project would typically contract the entire quayside area and thus minimize interference to and with other port activities). Similarly, vessels would ideally have unrestricted access to the project site, meaning that no drawbridges or locks stand between the port and open water and the access channel needs to be of sufficient width to allow vessels to pass.

Given the number of trips required to and from the project site, the staging port is ideally located close to the project site. While this is not essential, transit distance to site is a significant factor in the cost of construction, as well as vessel access to the port.

Transport and Lifting in Port

Transport within the port is assumed to be done using SPMTs, which allows the bearing pressure of the component to be limited. For foundations, the recommended bearing capacity is 20 t/m^2 (4,096 psf), while for turbine components, the recommended value is 10 t/m^2 (2,048 psf). Ports with bearing capacities greater than these recommendations will have additional transportation options available, such as the use of crawler cranes. These levels are higher than was found for the typical cargo port in the U.S. (DNV GL, 2014).

Lifting of components requires a land-based crane or the use of the vessel crane. For heavy components such as nacelles and foundations, the specific crane plan and lifting locations will need to be engineered such that the distributed and point loads are accommodated. Different options exist for accomplishing the load-spreading required during lifting, including modifications (e.g., soil compaction, pile installation, increased pavement/quayside decking thickness) to provide sufficient ground bearing capacity over the entire quayside or storage area, and the use of “hard points.” Hard points are small areas that are strengthened, for example, where cranes are positioned or mounted.

Component Preparation

Final assembly of components may be performed in port. The key considerations for this type of activity are the overhead clearance for any cranes required for the work, ground bearing capacity to support the required transportation and lifting activities, work space with sufficient buffer to complete the assembly safely, and power and other auxiliary services required to complete the work.

Storage

Storage of components requires sufficient area to store the components, sufficient ground strength and load spreading (e.g., cribbing) to distribute the weight of the component, security at the site, and potentially auxiliary services (e.g., power) to provide any periodic maintenance required by a given component. For ground bearing capacity, a minimum of 10 t/m^2 (2,048 psf) is the recommended threshold for turbine components and 20 t/m^2 (4,096 psf) for foundations. These levels are higher than was found for the typical cargo port in the U.S. (DNV GL, 2014).

2.6 Current Status of Ports and Planned and Implemented Port Expansions

Much of the infrastructure critical to the success of offshore wind projects does exist in the U.S.; however, it is currently serving other industries. Furthermore, modifications have already been implemented or are being planned in the U.S. to accommodate wind energy facility construction (i.e., Quonset, RI; New Bedford, MA). This section provides a brief summary of the current status of U.S. ports, as well as some of the planned and implemented port expansions to further support offshore wind.

2.6.1 Current Status of U.S. Ports

There are approximately 360 commercial ports in the U.S. today handling various types of cargo. The most abundant types of cargo include petroleum products, chemicals, coal, farm products, timber products, iron, steel, soil, sand, gravel, and stone (American Association of Port Authorities, 2013).

As stated in (DNV GL 2014), U.S. ports possess much of the required infrastructure for successful offshore wind project installation. Specifically, offshore wind staging ports require significant storage and lay-down space, equipment to transport large cargo within the port, cranes to load and unload components from the vessels, sufficient quayside space to accommodate transportation and installation vessels, and sufficient overhead clearance to allow these vessels to reach the port and the project site. All of these capabilities are available today in many of the ports along the U.S. coastlines. In the case of the cranes to load and unload components, this equipment typically is not provided by the port but is readily available for hire.

The exception is the capability of the typical U.S. cargo port to handle the weight of the heaviest offshore wind turbine components. Today's U.S. ports are configured for containers, automobiles (Ro-Ro), or bulk cargo (e.g., liquids or grain), whereas wind turbine components are considered to be breakbulk and/or heavy-lift cargo. Because the typical cargo that passes through a port is much lighter than offshore wind turbine components, the typical port has a lower bearing capacity requirement at the quayside and in the storage area – typically in the range of 5-8 t/m^2 (1,024-1,639 psf) (DNV GL 2014). Improvements to quayside or ground bearing capacity can be accomplished by recompacting soils, adding piles, or various other ground modifications (e.g., draining soils; confining soils). Quayside bearing capacity improvements will most likely require additional strengthening measures along the quayside bulkhead to maintain its structural integrity. Similarly, the deepening of berths will also require major strengthening measures of the quayside bulkhead.

Finally, it is important to note that several U.S. ports, including New Bedford; Quonset/Davisville; Searsport, ME; and the Port of Freeport, Texas, already handle cargo for onshore wind projects and are therefore familiar with the components, fixturing, storage requirements, and transportation of onshore wind turbine components, which are often smaller (1-3 MW turbine range) than offshore wind turbine components.

When assessing ports, it is possible that a port that does not meet a specific criterion identified in this study may still be able to accommodate a given project with alternative capabilities. As has been demonstrated in Europe, if reasonable alternatives are incorporated into the engineering design phase, a port with some capabilities below the minimum criteria can be a feasible option. For example, a port may not have the on-site crane capabilities required for an offshore wind energy project, but with proper coordination may be able to bring in temporary moveable cranes capable of handling offshore wind components. Insufficient storage area bearing capacity may be overcome with proper planning and distribution of the components over a larger area.

2.6.2 Port Modifications for Wind Energy Development

There are a number of existing ports along the Atlantic coast, that could provide some, or all of the infrastructure elements needed to support the development of the offshore wind energy industry -

with some level of modification. The willingness to undertake significant port modifications will vary from port to port, and state to state, depending upon political and economic priorities, and is likely to be influenced by input from numerous stakeholders. State government officials and port authorities; existing port users (such as commercial fishermen, cargo shippers, tug and tow vessel operators and cruise line operators) as well as wind energy developers, construction trade unions and manufacturers, will all have strong voices and sometimes competing or conflicting opinions, priorities and expectations as to what modifications are warranted. These stakeholders should be engaged early and throughout the process where a port is under consideration for use to support an offshore wind energy project.

While some of the environmental impacts related to many of the current marine industrial activities taking place at existing ports would not be expected to experience significant changes if modified to accommodate the offshore wind industry (i.e., noise, visual, air quality) there are a number of impacts that might be expected to change. These may include: socioeconomics; marine and land-based traffic; benthic and sediment transport impacts due to quayside construction; and/or water quality. If multiple ports look to compete for or simultaneously serve the offshore wind industry, the cumulative effects of the environmental impacts from modifications at more than one port will also need to be evaluated. Section 4.0 provides information on potential environmental and socioeconomic impacts that could be associated with port modifications to support the offshore wind energy industry as well as potential mitigation measures for these impacts.

2.6.3 Benefits from Panama Canal Related Port Modifications

Many Atlantic coast ports are making modifications to their port facilities and navigational channels to support the expanded Panama Canal, which will allow larger vessels to transit the Panama Canal and make calls at ports capable of handling these vessels. The original Panama Canal was capable of accommodating vessels with capacities of up to 4,400 TEU and drafts of 12 m (39.5 ft). The expansion of the Panama Canal entails the construction of two new sets of locks and the widening and deepening of existing navigational channels to accommodate vessels with capacities of 13,000 to 14,000 TEU and drafts up to 15 m (49.8 ft), termed Post-Panamax vessels.

The primary modifications to these ports are deepening navigational channels to 15 m (50 ft) (or deeper) and raising bridges to increase air draft in an effort to allow the deep draft vessels to access the port facilities. The deepening projects do not provide added benefit to a port’s ability to accommodate vessels associated with offshore wind installation since such vessels have drafts that are typically between 6 and 9 m (20 and 30 ft). Raising bridges or overhead electric transmission wires that cross a navigational channel to increase the air draft to accommodate taller vessels (e.g., the ongoing project to raise the Bayonne Bridge between Bayonne, NJ and Staten Island, NY) do provide benefit to offshore wind installation vessels given the height of some of these vessels, but may not be economically feasible for the sole purpose of facilitating channel use for the offshore wind energy industry. The new cranes being installed at some ports (i.e., Boston) provide added capability to transfer containers to/from larger container ships than currently possible; however, their height increase will be relatively small since the crane height is typically limited by other factors, such as flight paths to nearby airports, as it the case in Boston, and they still may not have the lifting capacity required for offshore wind components.

Table 2.6-1 summarizes the port modifications that are being implemented or planned to allow ports to accommodate Post-Panamax vessel.

Table 2.6-1. Summary of Port Modifications for Panama Canal Expansion

Port	Modifications	Status
Boston	Federal Channel Deepening	Planned
	Larger Container Cranes at Conley Terminal	Planned
	Larger Berths at Conley Terminal	Planned
New York/New Jersey	Federal Channel Deepening to 15 m (50 ft)	Ongoing
	Bayonne Bridge Navigational Clearance Project (raise to 66 m (215 ft))	Ongoing
Baltimore	Container Berth Deepening to 15 m (50 ft)	Complete
	Larger Container Cranes	Complete
Hampton Roads	Already Post-Panamax accessible	N/A
Charleston	Federal Channel Deepening to 15 to 16 m (50 or 52 ft)	Planned
Savannah	Federal Channel Deepening to 15 m (48 ft)	Ongoing

2.6.4 Port Networks

Small to medium ports may not need to make physical modifications to their facilities to support the offshore wind industry. It may be possible for groups of regionally located ports to form alliances that allow them to service the offshore wind industry as a network of ports, with each port playing to its strengths and contributing its physical capabilities to benefit the network as a whole.

Eight small to medium size ports in Northern Germany collaborated to diversify their operations to include logistics services for the offshore wind energy industry. This collaboration was coordinated by the LO-PINOD project and Brünsbuttel Ports GmbH, which operates seven ports. To address the challenge created by the tendency of wind energy operators to award contracts to large ports that can provide almost all of the port services needed, Brünsbuttel created a port network that combined each of the small to medium size ports' strengths to provide the range of port services needed to meet the requirements of the offshore wind energy industry. In the case study, LO-PINOD reports that the biggest challenge encountered by the eight ports was developing a collaboration agreement that was acceptable to all the ports. The ports network has since collaborated with a Danish port to expand the port network beyond Germany's borders. (LO-PINOD, 2014).

This collaboration demonstrates that physical port modifications are not always necessary to diversify a port's service offerings to include offshore wind industry support, and that alliances with other ports having similar desires to service the offshore wind industry can provide the same benefit but without the time and cost associated with physical port modifications.

2.7 Conclusions and Recommendations

Section 2.0 summarizes the usages of ports during the construction of offshore wind projects and the key technical requirements for these ports. The following are presented as the key points from this section:

- Ports are central to the manufacturing, construction, and operations and maintenance of offshore wind projects.
- Identifying a minimum set of criteria is a challenging exercise and there are many different ways to make a given port facility work for a given project. In reality, the wind project can adjust the logistics and equipment to adapt to the available capabilities of the port. For example, cranes can be rented, additional load-spreading devices can usually be utilized, and the choice of vessels can be adjusted to meet the capacity of the available berths. A given project may select a port with greater or lesser capabilities depending on the needs of the project and on a cost-benefit of available port facilities.
- To provide some examples of the physical dimensions that represent the typical "minimum requirements," the ESS Team has provided Table 2.5-1. It is important to keep in mind that this table is an example and may not represent the best solution for a specific project.
- The primary factors that are especially important for ports supporting the staging of offshore wind projects are vessel access (berth capacity and depth; navigation channel depth, width, and vertical clearance restrictions), lifting capabilities, bearing capacity of the quayside and storage area, number of berths and storage area, available transportation infrastructure, and the ability to accommodate specialized vessels like jack-ups.
- Most U.S. ports can serve as maintenance ports with their current capabilities, assuming that large components for major maintenance can be staged from the original staging port or the equivalent.
- One path for improving port readiness is development of offshore wind component manufacturing facilities near a port. Such supply-chain development could produce the economic incentive for ports to improve their facilities to better serve the new customers seeking to use the port. It should be noted that the improvements required for ports supporting offshore wind component manufacturing will be specific to the type of component(s) manufactured and the manufacturer itself.
- The improvements made to ports to support offshore wind projects typically do not reduce the port's ability to continue to handle other types of cargo or serve other industries. Any impact to the port use fees and tariffs imposed on other industries based on the improvements must be considered before the upgrades are undertaken.
- Staging ports will typically require improvements before they are capable of supporting an offshore wind project. A small number of ports have or are undergoing such improvements and these can serve as examples to other facilities. There are a number of port capabilities that are required for offshore wind staging ports but that are not commonly found in U.S. ports. These are:
  - Ground bearing capacity of at least 10 t/m^2 (2,048 psf) at the quayside, along the haul route(s), and in the storage area(s)
  - Seabed suitable for jack-up vessels at the quayside
  - Lifting capabilities in the port to be able to load, unload, and transport nacelles and foundations weighing in excess of 300 t (331 T)
  - Jacket and GBS foundations and floating turbines require unrestricted overhead clearance between the port and the project site
  - Access channel width that supports the required vessels and high vessel traffic during construction
  - Available storage area on the quayside for staging and temporary storage of components

- Finally, proximity of the staging port to the project location impacts the transit time for components and crew to and from site, which impacts the construction cost. Projects typically prefer to utilize a staging port as close to the project site as possible, however location is not likely to be the driving factor when selecting a staging port. A cost-benefit assessment should be conducted to identify the most cost-effective port for a given project.

3.0 PORT IDENTIFICATION AND CLASSIFICATION

Using the key technical requirements for ports supporting offshore wind energy projects described in section 2.0, the ESS Team identified and classified Atlantic coast ports using the approach described below. The objective was to prepare a list of ports along the Atlantic coast (the BOEM defined study area) that could potentially support offshore wind energy development and classify the list using the characteristics identified as critical to offshore wind energy. The locational scope of this study was the six BOEM wind energy areas (WEAs) offshore of Massachusetts, Rhode Island, New Jersey, Delaware, Maryland, and Virginia, and the BOEM call areas offshore of North Carolina and New York.

3.1 Port Identification

The ESS Team identified a list of ports in the study area (the “Identified Ports”) based on published global port databases that state they capture all commercial ports:

- IHS Maritime, "Ports & Terminals Guide Directory 2015-16,” published 2014.
- National Geospatial-Intelligence Agency, “World Port Index, 24th Edition,” published 2015.

Both of these databases provided information on location, characteristics, known facilities, and available services for commercial ports and terminals. The selection of ports that is included in these databases is based on criteria established by the publishers, and is not specific to the offshore wind industry. The list of ports considered did not specifically include recreational ports, also referred to as marinas. A marina consists of a dock or basin with moorings and supplies for personal vessels. A marina differs from a port in that a marina does not handle large passenger ships or cargo, and would in most cases not be capable of supporting offshore wind O&M activities. Identified Ports were denoted with their potential to serve as an offshore wind staging port or a staging and O&M port.

3.2 Initial Port Assessment and Screening

An initial assessment and screening of the Identified Ports was conducted to identify those ports in the study area that warranted more detailed consideration as potential offshore wind construction and staging ports. For the purpose of this analysis, the focus was on ports that were suitable for construction and staging activities, assuming that such ports would have facilities around them that would be suitable for O&M activities. Although routine O&M activities may be supported by smaller, less well-equipped ports, location will be a key factor in the ability of smaller ports to support such activities. Major maintenance activities (e.g., serial blade replacements) will require more robust capabilities that are similar to those required for construction and staging. It was also assumed that some fabrication/supply activities will occur elsewhere (outside of the study area) and was not considered part of this study.

In this initial screening, the ESS Team established a set of Minimum Criteria to identify suitable ports. These criteria included the following:

- Port size and accessibility – The ESS Team established minimum criteria based on the least restrictive requirements for the various construction and staging activities; and,
- Vessel transit distance from identified lease areas and call areas.

The ESS Team then evaluated the Identified Ports in terms of the screening criteria identified above. Information was gathered from the aforementioned databases, information that was in the online Offshore Wind Port Readiness tool developed for the U.S. DOE, and other online sources. The ESS Team compared these attributes for each of the Identified Ports to the Minimum Criteria and eliminated from further consideration those ports that did not meet the Minimum Criteria. The result of this initial assessment was a list of 50 ports for further consideration (the "Prioritized Ports").

3.3 Port Assessment and Characterization

For the Prioritized Ports, the ESS Team assessed each port based on the characteristics identified in Section 2.0, namely the following:

- Vessel access (berth capacity and depth; navigation channel depth, width, and vertical clearance restrictions) and ability to accommodate specialized vessels like jack-ups
- Lifting capabilities given the weight and height of components
- Bearing capacity of the quayside and storage area
- Number of berths and storage area
- Available transportation infrastructure

The Requirements for each of the characteristics identified was detailed for each Prioritized Port and grouped according to the following Capability Categories in Table 3.3-1:

Table 3.3-1. Port Requirements by Capability Category

Capability Category	Requirement
Access	Port access channel width
	Port access water depths
	Overhead draft
	Number of berths
Quayside	Quayside bearing capacity
	Quayside length
	Quayside water depths
	Quayside seabed suitable for jacking
Storage	Haul route bearing capacity
	Storage area bearing capacity
	Size of storage area
Roll-On/ Roll-Off	Roll-On/Roll-Off capability
	Width of Ro-Ro berth
	Bearing capacity of Ro-Ro berth and ramps
Cranes	On-site crane type and capabilities
	Crane height restrictions
Transportation	Transportation infrastructure

It is important to note that information on some capability requirements was difficult or impossible to obtain solely from publically available information sources. For example, most ports do not know the bearing capacity of their quaysides or if their quayside seabed is suitable for jacking because their normal port operations do not require this capability. As a result, these data were generally hard to find and were not available. However, they may be available in the future with specific data requests or geotechnical studies at a given port.

The result of this assessment was an Excel spreadsheet included in Appendix I.

3.4 Port Evaluation

The ESS Team established threshold values for each Requirement for 4 MW, 6 MW, and 8 MW scenarios, based on U.S. DOE Port Readiness Report, and the ESS Team's experience with verification from publically available literature sources. Based on the assessment of each of the Prioritized Ports, the ESS Team compared the Capabilities for each Prioritized Port to the Requirements for offshore wind projects (see Table 2.5-1 in the Required Port Characteristics). Requirements for three Scenarios were established based on different evolutions of offshore wind technology as follows:

- 4 MW wind turbines
- 6 MW wind turbines
- 8 MW wind turbines

The 4 MW turbine was included here because it represents part of the current standard practice and provides a benchmark against which to compare the next generation(s) of offshore turbines. Although 6 MW is becoming the standard, some projects are still proposing to use 4 MW turbines (and will likely to continue to do so in the future), while 8 MW turbines are expected to become the standard in the future.

In some cases, foundation type is the controlling factor relative to quayside bearing capacities and crane lifting capabilities; however, at other times, it could be the WTGs. This is largely dependent on WTG size, as a monopile foundation is typically unable to support an 8 MW WTG. For this study, 4 MW and 6 MW turbines assume the use of monopole foundations, while the 8 MW turbines assume a jacket foundation. It is also important to note that although the project sizes currently being proposed range from approximately 200 to 600 MW, most developers are considering a phased approach and it is unlikely that all the equipment and supplies required for a complete project will need to be stored at the same time.

For each Port and Scenario, each Requirement was evaluated, based on the following system:

- Meets or exceeds most or all capability requirements (based on threshold values for 8 MW scenario for all requirements, except quayside bearing capacity, in which the weight of the monopile foundation assumed for the 6 MW scenario exceeds the weight of the 8 MW jacket foundation).
- Meets or exceeds lowest capability requirement (threshold value is 4 MW scenario).
- Does not meet capability requirements, but data is available.
- Information not available.

To the extent possible, the evaluation system was set up to minimize the effect that unavailable information had on assessing a port's capability to handle offshore wind activity. The ESS Team also developed weighting factors for the various Port Capability Categories described above to evaluate a port's readiness.

Weighting Factors

The ESS Team developed weighting factors for the various port Capability Categories. For each port, the scores across Capability Categories were weighted and summed to determine a Total

Score and ordinal scores of low, medium, or high potential were assigned based on the same categorization that was applied to each Capability Category. The weighting of the Capability Categories was developed based on professional judgment of the relative importance of the various capabilities. This professional judgment was further guided through discussions with BOEM and by a number of expert discussions held with port owners or managers and industry experts.

Overall, categories such as Access, Quayside, and Storage capabilities have been weighted more heavily than Crane, Transportation, and Roll-On/Roll-Off capabilities. A justification for each weighting is provided below.

Weighting Factors for Capability Categories necessary for Port Classification

The categories are listed below in order of importance and weighting.

1. **Access:** Access to a port is one of the two most critical capabilities for readiness in accommodating an offshore wind energy project. If the accessibility of a port is limited in a way that ships of the size required to deliver offshore wind project components to or from the port cannot physically access the port, then the port cannot be ready for serving this industry. Thus access is one of the two most highly weighted factors for the classification of port readiness.
2. **Quayside:** The quayside is the second of the two most critical capabilities for readiness in accommodating an offshore wind energy project. If the physical attributes at the quayside are not suitable to berth, load, and unload wind farm components, then the port cannot be considered ready for serving this industry. Quayside attributes carry the same weight as access, because if ships and components can access a port, but cannot utilize the port, that port cannot be considered as ready for supporting the offshore wind industry.
3. **Storage:** Storage area and capacity within a port is a very important capability in accommodating an offshore energy project. While storage capability is very valuable, there are scheduling and delivery logistics options that can overcome a port’s storage limitations. Therefore, Storage has been assigned a slightly lesser weight than the two most critical capabilities of Access and the Quayside.
4. **Cranes:** The availability, type, and capacity of cranes in a port are very important in accommodating an offshore energy project. In the event that cranes of sufficient capacity are not available at a port, the appropriate cranes can typically be procured for use in a selected port. Therefore, Cranes are weighted slightly less than Storage.
5. **Transportation:** Onshore transportation infrastructure at a port is moderately important to a port’s readiness to accommodate an offshore energy project. Since most of the materials would be transported to and from the port by sea, only limited onshore transportation infrastructure in the vicinity of the port is necessary.
6. **Roll-On/Roll-Off Capability:** Ro-Ro technology is an important and valuable capability for ports that are required to lift and move heavy, oversized components. Nonetheless, a port can use other means of loading, unloading, and moving wind farm components within the port and still be effective. Ro-Ro capability receives a lower weighting factor due to the fact that it is not absolutely critical to port readiness.

3.5 Summary

This study highlighted 16 ports, selected by the ESS Team and BOEM, along the Atlantic coast that possess much of the required infrastructure deemed necessary for successful offshore wind project installation. The ports selected are intended to serve as a cross-section of the existing infrastructure and capabilities of Atlantic coast ports. The 16 ports highlighted by this study do not necessarily represent the best ports for an offshore wind project, ports recommended for use by BOEM or the ESS Team, or the only ports capable of handling these projects. When offshore wind energy project developers identify and select ports for future potential offshore wind projects, other options may and should be considered, as necessary to support the particular project under consideration. Multiple terminals at Philadelphia and Hampton Roads were identified and evaluated at each of these ports. Additionally, some of the selected ports were identified as having the potential to support O&M activities, as well as construction and staging activities. The decision was made to not develop port profiles for ports that could only support O&M activities. The port profiles are described in Section 6.0 and provided in Appendix III.

Table 3.5-1. Selected Ports

Port/Terminal	State
Boston-Conley Terminal	MA
New Bedford	MA
Providence	RI
Quonset Point/Davisville	RI
New London (south of I-95)	CT
New Haven (south of I-95)	CT
Bridgeport (south of I-95)	CT
Philadelphia (Packer Avenue Marine Terminal; Tioga Marine Terminal)	PA
Paulsboro	NJ
Wilmington	DE
Baltimore	MD
Hampton Roads (Norfolk International Terminal; Portsmouth Marine Terminals; Newport News Marine Terminal; Peck Marine Terminal)	VA
Morehead City	NC
Wilmington	NC
Charleston	SC
Savannah	GA

4.0 IDENTIFICATION OF ENVIRONMENTAL AND SOCIOECONOMIC IMPACTS AND MITIGATION EFFORTS

The ESS Team has summarized the broad potential environmental and socioeconomic impacts and mitigation efforts associated with potential port modifications, as identified in Section 2.0, Required Port Characteristics, necessary to support offshore wind energy development along the Atlantic coast. This summary was developed based on a review of the existing literature, discussions with selected experts (Section 5.0), and the ESS Team's experience with environmental and socioeconomic reviews of construction projects and wind energy development under the NEPA. This summary is supported by a table (Appendix II, Table 1) summarizing the impact producing factors associated with typical port modifications to support offshore wind, and a table summarizing the potential environmental and socioeconomic impacts and mitigation measures associated with typical port modifications to support offshore wind (Appendix II, Table 2).

4.1 Scope of Activities Considered

Currently, very few ports exist on the Atlantic coast that are capable of fully supporting an offshore wind energy project; however, port modifications are already being implemented or planned to accommodate wind energy facility construction and operations. Offshore wind will require specialized equipment, services, and labor not currently available in most U.S. ports. Understanding what will be needed to support both short-term construction and long-term operational and maintenance activities involves learning from the recent experience of European offshore wind projects, as well as identifying similar services and activities already associated with existing marine industries here in the U.S. (refer to Section 2.0 for more detailed information).

Port facilities are anticipated to host three primary activities to support offshore wind development: fabrication and assembly, installation and staging, and operations and maintenance. Associated with each of these activities are a set of typical tasks performed at a port, including loading and unloading components, transporting components, storing components, maintenance of components, and fabrication and/or final assembly of components. A recent study by Totaro & Associates determined that significant quayside infrastructure exists to enable offshore wind, but the company has estimated that approximately $637.4 million in infrastructure improvements will be necessary for ports to be capable of supporting turbine production and offshore component load-out, as well as service and repair (2015).

ISO 29400 (2015) was developed to provide comprehensive requirements and guidance for the planning, engineering, and safe execution of port and marine operations for all types of components of offshore wind farms, including WTGs, cables, and topsides. Port operations for installation of offshore wind farm components cover all component transport to the ports (whether by land or via waterways), any intermediate storage, preassembly activities at the ports, and placing the components close to any quayside for subsequent marine operations to start. Marine operations for offshore wind farm structures cover loadout from the quayside, offshore transportation, and installation phases through commissioning. Marine operations can also extend to decommissioning, redeployment, and removal.

The primary activities considered for this study are associated with the modification of staging ports to support the staging and installation of extremely large and heavy components and facilitating the access and docking of vessels that transport and install them.

4.2 Literature Review

The ESS Team reviewed readily available literature looking not only for expected impacts of port modifications, but for indications of the magnitude of changes to impact producing factors and local conditions that influenced expected impacts. Few documents were identified that focused on environmental and socioeconomic impacts associated with port modifications specific for offshore wind energy development; however, several documents were identified that illustrate potential impacts of port modifications similar to those expected for wind energy development. These are described below.

4.2.1 European Perspective

Europe is currently the leader in offshore wind energy with over 8 gigawatts of installed capacity—1,483 MW was connected in 2014 with another 2,900 MW of capacity awaiting connection, and significant ongoing plans for future growth and development of the industry. Europe's established port facilities offer guidance, demonstrate current infrastructure requirements, and project future needs of the industry as U.S. ports begin to prepare for the offshore wind industry (Cooper & Marrone 2013; EWEA, 2015).

Based on a review of the current literature, there are a number of European ports that have or are currently undergoing modifications to further accommodate the European offshore wind industry, which has been maturing over the past 20 years. Overviews of several of these European port projects provide a comparison and insight into the potential impacts and environmental issues that can be expected from similar modifications to U.S. ports.

In general, the European port expansions shared similar issues related to the reclamation of large amounts of intertidal areas and coastal habitat, dredging, noise, and air quality. While dredging, noise and air quality impacts are frequently mitigated by the use of commonly used Best Management Practices, it is most notable that the loss of intertidal areas, mud flats, and important bird habitat has been addressed through extensive compensatory mitigation involving the development of substitute sites of sufficient acreage and habitat diversity to provide new or replacement habitat for affected resources such as birds and benthic invertebrates.

Harwich International Port (United Kingdom)

Harwich International Port (HIP), which is located on the southeastern coast of the UK with direct access to the North Sea, has served as the installation base for several large offshore wind projects including Gun Fleet Sands, Greater Gabbard, and Thanet wind installations. HIP expanded its facilities with a major new port development at Bathside Bay, immediately adjacent to the existing facility, to support further opportunities for the offshore wind industry, including the proposed Round 3 projects and current and potential future sites off the coasts of Germany, the Netherlands, and Belgium. Bathside Bay also has the potential to be a multifunctional site for manufacturing and assembly. It is capable of supporting multiple large-scale facilities as well as being a prime installation base for offshore wind.

The port expansion at Harwich into Bathside Bay involved the reclamation of a large amount of intertidal area, construction of a quay wall extension, dredging and disposal of dredge spoils related to the deepening and widening of the approach channel, construction of a small boat harbor, and land-side development involving several new cranes, rail spurs and support buildings.

The main change involved the conversion of Bathside Bay from intertidal habitat to deepwater port. The EIS found that the primary environmental impacts were habitat impacts from loss of intertidal area, loss of mud flats, and erosion. Impacts to benthic invertebrate communities and feeding/roosting areas for waterfowl could not be mitigated and required obtaining/creating compensatory habitat. Erosion and sedimentation were mitigated through the use of erosion control measures (such as monitoring and adjusting dredge speed) and a sediment replacement program. While silt from dredging was disposed of offshore, the dredged sand and gravel from deeper layers were reclaimed and used as upland fill behind the retaining walls for construction of the quay wall extension.

Visual impacts were mitigated by design of landscaping and lighting. During construction and operations (maintenance dredging), access restrictions to specific fishing grounds would affect commercial fisheries. These impacts were considered minor to moderate and would be minimized by avoiding sensitive periods and locations for fisheries. The expansion would result in the displacement of an existing small boat mooring field, which would be mitigated by the construction of a new small boat harbor. Increased traffic during operations was expected to exceed capacity at specific intersections. Highway improvements were proposed to accommodate increased traffic and a Traffic Management Plan would be developed to minimized impacts during both construction and operations. Socioeconomic impacts were considered beneficial through increased local employment (Royal Haskoning 2003).

Port of Rotterdam (Netherlands)

Maasvlakte 2 is a new port and industrial site that will be built alongside the existing Maasvlakte site within the Port of Rotterdam. The Port of Rotterdam was dealing with a shortage of space for the steadily growing wind and industrial businesses. Maasvlakte 2 will provide space for companies that need large sites in the immediate vicinity of a deep sea port (Royal Haskoning 2007).

The primary impact producing activity associated with Maasvlakte 2 was determined to be the extraction of sand from the nearby North Sea to fill in the site and create the sea walls. The impacts associated with this sand extraction were determined to primarily be local and temporary impairment of seabed life. With a planned extraction depth up to 20 m below the seabed, it was determined there will be no obstructions for recolonization, and complete recovery has been estimated to take two to four years. The maximum potential effect was assessed as “not significant.” The maximum reduction is also substantially less than the natural fluctuations that occur in the size of the populations of seabed life.

In terms of water quality, the impacts associated with extraction of sand would be release of fine silt, which will spread with the tidal current both to the south and north of Maasvlakte 2 and would join the fine silt that is naturally present, resulting in higher fine silt concentration and cloudier water conditions. Documentation associated with Maasvlakte 2 noted the natural variation in fine silt concentration is exceptionally large with typical values for the annual average fine silt concentration in the Voordelta of 20-30 mg/litre near the coast and 5-10 mg/litre farther out to sea. During stormy periods, the fine silt concentration could rise to 100 mg/litre. The anticipated increase in the annual average fine silt concentration in the Voordelta caused by sand extraction associated with Maasvlakte 2 is expected to reach at most approximately 6 mg/litre.

Also, assessed were impacts generated by the equipment used for sand extraction and port construction activities. Fuel consumed by equipment would cause emissions of substances that will affect air quality. For the air quality on land, it was determined the emissions near or on the reclaimed land will be the most significant; however, the standards will not be exceeded. The dredging fleet and the equipment used to reclaim land were identified as the major sources of noise (below and above water). The noise may temporarily cause birds and other species inhabiting the area to avoid the immediate vicinity of the source of the disturbance. The temporary effects on the living and foraging area of species (birds, mammals, and fish) were found to be slight. The EIS also determined that the total noise load will not exceed the standards stipulated in the Noise Nuisance Act at any time during construction of Maasvlakte 2.

The space utilized by the reclaimed land has significant effects for one protected habitat type and three protected bird species. These effects are unavoidable because it is not possible to achieve any further reduction of space utilization. Construction of a new marine reserve was proposed to compensate for these effects. Temporary space use conflicts during construction with fisheries and recreational use during construction were also identified. Small fisheries would no longer be able to use the location of the sand extraction pits, as well as temporary closure of a beach used for recreation. The project would, however, generate greater recreational opportunities when completed due to the land reclaimed from the sea resulting in more beaches than before. Seabed archeological values were also identified and would be affected. Disturbance would be subject to additional studies and avoided to the extent possible.

During construction, usage rules for dredgers and other vessels, will be employed to ensure that safety is not jeopardized and that regular shipping will not be inconvenienced by the construction work.

The EIS determined that significant effects require compensatory measures. The proposed compensation included creating a marine reserve in the Voordelta, together with a management plan. The sizing of the marine reserve requires it be at least 10 times as large as the ultimate loss of 1,110 acres. The EIS also required that the management plan be updatable, allowing for the possibility of modifying management activities.

Port of Bremerhaven (Germany)

Bremerhaven is located on the northern coast of Germany, on the Weser River estuary with direct access to the German North Sea. The city of Bremerhaven and the region around the Weser estuary are already heavily involved in offshore wind with a significant cluster of wind turbine nacelle, blade, tower, and foundation manufacturers operating production facilities in the area. To complement the production capabilities, the port of Bremerhaven is expanding to include the Offshore Terminal Bremerhaven (OTB). The OTB will allow for more efficient transportation and handling from these production facilities to the loading of installation and transport vessels.

The OTB expansion on the south of Bremerhaven involves the addition of approximately 60 acres of staging/storage and approximately 500 meters of new quay with 2-3 berths. These improvements involved the reclamation of intertidal areas, mud flats, and important habitat for shore birds, along with channel dredging and the associated disposition of spoils, as well as pile driving and land side filling required for construction of the new quay wall.

The primary environmental impacts associated with the port expansion included the loss of intertidal areas and coastal habitat, changes in aquatic habitat from dredging, and noise. The loss of coastal habitat was addressed through the development of ecological compensation and substitute sites along the Weser River, which reclaimed formerly heavily farmed areas to a more natural, tidally influenced condition conducive to coastal birds. Impacts from dredging were minimized by the development of extensive upland treatment facilities for contaminated spoils and the reuse of clean dredge spoils as upland site fill and fill behind the sheet piles of the new quay wall. Noise issues were addressed both actively and passively, through planned noise reduction at the source as well as installation of sound proof windows, doors, and modern ventilation systems in nearby residences that were determined to be at risk of impact from the port expansion.

Galway Harbor (Ireland)

Situated on Ireland’s west coast with open access to the Atlantic Ocean, Galway Harbor is located on the northern shore of Galway Bay and immediately adjacent to the inner city of Galway City. To address severe constraints, remain economically viable and, in part, service the offshore energy sector, a proposal is under review to develop a new all-tide, deep water, larger vessel facility by reclaiming lands seaward of the existing harbor utilizing naturally occurring deeper waters.

The proposed Galway Harbor Extension will include:

- 660 m of new quayside berth;
- Dredging of new turning area, access channel, and berths;
- 70 acres of land-side development; and a

- New small boat marina, fishing pier, and rail link.

The project involves the dredging of approximately 1.815 million cubic meters of material, and extensive land reclamation that will be accomplished by constructing seven discrete lagoon areas, each contained by robust wall systems and lined with geo-membrane. The lagoons will be filled with dredge materials and the lagoon walls will contain and control sediment and erosion from the land reclamation process. All dredged material will be reused in the land reclamation efforts and none will be disposed of offshore. The construction of new quay walls will involve the driving of sheet piles, tubular piles, and combi-walls (king piles with sheet piles between them) into pre-blasted rock pockets. Impacts are anticipated from construction noise and vibration, which will be mitigated through the employment of marine mammal observers and limitations on the hours of pile driving and /or blasting.

The proposed development is located in a designated candidate special area of conservation and special protection area. The development will result in the loss of feeding and foraging habitat for seals, otters, lamprey, salmon and some species of birds, although none of the habitats are exclusive to the site, nor is it considered to be high quality habitat. Impacts to these species will be minimized primarily through time of year restrictions on construction activities and habitat creation in the rock walls of the lagoons and breakwaters.

The main adverse socioeconomic impacts identified were those related to visual, cultural, and archeological resources. During construction, driving of steel piles and vessel movements would interfere with the views of nearby receptors, although the impacts would be temporary. The design of the harbor extension helped mitigate visual impacts with the main construction location largely screened from public view by existing structures. Additional mitigation measures to be applied included landscaping to reflect the general surrounding environment, use of color to reduce contrast and lighting specifications. The relocation of existing harbor operations was interpreted as a "cultural loss" to the public valuing proximity to large ships entering and departing the harbor. Archeological resources were considered to be potentially affected and monitoring of construction by licensed archeologists was recommended for mitigation, with the possibility of recovery of any detected archeological material during construction (Galway Harbour Company. Undated).

4.2.2 U.S. Perspective

There are a number of marine industries currently in operation in the waters offshore of the U.S., each with its own specialized port requirements. These industries include, but are not limited to, petroleum extraction, LNG off loading or storage, commercial shipping, and commercial fishing. Each marine industry is specialized, requiring differing shore-side support as well as different configurations for the appropriate offshore environment. However, comparing and contrasting the needs of these industries with European experience can increase our understanding of the port-related requirements for offshore wind development and the potential utilization of the available marine industrial capabilities in the U.S. In an analysis of the port and infrastructure of the U.S., TetraTech EC (2010) concluded that port requirements for maintenance and support of offshore wind farms would be similar to those for offshore LNG ports and petroleum platforms.

Many U.S. ports are currently making modifications to their port facilities and navigational channels to support the expanded Panama Canal, which will allow larger vessels to transit the Panama Canal and make calls at ports capable of handling these vessels. The primary modifications to these ports are deepening navigational channels to 15 m (50 feet) (or deeper) and raising bridges to increase air draft in an effort to allow the deep draft vessels to access the port facilities. Some of the activities (impact producing factors) and resulting impacts associated with these deepening projects are relatively similar to the impact producing factors identified above.

In the early days of U.S. offshore wind development, it is expected that numerous components will be delivered to the staging port from Europe requiring the storage of more components at the staging port until a local manufacturing facility is identified. As a result, U.S. ports would need larger storage areas than are common in European staging ports.

Socioeconomic impacts of port modifications depend largely on the dimensions of these modifications relative to the socioeconomic reality of the affected area. In a study conducted for the U.S. DOE, Navigant (2013) simulated investments in port infrastructure under three different scenarios (low - $50 million, mid - $200 million, and high - $700 million) to estimate potential labor and economic impacts at the state level. Port manufacturing was added as an assumption in the medium and high investment scenarios but not for the low investment scenario. The estimates used assumptions for representative states of various U.S regions. The resulting estimate of statewide direct employment under the low investment scenario ($50 million) for a port in the North Atlantic would be 600 FTE over the construction period (i.e., 300 annual jobs, if a 2 year construction period is assumed) with $33 million in labor earnings over the construction period (average earnings per job of $55,000).

New Bedford (Massachusetts)

The Port of New Bedford is managed by the Harbor Development Commission, led by the City of New Bedford. It is a major commercial fishing port[2] and also handles bulk cargo. The Port of New Bedford was identified as a capable port, given specific modifications, to support offshore renewable energy development. The key port modifications included the construction of a 28.45 acre marine terminal, navigational dredging, construction of confined aquatic disposal cells, and the creation/modification of mitigation areas. The new terminal, called the Marine Commerce Terminal in New Bedford, which is located south of existing terminals within a Designated Port Area, was funded by the Commonwealth of Massachusetts, and is currently managed by the Massachusetts Clean Energy Center (a publicly-funded agency).

New Bedford is one of the largest U.S. Environmental Protection Agency (U.S. EPA) Superfund sites in the country and presented many environmental challenges related to cleanup. Because of the Superfund designation, Massachusetts Clean Energy Center (MACEC) was able to build under the unique State Enhanced Remedy Authority, which allowed them to accelerate the construction. More landside contamination than anticipated was encountered and MACEC had to work with U.S EPA to get sampling and removal methods approved. Large quantities of material had to be removed out of state to U.S. EPA approved disposal sites.

The major potential impacts due to the activities listed above include issues related to noise, traffic, air quality, water quality, and habitat loss. Based on the U.S. EPA's Final Determination (2012) for the port improvements, the impacts would not be detrimental to human health or the environment, assuming mitigation measures are followed.

---

[2] According to the National Ocean Economics Program, New Bedford was, in 2013, the top ranked U.S. fishing port as measured by landed value (14th, if measured by landing weight). The next ports on the Atlantic coast only appear in 19th and 20th in landed value (Newport, RI and Hampton Roads Area, VA, respectively). Measured in weight, the next ports are Gloucester, MA (22nd), Point Judith, RI (225th) and Rockland, ME (30th) (NOEP 2015)

Most of the area is industrial property owned by the Commonwealth of Massachusetts and underutilized, but some was acquired from private owners and some commercial activity was displaced. Several alternatives were developed to avoid impacts to specific sources. For example, alternatives were developed to avoid adverse impacts to areas of cultural importance with the final design receiving no objections from State Historic Preservation Office (SHPO) or Wampanoag Tribes with whom consultations were held. The main impacts from construction on neighboring populations included impacts of noise, traffic, and dust (EPA 2012). Several mitigation measures were identified to reduce these impacts, including designation of access routes to the terminal for construction trucks, best practices in construction to reduce dust, and coordination with harbor officials and with the U.S. Coast Guard to reduce potential impacts from dredging on fishing, cargo, and recreational vessels.

The first step in the mitigation process was a public outreach program to ensure the community involvement and input help move the project forward. To mitigate effects of noise, construction equipment was fitted with enclosures and mufflers; in-water noises were mitigated with bubble curtains, low impact vibratory hammers, and non-explosive rock removal techniques. To minimize potential traffic implications, there were specific traffic routing requirements. Air quality control measures included dust suppression, use of ultra-low sulfur fuel, and other best management practices. To minimize sedimentation and water quality impacts, standard upland surface water control practices were deployed, as well as bubble curtains, silt curtains, and absorbent booms for in-water work. To control for coastal habitat loss, new subtidal habitat was created, intertidal habitat will be enhanced, and shellfish seeding will be conducted. In addition, protective measures were employed to protect archeological resources and to prevent protected species from entering construction zones.

To verify that mitigation measures and performance standards are maintained, the project has several approved monitoring plans in place. These monitoring plans will ensure fish deterrents are effective, noise levels are not detrimental, air and water quality standards are not exceeded, and new invasive species have not been introduced.

Port of Los Angeles (California)

The Los Angeles Harbor Department led several environmental reviews of modifications to the Port of Los Angeles to expand its capacity to handle containerized cargo. From the environmental and socioeconomics point of view, these modifications included aspects similar to those that may be needed for ports to accommodate offshore wind energy development, including: dredging and disposing of dredged materials, new wharf and terminal building construction, installation of new cranes, transportation infrastructure improvements in the vicinity of the terminal and new bridges (The Los Angeles Harbor Department 2007; 2008; 2014).

Because most increases in the local demand for labor and services were temporary and because of the large labor force and population of the surrounding area, impacts to employment, population, housing, local public services, fiscal revenues and stimulus to local economic growth were not expected to be substantial. However, the presence of minority and low-income populations surrounding the Port area led to an assessment of disproportionately high and adverse human health and environmental impacts to minority and low-income populations from aesthetic, air quality and noise impacts during construction, cumulative impacts to transportation systems (traffic) during construction, as well as cumulative impacts of operational activities to health risk and air toxics. Other socioeconomic impacts of relevance identified included unavoidable aesthetic impacts related to view blockages from newly installed cranes; onshore paleontological resources affected by a buffer zone (park) proposed in one of the modifications; and long-term impacts on vehicular traffic.

From an environmental perspective, given the existing size and operation of the Port, the environmental impacts were largely deemed to be less than significant as the footprint and functionality of the Port would not be drastically different than the existing conditions.

Port Everglades (Florida)

The Port Everglades Harbor Navigation Study proposed to widen and deepen various channels and harbors for container ships and oil tankers as well as make the necessary dock and crane infrastructure improvements at the existing Port Everglades in Hollywood, Dania Beach, and Fort Lauderdale, Florida. The Project was proposed to support the expansion of international trade and deployment of post-Panamax vessels to U.S. ports with the impending completion of the Panama Canal expansion. Project components include dredging and blasting and the associated impacts of the dredges and/or excavators.

While Port Everglades is located in a developed, urban area it provides a unique and diverse marine setting and home to variety of organisms. The Final Environmental Impact Report focused heavily on the environmental impacts that could potentially occur as a result of the proposed Project since the area is so biologically rich and diverse. The warm, tropical waters provide habitat to several species protected under the Endangered Species Act, including Johnson's seagrass, Elkhorn and staghorn corals, manatees, sea turtles, dolphins, whales, and smalltooth sawfish. Impacts to certain threatened and biologically important organisms, such as corals, seagrass, and mangroves, are unavoidable and therefore require compensatory mitigation. Mitigation for reefs includes the construction of artificial reefs off-site along with some corals transplanted from the site. Mitigation also includes the enhancement of various reef habitats using coral colonies outplanted from nurseries and the associated monitoring plan to ensure survival. The removal of aquatic vegetation (seagrass) and coastal habitat (mangrove wetlands) requires mitigation in the form of mitigation credits. Many of the other associated impacts to environmental and biological resources are temporary in nature and occur as a result of Project construction. These temporary impacts are expected to last throughout the construction activities. After Project completion many of the impacts to resources in the area are reduced and return to pre-Project conditions. Temporary impacts include impacts to water quality; air quality; acoustic environment; marine mammals; sea turtles; sedimentation; and fish populations. In the long-term most of these impacts are not determined to be major. Monitoring of conditions pre- and post-dredge/blast and turbidity monitoring throughout the Project will also occur to ensure impacts are not permanent and do not exceed certain thresholds.

Aesthetic impacts were considered to be only temporarily affected during construction with mitigation measures including prompt removal of trash and debris and construction fences. Impacts to recreational boating were identified during dredging through closure of offshore areas, but considered to be temporary because the areas affected would move through time and space. Cultural and historic surveys identified no impacts to cultural and historic resources. Positive impacts were identified to economic resources (decreased costs with vessel delays and economies of scale) and to navigation safety (reduction in accidents, improved maneuverability and adequate width and depth of channel).

4.3 Main Drivers of Impacts

The activities associated with achieving each of the capabilities identified above and described in detail in the Required Port Characteristics (Section 2.0), are listed in Appendix II Table 1 and include sediment dredging, rock blasting, land clearing, pile driving, drilling, fill placement, compaction, and paving. Each of these activities results in impact producing factors (stressors) that in turn have a measured impact on environmental and socioeconomic resources (receptors).

The environmental and socioeconomic impacts of port modifications are typically location specific and depend on magnitude of changes to the impact producing factors relative to local conditions. As identified in Appendix II Table 1, and further detailed in Section 4.4, impact producing factors for environmental and socioeconomic impacts are expected to be the following:

- Seafloor/land disturbance;
- Sediment suspension/deposition;
- Noise;
- Lighting;
- Discharges (dewatering, stormwater, accidental spills);
- Trash/debris;
- Vessel and vehicular traffic;
- Air emissions;
- Visible infrastructure;
- Aquatic habitat alteration;
- Species injury, mortality, or displacement;
- Offshore/onshore space use conflicts; and
- Increased demand for local labor and services.

4.4 Overview of Impacts Anticipated from a Typical Port Modification and Potential Mitigation Measures

Appendix II Table 2 describes the potential environmental and socioeconomic impacts and mitigation measures that could be associated with port modifications to support development of offshore wind farms along the Atlantic coast.

These impacts may range in severity and depend upon numerous factors, including the impact producing factors, environmental and socioeconomic resources present, location, time of year, and presence of other factors not associated with the intended port modifications.

Each port modification activity was evaluated on a resource-specific basis to determine the anticipated impact for each impact producing factor. These evaluations were refined in the port profiles to consider the unique attributes and setting of the resource being evaluated, coupled with location of the port. For biological resources, attributes such as distribution/range, life history, and susceptibility to impact of individual and populations should be considered, among other factors. For socioeconomic resources, attributes such as archaeological or socioeconomic characteristics and susceptibility to impact should be evaluated, among other factors.

4.4.1 Environmental Impacts

Benthic. Impact to the benthic habitat and benthic community is one of the primary impacts identified during port modification activities, namely from the dredging of the seafloor along the port berth and quayside, as well as within the harbors and channels. Potential impacts include loss of aquatic habitat (e.g., seagrass, eelgrass, and coral communities), smothering and crushing of benthic organisms, increased turbidity and reduced water clarity, and release of contaminants from contaminated sediments. Impacts to the benthic community are temporary, lasting throughout construction. Signs of recolonization can typically been found within 3 months of construction completion and recolonization to pre-construction levels typically occurs within 3 years of construction completion. Positive impacts to benthic communities have also been seen in marina and port expansion. New surfaces such as piles and wall surfaces result in increased area for coral and sessile organisms to colonize (Roger 1990).

Fish and Essential Fish Habitat. Fish and essential fish habitat (EFH) may be impacted by dredging of the seafloor associated with port modifications, as well as by the noise associated with increased activity at the port. Dredging and similar seafloor disturbing activities may result in loss of habitat and increased turbidity and sedimentation. Increased turbidity could result in gill clogging in adult fish and smothering and crushing of eggs/larvae. Noise associated with vessel traffic, dredging, blasting, and pile driving may cause fish to leave the area but is unlikely to cause injury. Impacts and injury to fish with air bladders could occur as a result of blasting and drilling. In most cases, the impact will be minor and temporary (expected to last throughout construction activities) with conditions returning to pre-construction conditions and individuals returning to the area shortly after completion of construction. Depending on the location and species present, time of year (TOY) restrictions may be employed to avoid or minimize disturbance. Noise abatement or deterrent techniques may also be employed, as well as turbidity monitoring during dredging activities.

Air Quality. The activities associated with the identified port modifications all involve the use of vehicles or vessels that would produce emissions that could impact air quality. The temporary increases in particulate and gaseous emissions are expected to have a minor to moderate impact on air quality, depending on the location. These temporary increases are expected to last throughout construction activities returning to pre-construction conditions after project completion. Tugboats, typically used to assist other vessels (including those that use the port prior to modification), would produce most emissions. Typically management practices include the use of vehicles and vessels that meet appropriate standards and monitoring for compliance. Land-side construction activities, including land clearing and fill placement and compaction, create dust with the potential to impact air quality. Site management practices typically include implementation of a dust control plan, which may involve watering of the site; use of soil stabilizers; covering of truck loads and disturbed areas; and halting activities in high winds.

Terrestrial Biota. Terrestrial habitat and biota have the potential to be impacted by land-side construction activities including land clearing, drilling, fill placement and compaction, and paving. Potential impacts include loss of habitat and disturbance due to noise and land clearing. Noise associated with vessel traffic and drilling may cause biota to leave or avoid the area but is unlikely to cause injury. Increased noise as a result of construction will be minor and temporary with conditions returning to pre-construction conditions and individuals returning to the area shortly after completion of construction. Activities that result in land clearing and land use change from habitat to port activity are major and permanent activities, which would likely result in some form of mitigation. Depending on the location and species present, there may be restrictions placed on the construction in the form of TOY restrictions or work hour restrictions. Noise abatement or deterrent techniques may also be employed.

Marine Mammals and Sea Turtles. Marine mammals and sea turtles are most likely to be impacted by the noise associated with increased activity at the port. Noise associated with vessel traffic, dredging, blasting, and pile driving may cause any marine mammals or sea turtles to temporarily leave the area, resulting in an incidental take, but is unlikely to cause injury. Incidental take authorizations are required for activities that produce underwater sound, including pile driving associated with construction projects. In most cases, the impact will be minor and temporary (expected to last throughout construction activities) with conditions returning to pre-construction conditions and individuals returning to the area shortly after completion of construction. Depending on the location and species present, TOY restrictions may be employed to avoid or minimize disturbance. Noise abatement or deterrent techniques may also be employed. An incidental take authorization often includes additional monitoring of the area for the presence of indicated species to avoid or minimize injury or death.

Birds and Bats. Birds and bats are most likely to be impacted from noise associated with construction activities. Noise associated with vehicle/vessel traffic and drilling may cause birds to leave or avoid the area but is unlikely to cause injury; likewise any construction activities occurring at night may impact foraging bats. In most cases, the impact will be minor and temporary (expected to last throughout construction activities) with individuals returning to the area shortly after completion of construction. The modification of existing bridges and towers also has the potential to temporarily alter the migration patterns of birds and roosting locations for bats. Depending on the location and species present, there may be restrictions placed on the hours of construction and lighting requirements. Noise abatement or deterrent techniques may also be employed. Additional impacts related to birds may include the ingestion of contaminants and collision risks. During dredging operations contaminants may be suspended into the water column and ingested/filtered by animals preyed on by birds. Silt curtains and temporary cofferdams in conjunction with water quality monitoring will mitigate the potential impacts. The added risk of collision may occur due to the raising of utility lines and towers. Anti-perching and utility line marking measures may be utilized to minimize these avian interactions.

Water Quality. Dredging and similar seafloor disturbing activities may result in increased turbidity and potential release of contaminants into the water column from contaminated sediments. Sediment testing and turbidity monitoring are often employed to minimize impacts to water quality. Impacts associated with increases in turbidity are temporary (expected to last throughout construction activities) with conditions returning to pre-construction conditions shortly after construction. Impacts to water quality may also result from stormwater runoff, dewatering (removal of water from a site for construction activities to take place below surface water and groundwater), accidental spills, and the unintentional release of trash and debris. These impacts are unlikely and will be controlled by the employment of standard site management practices.

Currents and Tides. Currents and water movement may be impacted by the construction of a new berth or significant alteration of the seafloor/shoreline at an existing port. Seafloor or shoreline alteration could result in shoreline erosion in surrounding areas. Studies should be completed prior to construction to determine the likelihood and extent of impact. In some cases, ocean currents and movements in an area could improve as a result of dredging. Tides will not be affected by port modifications.

Sediment Deposition. Dredging of the seafloor along the port berth and quayside, as well as within the harbors and channels will result in suspension of sediments that will redeposit in the general area. The spatial and temporal extent of deposition will depend on the local currents and tides. Sediment deposition may result in changes in the local bathymetry, as well as smothering of sessile organisms. Sediment deposition can be particularly problematic for coral, submerged aquatic vegetation, and other photosynethic organisms as it disrupts the availability of light (Rogers 1990). These impacts are anticipated to be minor as after project completion, sediment resuspension and deposition will dissipate and return to pre-construction conditions. Over time, without further disturbance, the area will revert back to its original bathymetry and composition.

Acoustic Environment. Increases in noise associated with construction activities around the port will result in the disturbance of fish, mammals, turtles, birds, and other animals. Mobile species are expected to leave the area until completion of construction. Because most ports are located in existing industrialized areas, impacts are anticipated to be minor. If resources are identified nearby, hours of construction may be restricted and noise abatement techniques may be employed.

Coastal Habitats. Impacts to coastal habitats (which may be designated as Critical Habitats) are expected to be negligible, when expanding within the footprint of an existing port facility. Impacts are expected to be minor to major, when expanding into areas of previously undeveloped coastal habitat. Impacts to coastal habitat could include the reduction or loss of habitat for aquatic and terrestrial biota, particularly nesting, roosting, and foraging habitat for birds and bats, nesting habitat for sea turtles, and nursery grounds for commercially and ecologically valuable fish species. Coastal habitats likely to be affected by port modifications are mangrove forests, wetlands, and salt marshes. Reduction or loss of mangrove forests and marsh areas could result in increased coastal erosion and reduced storm protection (USACE 2015).

4.4.2 Socioeconomic Impacts

Military Use Areas. Impacts to military use areas from modifications to ports depend on the existence of space use conflicts between port modifications and military activities such as vessel training exercises and aviation exercises. Because military vessel operations that are not compatible with commercial or recreational activities are typically confined to Military Operating Areas away from commercially used waterways (BOEM 2015), there would be no expected conflicts with vessels used for port modifications. To the extent that dredging is needed in channel segments shared with military vessels, there would be a potential for use conflict for the channel, but this type of conflict is routinely managed through coordination. Because no aircraft are expected to be needed for port modifications, no expected space use conflicts would be expected with the military use of airspace. Air draft improvements to bridges or utility towers would occur within heights common to urban development and commercial use.

Land Use and Existing Infrastructure. Expansion of port infrastructure could generate space use conflicts with current or planned uses of the affected areas. Space use conflicts are more likely in ports requiring construction modifications beyond their current property. Because expansion would likely occur to adjacent areas of the port, potential conflicts with coastal zone management plans are not likely. Activities that require dredging, pile driving and fill placement may generate space use conflicts with other uses of port waterways, particularly channel widening or deepening, because dredging may occur over a larger area.

Transportation (terrestrial). Vehicle traffic may be impacted by the transportation of construction materials and workers during port modification whether directly, if construction materials are transported by truck, or indirectly, through traffic delays at crossings with rail lines, if materials are transported by rail. Transportation on land may also be affected if port expansions occupy areas currently in use by vehicle or rail traffic. At Harwich, increased traffic on the local road network was identified as a potential adverse effect during construction (Royal Haskoning 2003). Port modification may also positively impact traffic on land in the surrounding area. The demand for larger and increased vehicles to the port may require road widening, improvement/reconstruction, or added traffic lights. Traffic in the area could become more efficient as a result of these modifications. At the Port of Los Angeles, projects typically included widening of roads and other infrastructure improvements to accommodate expected increases in traffic.

Cultural and Historical Resources. The two most likely types of impact producing factors that could lead to adverse impacts to cultural and historical resources are seafloor disturbance and visible infrastructure. Seafloor disturbance could affect shipwrecks or archeological sites and could occur with dredging, pile driving or fill placement activities. Visible infrastructure could affect cultural and historical resources if they disrupt the visual landscape of a culturally or historically important place or building. Disturbance of offshore buried artifacts and sites could be permanent. At New Bedford, archeological surveys identified sensitive “paleosols” and a shipwreck (EPA 2012). At Harwich, potential effects on archeological sites from silt removal and dredging activities were also identified (Royal Haskoning 2003). At Galway, the relocation of existing harbor operations was interpreted as a “cultural loss” to the public valuing close proximity to large ships entering and departing the harbor and archeological resources were considered to be potentially affected (Galway Harbour Company. Undated).

Visual Resources. Impacts to visual resources depend mostly on the existing visual setting and the contrast with the perceived quality of a landscape or seascape. Adverse impacts are considered to increase with perceived contrast and with the number of those exposed to such contrast. Most port modifications would likely not contrast greatly with the surrounding environment, given they would be expected to be expanding, building or reinforcing structures and facilities of the same type as those already present at ports. Effects during construction would be temporary. Installation of taller cranes, as well as modification to bridges and power lines to improve air draft have the most potential for lasting visual impacts. In the case of New Bedford, long-term run visual impacts involved changing the site from a demolished mill property to an active marine terminal, with the impacts being considered positive or negative depending on subjective judgement. However, the resulting visual effect would have little contrast with adjacent waterfront properties (EPA 2012). At Harwich, visual effects of construction would derive from the contrast of construction activities with the currently tranquil view of the site both from land and from open water (Royal Haskoning 2003). At Galway, driving of steel piles and vessel movements would interfere with the views of nearby receptors (Galway Harbour Company. Undated).

Environmental Justice. Although port modifications have the potential to generate high and adverse human health or environmental effects in the area of the planned work, as do most construction projects, effects are likely temporary and often can be mitigated through best practices in construction or other measures. If after mitigation, effects are still considered high and adverse, the presence of environmental justice impacts depends on the population characteristics of the area affected by those high and adverse effects and treatment and involvement of those populations. Minority or low-income populations would need to be present and disproportionately impacted by the high and adverse human health effects. One potential impact to surrounding minority or low-income populations is degraded air quality as a result of vehicle and vessel emissions or earth moving activities throughout construction and after project completion. Additionally, noise associated with construction activities and traffic may also disproportionately impact communities surrounding the port facility. An increase in vehicle traffic to and from the port for both construction and day-to-day port activity may also impact these populations. In the case of New Bedford, census block groups were identified as “environmental justice areas” within the study area. However, no disproportionately high and adverse impacts were identified, because traffic, noise, and air impacts analyzed in the study area were found to be minimal (EPA 2012). The Port Everglades Harbor Navigation Study found that the Port is located in a highly urbanized area close to an International Airport and several Interstates. Impacts to air quality, noise, and traffic were not found to be significant in this area. Also, low-income and minority populations were not found to be disproportionately located within the region of influence. Surrounding communities to the Port and throughout the waterways were characterized by high-value condominiums and single-family homes. The U.S. EPA threshold of “disproportionately high and adverse” would not be met (USACE 2015).

Commercial Fishing. Because offshore activities for port modifications would be limited to the immediate vicinity of the port, and potentially the port channel (if widening or deepening is necessary), impacts on fisheries are expected to be mostly limited to space use conflicts in the use of port facilities and access channel. Potential impacts within the vicinity of the port could be navigational limitations or vessel restrictions during construction activities (e.g., channel deepening, improvements to quayside), the need for new or additional navigational markers, and the potential for collisions or allisions (BOEM 2012). At New Bedford, despite the high value of landings, conflicts were not expected and so far have not occurred. The new terminal was expected to be fully rented out to a wind project developer and any conflicts to be managed through a fisheries working group (MACEC 2015). At Rotterdam and Harwich, fisheries faced some restrictions at the location of the sand extraction pits or during dredging (Royal Haskoning 2003; Royal Haskoning 2007).

Tourism and Recreation. Impacts of port modifications on tourism and recreation depend on the location of tourist and recreational areas relative to ports. Temporary effects could occur through construction related onshore traffic as well as recreational boating space use conflicts. Permanent effects could occur through visual effects if taller cranes are installed at ports or if bridges or utility towers are modified to improve air draft. Impacts from offshore activities are unlikely because of the proximity of these activities to the port or port channel, with the exception of trash and debris or accidental fuel spills from construction vessels. Positive impacts in the form of increased accessibility and port calls by cruise ships could result from channel deepening, air draft improvements, and creation of additional berthing space. At New Bedford, construction of the new terminal was to impact an existing boat ramps and required relocation of existing recreational boat moorings requiring revisions in project design (EPA 2012). At Rotterdam, land reclamation works involved closing off a recreational beach. In the long run, more beaches would be present than before and the adverse impact on recreation would be temporary (Royal Haskoning 2007). At Port Everglades, impacts from closures to recreational boating were identified during dredging but considered temporary (USACE 2015). However, port modifications could also improve air draft, channel depths, and berth size to allow for cruise ships to access ports previously inaccessible or with inadequate equipment to handle such large vessels. Tourism could be positively impacted by these improvements.

Navigation. Vessel traffic in the proximity of the port may be temporarily and adversely impacted by some activities such as dredging (e.g., vessel transit delays of hours or days to accommodate dredging operations). In the long run, however, impacts from port modifications could be positive. At New Bedford, the additional maintenance dredging expected was considered a potential positive impact on navigation for maritime properties along the New Bedford shoreline (EPA 2012). At Harwich, a potential for disruption of commercial navigation during construction was identified (Royal Haskoning 2003).

Socioeconomic Resources. Socioeconomic impacts will be both positive and negative. Impacts may include those to the local population and labor force, derived effects on the demand for housing and local public services, changes in livelihoods, social cohesion, and changes in fiscal resources available to local governments. These impacts stem from two main impact producing factors: changes in demand for local labor, goods and services; and space use conflicts. Port modifications would be expected to bring a temporary increase in demand for local labor, goods and services during construction, followed by a second phase increase in demand for local labor, goods, and services, if the modifications are followed by the staging of offshore wind projects, and a third phase (likely smaller) permanent increase in demand for local labor, goods and services during maintenance and operations of the offshore wind projects. However, other sectors may reduce their demand for local labor, goods, and services during the various phases of project development, if space use conflicts exist. The resulting socioeconomic impacts depend largely on the magnitude of demand increased relative to the size and characteristics of the local labor force, economic sectors, and tax base. These relative magnitudes will vary from project to project and port to port. Affected parties and user groups will need to be identified in the future relative to both positive and negative impacts. As a reference, upgrades to the New Bedford Port to support offshore wind farm construction seem to have cost over

$100 million (Navigant 2014). German ports are said to have invested between $100 million and $250 million in upgrades and infrastructure to support offshore wind energy (Navigant 2013).

Job Creation. As described in Section 4.2.2, the number of construction jobs supported by these estimates would depend on location and the geographic extent for which jobs are being estimated. A Navigant (2013) study estimated 300 annual statewide jobs over a 2 year construction period would correspond to a $50 million investment for a U.S. North Atlantic port. At New Bedford, local jobs were estimated at 150 short-term construction jobs, with larger numbers during staging and operations (South Coast Today 2013).

4.5 Mitigation Measures

Mitigation measures for port modifications require the consideration of whether project design can be modified in any way to reduce the quantity and duration of disturbances from impact producing factors such as land clearing, dredging, or filling. There are three commonly used types of mitigation. These are compensatory mitigation, operational controls, and regulations and BMPs. They are described in further detail below and can be found in Appendix II Table 2 for each activity and resource area.

4.5.1 Compensatory Mitigation

For unavoidable impacts to resources, compensatory mitigation is often used. Compensatory mitigation may be required in the form of on- or off-site enhancement, restoration, and preservation or mitigation credits to address unavoidable impacts or impacts that will remain, even after project completion. For example, as part of the 2015 Port Everglades Harbor Navigation Study, it was determined that there would be several acres of unavoidable impacts to mangrove wetlands and seagrass habitats as a result of dredging and associated activities. To mitigate for this impact, the U.S. Army Corps of Engineers (USACE) proposed compensatory use of an on-going habitat enhancement and restoration project at West Lake Park. The West Lake Park project includes previously permitted restoration, enhancement, and preservation of like habitats in this county-operated, state-owned natural area located to the south of the project area. Credits are purchased at a pre-determined ratio equal to the value of the impacted resource. They are purchased through Broward County, which is responsible for overall construction, monitoring, and success of the mitigation at the Park. In some locations, this type of mitigation could be used for unavoidable impacts to benthic communities (seagrass, coral), coastal communities (wetlands, mangrove forests), or terrestrial communities (forests) associated with port modifications. Refer to Port Everglades in Section 4.2.2 for further mitigation techniques planned for Port Everglades with regards to unavoidable impacts to corals. These forms of ecological compensation also appear to be commonly utilized in European port expansion projects. The expansion of the ports of Harwich (UK), Rotterdam (Netherlands) and Bremerhaven (Germany) all involved the development of replacement or compensatory habitat (offsite as well as onsite) as mitigation for unavoidable loss of benthic, fish or avian habitat.

Socioeconomic compensatory mitigation may take the form of a contingency fund that is set up to compensate for losses. For example, contingency funds could be established to provide compensation to fisherman where port expansions cover fishing grounds. Other forms of socioeconomic compensatory mitigation may include the improvement of infrastructure for specific industries. To mitigate for port modifications affecting commercial fishermen, a port may include improved docks, off-loading ramps, and/or fueling stations. For ports with tourism and recreational activities, mitigation may include improved or new tourist facilities (i.e., cruise terminals) or transportation facilities between the port and tourist attractions. Dredging, channel widening, air draft improvements, and improved bearing capacity of quayside may allow for ports to harbor cruise ships or boat tours where previously inaccessible.

4.5.2 Regulations and Best Management Practices

In general, many of the impacts to environmental resources are temporary in nature and occur as a result of construction activities associated with proposed port modifications. Impacts are expected to be temporary, limited to the construction period and, returning to pre-construction conditions after a period of time. Such temporary impacts can also be mitigated through regulations and BMPs. These can be effective forms of mitigation that reduce the impacts to resources and prevent further or more significant impacts from occurring. A successful example of using regulations to mitigate impacts are the time of year restrictions that state and federal agencies place on marine construction activities to avoid having these activities take place during sensitive spawning periods or life stages for aquatic species. BMPs can be those used for specific port modification activities (dredging, pile driving, land clearing, etc.) or regulations imposed through permits and authorizations by regulatory bodies on a specific area (port authorities, municipalities, states, etc.) or resource (National Marine Fisheries Service [NMFS], U.S. Fish and Wildlife Service [USFWS], SHPO, etc.).

As an example, BMPs can be implemented during blasting and pile driving activities, which can have various impacts on resources in the immediate project vicinity and the surrounding area. Sound pressure waves associated with these activities can impact fish, marine mammals, sea turtles, and other aquatic biota. Fish with air bladders are particularly vulnerable to air and sound wave pressure. To minimize impacts to these organisms, bubble curtains or air curtains can be used. Bubble curtains and air curtains minimize pressure wave impacts to fish by absorbing and lessening the shockwaves as they move outward from the site (Johnson et al. 2008). As part of the New Bedford port modification mitigation plan (see Section 4.2.2, New Bedford), this type of mitigation was proposed.

Other BMPs that can reduce impacts associated with dredging and pile driving to aquatic biota include using a soft start or ramp up technique as typically recommended by NMFS under incidental harassment authorizations for marine mammals. This practice involves starting the vibratory hammer used in pile driving at the lowest power setting and gradually ramping up the power over a prolonged period of time until it reaches full power. Other ways to alert biota in the area before the commencement of work include sending out low-velocity pulses through the water or noise abatement techniques on land for birds, bats, and other terrestrial fauna. This allows organisms to move out of the area prior to construction activity and prevent injury or harm. Site-specific BMPs or regulations may govern how to mitigate for certain species known to inhabit or traverse the project area such as TOY restrictions, construction hour restrictions, and on-site monitoring.

In terms of navigational impacts, the U.S. Coast Guard routinely works with local waterway uses and marine construction operations to establish regulations and procedures to deconflict the waterway to allow normal waterborne commerce to coexist with marine construction activities and minimize delays and other impacts to both.

Socioeconomic impacts can also be mitigated through regulations and BMPs. Transportation both during and after construction can be a major impact to surrounding communities and industries that requires mitigation. Construction-related vehicle traffic on land can be regulated and restricted to off-peak, non-rush hour times through coordination with local authorities. Traffic mitigation on land may also include road improvements such as widening heavily traversed roads and adding traffic lights if increased vehicle traffic is expected as a result of port modifications. Construction-related vessel traffic can also be regulated and restricted to non-peak hours of waterway traffic (shipping, fishing, and recreational) through coordination with the U.S. Coast Guard, port operators, and local authorities.

Other socioeconomic impacts such as space use conflicts with commercial fishing, shipping, and navigation can be mitigated through BMPs. Construction activities associated with channel widening or deepening as well as improvements to quayside bearing capacity may impact fishermen, the shipping industry, and other commercial or recreational industry that utilize a port. BMPs may include timing construction to avoid peak hours or seasons for these industries. BMPs may vary across ports and be location specific, so it is critical to communicate early and often with these community user groups (BOEM 2012).

4.5.3 Operational Controls

The third type of mitigation commonly used is operational controls, which includes mitigation that occurs after project completion during the day-to-day operations of the port. These are ways in which the port can reduce its impact to surrounding environmental and socioeconomic resources while co-existing with them. For example, utility towers and lines pose collision risks to birds and bats. By using utility line marking measures, ports can reduce this risk and their impact on local bird and bat populations. Mitigation used during construction for traffic impacts can be extended to post-construction and implemented on a permanent basis. This includes restricting port vehicle traffic to off-peak hours when possible, modifying roads to accommodate an increase in vehicles and improving safety features such as traffic lights and turning lanes. Impacts caused by noise and light can also be mitigated by restricting port hours of operation or shielding lights that may be on throughout the night. Ports located near sea turtle nesting beaches can use red lights to reduce impacts on sea turtles. Other operational controls may include additional navigation markers and channel route adjustments to avoid space use conflicts of ports that are also utilized for shipping, fishing, or recreational and tourism activities (BOEM 2012). Operational controls are determined on a site-specific basis as each port has unique environmental and socioeconomic impacts and concerns.

4.5.4 Mitigation Effectiveness

Impacts and mitigation vary from port to port. Effective mitigation for each impacted resource may employ one of the three methods described above, some combination of the three or an entirely new type of mitigation. For socioeconomic resources, space use conflicts are often mitigated through coordination with the affected parties to seek measures such as proper scheduling of construction activities. When adverse impacts cannot be properly mitigated, compensation may be used as the mitigation measure. For example, in New Bedford, the dredging schedule was to be coordinated between the USFWS, National Oceanic and Atmospheric Administration (NOAA) and the State Division of Marine Fisheries DMF to minimize impacts on shellfish. Division of Marine Fisheries required compensatory replacement of lost shellfish for any remaining adverse impacts (EPA 2012). Impacts that may disproportionately affect minority and low-income populations are often mitigated through measures aimed at the source of high and adverse impacts (e.g. noise, air quality). If disproportionately high and adverse impacts remain, recommendations typically include that an effort be employed, starting as early as possible, and throughout project implementation, to engage affected communities in project development such as to communicate and seek input into potential measures to minimize impacts (EPA 2012, FHWA 2013). The goal of mitigation is to reduce the impacts to both environment and people through coordination and planning.

The readily available literature on the effectiveness of mitigation measures is limited. In 2011, the Council on Environmental Quality (CEQ) released guidance on establishing, implementing, and monitoring mitigation commitments identified and analyzed during the NEPA process. The new guidance followed concerns that a lack of monitoring of mitigation commitments could contribute to a “fail to advance NEPA’s purpose of ensuring informed and transparent decision making” (CEQ 2011). It then provided recommendations to agencies to strengthen monitoring of mitigation measures, use lessons learned on mitigation effectiveness, and engage the public in mitigation planning and monitoring.

While there is not a significant amount of literature documenting post-construction monitoring of port modification impacts in the U.S., there are some instances from elsewhere, including in Australia, where post-construction monitoring one-year after completion of port development examined physical conditions for shorebird roosting and feeding habitat, as well as seagrass creation. Indicators, such as water quality and biomass of invertebrates, used to monitor the health of wildlife and these important habitats have been seen to meet or exceed targets for rehabilitation or were on positive trajectories to do so (Cardno 2013).

5.0 EXPERT DISCUSSIONS

5.1 Methodology

Exploratory discussions were conducted with a variety of industry experts over the course of the project, as needed, to supplement the knowledge and experiences of the ESS Team, to explore potential new information/topics identified throughout the various phases of the study, and to confirm the findings obtained from the literature regarding necessary port modifications, the potential environmental and socioeconomic impacts of such actions, and the mitigation measures that could be employed. The timing of discussions was opportunistic and flexible, in response to information obtained throughout the study, as follow-up to particularly relevant and pertinent information.

The initial discussions were held with port managers that have already been involved in the construction of an offshore wind project, as well as, port managers in the states that are most likely to advance an offshore wind project on the Atlantic coast (MA, RI, MD, NJ, and VA). Topics of particular interest, when speaking to port managers, included important “lessons learned” from those who have already made modifications to support an offshore wind project, as well as identification of major information gaps that exist or particular hurdles that need to be addressed prior to modification.

The topics of discussion included:

- Port characteristics that are considered “mission critical” for facilitating offshore wind construction and operation;
- Insights on the desired port characteristics and how existing ports may have been, or could be, altered to accommodate offshore wind energy development;
- Key factors that influence a port’s decision to initiate upgrades, and how do environmental impacts/mitigation and permitting timeframes affect that decision;
- Environmental and socioeconomic impacts resulting from the analysis of similar port improvement and expansion modifications;
- Mitigation experiences, particularly the identification of useful mitigation measures;
- Most common public concerns with respect to construction activities at ports and whether these concerns have typically influenced the design/permitting of port modifications or choice of alternatives; and
- Potential conflicts with current port users.

The ESS Team conducted seven exploratory discussions with select experts in the U.S. and Europe to provide further insight into the expansion and modification of existing ports to accommodate proposed offshore wind projects on the Atlantic OCS. The ESS Team spoke with individuals from the following entities:

- Quonset Development Corporation;
- MACEC;
- USACE Baltimore District;
- USACE New England District;
- UK Crown Estate;
- USACE Wilmington District; and
- Blue Water Shipping Company.

5.2 Key Themes and Concerns

The seven individuals/entities that the ESS Team spoke with came from different backgrounds and had varying levels of engagement in offshore wind energy development. Despite their different roles in the offshore wind energy sector there were some common themes and comments that they shared.

- **Financial commitment.** A major theme echoed throughout the discussions was that of the financial investment involved from the planning process through construction. The financial commitment necessary to permit, design, and prepare to modify a port for offshore wind component readiness can be incredibly large and take place over a long period of time. The individuals contacted emphasized the importance of obtaining the proper funding and understanding the magnitude of the investment needed to fully support a port modification project from start to finish.
- **Length of project.** In addition to the financial investment, there is also the investment of time. There is often a long lead time involved in developing and permitting these projects prior to construction. Furthermore, everyone is looking for a long term commitment to justify the financial investment. Because of the long lead time and expense of port modification projects, the need for long term contracts and more certainty in the supply chain is critical.
- **Evolving needs and technology.** The offshore wind energy industry is still in its infancy, especially in the U.S. The technology is constantly evolving and the needs and requirements for offshore wind components may quickly become outdated over the course of a project. When seeking permits and obtaining funding, flexibility and scalability are important. Similar to the importance of money and time involved in the process, there is the concern that unforeseen issues, technological advancements, or siting requirements that may not be known at the onset of an offshore wind energy project may have a material effect on the project during the development and permitting stage, with could affect the decision about which port to use or change the types of port modifications necessary to support the offshore wind project. The USACE Districts that were contacted have said they plan to follow the regulatory program that is in place when evaluating and permitting both offshore wind energy and port modification projects, however, they have also mentioned that this is an evolving process. As the industry continues to change and advance, so too could the regulatory and permitting process.
- **Each project is unique.** Despite common technology and the intended outcome of these offshore wind energy projects, they vary in many aspects. As a result, the types of port characteristics that are needed to support construction staging and operations and maintenance activities will vary from project to project. As with most any project, the location is primarily what defines the project impacts for a port modification project. The socioeconomic and environmental impacts vary from place to place depending on what infrastructure already exists, who or what surrounds a port, and the politics or stakeholders involved.

- **Stakeholder involvement.** It is critical for offshore wind energy project developers to be communicating early and often with the port authority; federal, state, and local authorities; and other key stakeholders, such as fisherman, harbormasters, and other port users in the area of the port(s) they intend to use for their project. It is imperative that these agencies and stakeholders be involved early and often throughout the planning, design and ultimately construction of any project.

Overall, the general consensus of being able to expand and modify existing ports to accommodate proposed offshore wind energy projects was positive and viewed as feasible across the various sectors interviewed. These discussions further confirmed the complexity of these projects and emphasized the need for early coordination between various stakeholders, as some of the many components that go into successfully siting, permitting, and preparing a port for an offshore wind energy project.

6.0 ENIRONMENTAL AND SOCIOECONOMIC PORT PROFILES

6.1 Introduction to Port Profiles

Sixteen ports were selected, as described in Section 3.2, for further evaluation in the form of a port profile to provide an overview of each port's capacity to accommodate offshore wind energy development. The port profiles provide a general overview of the port, a classification of its existing capabilities and potential modifications to support offshore wind, a summary of the existing environmental and socioeconomic conditions, and anticipated impacts of potential modifications. Should port modifications at a specific port included in this study be proposed, a more thorough and detailed environmental assessment should be conducted. However, if a port was not selected for profiling, this does not mean that it is not a candidate to support offshore wind activity. This selection of ports is intended to serve as a sampling of the ports along the Atlantic coast that could function as staging and potentially O&M ports for future offshore wind projects.

Due to the limited scope of this study, the description of the existing environmental and socioeconomic conditions at each port is intended to provide a general indication of areas potentially impacted. The geographic area of interest around each port is not necessarily the same for each environmental and socioeconomic aspect of the port described. In general, the geographic area of interest described was the following:

- Immediate vicinity of the port and access channel for most environmental resources, land use, transportation, cultural and historic resources, and visual resources;
- Metropolitan Statistical Areas, County or City for socioeconomic and environmental justice resources, recreational fishing communities, and tourism and recreation;
- Port area and surrounding fishing communities for commercial fishing; and
- Vessel traffic to and from the port for navigation.

The information gathered for each of the port profiles was drawn from publically available information. The data sources used in the description of the current characteristics were selected to provide a brief overview of current conditions and often of selected aspects, but greater detail should be considered in programmatic or project specific environmental review documents. In some cases the available information was limited or conflicted with other data sources. Where they existed, data gaps were identified. For example, most ports do not know the bearing capacity of their quaysides or if their quayside seabed is suitable for jacking because their normal port operations do not require this capability. As a result, these data were generally hard to find and were not always available. This information may be acquired in the future with specific data requests or geotechnical studies at a port. It is important to note that the information contained in each profile was obtained in the second half of 2015 and may change with the passage of time. Each port profile includes a date in the footer to provide future readers with the context of when the profile was prepared. Port operators and owners are encouraged to provide updated information about their capabilities via the U.S. DOE Port Readiness Assessment Tool, available at www.offshorewindportreadiness.com.

The profiles were developed using a standardized template containing the following sections:

- Port Overview
- Port Classifications – Existing Capabilities
- Potential Modifications Necessary to Support Offshore Wind
- Impact Producing Factors
- Description of Existing Environmental & Socioeconomic Conditions
- Anticipated Impacts
- Data Sources & Additional Information

A brief description of each section is provided below, as well as the methodology used to gather the pertinent information. Further clarifications on specific sections are also included.

6.2 Port Overview

This section provides a general description of the port, including the geographic location, identification of available terminals, port governance, primary uses, land area, port employment (where available), and distance to closest wind energy area. In instances where there are multiple terminals identified within a port, the terminal with the greatest potential to support offshore wind is identified and described.

6.3 Port Classifications - Existing Capabilities

This section summarizes key criteria determined to be important in characterizing ports for their readiness (at present) in supporting activities associated with offshore wind energy facility construction. This information was not readily or publically available for every criterion or for every port. A “U” was used to indicate that the information was either unknown or unavailable. “N/A” was used to indicate that a criterion was not applicable. A threshold was determined for each category based on the requirements to support staging of a project utilizing 8 MW wind turbines (e.g., Port Access Channel Width threshold of 30 m) (Table 6.3-1). The 8 MW wind turbine scenario was chosen because it is expected to become the standard in the future. It is important to note that each requirement may not represent the best solution for a specific project; it is intended to provide guidance in the planning process.

Table 6.3-1. Port Classification Key Criteria and Thresholds for 8 MW Projects

Capability Area	Criteria (units)		Capability Area	Criteria (units)	
Potential Use	Staging Port	X	Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	10
	O&M Port	X		Storage Area Bearing Capacity (t/m^2)	10
Access	Port Access Channel Width (m)	30		Size of Storage Area (m^2)	25,000
	Port Access Water Depths (m)	8.1	Roll-On, Roll-Off	Ro-Ro Capability (Yes/No)	No
	Overhead Draft (m)	75		Width of Ro-Ro Berth (m)	8

Capability Area	Criteria (units)	
	Number of Berths	1
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	17
	Quayside Length (m)	170
	Quayside Seabed Suitable for Jacking	Yes

Capability Area	Criteria (units)	
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	10
Cranes	On-site Cranes' Capabilities (t)	600
	Crane Height Restrictions (m)	50
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	No

U = Unknown

Ports were classified as construction and staging ports ("Staging Port") or as both construction and staging ports and operation and maintenance ports ("O&M Port"). For the port profiles, the focus was primarily on ports that were suitable for construction and staging activities, assuming that such ports would have marine facilities around them suitable for some O&M activities. However, routine O&M activities may be supported by smaller, less well-equipped ports and would likely require fewer potential port modifications. Location relative to the nearest wind energy area will likely be the key factor in the ability of smaller ports to support O&M activities. Distance would likely preclude ports from efficiently supporting routine O&M activities given the amount of time it would take for a vessel to transit between the port and the wind energy area.

Overhead draft was determined by identifying the lowest height of an overhead structure, such as a bridge or overhead power cables, which could limit the passage of a vessel with turbine components traveling between the open ocean and the port. The overhead draft restriction determined for an 8 MW wind turbine scenario is 75 m. This height is based on the size of the jacket structure used in the 8 MW scenario. While it may not always be realistic or feasible (technically or economically) to raise a highway, railroad bridge, or power lines, "improve overhead draft to 75 m" was included as a potential port modification since there is precedent for raising a bridge to accommodate expected larger vessels size at port (i.e., the ongoing project to raise the Bayonne Bridge from 151 feet of clearance to 215 of clearance to accommodate post-Panamax vessels). This is more likely to be considered an option, if coupled with a bigger project. Modifying a highway or railroad bridge would have additional financial, environmental, and socioeconomic benefits and impacts associated with it that would need to be studied and assessed if that modification was deemed to be necessary for a specific port either to support the offshore wind energy industry or for some other purpose.

The crane capability of a port was evaluated with two criteria: on-site crane capability, which identifies whether the port has existing on-site crane capabilities and is expressed as the lifting capacity (in tons) that the crane(s) can handle at a port, and as crane height restrictions, which defines any height restrictions, if present. If on-site cranes are not present at a port, the value of the on-site crane capability criteria was "No." Crane height restrictions (due to nearby aviation activity, bridges, etc.) were identified regardless of whether the port had an on-site crane due to the fact that a port could utilize mobile cranes on a project-specific, as-needed basis.

The transportation capability of a port was determined based on the presence of on-site transportation facilities. For the purposes of the port profiles, rail transportation means rail service that is capable of transporting goods, including offshore wind energy project components. It does not include commuter rails and subways used for transporting people. For a port to be classified as having rail transportation, the rail has to be located within the port and accessible to vessels without the use of a truck or additional transportation. Ports with railroad transportation have direct rail access or on-dock rails typically supported by cranes. If the port does not have direct rail access at the port, it is not considered to have rail access or rail transportation. Highway access was determined if a port was within a couple miles of a major highway via major roads and not residential, small streets.

6.4 Potential Port Modifications

For each port, the existing capabilities for each criteria were compared to the criteria thresholds identified in Table 6.3-1. If the port did not meet or exceed the threshold for a category, it was included in the potential port modification table (refer to Table 6.4-1 for an example). Where information was unknown, it was included as a potential port modification in the profile as well. To differentiate between known potential port modifications and assumed potential port modifications, the assumed construction activities were shown as italicized. This is denoted in the profile with "Modifications shown in italics are a*ssumed to be required based on port classifications.*" The specific criteria needed to reach the threshold within each capability area are identified beneath the table as well.

It is also important to note, when assessing Ports, it may be the case that a port that does not meet the minimum criteria established in Section 2, may prove to be the preferred option for a given project. As has been the case in Europe, if reasonable alternatives are incorporated into the engineering design phase, a port with some capabilities below the minimum required, can be viable. Cost-benefit analyses should be carried out between utilizing alternative means and methods in existing infrastructure, versus adopting "non-transferrable" construction strategies that require capital investment in enhancing port infrastructure up to what may be considered to be "ideal".

Table 6.4-1. Port Modifications Necessary to Support Offshore Wind and Associated Impact Producing Factors

Potential Port Modifications	Construction Activity					
	Dredging	Pile Driving/ Drilling	Land Clearing	Fill Placement	Fill Compaction	Paving
Channel Access	●	●				
Quayside Improvements	●	●		●	●	
Storage Capacity			●	●	●	●
Ro-Ro Capability[a]		●	●	●	●	●
Cranes[b]			●	●	●	●

Modifications shown in *italics* are assumed to be required based on port classifications
[a] Provide Ro-Ro Capability; improve Ro-Ro Berth Width to 8 m; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2
[b] *Provide On-Site Cranes with 600 t lifting capability*

The Port Modifications table in each profile also identifies the construction activities likely to be necessary to achieve the threshold indicated for a specific port. This table is based off of the port-specific Existing Capabilities table in the profile. The activities associated with achieving each of the threshold capabilities identified in Table 6.3-1, and described in detail in the Port Characteristics, include sediment dredging, rock blasting, land clearing, pile driving, drilling, fill placement, compaction, and paving.

6.5 Impact Producing Factors

The activities identified as necessary to achieve the criteria threshold will generate impact producing factors (stressors) that in turn have a measured impact on environmental and socioeconomic resources (receptors) in the area of the port as previously described in Section 4.0. Impact producing factors associated with the activities identified in Table 6.4-1 are expected to include the following:

- Seafloor/land disturbance;
- Sediment suspension/deposition;
- Noise;
- Lighting;
- Discharges (dewatering, stormwater, accidental spills);
- Trash/debris;
- Vessel and vehicular traffic;
- Air emissions;
- Visible infrastructure;
- Species injury, mortality, or displacement;
- Offshore/onshore space use conflicts; and
- Increased demand for local labor and services.

6.6 Description of Existing Environmental & Socioeconomic Conditions

The existing environmental and socioeconomic conditions for each port are described in this section of the port profile. To provide consistency, where possible, sources were identified that provided consistent information on a specific resource for each of the ports. Additionally, port-specific sources were used to provide further description and detail. For more detailed information on references, see citations throughout the tables and the list of the data sources found at the end of each profile. Table 6.6-1 provides the source of the data for each environmental and socioeconomic resource category, as well as a brief description of how and/or where the information was gathered for each resource. Where a consistent source(s) was unavailable for a resource, or special considerations were made, it is noted in the table below. All sources used and obtained are publically available.

The geographic area of interest around each port is not necessarily the same for each environmental and socioeconomic resource described. While the geographic extent of the environmental resources is often more easily defined by the physical land and water resources surrounding the port, the geographic extent of the socioeconomic resources can be more complicated and is described in the following table.

Table 6.6-1. Description and Source of Environmental and Socioeconomic Resource Data Gathered

Resource	Description of Existing Conditions
Benthic	Consistent source unavailable or unknown. Port- and location-specific sources used where available. Information on benthic communities typically found in Environmental Assessments/EIS/Environmental Impact Reports for projects (typically dredging projects) proposed or done within the vicinity of the port. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.

Resource	Description of Existing Conditions
Fish & EFH	NOAA Essential Fish Habitat Mapper was used identify EFH in waters surrounding the ports: http://www.habitat.noaa.gov/protection/efh/efhmapper/. Port- and location-specific sources were also used to provide further detailed information on fish and EFH habitat. If applicable, anadromous species were identified for ports along rivers. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Air Quality	Air quality classifications were identified using U.S. EPA's National Ambient Air Quality Standards (NAAQS) (http://www3.epa.gov/ttn/naaqs/criteria.html). Identified whether an Air Quality Control Region (AQCR) was in attainment or non-attainment of the NAAQS for any or all of the criteria pollutants. Geographic region: air quality control region, which includes several towns/cities/counties in an area.
Terrestrial Biota	Terrestrial biota information for ports in Massachusetts through Virginia was gathered using The Nature Conservancy's Northeast Habitat Map http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8 A consistent source for ports located south of Virginia was not available or known. Port- and location-specific sources were used, where available. Geographic region: immediate vicinity of the port and adjacent properties and communities and/or habitats.
Marine Mammals & Sea Turtles	USFWS (http://www.fws.gov/endangered/) was consulted to identify sea turtles in the area and NOAA (http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals) was consulted to identify marine mammals in the area. Geographic region: surrounding waterbodies and extending to larger geographic areas of the Atlantic Ocean given transient lifestyle of these animals.
Birds & Bats	USFWS (http://www.fws.gov/endangered/) was consulted to identify birds and bats in the area. Geographic region: immediate vicinity of the port and extending to larger geographic areas such as surrounding water bodies and the port's county given the transient lifestyle of these animals.
Water Quality	Water quality was addressed by identifying impaired waters. Impaired waters were identified using U.S. EPA's National Summary of Impaired Waters and Total Maximum Daily Load (TMDL) Information (http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state). If a waterbody was designated as impaired, the state's most current integrated water quality report was consulted for further information. An explanation of the water quality classification was provided for impaired waters as well. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Currents & Tides	Tidal range and currents identified using NOAA Tidal Bench Mark Data Sheets (https://tidesandcurrents.noaa.gov/stations.html). Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Sediment Deposition	Consistent source unavailable or unknown. Port- and location-specific sources used, where available. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Acoustic Environment	Consistent source unavailable or unknown. Port- and location-specific sources, where available. Geographic region: town, city, or county where the port is located.

Resource	Description of Existing Conditions
Critical Habitat	Critical habitat designations around the port identified using USFWS' Critical Habitat Mapper (http://ecos.fws.gov/ecp/report/table/critical-habitat.html). Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Military Use Areas	Used MilitaryBases.com and local knowledge of the ESS Team to identify military bases within and surrounding the ports. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Land Use & Existing Infrastructure	To identify land use and existing infrastructure around a port, Google Earth and Multi-Resolution Land Characteristics Consortium's National Land Cover Database Evaluation, Visualization, and Analysis Tool were used (http://www.mrlc.gov/eva/viewer.html). Geographic region: immediate vicinity of the port and access channel.
Transportation	Transportation within and surrounding the ports was identified using Google Earth and supporting port websites. Where possible, distances to highways were provided and for rail service, it was noted if service was direct to dockside or within port. Geographic region: immediate vicinity of the port and access channel.
Cultural & Historical	Nearby historical places and buildings were identified using the National Register of Historic Places Database (http://www.nps.gov/nr/research/index.htm). Shipwrecks within the port vicinity were identified using NOAA's Wrecks and Obstructions Database (http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html). Geographic region: immediate vicinity of the port and access channel.
Visual	Google Earth was used to identify the viewscapes around the ports and identify urbanized/developed or undeveloped land. Geographic region: immediate vicinity of the port and access channel.
Environmental Justice	The percentage of total minorities in the county and state were identified using U.S. Census Bureau's (USCB) American Community Survey (ACS), 5-Year Estimates (2009-2013): http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml The percentage of low-income in the county and state were identified using USCB's American Community Survey, 5-Year Estimates (2009-2013): http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml The percentage of total minority populations and individuals below the poverty level in the area surrounding the port was identified using U.S. EPA's Environmental Justice Screening and Mapping (EJSCREEN) Tool: http://www2.epa.gov/ejscreen Geographic region: Metropolitan Statistical Areas (see additional discussion below), county, or city.
Commercial Fishing	Commercial landings for the port and state as well as rank in the U.S. identified using NMFS' Commercial Fisheries Statistics: http://st.nmfs.noaa.gov/commercial-fisheries/index Commercial fishing engagement in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Commercial fishing reliance in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Geographic region: surrounding fishing communities.

Resource	Description of Existing Conditions
Tourism & Recreation	The percentage of employment in tourism-related industries in the county identified using Bureau of Labor Statistics' Local Area Unemployment Statistics: http://www.bls.gov/lau/ Recreational fishing engagement in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Recreational fishing reliance in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Geographic region: Metropolitan Statistical Areas or county.
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port and main vessel types to and from port identified using Marine Traffic's Automatic Identification System: http://www.marinetraffic.com/en/ais/index/ports/all Vessel types include: cargo, tanker, passenger, high speed craft, tug, fishing, and pleasure Geographic region: Metropolitan Statistical Areas or county.
Socioeconomic Resources	Population of County or City identified using USCB ACS: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml Labor Force identified using Bureau of Labor Statistics' Local Area Unemployment Statistics: http://www.bls.gov/lau/ Main Sources of fiscal revenues identified using U.S. Census Bureau's State Finances, 2012 Census of Governments: http://census.gov/govs/local/ Geographic region: Metropolitan Statistical Areas, county, or city.

Metropolitan Statistical Areas are usually adequate geographic areas for the description of socioeconomic characteristics of port areas because the affected area must consider the community in which ports are located, as well as surrounding communities that may be impacted by activities at the port through commercial or fiscal ties or through movements of people for work, recreation or other activities. Metropolitan Statistical Areas consist of one or more counties with a high degree of social and economic integration, as measured by commuter ties and with a core urban area. They are defined and revised with some regularity by the Office of Management and Budget (OMB 2015). Additional information on commuter data is available through the following USCB online tool and can also be a useful alternative in defining the study area for socioeconomics (USCB 2015a; USCB 2015b). However, for populous and economically large Metropolitan Statistical Areas, impacts of construction and operation of projects will very often be negligible in magnitude, and stakeholders often would like to know how they compare to smaller economic areas, such as their city or county. In addition, for some aspects analyzed (e.g. fiscal impacts) impacts may occur within sub-areas of the geographic area of interest, so these need to be described as well.

Existing conditions of port areas for environmental justice considerations are typically described for the same geographic area used for the socioeconomic analysis. The reason is that environmental justice assessments should consider all areas where potentially high and adverse human health and environmental impacts may occur. In the case of modifications to ports to accommodate wind energy development, this area is expected to be the same as the area for socioeconomic impacts. However, impacts often occur within a sub-area of the geographic area of interest, such as the immediate vicinity of the port or transportation routes. Therefore, these sub-areas often need to be described as well.

The data sources used in the description of the current characteristics were selected to provide a quick overview of current conditions and often of selected aspects, but greater detail should be considered in programmatic or project specific environmental review documents. A few notes on the data sources used follow.

- The main source of readily available data for identifying minority and low-income populations is the USCB ACS 5-Year Estimates (USCB 2015c). A quick overview at the census block group level is available through U.S. EPA's EJSCREEN tool (EPA 2015). The data currently available through this tool is from the ACS 2008-2012 5-Year Estimates.
- NOAA's community social indicators were developed to characterize communities engaged in fishing activities and their vulnerability to change. The indicators were developed for Census Designated Places based largely on data from the USCB ACS 5-Year Estimates. The latest data available used is for the 2005-2009 period. Each indicator combines several sources to reach a qualitative measure of how vulnerable communities are to change. Each indicator received a high, medium or low qualitative measure in each community, based on the community's position relative to the standard deviation of that indicator among the communities analyzed (NOAA Undated). The use of these indicators must be with careful consideration of the geographic area of analysis they describe and their interpretation. For the purposes of the community profiles, selected indicators from this source were used to characterize communities engaged in commercial and recreational fishing.
- Tourism-related employment is not well defined in data based on the NAICS classification of industries. Estimates typically require making assumptions regarding the share of certain codes that actually reflect tourism (e.g. restaurants).

6.7 Anticipated Impacts

The information gathered for these port profiles is intended to summarize what exists at the time of writing and includes general impacts that have been associated with similar construction activities at ports across the U.S. and Europe. However, offshore wind energy development is constantly evolving and needs and impacts may change in the future. There may be impacts associated with offshore wind not included in these profiles. These profiles should serve as a guide to evaluate the potential readiness and construction necessary to accommodate such activity. A more comprehensive, site-specific assessment should be conducted should a port be considered for supporting offshore activities.

7.0 CONCLUSIONS

The need for expansion and modification of existing ports to accommodate proposed offshore wind energy development on the Atlantic OCS was the primary focus of this study. Information gathered through existing experiences, a review of the available literature, and input from industry experts, served as the basis for this study. This study was conducted to provide BOEM with an understanding of the existing status of Atlantic coast port facilities as well as activities required for port expansion and modification to support proposed Atlantic OCS offshore wind energy development projects. The deliverables were developed to provide documentation to support future National Environmental Policy Act (NEPA) reviews of offshore renewable energy actions and aid in the project specific assessment of potential environmental and socioeconomically impacts associated with the expansion and use of port facilities to support proposed Atlantic OCS offshore wind energy development projects

The primary activities considered for this study were associated with the modification of ports to support the staging and installation of extremely large and heavy components associated with offshore wind energy projects and facilitating access and docking of vessels that transport and install them. Offshore wind staging ports are anticipated to require significant storage and lay-down space, equipment to transport large cargo within the port, cranes with heavy lift capacity to load and unload components from the vessels, sufficient quayside space to accommodate transportation and installation vessels, and sufficient overhead clearance along waterbodies leading to ports to allow these vessels to reach the port. While many of these capabilities are available today in ports along the U.S. coastlines, the primary exception is the capability of the typical U.S. cargo port to handle the weight of the heaviest offshore wind turbine components since they are configured for lighter load cargo.

Environmental and socioeconomic impacts of port modifications are typically location specific and depend on magnitude of changes to the impact producing factors relative to local conditions. These impacts may range in severity and depend upon numerous factors, including the impact producing factors, environmental and socioeconomic resources present, location (a primary determinant), time of year, and presence of other factors not associated with the intended port modifications.

The study found that information about the characteristics of various ports is inconsistent across data sources, often out-of-date, and for some characteristics, information is nonexistent in the public domain. While the study found that some ports along the Atlantic coast already possess many of the necessary capabilities and infrastructure needed to support offshore wind projects, the offshore wind industry is still evolving and there are unforeseen issues, technological advancements, and changing regulatory environments that could affect the decision about which port to use or change the types of port modifications necessary to support the offshore wind project. Therefore, flexibility and scalability are important.

Communication is also critical to the successful implementation of port modifications. Offshore wind energy project developers should be communicating early and often with the port authority; federal, state and local authorities; and other key stakeholders, such as fisherman, harbormasters, and other port users in the area of the port(s) they intend to use for their project. It is imperative that these agencies and stakeholders be involved early and often throughout the planning, design and ultimately construction of any project.

The results of this study further confirmed the complexity of these projects, the need for more consistent information about U.S. port characteristics, and emphasized the need for site-specific information and early coordination between various stakeholders, as some of the many components that go into successfully siting, permitting, and preparing a port for an offshore wind energy project.

7.1 Further Research Needs

This study developed a set of criteria defining the port requirements (e.g. vessel access, lifting capabilities, transportation infrastructure, etc.) necessary to support offshore wind construction; identified and classified Atlantic coast ports that could potentially service proposed areas for the offshore wind energy industry; identified potential modifications needed to support the industry at these ports; and summarized potential impact producing factors, potential environmental and socioeconomic impacts, and potential mitigations measures associated with the port modification activities.

The U.S. DOE Port Readiness Assessment Tool is a good source of information about port characteristics, but the data does not appear to be regularly updated by port facilities, is not always consistent with data reported by the port's website or other data sources, and can be a combination of data from multiple ports terminals in a geographic port area. A means to promote a consistent set of data that is updated on a regular basis would be a worthy topic for additional research.

Identifying a minimum set of criteria for selecting a port to support an offshore wind project is a challenging exercise and there are many different ways to make a given port facility work for a given project. In reality, the wind project can adjust the logistics and equipment to adapt to the available capabilities of the port. A given project may select a port with greater or lesser capabilities depending on the needs of the project, on a cost-benefit of available port facilities, and the costs and impacts associated with making necessary modifications to the port's facilities.

Despite common technology and the intended outcome of these offshore wind energy projects, they vary in many aspects. As a result, the types of port characteristics that are needed to support construction staging and operations and maintenance activities will vary from project to project. As with most any project, the location is primarily what defines the project impacts for a port modification project. The socioeconomic and environmental impacts vary from place to place depending on what infrastructure already exists, who or what surrounds a port, and the politics or stakeholders involved. As a port is identified as a potential staging port for offshore wind activities, further studies and investigations should be done. More information should be gathered through further discussions with or surveys of port operators and by making specific data requests. To provide information on quayside and seabed bearing capacity, which is not known by most ports, geotechnical studies could be performed.

One other area that is seemingly lacking in available literature is mitigation. The impacts associated with anticipated port modifications vary in scale from minor and temporary (e.g. noise during construction; displacement of marine mammals and sea turtles during in-water work; increase in vessel traffic associated with construction vehicles) to major and permanent (e.g. removal of wetlands and coastal habitat; land use changes from natural habitats or open space to industrial use; habitat loss) and differ across ports. Mitigation may take a variety of forms such as compensatory mitigation, regulations and BMPs, and operational controls. There is information available regarding the types of mitigation and potential mitigation strategies throughout EISs and other project documents; however, there is a lack of information with regards to the mitigation that was employed, its effectiveness, and how it is monitored over time.

Mitigation such as habitat creation or restoration is often proposed when a project removes or changes a natural habitat, but follow-up monitoring documentation or studies several months to years after the work is completed is often missing, not conducted, or made publically available. Therefore, the effectiveness of mitigation measures associated with port modification and expansion needs further investigation to determine the best form of mitigation for a specific project, impact, and port.

The information provided in terms of potential impacts and mitigation measures, as well as that provided in the port profiles, is relatively general in nature and relies on publically available information. When BOEM or any other federal agencies are conducting NEPA reviews, they should use this information as a guide to potentially relevant issues and require the project proponent to provide location and project-specific research and impact evaluations for agency review and decision-making.

7.2 Recommendations

While the study identified typical “minimum requirements” for physical dimensions and capabilities of ports, these “requirements” should primarily serve as initial recommendations when determining a port’s readiness. For a port to be suitable to handle offshore wind components, all of the criteria identified may not need to be present. Having all of the “requirements” may be ideal on paper or nice to have, but may not be necessary in practice. By involving port operators, port authorities, and other key stakeholders from the beginning, minimum requirements and potential obstacles may be addressed and solved. Several port operators and ports (via phone discussions or port websites) indicated that they are willing to work with interested parties to accommodate their projects (e.g., purchasing or renting additional equipment).

Although the requirements or characteristics identified as necessary for a port to support offshore wind may play a large role in determining which port may be used for a project, the most influential factor may be the location or site of a port. The location is critical and plays a role in the potential environmental and socioeconomic impacts. It is important to fully understand the distance and proximity to various places and populations surrounding a port. A port’s distance to a wind energy area is important as is a port’s proximity to highways, airports, and trains; terrestrial biota, critical habitats, and coastal wetlands; and cities, cultural or historical sites, and minority or low-income populations. While a port may have many of the minimum requirements, necessary modifications may have major or permanent impacts that make a project impracticable or infeasible.

At present, the European offshore wind energy industry is more experienced and advanced than the U.S. industry. European ports have conducted similar modifications and experienced similar challenges associated with offshore wind activity resulting in comparable environmental and socioeconomic impacts. The U.S. should use Europe's experiences, as well as lessons learned from U.S. ports that have already supported onshore and offshore wind projects (e.g., New Bedford, MA; Quonset/Davisville, RI; Searsport, ME) to plan and model the growing industry. The U.S. can learn from what has worked and what has not worked in Europe and these U.S. ports and try to implement procedures, modifications, and mitigation that have been successful.

There are 360 commercial ports throughout the U.S. today handling various types of cargo (American Association of Port Authorities, 2013). This study highlighted 16 ports, selected by the ESS Team and BOEM, along the Atlantic coast that possess much of the required infrastructure deemed necessary for successful offshore wind project installation. The 16 ports highlighted by this study do not necessarily represent the best ports for an offshore wind project, ports recommended for use by BOEM or the ESS Team, or the only ports capable of handling these projects. The ports selected are intended to serve as a cross-section of the existing infrastructure and capabilities of Atlantic coast ports. When offshore wind energy project developers identify and select ports for future potential offshore wind projects, other options may and should be considered, as necessary to support the particular project under consideration.

Fully understanding the complexity of these projects is the key to successfully seeing a project from permitting and design to implementation and completion. It is important to understand the financial and time commitment needed to prepare a port for offshore wind energy project readiness. There may be unforeseen technological, permitting, and siting issues encountered. This industry is constantly evolving with technological changes and advancements. Port expansion and modification should be viewed and understood from all levels – port authorities, permitting agencies, port user groups, and surrounding communities. It is critical to be flexible and coordinate with all parties involved to reduce impacts and successfully complete the project.

8.0 REFERENCES

8.1 Required Port Characteristics References

American Association of Port Authorities. *U.S. Public Port Facts*. 2013. http://www.aapa-ports.org/Industry/content.cfm?ItemNumber=1032 (accessed April 10, 2015).

Business Research & Economic Advisors. *The Contribution of the North American Cruise Industry to the U.S. Economy in 2013*. Prepared for Cruise Lines International Association. 2013. http://www.cruising.org/sites/default/files/pressroom/US-Economic-Impact-Study-2013Final_20140909.pdf (accessed March 31, 2015).

BVG Associates. *UK Ports for the Offshore Wind Industry: Time to Act*. Prepared for the Department for Energy and Climate Change. 2009. http://webarchive.nationalarchives.gov.uk/+/http:/www.berr.gov.uk/files/file49871.pdf (accessed March 1, 2015).

Cicin-Sain, B and Knecht, R. *The Future of U.S. Ocean Policy: Choices for the New Century*. Island Press, 2000.

Cooper, B. and Marrone, J. *Port Requirements to Support Offshore Wind Development in North America*. 2013. Proceedings *Ports 2013*.

DNV GL. *Offshore Wind Port Readiness Tool*. 2015. http://www.offshorewindportreadiness.com/.

DNV GL. *Assessment of Ports for Offshore Wind Development in the United States*. Prepared for the U.S. Dept. of Energy. 2014. http://energy.gov/sites/prod/files/2014/03/f14/Assessment%20of%20Ports%20for%20Offshore%20Wind%20Development%20in%20the%20United%20States_1.pdf (accessed March 3, 2015).

DNV GL. Design of Offshore Wind Turbine Structures. Offshore Standard Det Norske Veritas DNV-OS-J101. October 2010. https://rules.dnvgl.com/docs/pdf/DNV/codes/docs/2010-10/Os-J101.pdf (accessed March 14, 2016)

GL Noble Denton and DNV. *Guidelines for Offshore Wind Farm Infrastructure Installation*. Authorized by the Technical Standards Committee. 2015. http://rules.dnvgl.com/docs/pdf/GL/NobleDenton/0035_ND%20%20Rev_1%20%2014-Dec-15%20%20Guidelines%20for%20offshore%20wind%20farm%20infrastructure%20installation.pdf?utm_source=oilgas&utm_medium=website&utm_content=http%3A%2F%2Frules.dnvgl.com%2Fdocs%2Fpdf%2FGL%2FNobleDenton%2F0035_ND%2520%2520Rev_1%2520%252014-Dec-15%2520%2520Guidelines%2520for%2520offshore%2520wind%2520farm%2520infrastructure%2520installation.pdf (accessed March 3, 2016).

ICF Incorporated, Inc. *Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development*. Prepared for the U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study. 2012. www.data.boem.gov/PI/PDFImages/ESPIS/5/5228.pdf (accessed March 4, 2015).

Kinetik Partners. *Analysis of Maryland Port Facilities for Offshore Wind Energy Services*. Prepared for State of Maryland, Maryland Energy Administration. 2011. http://energy.maryland.gov/documents/AnalysisofMarylandPortFacilitiesforOffshoreWindEnergyServices.pdf (accessed March 4, 2015).

Logistics Optimisation for Ports Intermodality: Network, Opportunities, Development (LO-PINOD). *Case Study 03: Offshore wind-energy markets-Regional ports combine their offerings*. July 10, 2014. http://www.northsearegion.eu/files/repository/20141201191841_LOPINODCASESTUDY03-PortdiversificationstrategiesAW(2).pdf (accessed March 5, 2015).

National Oceanic and Atmospheric Administration (NOAA). *NOAA's State of the Coast*. 2010 http://stateofthecoast.noaa.gov/ (accessed March 31, 2015).

Navigant Consulting, Inc. *Offshore Wind Market and Economic Analysis, Annual Market Assessment*. Prepared for the U.S. Dept. of Energy. 2013.

http://www1.eere.energy.gov/wind/pdfs/offshore_wind_market_and_economic_analysis.pdf (accessed March 3, 2015).

North Carolina State University. *North Carolina Port Capabilities for Offshore Wind Farms*. Undated.

Offshore: Risk & Technology Consulting Inc. (ORTC). *Offshore Electrical Cable Burial for Wind Farms: State of the Art; Standards and Guidance; Acceptable Burial Depths and Separation Distances; and Sand Wave Effects*. Prepared for Bureau of Safety and Environmental Enforcement. 2011. http://www.bsee.gov/uploadedFiles/BSEE/Technology_and_Research/Technology_Assessment_Programs/Reports/600-699/Final%20Report%20Offshore%20Electrical%20Cable%20Burial%20for%20Wind%20Farms.pdf (accessed April 7, 2015).

PMSS America, Inc. *Offshore Wind Submarine Cable Spacing Guidance*. Prepared for Bureau of Safety and Environmental Enforcement. 2014. http://www.bsee.gov/uploadedFiles/BSEE/Technology_and_Research/Technology_Assessment_Programs/Reports/700-799/722AA.pdf (accessed April 7, 2015).

SAIC/VCERC. *Hampton Roads Maritime and Port Capacity Report*. 2009. http://www.vcerc.org/FINAL%20HRMARITIME.pdf (accessed March 3, 2015).

Society of Naval Architects and Marine Engineers. *Guidelines for Site Specific Assessment of Mobile Jack-Up Units T&R Bulletin 5-5 and 5-5A*. PANEL OC-7 SITE ASSESSMENT OF JACK-UP RIGS, 2008.

TetraTech EC. *Port and Infrastructure Analysis for Offshore Wind Energy Development*. Prepared for Massachusetts Clean Energy Center. 2010. http://files.masscec.com/research/OffshoreWindPortInfrastructureAnalysis.pdf (accessed March 4, 2015).

U.S. Department of Transportation Maritime Administration. *Marine Transportation System*. 2015. http://www.marad.dot.gov/ports_landing_page/marine_transportation_system/MTS.htm (accessed April 1, 2015).

8.2 Identification of Environmental and Socioeconomic Impacts and Mitigation Efforts References

BOEM (Bureau of Ocean Energy Management). 2012. *Identification of Outer Continental Shelf Renewable Energy Space-Use Conflicts and Analysis of Potential Mitigation Measures*. www.data.boem.gov/PI/PDFImages/ESPIS/5/5203.pdf. (accessed March 7, 2016).

BOEM (Bureau of Ocean Energy Management). 2015. *Commercial Wind Lease Issuance and Site Assessment Activities on the Atlantic Outer Continental Shelf Offshore North Carolina. Environmental Assessment*. http://www.boem.gov/BOEM_NC_EA_For_Publication/. (accessed July 6, 2015).

Cardno. *Port Botany Post Construction Monitoring Annual Report*. Prepared for Sydney Ports Corporation, September 2013. 2013. http://www.sydneyports.com.au/__data/assets/pdf_file/0008/29681/Pt_Botany_Expansion_Annual_Post_Construction_Monitoring_Report_September_2013-Final_V10_17_September_2013.pdf (accessed July 13, 2015).

CEQ (Council on Environmental Quality). *Appropriate Use of Mitigation and Monitoring and Clarifying the Appropriate Use of Mitigated Findings of No Significant Impact*. Memorandum for Heads of Federal Departments and Agencies. 2011. January 14.

Cooper, B. and Marrone, J. *Port Requirements to Support Offshore Wind Development in North America*. Proceedings Ports, 2013.

DNV GL. *Assessment of Ports for Offshore Wind Development in the United States*. Prepared for the U.S. Dept. of Energy. 2014. http://energy.gov/sites/prod/files/2014/03/f14/Assessment%20of%20Ports%20for%20Offshore%20Wind%20Development%20in%20the%20United%20States_1.pdf (accessed March 3, 2015).

EWEA (European Wind Energy Association). *Offshore Wind*. 2015. http://www.ewea.org/policy-issues/offshore/ (accessed July 13, 2015).

EPA (U.S. Environmental Protection Agency). *Final Determination for the South Terminal Project*. 2012. www3.epa.gov/region1/superfund/sites/newbedford/525556.pdf (accessed July 9, 2015).

FHWA (Federal Highway Administration). *Environmental Justice and NEPA in the Transportation Arena: Project Highlights*. 2013. http://www.fhwa.dot.gov/environment/environmental_justice/ej_and_nepa/highlights/ (accessed July 10, 2015).

Galway Harbour Company. *Galway Harbour Extension Environmental Impact Statement*. Undated. http://www.galwayharbourextension.com/environmental-impact-statement-eis/ (accessed August 17, 2015).

ISO 29400. *Ships and marine technology — Offshore wind energy — Port and marine operations*. First edition 2015-05-01, 2015.

Johnson MR, Boelke C, Chiarella LA, Colosi PD, Greene K, Lellis K, Ludemann H, Ludwig M, McDermott S, Ortiz J, Rusanowsky D, Scott M, Smith J. *Impacts to marine fisheries habitat from nonfishing activities in the Northeastern United States*. 2008. http://www.nefsc.noaa.gov/publications/tm/tm209/tm209.pdf (accessed August 7, 2015).

MA Clean Energy Center. 2015. Personal communication. 08/15/2015.

NOAA. *Fisherman's Contingency Fund*. Undated. http://www.nmfs.noaa.gov/mb/financial_services/fcf.htm

NOEP (National Ocean Economics Program). *Living Marine Resources. Top Commercial Fishing Ports*. 2015. http://www.oceaneconomics.org/LMR/topPorts.asp (accessed August 14, 2015).

Navigant Consulting, Inc. *U.S. Offshore Wind Manufacturing and Supply Chain Development.* Prepared for the Department of Energy. February 2013. Available: http://energy.gov/sites/prod/files/2013/12/f5/us_offshore_wind_supply_chain_and_manufacturing_development.pdf (accessed July 9, 2015).

Navigant Consulting, Inc. *Offshore Wind Market and Economic Analysis. 2014 Annual Market Assessment*. Prepared for U.S. Department of Energy. September 2014. http://energy.gov/sites/prod/files/2014/09/f18/2014%20Navigant%20Offshore%20Wind%20Market%20%26%20Economic%20Analysis.pdf (accessed July 9, 2015).

Rogers, Caroline S. *Responses of coral reefs and reef organisms to sedimentation*. Marine Ecology Progress Series. Vol. 62: 185-202. April 1990.

Royal Haskoning. *Bathside Bay Container Port: Planning Applications. Environmental Statement*. Prepared for Hutchison Ports (UK) Ltd. April 2003. 2003. http://www.hict.co.uk/data/downloads/nts-01-06.pdf (accessed June 24, 2015).

Royal Haskoning. *Environmental Impact Assessment for Construction of Maasvlakte 2 Summary*. Prepared for Port of Rotterdam Authority, April 2007. 2007. https://www.maasvlakte2.com/uploads/summary_eia_contruction_maasvlakte_2.pdf (accessed June 24, 2015).

South Coast Today. *Officials Break Ground on New Bedford Marine Commerce Terminal*. 2013. http://www.southcoasttoday.com/article/20130507/NEWS/305070320 (accessed August 19, 2015).

TetraTech EC. *Port and Infrastructure Analysis for Offshore Wind Energy Development*. Prepared for Massachusetts Clean Energy Center. 2010. http://www.masscec.com/content/port-and-infrastructure-analysis-offshore-wind-energy-development (accessed March 4, 2015).

The Los Angeles Harbor Department. *Berths 97-109 [China Shipping] Container Terminal Project. Draft Environmental Impact Statement*. 2008. http://www.portoflosangeles.org/EIR/ChinaShipping/DEIR/deir_china_shipping.asp (accessed June 24, 2015).

The Los Angeles Harbor Department. *Berths 136-147 [TraPac] Container Terminal Project. Final Environmental Impact Statement*. 2007. http://www.portoflosangeles.org/EIR/TraPac/FEIR/feir_trapac.asp (accessed June 24, 2015).

The Los Angeles Harbor Department. *Berths 212-224 [YTI] Container Terminal Improvement Project. Draft Environmental Impact Statement*. 2014. http://www.portoflosangeles.org/EIR/YTI/DEIR/deir_yti.asp (accessed June 24, 2015).

Totaro & Associates. *US Offshore Wind Could Flourish with More JVs and Technology Transfer*. 2015. http://www.offshorewind.biz/2015/07/08/us-offshore-wind-could-flourish-with-more-jvs-and-technology-transfer/?utm_source=emark&utm_medium=email&utm_campaign=Daily+update+Offshore+Wind%2C+2015-07-09&uid=35213 (accessed July 9, 2015).

U.S. Department of the Interior Minerals Management Service. *Programmatic Environmental Impact Statement for Alternative Energy Development and Production and Alternate Use of Facilities on the Outer Continental Shelf. Final Environmental Impact Statement*. 2007. http://www.boem.gov/Renewable-Energy-Program/Regulatory-Information/Guide-To-EIS.aspx (accessed August 12, 2015).

USACE (United States Army Corps of Engineers) Jacksonville District. *Port Everglades Harbor Navigation Study. Broward County, Florida. Final Environmental Impact Statement.* March 2015.

8.3 Environmental and Socioeconomic Port Profiles

BOEM (Bureau of Ocean Energy Management). 2012. Ideentification of Outer Continental Shelf Renewable Energy Space-Use Conflicts and Analysis of Potential Mitigiation Measures. www.data.boem.gov/PI/PDFImages/ESPIS/5/5203.pdf. (accessed March 7, 2016).

Bureau of Labor Statistics. *Local Area Unemployment Statistics*. Undated. http://www.bls.gov/lau/ (accessed September 10, 2015).

EPA (U.S. Environmental Protection Agency). *EJSCREEN. Environmental Justice Screening and Mapping Tool.* 2015. http://www2.epa.gov/ejscreen (accessed September 10, 2015).

EPA (U.S. Environmental Protection Agency). *National Ambient Air Quality Standards (NAAQS).* Undated. http://www3.epa.gov/ttn/naaqs/criteria.html (accessed October 25, 2015).

EPA (U.S. Environmental Protection Agency). *National Summary of Impaired Waters and TMDL Information*. 2015. http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state (accessed October 21, 2015).

Marine Traffic. *Automatic Identification System*. Undated. http://www.marinetraffic.com/en/ais/index/ports/all (accessed September 10, 2015).

Military Bases.com. *US Military Bases*. 2015. http://militarybases.com/ (accessed October 28, 2015).

MRLC (Multi-Resolution Land Characteristics Consortium). *2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool*. 2014. http://www.mrlc.gov/eva/viewer.html. (accessed October 28, 2015).

NMFS (National Marine Fisheries Service). *Endangered and Threatened Marine Species under NMFS' Jurisdiction*. 2015. http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals (accessed December 7, 2015).

NMFS (National Marine Fisheries Service). *Commercial Fisheries Statistics*. 2013. http://www.st.nmfs.noaa.gov/commercial-fisheries/index (accessed September 10, 2015).

NMFS (National Marine Fisheries Service). *Community Social Indicators.* 2009. http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map (accessed September 10, 2015).

NOAA (National Oceanic and Atmospheric Administration). *Essential Fish Habitat Mapper*. Undated. http://www.habitat.noaa.gov/protection/efh/efhmapper/ (accessed September 29, 2015).

NOAA (National Oceanic and Atmospheric Administration). *Tides Online and Current Predictions.* 2013. https://tidesandcurrents.noaa.gov/stations.html?type=Bench+Mark+Data+Sheets (accessed September 9, 2015).

NOAA (National Oceanic and Atmospheric Administration), Office of Coast Survey. *Wrecks and Obstructions Database.* Undated. http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html (acessed October 28, 2015).

NPS (National Park Service). *National Register of Historic Places.* Undated. http://www.nps.gov/nr/research/index.htm (accessed September 10, 2015).

OMB (Office of Management and Budget). *Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas. OMB Bulletin N. 15-01*. 2015. https://www.whitehouse.gov/omb/bulletins_default (accessed September 10, 2015).

The Nature Conservancy. *Northeast Habitat Map.* Undated. http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8 (accessed October 28, 2015).

USCB (U.S. Census Bureau). *American Community Survey, 5-Year Estimates, 2009-2013*. 2015c. http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml (accessed September 10, 2015).

USCB (U.S. Census Bureau). *Longitudinal Employer-Household Dynamics.* 2015a. http://lehd.ces.census.gov/ (accessed September 10, 2015).

USCB (U.S. Census Bureau). *OnTheMap.* 2015b. http://onthemap.ces.census.gov (accessed September 10, 2015).

USCB (U.S. Census Bureau). *State Finances, 2012 Census of Governments*. 2015. http://www.census.gov/govs/local/ (accessed September 10, 2015).

USFWS (U.S. Fish and Wildlife Service). Threatened & Endangered Species Active Critical Habitat Report. Undated. http://ecos.fws.gov/ecp/report/table/critical-habitat.html (accessed December 1, 2015).

USFWS (U.S. Fish and Wildlife Service). *Endangered Species*. 2015. http://www.fws.gov/endangered/ (accessed December 9, 2015).

Appendix I

Port Classification Matrix

Capability Area	Potential Use		Access				Quayside Capabilities			Storage Capabilities			Roll On/Roll Off			Cranes		Transportation
Criteria	**Staging Port**	**O&M Port**	**Port Access Channel Width**	**Port Access Water Depths**	**Overhead Draft**	**Number of Berths**	**Quayside Bearing Capacity**	**Quayside Length**	**Quayside Seabed Suitable for Jacking**	**Haul Route Bearing Capacity**	**Storage Area Bearing Capacity**	**Size of Storage Area**	**Roll On/Roll Off Capability**	**Width of Ro-Ro Berth**	**Bearing Capacity of Ro-Ro Berth and Ramps**	**On-site Cranes' Capabilities**	**Crane Height Restrictions**	**Onshore Transportation Infrastructure (e.g. rail access)**
Units	-	-	m	m	m	-	t/m^2	m	binary	t/m^2	t/m^2	m^2	binary	m	t/m^2	t	m	binary
Threshold Value, 4 MW			30	8.1	75	1	10	100	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Monopile	Nacelle	Nacelle	Nacelle	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A
Threshold Value, 6 MW			30	8.1	75	1	27	130	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Monopile	Nacelle	Nacelle	Nacelle	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A
Threshold Value, 8 MW			30	8.1	75	1	17	170	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Jacket	Nacelle	Nacelle	SPMTs	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A
Weighting Factor	-		1.0				1.0			0.9			0.3			0.8		0.5
EXAMPLE																		
Port/Terminal	**Staging Port**	**O&M Port**	**Port Access Channel Width**	**Port Access Water Depths**	**Overhead Draft**	**Number of Berths**	**Quayside Bearing Capacity**	**Quayside Length**	**Quayside Seabed Suitable for Jacking**	**Haul Route Bearing Capacity**	**Storage Area Bearing Capacity**	**Size of Storage Area**	**Roll On/Roll Off Capability**	**Width of Ro-Ro Berth**	**Bearing Capacity of Ro-Ro Berth and Ramps**	**On-site Cranes' Capabilities**	**Crane Height Restrictions**	**Onshore Transportation Infrastructure (e.g. rail access)**
Massachusetts																		
Boston-Conley Terminal	x		182.9	12.2	Unlimited	5		304			404,700		FALSE	0	0	51	61	TRUE
Boston-Autoport	x		182.9	12.2	41.1	1		335					FALSE	0	0			TRUE
Nantucket Harbor		x	91.4	4.6	Unlimited			9.1					FALSE	0	0			TRUE
Hyannis Inner Harbor		x	30.5	4.0	Unlimited								FALSE	0	0			TRUE
Falmouth Harbor		x	30.5	3.0	Unlimited													TRUE
Edgartown Harbor		x	45.7	5.2	Unlimited													TRUE
Vineyard Haven Harbor		x	83.3	3.7	Unlimited											24		FALSE
New Bedford	x	x	36.6	9.1	Unlimited	1	20	305	TRUE	20	20	114,323	FALSE	0	0	0	51.8	TRUE
Fall River		x	121.9	10.7	41.1			175				27,520	TRUE					TRUE
Rhode Island																		
Providence	x	x	182.9	12.2	59.1	27						42,000	TRUE			144		TRUE
Newport		x	30.5	5.5	Unlimited								FALSE	0	0	30		TRUE
Melville		x	457.2	10.1	59.1								FALSE	0	0			FALSE
Quonset Point/Davisville	x	x	152.4	9.8	59.1	2		366				450,000	TRUE			150		TRUE
Bristol Harbor		x	2,092	4.6	59.1								FALSE	0	0			TRUE
Point Judith		x	45.7	4.6	Unlimited													
Connecticut																		
Stonington Harbor		x	381	4.0	Unlimited			188					FALSE	0	0	40		FALSE
New London (south of I-95)	x	x	152.4	10.6	Unlimited	2	4.8	305				141,600	FALSE	0	0			TRUE
New Haven (south of I-95)	x	x	121.9	10.7	Unlimited	12		228				37,200	FALSE	0	0	100		TRUE
Bridgeport (south of I-95)	x	x	121.9	10.7	Unlimited	4		105				19,788	FALSE	0	0	100		TRUE
New York																		
Montauk		x	45.7	3.7	Unlimited													
Greenport (Long Island)		x	30.5	2.4	Unlimited	3		97.5					FALSE	0	0	50		TRUE
New York-Staten Island	x	x	609.6	16.2	60.4													
New York-Erie Basin	x		63.6	12.2	60.4													
New York-Brooklyn (south of Brooklyn Bridge)	x		152.4	10.7	60.4													
Kismet Harbor		x	137.2	3.7	19.8													
Ocean Beach Harbor		x	137.2	4.0	19.8													
Pennsylvania																		
Philadelphia (Packer Avenue Marine Terminal)	x		121.9	12.2	50.6	6		1158					TRUE			340		TRUE
Philadelphia (Tioga Marine Terminal)	x		121.9	10.8	42.4	6		1164					TRUE			104		TRUE
New Jersey																		
Bayonne	x		91.4	13.7	60.1													TRUE
Newark	x		246.9	15.2	46.0	7						1,480,000	TRUE					TRUE
Elizabeth	x		152.4	15.2	46.0													TRUE
Perth Amboy	x	x	182.9	10.7	Unlimited													TRUE
Shark River		x	15.2	3.7	15.2													
Manasquan		x	45.7	2.3	Unlimited													

Capability Area	Potential Use		Access				Quayside Capabilities			Storage Capabilities			Roll On/Roll Off			Cranes		Transportation
Criteria	**Staging Port**	**O&M Port**	**Port Access Channel Width**	**Port Access Water Depths**	**Overhead Draft**	**Number of Berths**	**Quayside Bearing Capacity**	**Quayside Length**	**Quayside Seabed Suitable for Jacking**	**Haul Route Bearing Capacity**	**Storage Area Bearing Capacity**	**Size of Storage Area**	**Roll On/Roll Off Capability**	**Width of Ro-Ro Berth**	**Bearing Capacity of Ro-Ro Berth and Ramps**	**On-site Cranes' Capabilities**	**Crane Height Restrictions**	**Onshore Transportation Infrastructure (e.g. rail access)**
Units	-	-	m	m	m	-	t/m^2	m	binary	t/m^2	t/m^2	m^2	binary	m	t/m^2	t	m	binary
Threshold Value, 4 MW			**30**	**8.1**	**75**	**1**	**10**	**100**	**TRUE**	**10**	**10**	**25,000**	**FALSE**	**8**	**10**	**600**	**50**	**FALSE**
Assumed Governing Factor	-	-	**Jacket**	**WTG**	**Jackets**	**N/A**	**Monopile**	**Nacelle**	**Nacelle**	**Nacelle**	**Nacelle**	**Blades**	**N/A**	**Tower**	**Tower**	**Nacelle**	**WTG**	**N/A**
Threshold Value, 6 MW			**30**	**8.1**	**75**	**1**	**27**	**130**	**TRUE**	**10**	**10**	**25,000**	**FALSE**	**8**	**10**	**600**	**50**	**FALSE**
Assumed Governing Factor	-	-	**Jacket**	**WTG**	**Jackets**	**N/A**	**Monopile**	**Nacelle**	**Nacelle**	**Nacelle**	**Nacelle**	**Blades**	**N/A**	**Tower**	**Tower**	**Nacelle**	**WTG**	**N/A**
Threshold Value, 8 MW			**30**	**8.1**	**75**	**1**	**17**	**170**	**TRUE**	**10**	**10**	**25,000**	**FALSE**	**8**	**10**	**600**	**50**	**FALSE**
Assumed Governing Factor	-	-	**Jacket**	**WTG**	**Jackets**	**N/A**	**Jacket**	**Nacelle**	**Nacelle**	**SPMTs**	**Nacelle**	**Blades**	**N/A**	**Tower**	**Tower**	**Nacelle**	**WTG**	**N/A**
Weighting Factor	-		1.0				1.0			0.9			0.3			0.8		0.5
Paulsboro	x		243.8	12.2	15.2	3	7.3	330	TRUE	24	24	400,000	FALSE	0	0	180		TRUE
Cape May		x	91.4	3.7	Unlimited													FALSE
Delaware																		
Wilmington	x	x	61	11.6	11.5	7		935				88,000	TRUE			100		TRUE
Lewes		x														25		TRUE
Breakwater Harbor		x																
Maryland																		
Baltimore	x		213	15.2	12.8	13		505				5,000,000	TRUE			86.4		TRUE
Ocean City		x	61	3														
Solomons Island		x		9.1	3											75	7.7	FALSE
Virginia																		
Cape Charles	x	x	152	5.5	4.6	3		152					FALSE	0	0			TRUE
Hampton Roads-APM Terminal	x		304.8	16.7	15.2	1												
Hampton Roads-Norfolk International Terminal	x		304.8	11	12.2	5		305				217,000	TRUE			72	40	TRUE
Hampton Roads-Portsmouth Marine Terminals	x		304.8	13.1	12.2	3		360				30,000	TRUE			44		TRUE
Hampton Roads-Newport News Marine Terminal	x		304.8	10.7	12.2	9		285				61,000	TRUE			162		TRUE
Hampton Roads-Peck Marine Terminal	x		304.8	8.8	15.2	1		126.5				80,937	FALSE	0	0			TRUE
North Carolina																		
Morehead City	x		244	14.3	Unlimited	15	12.7	1188	TRUE	3.9	17	225,000	TRUE	76	3.9	113		TRUE
Wilmington	x	x	152	13.4	12.8	9		308				305,000	TRUE			225		TRUE
South Carolina																		
Charleston	x		305	14.3	Unlimited	32						452,842	TRUE	381		500		TRUE
Georgia																		
Savannah	x		152.4	13.4	12.8	34		515				248,920	TRUE	297		156.3	13.7	TRUE

Capability Area	Potential Use		Access				Quayside Capabilities			Storage Capabilities			Roll On/Roll Off			Cranes		Transportation	Data Sources
Criteria	Staging Port	O&M Port	Port Access Channel Width	Port Access Water Depths	Overhead Draft	Number of Berths	Quayside Bearing Capacity	Quayside Length	Quayside Seabed Suitable for Jacking	Haul Route Bearing Capacity	Storage Area Bearing Capacity	Size of Storage Area	Roll On/Roll Off Capability	Width of Ro-Ro Berth	Bearing Capacity of Ro-Ro Berth and Ramps	On-site Cranes' Capabilities	Crane Height Restrictions	Onshore Transportation Infrastructure (e.g. rail access)	
Units	-	-	m	m	m	-	t/m^2	m	-	t/m^2	t/m^2	m^2	-	m	t/m^2	t	m	-	
Threshold Value, 4 MW			30	9.5	75	1	13	100	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE	
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Monopile	Nacelle	Nacelle	Nacelle	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A	
Threshold Value, 6 MW			30	9.5	75	1	27	130	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE	
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Monopile	Nacelle	Nacelle	Nacelle	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A	
Threshold Value, 8 MW			30	9.5	75	1	17	170	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE	
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Jacket	Nacelle	Nacelle	SPMTS	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A	
Weighting Factor	-		1.0				1.0			0.9			0.3			0.8		0.5	
Massachusetts																			
Boston-Conley Terminal	x		NE District USACE Report	NE District USACE Report	Ports & Terminals Guide (Conley)	Ports & Terminals Guide (Conley)		Ports & Terminals Guide (Conley)					Ports & Terminals Guide (Conley)			Ports & Terminals Guide (Boston)	FAA Determination	Boston MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Boston-Autoport	x		NE District USACE Report; Ports & Terminals Guide (Boston)	Ports & Terminals Guide (Main Channel)	NOAA Chart 13272; Ports & Terminals Guide (Boston)	Ports & Terminals Guide (Boston)		Ports & Terminals Guide (Boston)					Ports & Terminals Guide (Boston)					Boston MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Nantucket Harbor		x	NE District USACE Report	NE District USACE Report	Ports & Terminals Guide (Nantucket)			Ports & Terminals Guide (Nantucket)					Ports & Terminals Guide (Nantucket)					Nantucket MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Hyannis Inner Harbor		x	NE District USACE Report	NE District USACE Report; Ports & Terminals Guide (Hyannis)	Ports & Terminals Guide (Hyannis)								Ports & Terminals Guide (Hyannis)					Hyannis MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16" ; World Port Source
Falmouth Harbor		x	NE District USACE Report	NE District USACE Report	NOAA Chart 13230													Falmouth MSI Portal	World ports source US Harbors http://ma.usharbors.com/harbor-
Edgartown Harbor		x	NE District USACE Report	NE District USACE Report	World Port Source (Edgartown)													Edgartown MSI Portal	
Vineyard Haven Harbor		x	NE District USACE Report	NE District USACE Report	World Port Source (Vineyard Haven)											World Port Source (Vineyard Haven Harbor)		Vineyard Haven MSI Portal	World Port Source
New Bedford	x	x	Port of New Bedofrd Website	NE District USACE Report	NOAA Chart 13229	Port of New Bedford Website	Port of New Bedford Website; Ports & Terminals Guide (New Bedford)			Port of New Bedford Website; DOE Ports Study (DNV GL)		Port of New Bedford Website; Ports & Terminals Guide (New Bedford)	World Port Source (New Bedford)			Ports & Terminals Guide (New Bedford)	Cape Wind FAA filing	New Bedford MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; World Port Source; Direct communication, DOE port readiness study
Fall River		x	NE District USACE Report	NE District USACE Report	NOAA Charts 13223, 13224, 13227; Ports & Terminals Guide (Fall River)			Ports & Terminals Guide (Fall River Line Pier)				Ports & Terminals Guide (Fall River Line Pier)	Ports & Terminals Guide (Fall River Line Pier)					Fall River (MSI Portal)	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Rhode Island																			
Providence	x	x	NE District USACE Report	NE District USACE Report	NOAA Chart 13223; Ports & Terminals Guide (Providence)	Ports & Terminals Guide (Providence)						Ports & Terminals Guide (Providence)	Ports America (Providence)			ProvPort and Leibherr websites; Ports & Terminals Guide (Providence)		Providence MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Newport		x	NE District USACE Report	NE District USACE Report	NOAA Chart 13223; Ports & Terminals Guide (Newport)								Ports & Terminals Guide (Newport)			Ports & Terminals Guide (Newport)		Newport MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Melville		x	NOAA Chart 13223	NOAA Chart 13223	NOAA Chart 13223; Ports & Terminals Guide (Melville)								Ports & Terminals Guide (Melville)					Melville MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Quonset Point/Davisville	x	x	NOAA Chart 13223	QDC 2015 Port Brochure; World Port Source (Davisville)	NOAA Chart 13223; World Port Source (Davisville)	Quonset Port Website		World Port Source (Davisville)				World Port Source (Davisville)	Ports & Terminals Guide (Davisville)			Quonset Port Website		Davisville MSI Portal	
Bristol Harbor		x	US Harbors (Bristol)	NOAA Chart 13224; Ports & Terminals Guide (Bristoal Harbor)	Ports & Terminals Guide (Bristol Harbor)								Ports & Terminals Guide (Bristol Harbor)					Bristol MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Point Judith		x	NOAA Chart 13219; NE District USACE Report	NOAA Chart 13219	NOAA Chart 13219														
Connecticut																			
Stonington Harbor		x	NOAA Chart 12372; NE District USACE Report	NOAA Chart 12372	NOAA Chart 12372; Ports & Terminals Guide (North Dock)			Ports & Terminals Guide (North Dock)					World Port Source (Stonington)			US Harbors (Boatyard)		Stonington MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
New London	x	x	NE District USACE Report	CT Dept. of Transporation (State Pier)	NOAA Chart 12372; Ports & Terminals Guide (New London)	Ports & Terminals Guide (New London)	Ports & Terminals Guide (State Pier)					Milone & MacBroom (State Pier Planning Study, 2011)	Ports & Terminals Guide (New London)					New London MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
New Haven	x	x	NE District USACE Report	NE District USACE Report	NOAA Chart 12371; Ports & Terminals Guide (New Haven)	Ports & Terminals Guide (New Haven)		Ports & Terminals Guide (Gateway Terminal)				World Port Source (New Haven)	Ports & Terminals Guide (New Haven)			World Port Source (New Haven)		New Haven MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16 World ports source US Harbors (New Haven)
Bridgeport	x	x	NE District USACE Report	NE District USACE Report	NOAA Chart 12369; Ports & Terminals Guide (Bridgeport)	Ports & Terminals Guide (Bridgeport)		Ports & Terminals Guide (United Illuminating Co Oil Dock)				Ports & Terminals Guide (Bridgeport)	Ports & Terminals Guide (Bridgeport)			Ports & Terminals Guide (Bridgeport)		Bridgeport MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
New York																			
Montauk		x	NOAA Chart 13209	NOAA Chart 13209	NOAA Chart 13209														US Harbors (Montauk)
Greenport (Long Island)		x	NY District USACE Report	NY District USACE Report	NOAA Chart 12358; Ports & Terminals Guide (Greenport)	Ports & Terminals Guide (Greenport)		World Port Source (Greenport)					Ports & Terminals Guide (Greenport)			US Harbors (Greenport)		Greenport MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
New York-Staten Island	x	x	NOAA Chart 12334	NOAA Chart 12334	NOAA Chart 12334														
New York-Erie Basin	x		NOAA Chart 12334 (at Basin entrance)	NY District USACE Report	NOAA Chart 12334														
New York-Brooklyn	x		NY District USACE Report	NY District USACE Report	NOAA Chart 12334														
Kismet Harbor		x	NOAA Chart 12352	NOAA Chart 12352	NOAA Chart 12352														
Ocean Beach Harbor		x	NOAA Chart 12352	NOAA Chart 12352	NOAA Chart 12352														
Pennsylvania																			
Philadelphia (Packer Avenue Marine Terminal)	x		NOAA Chart 12312	Philadelphia Regional Port Authority	NOAA Chart 12312	Philadelphia Regional Port Authority		Philadelphia Regional Port Authority					Philadelphia Regional Port Authority			Philadelphia Regional Port Authority		Philadelphia Regional Port Authority	
Philadelphia (Tioga Marine Terminal)	x		NOAA Chart 12313	Philadelphia Regional Port Authority	NOAA Chart 12313	Philadelphia Regional Port Authority		Philadelphia Regional Port Authority					Philadelphia Regional Port Authority			Philadelphia Regional Port Authority		Philadelphia Regional Port Authority	

Capability Area	Potential Use		Access				Quayside Capabilities			Storage Capabilities			Roll On/Roll Off			Cranes		Transportation	Data Sources
Criteria	**Staging Port**	**O&M Port**	**Port Access Channel Width**	**Port Access Water Depths**	**Overhead Draft**	**Number of Berths**	**Quayside Bearing Capacity**	**Quayside Length**	**Quayside Seabed Suitable for Jacking**	**Haul Route Bearing Capacity**	**Storage Area Bearing Capacity**	**Size of Storage Area**	**Roll On/Roll Off Capability**	**Width of Ro-Ro Berth**	**Bearing Capacity of Ro-Ro Berth and Ramps**	**On-site Cranes' Capabilities**	**Crane Height Restrictions**	**Onshore Transportation Infrastructure (e.g. rail access)**	
Units	-	-	m	m	m	-	t/m^2	m	-	t/m^2	t/m^2	m^2	-	m	t/m^2	t	m	-	
Threshold Value, 4 MW			30	9.5	75	1	13	100	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE	**Data Sources**
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Monopile	Nacelle	Nacelle	Nacelle	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A	
Threshold Value, 6 MW			30	9.5	75	1	27	130	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE	
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Monopile	Nacelle	Nacelle	Nacelle	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A	
Threshold Value, 8 MW			30	9.5	75	1	17	170	TRUE	10	10	25,000	FALSE	8	10	600	50	FALSE	
Assumed Governing Factor	-	-	Jacket	WTG	Jackets	N/A	Jacket	Nacelle	Nacelle	SPMTS	Nacelle	Blades	N/A	Tower	Tower	Nacelle	WTG	N/A	
Weighting Factor	-		1.0				1.0			0.9			0.3			0.8		0.5	
New Jersey																			
Bayonne	x		NY District USACE Report	NY District USACE Report	NOAA Chart 12334													Bayonne MSI Portal	World Port Source
Newark	x		NY District USACE Report	NY District USACE Report	NOAA Chart 12333	World Port Source (Newark)						World Port Source (Newark)	World Port Source (Newark)					Newark MSI Portal	World Port Source
Elizabeth	x		NY District USACE Report	NY District USACE Report	NOAA Chart 12333													Elizabeth MSI Portal	World Port Source
Perth Amboy	x	x	NY District USACE Report	NY District USACE Report	NOAA Chart 12331													Perth Amboy MSI Portal	World Port Source
Shark River		x	NY District USACE Report	NY District USACE Report	NOAA Chart 12324														
Manasquan		x	NOAA Chart 12324	NOAA Chart 12324	NOAA Chart 12324														
Paulsboro	x		NOAA Chart 12312	NOAA Chart 12312	NOAA Chart 12312	Port of Paulsboro Website	DOE Ports Study (DNV GL)			DOE Ports Study (DNV GL)			Ports & Terminals Guide (Paulsboro)			DOE Ports Study (DNV GL)		Port of Paulsboro Website	IHS Maritime, "Ports & Terminals Guide Directory 2015-16" Direct communication
Cape May		x	NOAA Chart 12317	NOAA Chart 12317	NOAA Chart 12317													Cape May MSI Portal	World Port Source
Delaware																			
Wilmington	x	x	Philly District USACE Report	Philly District USACE Report	World Port Source (Wilmington)	World Port Source (Wilmington)		World Port Source (Wilmington)				World Port Source (Wilmington)	World Port Source (Wilmington)			Port of Wilmington Website		Wilmington MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; Ports America
Lewes		x														US Harbors (Lewes)		US Harbors (Lewes)	
Breakwater Harbor		x																	
Maryland																			
Baltimore	x		Ports & Terminals Guide (Baltimore)	Ports & Terminals Guide (Baltimore)	Ports & Terminals Guide (Baltimore)	Ports America (Baltimore)		Ports & Terminals Guide (Baltimore Metal & Commodities Terminal)				Port of Baltimore Website	Ports & Terminals Guide (Dundalk Marine Terminal & Atlantic Terminal Pier)			MD Dept. of Transportation Port Admin.		Baltimore MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; World Port Source
Ocean City		x	Baltimore District USACE Report	Baltimore District USACE Report															
Solomons Island		x		World Port Source (Solomons)	World Port Source (Solomons)													Solomons MSI Portal	
Virginia																			
Cape Charles	x	x	Ports & Terminals Guide (Bar Channel)	Ports & Terminals Guide (Bar Channel)	Ports & Terminals Guide (Wharf)	Ports & Terminals Guide (Cape Charles)		Ports & Terminals Guide (Wharf)					Ports & Terminals Guide (Cape Charles)					Cape Charles MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Hampton Roads-APM Terminal	x		Ports & Terminals Guide (Thimble Shoal Channel)	Ports & Terminals Guide (Thimble Shoal Channel)	Ports & Terminals Guide (Hampton Roads)	Port of Virginia Website													IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Hampton Roads-Norfolk International Terminal	x		Ports & Terminals Guide (Thimble Shoal Channel)	VA DMME RFP (Alongside Depth)	Ports & Terminals Guide (Norfolk International Terminal)	Ports & Terminals Guide (Norfolk International Terminal)		Ports & Terminals Guide (Norfolk International Terminal); VA DMME RFP				Ports & Terminals Guide (Norfolk International Terminal)	Ports & Terminals Guide (Norfolk International Terminal)			Ports & Terminals Guide (Norfolk International Terminal)	FAA Determination	Hampton Roads MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; World Port Source; Port of Virginia Website
Hampton Roads-Portsmouth Marine Terminals	x		Ports & Terminals Guide (Thimble Shoal Channel)	VA DMME RFP (Alongside Depth)	Ports & Terminals Guide (Portsmouth Marine Terminals)	Ports & Terminals Guide (Portsmouth Marine Terminals)		Ports & Terminals Guide (Portsmouth Marine Terminals)				Ports & Terminals Guide (Portsmouth Marine Terminals)	Ports & Terminals Guide (Portsmouth Marine Terminals); Port of Virginia Website			Port of Virginia Website		Hampton Roads MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; World Port Source
Hampton Roads-Newport News Marine Terminal	x		Ports & Terminals Guide (Thimble Shoal Channel)	VA DMME RFP (Alongside Depth)	Ports & Terminals Guide (Newport News Marine Terminal)	Ports & Terminals Guide (Newport News Marine Terminal)		Ports & Terminals Guide (Newport News Marine Terminal)				Ports & Terminals Guide (Newport News Marine Terminal)	Ports & Terminals Guide (Newport News Marine Terminal)			Port of Virginia Website		Hampton Roads MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; World Port Source
Hampton Roads-Peck Marine Terminal	x		Ports & Terminals Guide (Thimble Shoal Channel)	VA DMME RFP (Alongside Depth)	Ports & Terminals Guide (Peck Marine Terminal)	Port of Virginia Website		Peck Marine Terminal			Port of Virginia Website		Port of Virginia Website					Port of Virginia Website	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
North Carolina																			
Morehead City	x		DOE Ports Study (DNV GL); North Carolina Ports Website (Marine Commerce); Direct Communication				DOE Ports Study (DNV GL)			DOE Ports Study (DNV GL)		North Carolina Ports Website (Warehouse)	Ports & Terminals Guide (Ro-Ro Berth)	Ports & Terminals Guide (Ro-Ro Berth)	DOE Ports Study (DNV GL)	North Carolina Ports Website		Morehead MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; World Ports Source
Wilmington	x	x	Ports & Terminals Guide (Ocean Bar Channel)	Ports & Terminals Guide (Ocean Bar Channel)	Ports & Terminals Guide (Wilmington)	Ports & Terminals Guide (Wilmington)		Ports & Terminals Guide (Vopak South DC 160)				Ports & Terminals Guide (Wilmington)	Ports & Terminals Guide (Wilmington)			Ports & Terminals Guide (Wilmington)		Wilmington MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"; World Port Source
South Carolina																			
Charleston	x		World Port Source (Charleston)	Ports & Terminals Guide (Inner Harbor)	Port of Charleston Website; NOAA Chart 11518_2	Ports & Terminals Guide (Charleston)						Ports & Terminals Guide (Charleston)	Ports & Terminals Guide (Charleston)	Port of Charleston Website		Port of Charleston Website		Charleston MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"
Georgia																			
Savannah	x		Ports & Terminals Guide (Garden City & Ocean Terminals)	Ports & Terminals Guide (Tybee Roads)	Ports & Terminals Guide (Savannah)	Ports & Terminals Guide (Savannah)		Ports & Terminals Guide (Garden Terminal CB1)				Ports & Terminals Guide (Savannah)	Ports & Terminals Guide (Ocean Terminals & Slip Berths)	Ports & Terminals Guide (Ocean Terminal No. 13)		Ports & Terminals Guide (Ocean Terminal Clyde Berth)	Ports & Terminals Guide (Ocean Terminal Clyde Berth)	Savannah MSI Portal	IHS Maritime, "Ports & Terminals Guide Directory 2015-16"

APPENDIX I PORT CLASSIFICATION MATRIX REFERENCES

Connecticut Department of Transportation. *New London State Pier, Property Characteristics*. Undated. http://www.ct.gov/dot/lib/dot/documents/dcommunications/majorprojectupdates/State_Pier_Property_Characteristics_handout%5B1%5D.pdf (accessed May 12, 2015).

DNV GL. *Assessment of Ports for Offshore Wind Development in the United States*. Prepared for the U.S. Department of Energy. 2014. http://energy.gov/sites/prod/files/2014/03/f14/Assessment%20of%20Ports%20for%20Offshore%20Wind%20Development%20in%20the%20United%20States_1.pdf (accessed March 4, 2015).

FAA (Federal Aviation Administration). *Determination of No Hazard to Air Navigation for Temporary Structure.* Aeronautical Study No. 2015-AEA-1837-OE. 2015.

IHS Maritime. *Ports & Terminals Guide Directory 2015-16.* 2014.

Liebherr. *Liebherr USA*. Undated. http://www.liebherr.us/en-GB/default_us-lh.wfw (accessed May 15, 2015).

Maryland Department of Transportation Port Administration. *Port of Baltimore*. 2015. http://www.mpa.maryland.gov/ (accessed May 28, 2015).

Milone & MacBroom. *State Pier Needs and Deficiencies Planning Study: New London, Connecticut*. 2011. http://www.ct.gov/dot/lib/dot/documents/dcommunications/MajorProjectUpdates/FINAL_DRAFT_REPORT-March2011.pdf (accessed May 12, 2015).

NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. *Raster Navigational Charts*. [via Google Earth]. Undated. http://nauticalcharts.noaa.gov/ (accessed 2015).

North Carolina Ports. *Port of Morehead City*. Undated. http://www.ncports.com/port-of-morehead-city/ (accessed May 26, 2015).

Philadelphia Regional Port Authority. *Port of Philadelphia*. Undated. http://www.philaport.com/index.htm (accessed May 12, 2015).

Port of Baltimore. *Marine Terminals*. Undated. http://pobdirectory.com/terminals.php (accessed May 12, 2015).

Port of New Bedford. *Port of New Bedford*. 2015. http://www.portofnewbedford.org/ (accessed May 15, 2015).

Port of Wilmington Delaware. *The Port of Wilmington Delaware*. Undated. http://www.portofwilmington.com (accessed May 27, 2015).

Ports America. *Port of Baltimore*. Undated. https://www.portsamerica.com/portofbaltimore-maryland.html (accessed May 15, 2015).

Ports America. *Port of Providence*. Undated. https://www.portsamerica.com/portofprovidence-rhode-island.html (accessed May 15, 2015).

Ports America. *Port of Wilmington, DE*. Undated. https://www.portsamerica.com/portofwilmington-delaware.html (accessed May 15, 2015).

ProvPort. *ProvPort*. Undated. http://www.provport.com/ (accessed May15, 2015).

Quonset Development Corporation. *Port of Davisville Quonset Development Park*. 2015. http://www.quonset.com/_resources/common/userfiles/Kait/POD_Insert_2015.pdf (accessed May 27, 2015).

South Carolina Ports. *Port of Charleston*. 2015. http://www.port-of-charleston.com/ (accessed May 12, 2015).

South Jersey Port Corporation. *Paulsboro Marine Terminal*. 2015. http://southjerseyport.com/facilities/paulsboro-marine-terminal/ (accessed May 12, 2015).

The Port of Virginia. *The Port of Virginia*. 2015. http://www.portofvirginia.com/ (accessed May 12, 2015).

US Harbors. *Bristol*. Undated. http://ri.usharbors.com/harbor-guide/bristol (accessed May 15, 2015).

US Harbors. *Falmouth*. Undated. http://ma.usharbors.com/harbor-guide/falmouth (accessed May 15, 2015).

US Harbors. *Greenport*. Undated. http://ny.usharbors.com/harbor-guide/greenport (accessed May 15, 2015).

US Harbors. *Lewes*. Undated. http://de.usharbors.com/harbor-guide/lewes (accessed May 12, 2015).

US Harbors. *Montauk*. Undated. http://ny.usharbors.com/harbor-guide/montauk (accessed May 12, 2015).

US Harbors. *New Haven*. Undated. http://ct.usharbors.com/harbor-guide/new-haven (accessed May 12, 2015).

US Harbors. *Stonington, CT*. Undated. http://ct.usharbors.com/harbor-guide/stonington-ct (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) Baltimore District. *Federal Navigation Channels: Controlling Depth Report: Ocean City, Worcester County, Maryland*. October 27, 2014. http://www.nab.usace.army.mil/Missions/CivilWorks/NavMaps.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) Charleston District. *Federal Navigation Channels: Controlling Depth Report: Charleston Entrance Channel, South Carolina*. March 12, 2015. http://www.sac.usace.army.mil/Missions/Navigation/ChannelConditions.aspx (accessed June 12, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Boston Harbor Channels, Boston, MA*. March 4, 2014. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Bridgeport Harbor*, CT. November 15, 2010. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Edgartown Harbor, Martha's Vineyard, Massachusetts*. May 3, 2012. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Fall River Harbor, Fall River, Massachusetts*. August 22, 2013. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Falmouth Harbor*, *Falmouth, Massachusetts*. November 20, 2013. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Hyannis Harbor, Barnstable (Hyannis) and Yarmouth, Massachusetts*. July 22, 2014. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Nantucket Harbor*, *Nantucket MA.* February 27, 2014. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: New Bedford Harbor, New Bedford and Fairhaven, MA*. February 17, 2012. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: New Haven Harbor, New Haven, CT*. May 22, 2014. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: New London Harbor*, *New London/Groton, CT*. December 14, 2010. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Newport Harbor, Newport, Rhode Island*. January 23, 2012. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Point Judith Pond and Harbor of Refuge*. February 15, 2012. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 27, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Providence River and Harbor, Providence, RI*. March 2, 2012. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Stonington Harbor, Stonington, Connecticut*. March 15, 2012. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New England District. *Federal Navigation Channels: Controlling Depth Report: Vineyard Haven Harbor, MA*. May 17, 2011. http://www.nae.usace.army.mil/Missions/Navigation/MassachusettsProjects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: Bay Ridge and Red Hook Channels, New York*. December 8, 2014. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: Buttermilk Channel, New York*. August 12, 2014. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 28, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: Greenport Harbor, New York*. July 14, 2009. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 28, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: Newark Bay, Hackensack & Passaic Rivers, New Jersey; Newark Bay – Main Channel South and Middle Reaches*. May 20, 2015. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: Newark Bay, Hackensack & Passaic Rivers; Port Elizabeth Channel, NJ*. March 12, 2015. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: Newark Bay, Hackensack & Passaic Rivers; Port Newark and Port Newark Pierhead Channels, New Jersey*. April 21, 2015. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 28, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: New York and New Jersey Channels, Perth Amboy, Anchorage, NJ*. February 24, 2015. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) New York District. *Federal Navigation Channels: Controlling Depth Report: Shark River, New Jersey*. February 23, 2015. http://www.nan.usace.army.mil/Missions/Navigation/ControllingDepthReports.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) Philadelphia District. *Federal Navigation Channels: Controlling Depth Report: Christina River, Wilmington Delaware*. January 27, 2015. http://www.nap.usace.army.mil/Missions/CivilWorks/Surveys/Projects.aspx (accessed May 26, 2015).

USACE (U.S. Army Corps of Engineers) Savannah District. *Federal Navigation Channels: Controlling Depth Report: Savannah Harbor, Georgia*. May 19, 2015. http://www.sas.usace.army.mil/About/DivisionsandOffices/OperationsDivision/NavigationBranch/ChannelSurveys.aspx (accessed June 12, 2015).

World Port Source. *USA Ports*. Undated. http://www.worldportsource.com/states.php.

Appendix II

Environmental & Socioeconomic Impacts

Table 1

Summary of Impact Producing Factors Associated with Typical Port Modifications to Support Offshore Wind

	Construction Activity	Sea Bottom/Land Disturbance		Sediment Suspension & Deposition	Noise	Lighting	Discharges			Trash & Debris
		Marine/Estuarine Sediment Disturbance	Soil Disturbance/ Erosion				Dewatering	Stormwater	Accidental Spills	
Access	**Channel Widening/ Deepening**									
	Sediment Dredging	✓		✓	✓	✓	✓		✓	✓
	Rock Dredging	✓		✓	✓				✓	✓
	Blasting	✓		✓	✓				✓	✓
	Air Draft Improvement (Bridges, Utility Lines)									
	Blasting	✓	✓	✓	✓		✓		✓	✓
	Pile Driving/Drilling	✓	✓	✓	✓	✓			✓	✓
	Dredging	✓	✓	✓	✓	✓	✓		✓	✓
	Utility Tower Extensions		✓		✓	✓			✓	✓
	Utility Line Moves		✓						✓	✓
	New Berth Construction									
	Dredging	✓		✓	✓	✓	✓		✓	✓
	Pile Driving/Drilling	✓	✓	✓	✓	✓			✓	✓
	Fill Placement	✓	✓	✓	✓		✓		✓	✓
	Fill Compaction				✓			✓	✓	✓
	Paving		✓		✓			✓	✓	✓
Quayside	**Quayside Length Expansion**									
	Pile Driving/Drilling	✓	✓	✓	✓				✓	✓
	Fill Placement		✓	✓	✓		✓	✓	✓	✓
	Fill Compaction		✓		✓				✓	✓
	Paving		✓		✓			✓	✓	✓
	Quayside Bearing Capacity Improvement									
	Pile Driving/Drilling		✓		✓		✓	✓	✓	✓
	Fill Compaction		✓		✓					✓
	Paving		✓		✓			✓	✓	✓
	Aggregate Dumping	✓		✓	✓				✓	✓
	Quayside Seabed Bearing Capacity Improvement									
	Dredging	✓		✓	✓	✓	✓		✓	✓
	Pile Driving/Drilling	✓		✓	✓				✓	✓
	Aggregate Dumping	✓		✓	✓				✓	✓
Storage	**Haul Road Bearing Capacity Improvement (between quayside and storage area)**									
	Land Clearing		✓		✓			✓	✓	✓
	Fill Placement		✓		✓		✓	✓	✓	✓
	Fill Compaction		✓		✓			✓	✓	✓
	Paving		✓		✓			✓	✓	✓
	Aggregate Dumping	✓		✓	✓				✓	✓
	Storage Area Bearing Capacity Improvement									
	Land Clearing		✓		✓			✓	✓	✓
	Fill Placement		✓		✓		✓	✓	✓	✓
	Fill Compaction		✓		✓			✓	✓	✓
	Paving		✓		✓			✓	✓	✓
	Aggregate Dumping	✓		✓	✓				✓	✓
	Storage Area Size Expansion									
	Land Clearing		✓		✓			✓	✓	✓
	Fill Placement		✓		✓		✓	✓	✓	✓
	Fill Compaction		✓		✓			✓	✓	✓
	Paving		✓		✓			✓	✓	✓
	Construction of storage structure		✓		✓	✓		✓	✓	✓

Table 1

Summary of Impact Producing Factors Associated with Typical Port Modifications to Support Offshore Wind

	Construction Activity	Sea Bottom/Land Disturbance		Sediment Suspension & Deposition	Noise	Lighting	Discharges			Trash & Debris
		Marine/Estuarine Sediment Disturbance	Soil Disturbance/ Erosion				Dewatering	Stormwater	Accidental Spills	
Roll On/Roll Off	**Provide RoRo Capability**									
	Land Clearing		✓		✓			✓	✓	✓
	Fill Placement		✓	✓	✓		✓	✓	✓	✓
	Paving		✓		✓			✓	✓	✓
	RoRo Berth (Width/Air Draft)									
	Land Clearing		✓		✓			✓	✓	✓
	Drilling		✓		✓				✓	✓
	Paving		✓		✓			✓	✓	✓
	RoRo Berth Bearing Capacity Improvement									
	Land Clearing		✓		✓			✓	✓	✓
	Fill Placement		✓	✓	✓		✓		✓	✓
	Fill Compaction		✓		✓				✓	✓
	Paving		✓		✓			✓	✓	✓
	Aggregate Dumping	✓		✓	✓				✓	✓
Cranes	**Provide Fixed Crane**									
	Land Clearing		✓		✓			✓	✓	✓
	Fill Placement		✓	✓	✓		✓	✓	✓	✓
	Fill Compaction		✓		✓			✓	✓	✓
	Paving		✓		✓			✓	✓	✓
	Provide Mobile Crane									
	Land Clearing		✓		✓			✓	✓	✓
	Fill Placement		✓	✓	✓		✓	✓	✓	✓
	Fill Compaction		✓		✓			✓	✓	✓
	Paving		✓		✓			✓	✓	✓
	Reduce Crane Height Restrictions									
	Land Clearing		✓		✓			✓	✓	✓
	Drilling		✓		✓				✓	✓
	Paving		✓		✓			✓	✓	✓
	Utility Tower Extensions		✓						✓	✓
	Utility Line Moves		✓							✓
Transportation Infrastructure	**Modify Rail Line**									
	Land Clearing		✓		✓			✓	✓	✓
	Blasting/Drilling		✓		✓			✓	✓	✓
	Fill Placement		✓	✓	✓	✓	✓	✓	✓	✓
	Fill Compaction		✓		✓	✓		✓	✓	✓
	Modify Road (widen, turning, bearing)									
	Land Clearing		✓		✓			✓	✓	✓
	Blasting/Drilling		✓		✓				✓	✓
	Fill Placement		✓	✓	✓	✓	✓	✓	✓	✓
	Fill Compaction		✓		✓	✓		✓	✓	✓
	Paving		✓		✓	✓		✓	✓	✓

Table 1

Summary of Impact Producing Factors Associated with Typical Port Modifications to Support Offshore Wind

	Construction Activity	Traffic		Air Emissions	Visible Infrastructure	Aquatic Habitat Alteration	Species Injury, Mortality, or Displacement		Space Use Conflicts		Demand for Local Labor, Goods & Services
		Vessels	Vehicles				Aquatic	Terrestrial	Offshore	Onshore	
Access	**Channel Widening/ Deepening**										
	Sediment Dredging	✓		✓		✓	✓		✓		✓
	Rock Dredging	✓		✓		✓	✓		✓		✓
	Blasting	✓		✓		✓	✓		✓		✓
	Air Draft Improvement (Bridges, Utility Lines)										
	Blasting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Pile Driving/Drilling	✓		✓	✓	✓	✓	✓	✓		✓
	Dredging	✓		✓	✓	✓	✓		✓		✓
	Utility Tower Extensions		✓	✓	✓			✓		✓	✓
	Utility Line Moves		✓	✓	✓					✓	✓
	New Berth Construction										
	Dredging	✓		✓	✓	✓	✓		✓		✓
	Pile Driving/Drilling	✓		✓	✓	✓	✓	✓	✓	✓	✓
	Fill Placement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fill Compaction		✓	✓	✓			✓		✓	✓
	Paving		✓	✓	✓			✓		✓	✓
Quayside	**Quayside Length Expansion**										
	Pile Driving/Drilling	✓		✓	✓	✓	✓	✓	✓		✓
	Fill Placement	✓	✓	✓	✓	✓	✓	✓	✓		✓
	Fill Compaction		✓	✓				✓			✓
	Paving		✓	✓	✓			✓		✓	✓
	Quayside Bearing Capacity Improvement										
	Pile Driving/Drilling		✓	✓				✓	✓	✓	✓
	Fill Compaction		✓	✓				✓			✓
	Paving		✓	✓	✓			✓		✓	✓
	Aggregate Dumping	✓		✓		✓	✓		✓		✓
	Quayside Seabed Bearing Capacity Improvement										
	Dredging	✓		✓		✓	✓		✓		✓
	Pile Driving/Drilling	✓		✓	✓	✓	✓		✓		✓
	Aggregate Dumping	✓		✓		✓	✓		✓		✓
Storage	**Haul Road Bearing Capacity Improvement (between qu**										
	Land Clearing		✓	✓				✓		✓	✓
	Fill Placement	✓	✓	✓				✓		✓	✓
	Fill Compaction		✓	✓							✓
	Paving		✓	✓	✓			✓		✓	✓
	Aggregate Dumping	✓		✓		✓	✓		✓		✓
	Storage Area Bearing Capacity Improvement										
	Land Clearing		✓	✓				✓		✓	✓
	Fill Placement	✓		✓				✓		✓	✓
	Fill Compaction		✓	✓							✓
	Paving		✓	✓	✓			✓		✓	✓
	Aggregate Dumping	✓		✓		✓	✓		✓		✓
	Storage Area Size Expansion										
	Land Clearing		✓	✓				✓		✓	✓
	Fill Placement		✓	✓				✓		✓	✓
	Fill Compaction		✓	✓							✓
	Paving		✓	✓	✓			✓		✓	✓
	Construction of storage structure		✓	✓	✓			✓		✓	✓

Table 1

Summary of Impact Producing Factors Associated with Typical Port Modifications to Support Offshore Wind

	Construction Activity	Traffic		Air Emissions	Visible Infrastructure	Aquatic Habitat Alteration	Species Injury, Mortality, or Displacement		Space Use Conflicts		Demand for Local Labor, Goods & Services
		Vessels	Vehicles				Aquatic	Terrestrial	Offshore	Onshore	
Roll On/Roll Off	**Provide RoRo Capability**										
	Land Clearing		✓	✓				✓		✓	✓
	Fill Placement		✓	✓				✓		✓	✓
	Paving		✓	✓	✓			✓		✓	✓
	RoRo Berth (Width/Air Draft)										
	Land Clearing		✓	✓				✓		✓	✓
	Drilling		✓	✓	✓			✓		✓	✓
	Paving		✓	✓						✓	✓
	RoRo Berth Bearing Capacity Improvement										
	Land Clearing		✓	✓				✓		✓	✓
	Fill Placement	✓		✓		✓	✓		✓		✓
	Fill Compaction		✓	✓							✓
	Paving		✓	✓	✓			✓		✓	✓
	Aggregate Dumping	✓		✓		✓	✓		✓		✓
Cranes	**Provide Fixed Crane**										
	Land Clearing		✓	✓	✓			✓		✓	✓
	Fill Placement		✓	✓				✓		✓	✓
	Fill Compaction		✓	✓							✓
	Paving		✓	✓						✓	✓
	Provide Mobile Crane										
	Land Clearing		✓	✓	✓			✓		✓	✓
	Fill Placement		✓	✓				✓		✓	✓
	Fill Compaction		✓	✓							✓
	Paving		✓	✓						✓	✓
	Reduce Crane Height Restrictions										
	Land Clearing		✓	✓				✓		✓	✓
	Drilling		✓	✓	✓			✓		✓	✓
	Paving		✓	✓							✓
	Utility Tower Extensions		✓	✓	✓			✓		✓	✓
	Utility Line Moves		✓	✓	✓					✓	✓
Transportation Infrastructure	**Modify Rail Line**										
	Land Clearing		✓	✓				✓		✓	✓
	Blasting/Drilling		✓	✓	✓			✓		✓	✓
	Fill Placement		✓	✓				✓		✓	✓
	Fill Compaction		✓	✓							✓
	Modify Road (widen, turning, bearing)										
	Land Clearing		✓	✓				✓		✓	✓
	Blasting/Drilling		✓	✓	✓			✓		✓	✓
	Fill Placement			✓				✓		✓	✓
	Fill Compaction		✓	✓						✓	✓
	Paving		✓	✓						✓	✓

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	ACCESS					
Port Modification Activities	Channel Widening/ Deepening		Air Draft Improvement		Construction of New Berths	
Environmental and Socioeconomic Resources Impacted	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation
Benthic	Potential for loss of habitat (coral, seagrass, eelgrass), smothering and crushing of benthic organisms, increased turbidity and reduced water clarity or release of contaminants from contaminated sediments. Signs of recolonization of benthic community can typically be found within 3 months of construction completion. Recolonization to pre-construction levels typically occurs within 3 years of construction completion.	Compensatory mitigation may be required. Create like or functional value habitat (coral, seagrass, eelgrass) off-site; transplanting; mitigation credits; pre-construction, construction and post-construction turbidity monitoring.	Potential for loss of habitat (coral, seagrass, eelgrass), smothering and crushing of benthic organisms, increased turbidity and reduced water clarity or release of contaminants from contaminated sediments. Signs of recolonization of benthic community can typically be found within 3 months of construction completion. Recolonization to pre-construction levels typically occurs within 3 years of construction completion.	Compensatory mitigation may be required. Create like or functional value habitat (coral, seagrass, eelgrass) off-site; transplanting; mitigation credits; pre-construction, construction and post-construction turbidity monitoring.	Potential for loss of habitat (coral, seagrass, eelgrass), smothering and crushing of benthic organisms, increased turbidity and reduced water clarity or release of contaminants from contaminated sediments. Signs of recolonization of benthic community can typically be found within 3 months of construction completion. Recolonization to pre-construction levels typically occurs within 3 years of construction completion.	Compensatory mitigation may be required. Create like or functional value habitat (coral, seagrass, eelgrass) off-site; transplanting; mitigation credits; pre-construction, construction and post-construction turbidity monitoring.
Fish & EFH	Impacts expected to last throughout construction activity. In most cases, habitat will return to pre-construction conditions and fish will return after construction completion. Potential for loss of habitat. Increased turbidity and sedimentation could result in gill clogging in adults and smothering and crushing of eggs/larvae.	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques; turbidity monitoring	Impacts expected to last throughout construction activity. In most cases, habitat will return to pre-construction conditions and fish will return after construction completion. Potential for loss of habitat. Increased turbidity and sedimentation could result in gill clogging in adults and smothering and crushing of eggs/larvae.	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques; turbidity monitoring	Impacts expected to last throughout construction activity. In most cases, habitat will return to pre-construction conditions and fish will return after construction completion. Potential for loss of habitat. Increased turbidity and sedimentation could result in gill clogging in adults and smothering and crushing of eggs/larvae.	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques; turbidity monitoring
Air Quality	Increase in particulate and gaseous emissions from vessels/vehicles throughout construction activity; tugboats would produce most emissions	Use vehicles and vessels meeting appropriate standards and monitor for compliance	Increase in particulate and gaseous emissions from vessels/vehicles throughout construction activity; fugitive dust as a result of earth moving activities; tugboats would produce most emissions	Use vehicles and vessels meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in particulate and gaseous emissions from vessels/vehicles throughout construction activity; fugitive dust as a result of earth moving activities; tugboats would produce most emissions	Use vehicles and vessels meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds
Terrestrial Biota	May effect terrestrial biota as a result of land-side construction for dredge activity accessing site via land.	Use existing roads and developed areas if land access is needed; avoid sensitive habitat areas; compensatory mitigation as required, likely in form of off-site habitat creation or enhancement; restrict hours; use noise abatement techniques	May effect terrestrial biota as a result of land-side construction for dredge activity accessing site via land.	Use existing roads and developed areas if land access is needed; avoid sensitive habitat areas; compensatory mitigation as required, likely in form of off-site habitat creation or enhancement; restrict hours; use noise abatement techniques	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas
Marine Mammals & Sea Turtles	Incidental takes could occur during pile driving, but highly unlikely, as these animals are mobile and could leave area during project; likely to return to area at completion of construction	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques such as slow starts or ramp up; turbidity monitoring	Incidental takes could occur during pile driving, but highly unlikely, as these animals are mobile and could leave area during project; likely to return to area at completion of construction	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques such as slow starts or ramp up; turbidity monitoring	Incidental takes could occur during pile driving, but highly unlikely, as these animals are mobile and could leave area during project; likely to return to area at completion of construction	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques such as slow starts or ramp up; turbidity monitoring

Port Requirement:	QUAYSIDE					
Port Modification Activities	Expanding Length of Quayside		Improving Bearing Capacity of Quayside		Improving Bearing Capacity of Seabed at Quayside	
Environmental and Socioeconomic Resources Impacted	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation
Benthic	Potential for loss of habitat (coral, seagrass, eelgrass), smothering and crushing of benthic organisms, increased turbidity and reduced water clarity or release of contaminants from contaminated sediments. Signs of recolonization of benthic community can typically be found within 3 months of construction completion. Recolonization to pre-construction levels typically occurs within 3 years of construction completion.	Compensatory mitigation may be required. Create like or functional value habitat (coral, seagrass, eelgrass) off-site; transplanting; mitigation credits; pre-construction, construction and post-construction turbidity monitoring.	Potential for loss of habitat (coral, seagrass, eelgrass), smothering and crushing of benthic organisms, increased turbidity and reduced water clarity or release of contaminants from contaminated sediments. Signs of recolonization of benthic community can typically be found within 3 months of construction completion. Recolonization to pre-construction levels typically occurs within 3 years of construction completion.	Compensatory mitigation may be required. Create like or functional value habitat (coral, seagrass, eelgrass) off-site; transplanting; mitigation credits; pre-construction, construction and post-construction turbidity monitoring.	Potential for loss of habitat (coral, seagrass, eelgrass), smothering and crushing of benthic organisms, increased turbidity and reduced water clarity or release of contaminants from contaminated sediments. Signs of recolonization of benthic community can typically be found within 3 months of construction completion. Recolonization to pre-construction levels typically occurs within 3 years of construction completion.	Compensatory mitigation may be required. Create like or functional value habitat (coral, seagrass, eelgrass) off-site; transplanting; mitigation credits; pre-construction, construction and post-construction turbidity monitoring.
Fish & EFH	Displacement expected during construction activity. Fish will return after construction completion.	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques	Displacement expected during construction activity. Fish will return after construction completion.	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques	Impacts expected to last throughout construction activity. In most cases, habitat will return to pre-construction conditions and fish will return after construction completion. Potential for loss of habitat. Increased turbidity and sedimentation could result in gill clogging in adults and smothering and crushing of eggs/larvae.	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques; turbidity monitoring
Air Quality	Increase in particulate and gaseous emissions from vessels/vehicles throughout construction activity; fugitive dust as a result of earth moving activities; tugboats would produce most emissions	Use vehicles and vessels meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vessels/vehicles throughout construction activities; fugitive dust as a result of earth moving activities	Use vehicles and vessels meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in particulate and gaseous emissions from vessels/vehicles throughout construction activity; fugitive dust as a result of earth moving activities; tugboats would produce most emissions	Use vehicles and vessels meeting appropriate standards and monitor for compliance
Terrestrial Biota	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	May effect terrestrial biota as a result of land-side construction for dredge activity accessing site via land.	Use existing roads and developed areas if land access is needed; avoid sensitive habitat areas; compensatory mitigation as required, likely in form of off-site habitat creation or enhancement; restrict hours; use noise abatement techniques
Marine Mammals & Sea Turtles	Incidental takes could occur during pile driving, but highly unlikely, as these animals are mobile and could leave area during project; likely to return to area at completion of construction	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques such as slow starts or ramp up; turbidity monitoring	Incidental takes could occur during pile driving, but highly unlikely, as these animals are mobile and could leave area during project; likely to return to area at completion of construction	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques such as slow starts or ramp up; turbidity monitoring	Incidental takes could occur during pile driving, but highly unlikely, as these animals are mobile and could leave area during project; likely to return to area at completion of construction	TOY Restrictions; segment project to minimize disturbance; use noise abatement techniques such as slow starts or ramp up; turbidity monitoring

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	**ACCESS**					
Port Modification Activities	**Channel Widening/ Deepening**		**Air Draft Improvement**		**Construction of New Berths**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Birds & Bats	Potential to impact birds and bats if toxic chemicals and heavy metals exist in substrate; dredge activities could stir up these contaminants and be ingested and work way through food chain to shorebirds and bats	Pre-dredge survey of substrate to avoid release contaminants into water; monitor pre- and post-construction	Potential to impact birds and bats if toxic chemicals and heavy metals exist in substrate; dredge activities could stir up these contaminants and be ingested and work way through food chain to birds and bats; air draft improvements could result in collisions with birds and bats; new or taller utility towers pose increased collision risk	TOY Restrictions; pre-dredge survey of substrate to avoid release of contaminants into water; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques; use antiperching and utility line marking measures	Potential to impact birds and bats if toxic chemicals and heavy metals exist in substrate; dredge activities could stir up these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of substrate to avoid release of contaminants into water; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques
Water Quality	Impacts expected to last throughout construction activity; expected to return to pre-dredge conditions shortly after completion of construction; potential for suspension of contaminated sediment; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release	Turbidity monitoring often required; compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases	Impacts expected to last throughout construction activity; expected to return to pre-dredge conditions shortly after completion of construction; potential for suspension of contaminated sediment; potential for runoff discharges; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release	Turbidity monitoring often required; compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases	Impacts expected to last throughout construction activity; expected to return to pre-dredge conditions shortly after completion of construction; potential for suspension of contaminated sediment; potential for runoff discharges; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release	Turbidity monitoring often required; compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases
Ocean Currents & Movements	Ocean currents and movements in area could improve as a result of dredging and seafloor alteration; impacts to ocean currents are irreversible; potential or erosion in surrounding areas	Ensure currents and movement are sufficient for bays and semi-enclosed waterbodies to prevent stagnant water; prevent shoreline erosion	Ocean currents and movements in area could improve as a result of dredging and seafloor alteration; impacts to ocean currents are irreversible; potential or erosion in surrounding areas	Ensure currents and movement are sufficient for bays and semi-enclosed waterbodies to prevent stagnant water; prevent shoreline erosion	Ocean currents and movements in area could improve as a result of dredging and seafloor alteration; impacts to ocean currents are irreversible; potential or erosion in surrounding areas	Ensure currents and movement are sufficient for bays and semi-enclosed waterbodies to prevent stagnant water; prevent shoreline erosion
Sediment Deposition	Impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-dredge conditions shortly after completion of construction	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold	Impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-dredge conditions shortly after completion of construction	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold	Impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-dredge conditions shortly after completion of construction	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold
Acoustic Environment	Impacts expected throughout construction activity in immediate vicinity; fish, mammals, turtles, and other mobile animals will leave area until construction activities end. There may be land impacts throughout construction depending on location of port, but not significant if Port is located in industrialized area.	Restrictions on hours of operation; IHA for dredge/blast activities, possible noise abatement techniques	Impacts expected throughout construction activity in immediate vicinity; fish, mammals, turtles, and other mobile animals will leave area until construction activities end. There may be land impacts throughout construction depending on location of port, but not significant if Port is located in industrialized area.	Restriction on hours of operation; IHA for dredge/blast activities, possible noise abatement techniques	Impacts expected throughout construction activity; concerns of in-water noise of pile-driving activities	Use sound abatement techniques for pile-driving activities

Port Requirement:	**QUAYSIDE**					
Port Modification Activities	**Expanding Length of Quayside**		**Improving Bearing Capacity of Quayside**		**Improving Bearing Capacity of Seabed at Quayside**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Birds & Bats	Potential to impact birds and bats if toxic chemicals and heavy metals exist in substrate; dredge activities in water and earth moving activities could stir up or expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of substrate and soil to avoid release of contaminants into water and expose to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques	Potential to impact birds and bats if toxic chemicals and heavy metals exist in substrate; dredge activities could stir up these contaminants and be ingested and work way through food chain to shorebirds and bats	Pre-dredge survey of substrate to avoid release contaminants into water; monitor pre- and post-construction
Water Quality	Impacts expected to last throughout construction activity; expected to return to pre-dredge conditions shortly after completion of construction; potential for suspension of contaminated sediment; potential for runoff discharges; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release	Turbidity monitoring often required; compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Impacts expected to last throughout construction activity; expected to return to pre-dredge conditions shortly after completion of construction; potential for suspension of contaminated sediment; potential for runoff discharges; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release	Turbidity monitoring often required; compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Impacts expected to last throughout construction activity; expected to return to pre-dredge conditions shortly after completion of construction; potential for suspension of contaminated sediment; potential for runoff discharges; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release	Turbidity monitoring often required; compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases
Ocean Currents & Movements	Ocean currents and movements in area could improve as a result of dredging and seafloor alteration; impacts to ocean currents are irreversible; potential or erosion in surrounding areas	Ensure currents and movement are sufficient for bays and semi-enclosed waterbodies to prevent stagnant water; prevent shoreline erosion	Ocean currents and movements in area could improve as a result of dredging and seafloor alteration; impacts to ocean currents are irreversible; potential or erosion in surrounding areas	Ensure currents and movement are sufficient for bays and semi-enclosed waterbodies to prevent stagnant water; prevent shoreline erosion	Ocean currents and movements in area could improve as a result of dredging and seafloor alteration; impacts to ocean currents are irreversible; potential or erosion in surrounding areas	Ensure currents and movement are sufficient for bays and semi-enclosed waterbodies to prevent stagnant water; prevent shoreline erosion
Sediment Deposition	None	None	None	None	Impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-dredge conditions shortly after completion of construction	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold
Acoustic Environment	Impacts expected throughout construction activity in immediate vicinity; fish, mammals, turtles, and other mobile animals will leave area until construction activities end. There may be land impacts throughout construction depending on location of port, but not significant if Port is located in industrialized area.	Restrictions on hours of operation; IHA for dredge/blast activities, possible noise abatement techniques	Impacts expected throughout construction activity in immediate vicinity; fish, mammals, turtles, and other mobile animals will leave area until construction activities end. There may be land impacts throughout construction depending on location of port, but not significant if Port is located in industrialized area.	Restrictions on hours of operation; IHA for dredge/blast activities, possible noise abatement techniques	Impacts expected throughout construction activity in immediate vicinity; fish, mammals, turtles, and other mobile animals will leave area until construction activities end. There may be land impacts throughout construction depending on location of port, but not significant if Port is located in industrialized area.	Restrictions on hours of operation; IHA for dredge/blast activities, possible noise abatement techniques

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	ACCESS					
Port Modification Activities	**Channel Widening/ Deepening**		**Air Draft Improvement**		**Construction of New Berths**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Coastal Habitats	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement
Military Use Areas	Space use conflicts unlikely	Coordination with USCG and military commanders	Space use conflicts unlikely	Coordination with military commanders	Space use conflicts unlikely	Coordination with military commanders
Land Use & Existing Infrastructure	Potential for space use conflicts throughout construction activity; conflicts expected to be resolved at construction completion	Coordination with other USCG and users of waterways	Potential for space use conflicts throughout construction activity; conflicts expected to be resolved at construction completion	Siting of expansion areas to minimize displacements; coordination with other USCG and users of waterways	Potential for space use conflicts throughout construction activity; conflicts expected to be resolved at construction completion	Siting of expansion areas to minimize displacements; coordination with other USCG and users of waterways
Transportation (terrestrial)	Associated land-side activity could disrupt some vehicle traffic and transportation in area during portions of construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings	Associated land-side activity could disrupt some vehicle traffic and transportation in area during portions of construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings	Associated land-side activity could disrupt some vehicle traffic and transportation in area during portions of construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings
Cultural & Historical	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act
Visual	Visual disturbance limited to presence of construction vessels during construction activity; No permanent changes to visual setting unless visible coastal habitats are removed.	None	Potential changes in visual setting resulting from elevated structures; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting; plantings	Potential changes in visual setting resulting from expanded berth areas; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting; plantings
Environmental Justice*	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.
Commercial Fishing	Potential to impact day-to-day fishing operations or vessel transits during portion construction activity if port is home to commercial fishing fleet	Segment project to minimize disturbance of fishing; time construction with off-season if possible; coordinate with USCG and local waterways users	Potential to impact day-to-day fishing operations or vessel transits during portion construction activity if port is home to commercial fishing fleet	Segment project to minimize disturbance of fishing; time construction with off-season if possible; coordinate with USCG and local waterways users	Potential to impact day-to-day fishing operations or vessel transits during portion construction activity if port is home to commercial fishing fleet	Segment project to minimize disturbance of fishing; time construction with off-season if possible; coordinate with USCG and local waterways users

Port Requirement:	QUAYSIDE					
Port Modification Activities	**Expanding Length of Quayside**		**Improving Bearing Capacity of Quayside**		**Improving Bearing Capacity of Seabed at Quayside**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Coastal Habitats	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement
Military Use Areas	Space use conflicts unlikely	Coordination with military commanders	None	None	None	None
Land Use & Existing Infrastructure	Potential for space use conflicts throughout construction activity; conflicts expected to be resolved at construction completion	Siting of expansion areas to minimize displacements; coordination with other USCG and users of waterways	Space use conflicts unlikely	None	Space use conflicts unlikely	None
Transportation (terrestrial)	Associated land-side activity could disrupt some vehicle traffic and transportation within port facility during portions of construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings	Associated land-side activity could disrupt some vehicle traffic and transportation within port facility during portions of construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings	None	None
Cultural & Historical	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act
Visual	Potential changes in visual setting resulting from expanded berth areas; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting; plantings	Visual disturbance limited to presence of construction equipment during construction activity; No permanent changes to visual setting.	None	Visual disturbance limited to presence of construction equipment during construction activity; No permanent changes to visual setting.	None
Environmental Justice*	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.	None	None	None	None
Commercial Fishing	Potential to impact day-to-day fishing operations or vessel transits during portion construction activity if port is home to commercial fishing fleet	Segment project to minimize disturbance of fishing; time construction with off-season if possible; coordinate with USCG and local waterways users	None	None	None	None

Table 2

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	ACCESS						QUAYSIDE					
Port Modification Activities	Channel Widening/ Deepening		Air Draft Improvement		Construction of New Berths		Expanding Length of Quayside		Improving Bearing Capacity of Quayside		Improving Bearing Capacity of Seabed at Quayside	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Tourism & Recreation	Potential for impacts to cruise ships or tourist activities during construction if port is home to cruise ships or near tourist areas; dredging could improve tourism and recreation to areas previously inaccessible by cruise ships	Time construction with off-season; segment project; coordinate with USCG and local waterway users	Potential for impacts to cruise ships or tourist activities during construction if port is home to cruise ships or near tourist areas; increased air draft could improve tourism and recreation to areas previously inaccessible by cruise ships	Time construction with off-season; segment project; coordinate with FAA, USCG, and local waterway users	Potential for impacts to cruise ships or tourist activities during construction if port is home to cruise ships or near tourist areas; new berths could be used cruise ships when not used for offshore wind or other uses.	Time construction with off-season; segment project; coordinate with USCG and local waterway users	Potential for impacts to cruise ships or tourist activities during construction if port is home to cruise ships or near tourist areas; expanded quayside could be used cruise ships when not used for offshore wind or other uses.	Time construction with off-season; segment project; coordinate with USCG and local waterway users	None	None	None	None
Navigation	May impact vessel traffic in immediate vicinity during construction activity; vessel schedules may need to be adjusted; likely to positively impact navigation by improving channels	Coordinate with USCG and local waterway uses; coordinate project schedule to minimize disturbance and conflict; time construction with off-season if possible; use of appropriate lighting, signals and markings	May impact vessel traffic in immediate vicinity during construction activity; vessel schedules may need to be adjusted; likely to positively impact navigation by improving channels	Coordinate with USCG and local waterway uses; coordinate project schedule to minimize disturbance and conflict; time construction with off-season if possible; use of appropriate lighting, signals and markings	May disrupt vessel traffic in immediate vicinity throughout construction activity; likely to positively impact navigation by providing new berth areas for use by ships	Coordinate with USCG and local waterway uses; coordinate project schedule to minimize disturbance and conflict; time construction with off-season if possible; use of appropriate lighting, signals and markings	May disrupt vessel traffic in immediate vicinity throughout construction activity; likely to positively impact navigation by providing new berth areas for use by ships	Coordinate with USCG and local waterway uses; coordinate project schedule to minimize disturbance and conflict; time construction with off-season if possible; use of appropriate lighting, signals and markings	May impact vessel traffic in immediate vicinity during construction activity; vessel port call schedules may need to be adjusted	Coordinate with USCG and local waterway uses; coordinate project schedule to minimize disturbance and conflict; time construction with off-season if possible; use of appropriate lighting, signals and markings	May impact vessel traffic in immediate vicinity during construction activity; vessel port call schedules may need to be adjusted	Coordinate with USCG and local waterway uses; coordinate project schedule to minimize disturbance and conflict; time construction with off-season if possible; use of appropriate lighting, signals and markings
Socioeconomic Resources	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None
Job Creation	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None

***Potential impacts only if high and adverse human health or environmental effects remain after mitigation and depending on demographics of affected area.**

Table 2

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	STORAGE						ROLL ON / ROLL OFF CAPABILITIES					
Port Modification Activities	Improving bearing capacity of haul road (between quayside and storage area)		Increasing the bearing capacity of storage areas		Increasing the size of the storage area		Provide Ro Ro Capability		Increase Width and Headroom of Ro Ro Berth		Ro Ro Berth Bearing Capacity Improvement	
Environmental and Socioeconomic Resources Impacted	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation
Benthic	None	None	None	None	None	None	None	None	None	None	None	None
Fish & EFH	None	None	None	None	None	None	None	None	None	None	None	None
Air Quality	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds
Terrestrial Biota	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas
Marine Mammals & Sea Turtles	None	None	None	None	None	None	None	None	None	None	None	None

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	**STORAGE**						**ROLL ON / ROLL OFF CAPABILITIES**					
Port Modification Activities	**Improving bearing capacity of haul road (between quayside and storage area)**		**Increasing the bearing capacity of storage areas**		**Increasing the size of the storage area**		**Provide Ro Ro Capability**		**Increase Width and Headroom of Ro Ro Berth**		**Ro Ro Berth Bearing Capacity Improvement**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Birds & Bats	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques; use antiperching and utility line marking measures	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques
Water Quality	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges as a result of land clearing and fill placement	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges as a result of land clearing	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges as a result of land clearing and fill placement	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls
Ocean Currents & Movements	None	None	None	None	None	None	None	None	None	None	None	None
Sediment Deposition	None	None	None	None	None	None	Potential impacts as a result of fill placement; impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-construction conditions shortly after project completion	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold	None	None	Potential impacts as a result of fill placement; impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-construction conditions shortly after project completion	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold
Acoustic Environment	Impacts expected throughout construction activity in immediate vicinity; mobile animals will leave area until completion of construction. Not significant if Port is located in industrialized area	Restrictions on hours of operation	Impacts expected throughout construction activity in immediate vicinity; mobile animals will leave area until completion of construction. Not significant if Port is located in industrialized area	Restrictions on hours of operation	Impacts expected throughout construction activity in immediate vicinity; mobile animals will leave area until completion of construction. Not significant if Port is located in industrialized area	Restrictions on hours of operation	Impacts expected throughout construction activity in immediate vicinity. Not significant if Port is located in industrialized area	None	Impacts expected throughout construction activity in immediate vicinity. Not significant if Port is located in industrialized area	Restrictions on hours of operation	Impacts expected throughout construction activity in immediate vicinity. Not significant if Port is located in industrialized area	Restrictions on hours of operation

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	**STORAGE**						**ROLL ON / ROLL OFF CAPABILITIES**					
Port Modification Activities	**Improving bearing capacity of haul road (between quayside and storage area)**		**Increasing the bearing capacity of storage areas**		**Increasing the size of the storage area**		**Provide Ro Ro Capability**		**Increase Width and Headroom of Ro Ro Berth**		**Ro Ro Berth Bearing Capacity Improvement**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Coastal Habitats	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement
Military Use Areas	None	None	None	None	None	None	None	None	None	None	None	None
Land Use & Existing Infrastructure	Space use conflicts unlikely	None	Space use conflicts unlikely	None	Space use conflicts unlikely	None	Space use conflicts unlikely	None	Space use conflicts unlikely	None	Space use conflicts unlikely	None
Transportation (terrestrial)	Associated land-side activity could disrupt some vehicle traffic and transportation within port facility during portions of construction activity.	Traffic management plan; restrictions on hours of construction, selection of routes, widening of road segments/crossings	May disrupt vehicle transportation in immediate vicinity during construction activity.	Restrictions on hours of construction selection of routes, widening of road segments/crossings	May disrupt vehicle transportation in immediate vicinity during construction activity.	Restrictions on hours of construction selection of routes, widening of road segments/crossings	May disrupt vehicle transportation in immediate vicinity during construction activity.	Restrictions on hours of construction selection of routes, widening of road segments/crossings	May disrupt vehicle transportation in immediate vicinity during construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings	May disrupt vehicle transportation in immediate vicinity during construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings
Cultural & Historical	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act
Visual	Visual disturbance limited to presence of construction equipment during construction activity; No permanent changes to visual setting.	None	Visual disturbance limited to presence of construction equipment during construction activity; No permanent changes to visual setting.	None	Potential changes in visual setting resulting from expanded storage areas/new buildings; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting; plantings	Visual disturbance limited to presence of construction equipment during construction activity; No permanent changes to visual setting.	None	Visual disturbance limited to presence of construction equipment during construction activity; No permanent changes to visual setting.	None	Visual disturbance limited to presence of construction equipment during construction activity; No permanent changes to visual setting.	None
Environmental Justice*	None	None	None	None	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.	None	None	None	None	None	None
Commercial Fishing	None	None	None	None	None	None	None	None	None	None	None	None

Table 2

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	STORAGE						ROLL ON / ROLL OFF CAPABILITIES					
Port Modification Activities	Improving bearing capacity of haul road (between quayside and storage area)		Increasing the bearing capacity of storage areas		Increasing the size of the storage area		Provide Ro Ro Capability		Increase Width and Headroom of Ro Ro Berth		Ro Ro Berth Bearing Capacity Improvement	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Tourism & Recreation	None	None	None	None	None	None	None	None	None	None	None	None
Navigation	None	None	None	None	None	None	None	None	None	None	None	None
Socioeconomic Resources	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None
Job Creation	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None

***Potential impacts only if hi**

Table 2

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	CRANES						TRANSPORTATION INFRASTRUCTURE			
Port Modification Activities	Provide Fixed Crane		Provide Mobile Crane		Reduce Crane Height Restrictions		Modify Rail Line		Modify Road (widen, turning, bearing capacity)	
Environmental and Socioeconomic Resources Impacted	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation	Description of Impacts	Mitigation
Benthic	None	None	None	None	None	None	None	None	None	None
Fish & EFH	None	None	None	None	None	None	None	None	None	None
Air Quality	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds	Increase in emissions from vehicles throughout construction activity; fugitive dust as a result of earth moving activities	Use vehicles meeting appropriate standards and monitor for compliance; watering of site and implementation of a dust control plan; use soil stabilizers; cover truck loads and disturbed areas; halt activities in high winds
Terrestrial Biota	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas	Potential for reduction or loss of terrestrial habitat through land clearing, compaction, or paving; displacement of terrestrial biota throughout construction with potential for permanent displacement with loss of habitat	Restrict hours; use noise abatement techniques compensatory as required, through on- or off-site habitat creation or enhancement; avoid sensitive habitat areas
Marine Mammals & Sea Turtles	None	None	None	None	None	None	None	None	None	None

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	CRANES						TRANSPORTATION INFRASTRUCTURE			
Port Modification Activities	**Provide Fixed Crane**		**Provide Mobile Crane**		**Reduce Crane Height Restrictions**		**Modify Rail Line**		**Modify Road (widen, turning, bearing capacity)**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Birds & Bats	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat; new cranes and crane construction could result in increased collision risk	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques; use marking measures to avoid collisions	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat; new cranes and crane construction could result in increased collision risk	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques; use marking measures to avoid collisions	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat; new cranes and crane construction could result in increased collision risk	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques; use antiperching and utility line marking measures	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques	Potential to impact birds and bats if toxic chemicals and heavy metals exist in soil; earth moving activities could expose these contaminants and be ingested and work way through food chain to birds and bats; destruction or loss of habitat	TOY Restrictions; pre-construction survey of soil to avoid exposure to air; segment project to minimize disturbance; monitor pre- and post-construction; use noise abatement techniques
Water Quality	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges as a result of land clearing and fill placement	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges as a result of land clearing and fill placement	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential for runoff discharges as a result of land clearing and fill placement	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Potential for pollution and emissions from construction vehicles; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential runoff discharges as a result of land clearing and fill placement	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls	Potential for pollution and emissions from construction vehicles; vessels or diesel generators or machinery requiring lubricants/chemicals may result in accidental spill or release; potential runoff discharges as a result of land clearing and fill placement	Compliance with all permits and plans; BMPs to reduce risk of spills; plans in place to handle accidental spills or releases; erosion and sedimentation controls
Ocean Currents & Movements	None	None	None	None	None	None	None	None	None	None
Sediment Deposition	Potential impacts as a result of fill placement; impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-construction conditions shortly after project completion	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold	Potential impacts as a result of fill placement; impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-construction conditions shortly after project completion	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold	None	None	Potential impacts as a result of fill placement; impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-construction conditions shortly after project completion	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold	Potential impacts as a result of fill placement; impacts expected to last throughout construction activity; sediment suspension and deposition levels expected to return to pre-construction conditions shortly after project completion	Monitoring of sediment suspension and deposition throughout construction to ensure does not exceed specified allowable threshold
Acoustic Environment	Impacts expected throughout construction activity. Increase in crane size and number would result in more noise	None	Impacts expected throughout construction activity. Increase in crane size and number would result in more noise	None	Impacts expected throughout construction activity. Not significant if Port is located in industrialized area	Restrictions on hours of operation	Impacts expected throughout construction activity. Not significant if Port is located in industrialized area	Restrictions on hours of operation	Impacts expected throughout construction activity. Not significant if Port is located in industrialized area	Restrictions on hours of operation

Table 2

Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	CRANES						TRANSPORTATION INFRASTRUCTURE			
Port Modification Activities	**Provide Fixed Crane**		**Provide Mobile Crane**		**Reduce Crane Height Restrictions**		**Modify Rail Line**		**Modify Road (widen, turning, bearing capacity)**	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Coastal Habitats	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	None	None	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement	Potential for reduction or loss of coastal habitat (mangrove forests or wetlands) if area previously undeveloped; possible loss or reduction in nesting, roosting and foraging habitat for birds and bats; possible loss or reduction in nesting habitat for sea turtles	Compensatory mitigation such as mitigation credits or on- or off-site habitat (wetland or mangrove) enhancement, restoration, and preservation for wetlands destroyed/altered or fill placement
Military Use Areas	Space use conflicts unlikely	Coordination with FAA and military commanders	Space use conflicts unlikely	Coordination with FAA and military commanders	Space use conflicts unlikely	Coordination with FAA and military commanders	None	None	None	None
Land Use & Existing Infrastructure	Space use conflicts unlikely	None	None	None	None	None	Space use conflicts unlikely	None	Potential space use conflicts	Siting of expansion areas to minimize displacements; Local coordination to minimize business and utilities disruption.
Transportation (terrestrial)	May disrupt vehicle transportation in immediate vicinity during construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings	None	None	May disrupt vehicle transportation in immediate vicinity during construction activity.	Restrictions on hours of construction, selection of routes, widening of road segments/crossings	May disrupt vehicle transportation in immediate vicinity; potential to reduce vehicular traffic congestion after construction completion	Restrictions on hours of construction selection of routes, widening of road segments/crossings	May disrupt vehicle transportation in immediate vicinity; potential to reduce vehicular traffic congestion after construction completion	Restrictions on hours of construction selection of routes, widening of road segments/crossings
Cultural & Historical	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	None	None	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act	Depends on port and whether there are historic properties identified within the Area of Potential Effects	Adverse effects on historic properties are resolved through consultation with SHPO(s) and interested parties under Section 106 of the National Historic Preservation Act
Visual	Potential changes in visual setting resulting from new fixed cranes; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting; plantings	Potential changes in visual setting resulting from new mobile cranes; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting; plantings	Potential changes in visual setting resulting from taller cranes; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting	None	None	Potential changes in visual setting resulting from new roads; Level of impact depends on surrounding visual setting.	Site and design management; controlled lighting; plantings
Environmental Justice*	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.	None	None	None	None	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.	Determine impacts on a case-by-case basis.	Develop mitigation on a case-by-case basis.
Commercial Fishing	None	None	None	None	None	None	Potential positive impacts on ability to transport landed catch by rail.	None	Potential positive impacts on ability to transport landed catch by truck.	None

Table 2

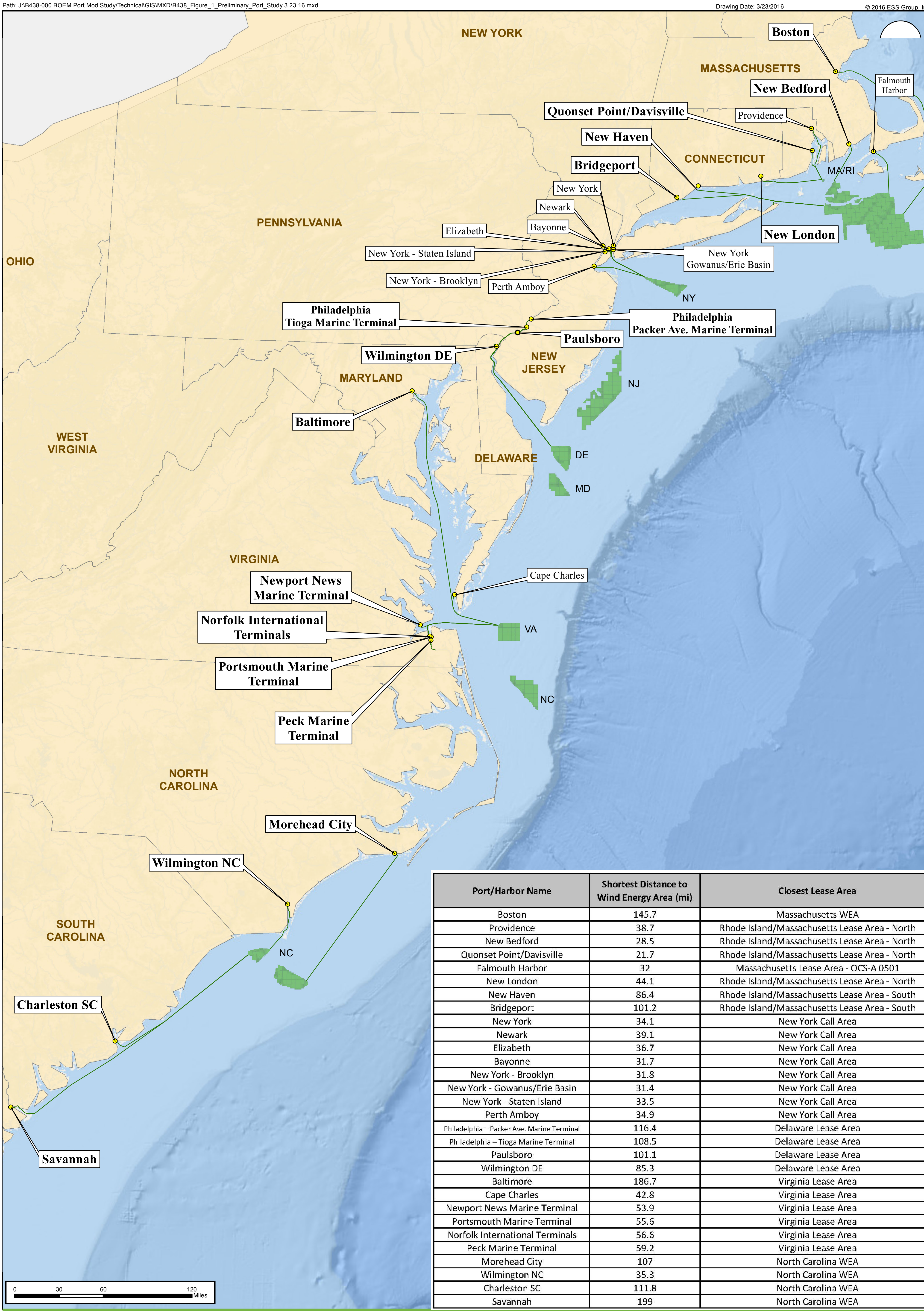
Potential Environmental and Socioeconomic Impacts, Mitigation Measures Associated with Typical Port Modifications to Support Offshore Wind

Port Requirement:	CRANES					
Port Modification Activities	Provide Fixed Crane		Provide Mobile Crane		Reduce Crane Height Restrictions	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Tourism & Recreation	None	None	None	None	None	None
Navigation	None	None	None	None	None	None
Socioeconomic Resources	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None
Job Creation	Determine impacts on a case-by-case basis.	None	None	None	Determine impacts on a case-by-case basis.	None

Port Requirement:	TRANSPORTATION INFRASTRUCTURE			
Port Modification Activities	Modify Rail Line		Modify Road (widen, turning, bearing capacity)	
Environmental and Socioeconomic Resources Impacted	**Description of Impacts**	**Mitigation**	**Description of Impacts**	**Mitigation**
Tourism & Recreation	None	None	Potential positive impacts on ability to transport people and materials to the port facility.	None
Navigation	None	None	None	None
Socioeconomic Resources	Potential for socioeconomic impacts in ports located in smaller communities	None	Potential for socioeconomic impacts in ports located in smaller communities	None
Job Creation	Determine impacts on a case-by-case basis.	None	Determine impacts on a case-by-case basis.	None

***Potential impacts only if hi**

Appendix III
Environmental & Socioeconomic Port Profiles



Port/Harbor Name	Shortest Distance to Wind Energy Area (mi)	Closest Lease Area
Boston	145.7	Massachusetts WEA
Providence	38.7	Rhode Island/Massachusetts Lease Area - North
New Bedford	28.5	Rhode Island/Massachusetts Lease Area - North
Quonset Point/Davisville	21.7	Rhode Island/Massachusetts Lease Area - North
Falmouth Harbor	32	Massachusetts Lease Area - OCS-A 0501
New London	44.1	Rhode Island/Massachusetts Lease Area - North
New Haven	86.4	Rhode Island/Massachusetts Lease Area - South
Bridgeport	101.2	Rhode Island/Massachusetts Lease Area - South
New York	34.1	New York Call Area
Newark	39.1	New York Call Area
Elizabeth	36.7	New York Call Area
Bayonne	31.7	New York Call Area
New York - Brooklyn	31.8	New York Call Area
New York - Gowanus/Erie Basin	31.4	New York Call Area
New York - Staten Island	33.5	New York Call Area
Perth Amboy	34.9	New York Call Area
Philadelphia – Packer Ave. Marine Terminal	116.4	Delaware Lease Area
Philadelphia – Tioga Marine Terminal	108.5	Delaware Lease Area
Paulsboro	101.1	Delaware Lease Area
Wilmington DE	85.3	Delaware Lease Area
Baltimore	186.7	Virginia Lease Area
Cape Charles	42.8	Virginia Lease Area
Newport News Marine Terminal	53.9	Virginia Lease Area
Portsmouth Marine Terminal	55.6	Virginia Lease Area
Norfolk International Terminals	56.6	Virginia Lease Area
Peck Marine Terminal	59.2	Virginia Lease Area
Morehead City	107	North Carolina WEA
Wilmington NC	35.3	North Carolina WEA
Charleston SC	111.8	North Carolina WEA
Savannah	199	North Carolina WEA

ess group
environmental consulting & engineering services

BOEM - The Identification of Port Modifications & the Environmental & Socioeconomic Consequences

Task Order No. M15PD00001

1 inch = 60 miles

Source: 1) BOEM, Wind Planning Areas, Feb. 2016
2) ESRI/NOAA, Online Basemap

Legend

- Port/Harbor
- Approximate Shortest Distance Line
- Wind Energy Area/ Call Area
- States

Overview

Figure 1

Introduction to Port Profiles

Currently, very few ports exist on the Atlantic coast that are capable of fully supporting an offshore wind energy project; however, port modifications are already being implemented or planned in some locations to accommodate wind energy facility construction and operations. Sixteen ports were selected to profile based on the ESS Team's knowledge of East Coast ports and their potential to accommodate offshore wind development. These ports were determined to have medium or high potential to support construction and staging activities, as well as Operation & Maintenance (O&M) activities, based on publically available data, as described below. It is important to note that even if a port was not selected for profiling, it could still be considered a candidate to support offshore wind in the future. Port operators and owners are encouraged to provide updated information about their capabilities via the U.S. Department of Energy Port Readiness Assessment Tool, available at www.offshorewindportreadiness.com.

The port profiles summarize the main characteristics with respect to their capacity to accommodate offshore wind energy development. They provide abbreviated descriptions of the existing physical, environmental, and socioeconomic conditions at each port and its surrounding areas. To the extent possible, the profiles highlight environmental and socioeconomic resources that could potentially be impacted by future port modifications associated with wind energy development. Should port modifications at a specific port included in this study be proposed, a more thorough and detailed environmental assessment will need to be conducted.

Due to the limited scope of this study, the description of the existing environmental and socioeconomic conditions at each port is intended to provide a general indication of areas potentially impacted. The geographic area of interest around each port is not necessarily the same for each environmental and socioeconomic aspect of the port described. In general, the geographic area of interest described was the following:

- Immediate vicinity of the port and access channel for most environmental resources, land use, transportation, cultural and historic resources, and visual resources;
- Metropolitan Statistical Areas, County or City for socioeconomic and environmental justice resources, recreational fishing communities, and tourism and recreation;
- Port area and surrounding fishing communities for commercial fishing; and
- Vessel traffic to and from the port for navigation.

The information gathered for each of the port profiles was drawn from publically available information. The data sources used in the description of the current characteristics were selected to provide a brief overview of current conditions and often of selected aspects, but greater detail should be considered in programmatic or project specific environmental review documents. In some cases, the available information was limited or conflicted with other data sources. Where they existed, data gaps were identified. For example, most ports do not know the bearing capacity of their quaysides or if their quayside seabed is suitable for jacking because their normal port operations do not require this capability. As a result, these data were generally hard to find and were not always available. This information may be acquired in the future with specific data requests or geotechnical studies at a port. It is important to note that the information contained in each profile was obtained in the second half of 2015 and may change with the passage of time. Each port profile includes a date in the footer to provide future readers with the context of when the profile was prepared.

The profiles were developed using a standardized template containing the following sections:

- Port Overview
- Port Classifications – Existing Capabilities
- Potential Modifications Necessary to Support Offshore Wind
- Impact Producing Factors
- Description of Existing Environmental & Socioeconomic Conditions
- Anticipated Impacts
- Data Sources & Additional Information

A brief description of each section is provided below, as well as the methodology used to gather the pertinent information. Further clarifications on specific sections are also included.

Port Overview

This section provides a general description of the port, including the geographic location, identification of available terminals, port governance, primary uses, land area, port employment (where available), and distance to closest wind energy area. In instances where there are multiple terminals identified within a port, the terminal with the greatest potential to support offshore wind is identified and described.

Port Classifications - Existing Capabilities

This section summarizes key criteria determined to be important in characterizing ports for their readiness (at present) in supporting activities associated with offshore wind energy facility construction. This information was not readily or publically available for every criterion or for every port. A "U" was used to indicate that the information was either unknown or unavailable. "N/A" was used to indicate that a criterion was not applicable. A threshold was determined for each category based on the requirements to support staging of a project utilizing 8 MW wind turbines (e.g., Port Access Channel Width threshold of 30 m) (Table 1). The 8 MW wind turbine scenario was chosen because it is expected to become the standard in the future. It is important to note that each requirement may not represent the best solution for a specific project; it is intended to provide guidance in the planning process.

Table 1. Port Classification Key Criteria and Thresholds for 8 MW Projects

Capability Area	Criteria (units)	
Potential Use	Staging Port	✓
	Operation & Maintenance (O&M) Port	✓
Access	Port Access Channel Width (m)	30
	Port Access Water Depths (m)	8.1
	Overhead Draft (m)	75
	Number of Berths	1
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	17
	Quayside Length (m)	170
	Quayside Seabed Suitable for Jacking	Yes

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	10
	Storage Area Bearing Capacity (t/m^2)	10
	Size of Storage Area (m^2)	25,000
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	No
	Width of Ro-Ro Berth (m)	8
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	10
Cranes	On-site Cranes' Capabilities (t)	600
	Crane Height Restrictions (m)	50
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	No

U = Unknown

Ports were classified as construction and staging ports ("Staging Port") or as both staging ports and operation and maintenance ports ("O&M Port"). For the port profiles, the focus was primarily on ports that were suitable for construction and staging activities, assuming that such ports would have marine facilities around them suitable for some O&M activities. However, routine O&M activities may be supported by smaller, less well-equipped ports and would likely require fewer potential port modifications. Location relative to the nearest wind energy area will likely be the key factor in the ability of smaller ports to support O&M activities.

Overhead draft was determined by identifying the lowest height of an overhead structure, such as a bridge or overhead power cables, which could limit the passage of a vessel with turbine components traveling between the open ocean and the port. The overhead draft restriction determined for an 8 MW wind turbine scenario is 75 m. This height is based on the size of the jacket structure used in the 8 MW scenario. While it may not always be realistic or feasible (technically or economically) to raise a highway, railroad bridge, or power lines, "improve overhead draft to 75 m" was included as a potential port modification since there is precedent for raising a bridge to accommodate expected larger vessels size at port (e.g., the ongoing project to raise the Bayonne Bridge from 151 feet of clearance to 215 of clearance to accommodate post-Panamax vessels). This is more likely to be considered an option, if coupled with a bigger project (e.g., replacement of an aging bridge). Modifying a highway or railroad bridge would have additional financial, environmental, and socioeconomic benefits and impacts associated with it that would need to be studied and assessed if that modification was deemed to be necessary for a specific port, either to support the offshore wind energy industry or for some other purpose.

The crane capability of a port was evaluated with two criteria: on-site crane capability, which identifies whether the port has existing on-site crane capabilities and is expressed as the lifting capacity (in tons) that the crane(s) can handle at a port and as crane height restrictions, which defines any height restrictions, if present. If on-site cranes are not present at a port, the value of the on-site crane capability criteria was "No." Crane height restrictions (due to nearby aviation activity, bridges, etc.) were identified regardless of whether the port had an on-site crane due to the fact that a port could utilize mobile cranes on a project-specific, as-needed basis.

The transportation capability of a port was determined based on the presence of on-site transportation facilities. For the purposes of the port profiles, rail transportation means rail service that is capable of transporting goods, including offshore wind energy project components. It does not include commuter rails and subways used for transporting people. For a port to be classified as having rail transportation, the rail has to be located within the port and accessible to vessels without the use of a truck or additional transportation. Ports with railroad transportation have direct rail access or on-dock rails typically supported by cranes. If the port does not have direct rail access at the port, it is not considered to have rail access or rail transportation. Highway access was determined if a port was within a couple miles of a major highway via major roads and not residential, small streets.

Potential Port Modifications

For each port, the existing capabilities for each criteria were compared to the criteria thresholds identified in Table 1. If a capability of the port did not meet the threshold for a category, it was included in the potential port modification table (refer to Table 2 for an example). Where information was unknown, we included it as a potential port modification in the profile as well. To differentiate between known potential port modifications and assumed potential port modifications, we italicized the assumed construction activities. This is denoted in the profile with "Modifications shown in italics are a*ssumed to be required based on port classifications.*" The specific criteria needed to reach the threshold within each capability area are identified beneath the table as well.

Table 2. Port Modifications Necessary to Support Offshore Wind

Potential Port Modifications	Construction Activity					
	Dredging	Pile Driving/ Drilling	Land Clearing	Fill Placement	Fill Compaction	Paving
Channel Access	●	●				
Quayside Improvements	●	●		●	●	
Storage Capacity			●	●	●	●
Ro-Ro Capability[a]		●	●	●	●	●
Cranes[b]			●	●	●	●

Modifications shown in *italics* are assumed to be required based on port classifications

[a] Provide Ro-Ro Capability; improve Ro-Ro Berth Width to 8 m; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m²

[b] *Provide On-Site Cranes with 600 t lifting capability*

The Port Modifications table in each profile also identifies the construction activities likely to be necessary to achieve the threshold indicated for a specific port. This table is based off of the port-specific Existing Capabilities table. The activities associated with achieving each threshold capabilities (identified in Table 1 and described in detail in the Port Characteristics deliverable), include sediment dredging, rock blasting, land clearing, pile driving, drilling, fill placement, compaction, and paving.

Impact Producing Factors

The activities identified as necessary to achieve the criteria threshold will generate impact producing factors (stressors) that in turn have a measured impact on environmental and socioeconomic resources (receptors) in the area of the port. Impact producing factors associated with the activities identified in Table 2 are expected to include the following:

- Seafloor/land disturbance;
- Sediment suspension/deposition;
- Noise;
- Lighting;
- Discharges (dewatering, stormwater, accidental spills);
- Trash/debris;
- Vessel and vehicular traffic;
- Air emissions;
- Visible infrastructure;
- Species injury, mortality, or displacement;
- Offshore/onshore space use conflicts; and
- Increased demand for local labor and services.

Description of Existing Environmental & Socioeconomic Conditions

The existing environmental and socioeconomic conditions for each port are described in this section of the port profile. To provide consistency, where possible, sources were identified that provided information on a specific resource for each of the ports. Additionally, port-specific sources were used to provide further description and detail. For more detailed information on references, see citations throughout the tables and the list of the data sources found at the end of each profile. Table 3 provides the source of the data for each environmental and socioeconomic resource category, as well as a brief description of how and/or where the information was gathered for each resource. Where a consistent source(s) was unavailable for a resource, or special considerations were made, we have noted this in the table below. All sources used and obtained are publically available.

The geographic area of interest around each port is not necessarily the same for each environmental and socioeconomic resource described. While the geographic extent of the environmental resources is often more easily defined by the physical land and water resources surrounding the port, the geographic extent of the socioeconomic resources can be more complicated and is discussed below.

Table 3. Description and Source of Environmental and Socioeconomic Resource Data Gathered

Resource	Description of Existing Conditions
Benthic	Consistent source unavailable or unknown. Port- and location-specific sources used where available. Information on benthic communities typically found in Environmental Assessments (EA) /Environmental Impact Statements (EIS) /Environmental Impact Reports (EIR) for projects (typically dredging projects) proposed or done within the vicinity of the port. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.

Resource	Description of Existing Conditions
Fish & EFH	National Oceanic and Atmospheric Administration (NOAA) Essential Fish Habitat (EFH) Mapper was used identify EFH in waters surrounding the ports: http://www.bls.gov/lau/ . Port- and location-specific sources were also used to provide further detailed information on fish and EFH habitat. If applicable, anadromous species were identified for ports along rivers. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Air Quality	Air quality classifications were identified using U.S. Environmental Protection Agency's (EPA) National Ambient Air Quality Standards (NAAQS) (http://www3.epa.gov/ttn/naaqs/criteria.html). Identified whether an Air Quality Control Region (AQCR) was in attainment or non-attainment of the NAAQS for any or all of the criteria pollutants. Geographic region: air quality control region, which includes several towns/cities/counties in an area.
Terrestrial Biota	Terrestrial biota information for ports in Massachusetts through Virginia was gathered using The Nature Conservancy's Northeast Habitat Map http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8 A consistent source for ports located south of Virginia was not available or known. Port- and location-specific sources were used, where available. Geographic region: immediate vicinity of the port and adjacent properties and communities and/or habitats.
Marine Mammals & Sea Turtles	U.S. Fish and Wildlife Service (USFWS) (http://www.fws.gov/endangered/) was consulted to identify sea turtles in the area and NOAA (http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals) was consulted to identify marine mammals in the area. Geographic region: surrounding waterbodies and extending to larger geographic areas of the Atlantic Ocean given transient lifestyle of these animals.
Birds & Bats	USFWS (http://www.fws.gov/endangered/) was consulted to identify birds and bats in the area. Geographic region: immediate vicinity of the port and extending to larger geographic areas such as surrounding water bodies and the port's county given the transient lifestyle of these animals.
Water Quality	Water quality was addressed by identifying impaired waters. Impaired waters were identified using U.S. EPA's National Summary of Impaired Waters and Total Maximum Daily Load (TMDL) Information (http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state). If a waterbody was designated as impaired, the state's most current integrated water quality report was consulted for further information. An explanation of the water quality classification was provided for impaired waters as well. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Currents & Tides	Tidal range and currents identified using NOAA Tidal Bench Mark Data Sheets (https://tidesandcurrents.noaa.gov/stations.html). Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Sediment Deposition	Consistent source unavailable or unknown. Port- and location-specific sources used, where available. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.

Resource	Description of Existing Conditions
Acoustic Environment	Consistent source unavailable or unknown. Port- and location-specific sources, where available. Geographic region: town, city, or county where the port is located.
Critical Habitat	Critical habitat designations around the port identified using USFWS Critical Habitat Mapper (http://ecos.fws.gov/ecp/report/table/critical-habitat.html). Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Military Use Areas	Used MilitaryBases.com and local knowledge of the ESS Team to identify military bases within and surrounding the ports. Geographic region: immediate vicinity of the port, access channel, and waterbodies surrounding the port.
Land Use & Existing Infrastructure	To identify land use and existing infrastructure around a port, Google Earth and Multi-Resolution Land Characteristics Consortium's National Land Cover Database Evaluation, Visualization, and Analysis Tool were used (http://www.mrlc.gov/eva/viewer.html). Geographic region: immediate vicinity of the port and access channel.
Transportation	Transportation within and surrounding the ports was identified using Google Earth and supporting port websites. Where possible, distances to highways were provided and for rail service, it was noted if service was direct to dockside or within port. Geographic region: immediate vicinity of the port and access channel.
Cultural & Historical	Nearby historical places and buildings were identified using the National Register of Historic Places Database (http://www.nps.gov/nr/research/index.htm). Shipwrecks within the port vicinity were identified using NOAA's Wrecks and Obstructions Database (http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html). Geographic region: immediate vicinity of the port and access channel.
Visual	Google Earth was used to identify the viewscapes around the ports and identify urbanized/developed or undeveloped land. Geographic region: immediate vicinity of the port and access channel.
Environmental Justice	The percentage of total minorities in the county and state were identified using US Census Bureau's American Community Survey, 5-Year Estimates (2009-2013): http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml The percentage of low-income in the county and state were identified using US Census Bureau's American Community Survey, 5-Year Estimates (2009-2013): http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml The percentage of total minority populations and individuals below the poverty level in the area surrounding the port was identified using EPA's Environmental Justice Screening and Mapping Tool: http://www2.epa.gov/ejscreen Geographic region: Metropolitan Statistical Areas (see additional discussion below), county, or city.

Resource	Description of Existing Conditions
Commercial Fishing	Commercial landings for the port and state as well as rank in the US identified using National Marine Fisheries Services' (NMFS) Commercial Fisheries Statistics: http://st.nmfs.noaa.gov/commercial-fisheries/index Commercial fishing engagement in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Commercial fishing reliance in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Geographic region: surrounding fishing communities.
Tourism & Recreation	The percentage of employment in tourism-related industries in the county identified using Bureau of Labor Statistics' Local Area Unemployment Statistics: http://www.bls.gov/lau/ Recreational fishing engagement in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Recreational fishing reliance in surrounding communities identified on scale of low to high using NMFS' Community Social Indicators: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map Geographic region: Metropolitan Statistical Areas or county.
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port and main vessel types to and from port identified using Marine Traffic's Automatic Identification System: http://www.marinetraffic.com/en/ais/index/ports/all Vessel types include: cargo, tanker, passenger, high speed craft, tug, fishing, and pleasure Geographic region: Metropolitan Statistical Areas or county.
Socioeconomic Resources	Population of County or City identified using US Census Bureau's American Community Survey: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml Labor Force identified using Bureau of Labor Statistics' Local Area Unemployment Statistics: http://www.bls.gov/lau/ Main Sources of fiscal revenues identified using US Census Bureau's State Finances, 2012 Census of Governments: http://census.gov/govs/local/ Geographic region: Metropolitan Statistical Areas, county, or city.

Metropolitan Statistical Areas are usually adequate geographic areas for the description of socioeconomic characteristics of port areas because the affected area must consider the community in which ports are located, as well as surrounding communities that may be impacted by activities at the port through commercial or fiscal ties or through movements of people for work, recreation or other activities. Metropolitan Statistical Areas consist of one or more counties with a high degree of social and economic integration, as measured by commuter ties and with a core urban area. They are defined and revised with some regularity by the Office of Management and Budget (OMB 2015). Additional information on commuter data is available through the following U.S. Census Bureau online tool and can also be a useful alternative in defining the study area for socioeconomics (USCB 2015a; USCB 2015b). However, for populous and economically large Metropolitan Statistical Areas, impacts of construction and operation of projects will very often be negligible in magnitude, and stakeholders often would like to know how they compare to smaller economic areas, such as their city or county. In addition, for some aspects analyzed (e.g. fiscal impacts) impacts may occur within sub-areas of the geographic area of interest, so these need to be discussed as well.

Existing conditions of port areas for environmental justice considerations are typically described for the same geographic area used for the socioeconomic analysis. The reason is that environmental justice assessments should consider all areas where potentially high and adverse human health and environmental impacts may occur. In the case of modifications to ports to accommodate wind energy development, this area is expected to be the same as the area for socioeconomic impacts. However, impacts often occur within a sub-area of the geographic area of interest, such as the immediate vicinity of the port or transportation routes. Therefore, these sub-areas often need to be described as well.

The data sources used in the description of the current characteristics were selected to provide a quick overview of current conditions and often of selected aspects, but greater detail should be considered in programmatic or project specific environmental review documents. A few notes on the data sources used follow.

- The main source of readily available data for identifying minority and low-income populations is the U.S. Census Bureau American Community Survey (ACS) 5-Year Estimates (USCB 2015c). A quick overview at the census block group level is available through EPA's EJSCREEN tool (EPA 2015). The data currently available through this tool is from the ACS 2008-2012 5-Year Estimates.
- NOAA's community social indicators were developed to characterize communities engaged in fishing activities and their vulnerability to change. The indicators were developed for Census Designated Places (CDPs) based largely on data from the U.S. Census Bureau American Community Survey (ACS) 5-Year Estimates. The latest data available used is for the 2005-2009 period. Each indicator combines several sources to reach a qualitative measure of how vulnerable communities are to change. Each indicator received a high, medium or low qualitative measure in each community, based on the community's position relative to the standard deviation of that indicator among the communities analyzed (NOAA Undated). The use of these indicators must be with careful consideration of the geographic area of analysis they describe and their interpretation. For the purposes of the community profiles, selected indicators from this source were used to characterize communities engaged in commercial and recreational fishing.
- Tourism-related employment is not well defined in data based on the NAICS classification of industries. Estimates typically require making assumptions regarding the share of certain codes that actually reflect tourism (e.g., restaurants).

Anticipated Impacts

The information gathered for these port profiles is intended to summarize what exists at the time of writing and includes general impacts that have been associated with similar construction activities at ports across the U.S. and Europe. However, offshore wind energy development is constantly evolving and needs and impacts may change in the future. There may be impacts associated with offshore wind not included in these profiles. These profiles should serve as a guide to evaluate the potential readiness and construction necessary to accommodate such activity. A more comprehensive, site-specific assessment should be conducted should a port be considered for supporting offshore activities.

References

EPA (U.S. Environmental Protection Agency). 2015. EJSCREEN. Environmental Justice Screening and Mapping Tool. Available: http://www2.epa.gov/ejscreen. Accessed: 09/10/2015.

NOAA (National Oceanic and Atmospheric Administration). Undated. Social Indicator Links. Available: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/index. Accessed: 09/10/2015.

OMB (Office of Management and Budget). 2015. Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas. OMB Bulletin N. 15-01. Available: https://www.whitehouse.gov/omb/bulletins_default. Accessed: 09/10/2015.

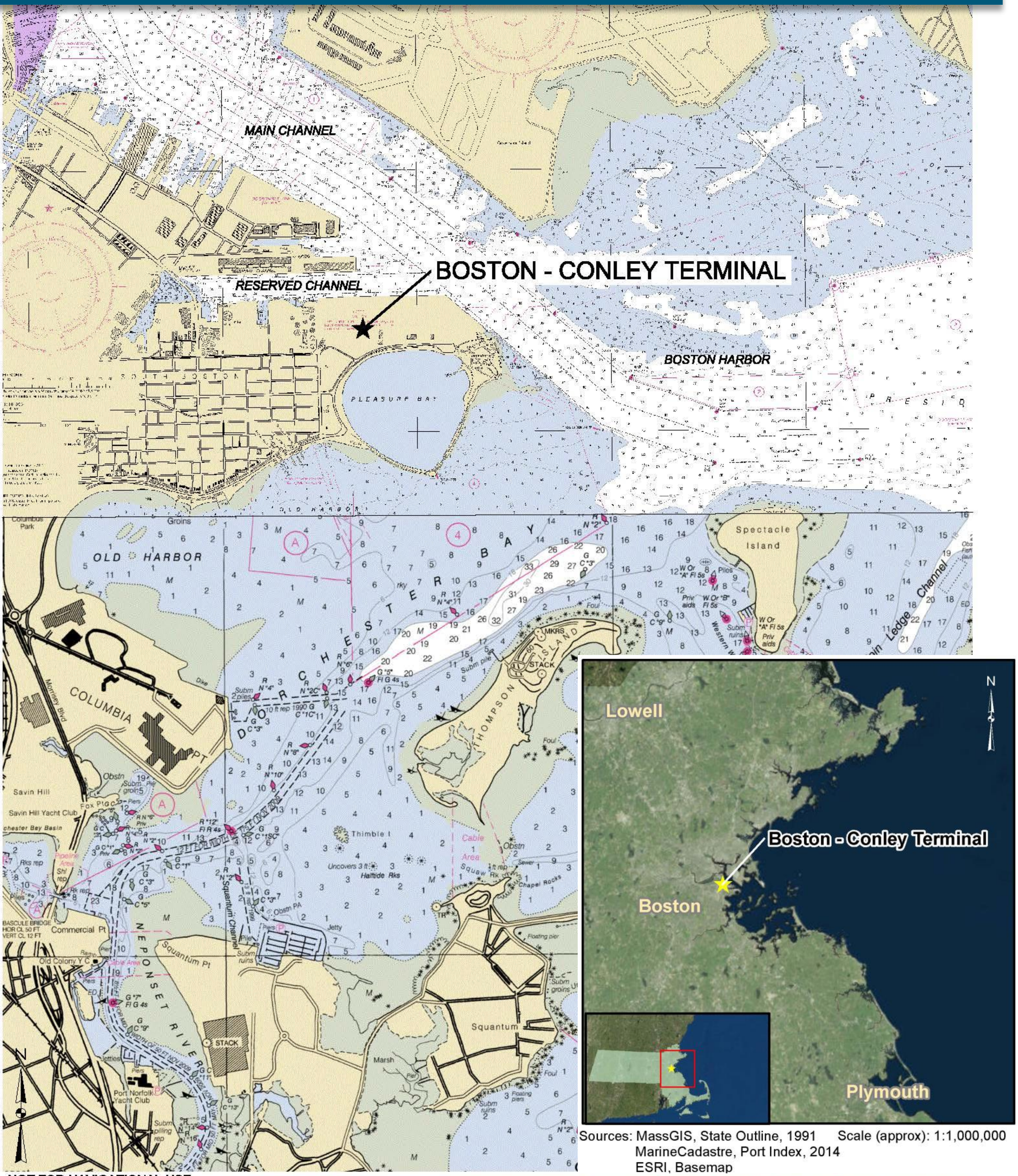
USCB (U.S. Census Bureau). 2015a. Longitudinal Employer-Household Dynamics. Available: http://lehd.ces.census.gov/. Accessed: 09/10/2015.

USCB (U.S. Census Bureau). 2015b. OnTheMap. Available: http://onthemap.ces.census.gov/. Accessed: 09/10/2015.

USCB (U.S. Census Bureau). 2015c. American Community Survey, 5-Year Estimates, 2009-2013. Available: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed: 09/10/2015.

BOSTON

Conley Terminal | Boston, Massachusetts | 42° 20’ 25” N, 71° 01’ 21” W



Sources: MassGIS, State Outline, 1991   Scale (approx): 1:1,000,000
MarineCadastre, Port Index, 2014
ESRI, Basemap

NOT FOR NAVIGATIONAL USE

Sources: NOAA Chart 13272_1, 2012; 13270_1, 2011

Scale (approx.): 1" = 3000'

BOSTON

Conley Terminal | Boston, Massachusetts | 42° 20' 25" N, 71° 01' 21" W

Port Overview

Owner:	Massachusetts Port Authority (Independent Public Authority)
Operator:	Massachusetts Port Authority (Independent Public Authority)
Primary Existing Uses:	Containerized Cargo Shipping
Primary Cargos Handled:	Seafood; Beer/Wine; Footwear; Apparel; Furniture; Waste Paper; Scrap Metal [1]
Typical Operating Hours:	8:00 AM – 5:00 PM [1]
Terminal Land Area:	Approximately 100 acres
Shortest Distance to Wind Energy Area:	145.7 miles
Closest Lease Area:	Massachusetts Wind Energy Area
Commercial Port Employment:	7,100 people [2]

The Port of Boston's Conley Terminal, owned and operated by Massachusetts Port Authority (Massport), is located within the South Boston Designated Port Area (DPA) on the Reserved Channel, and is New England's largest full service container terminal with the only deep-water access in the Port of Boston. Conley Terminal serves many of world's top container lines, including MSC, COSCO, Hanjin, Evergreen, Maersk and Hapag Lloyd, and handles nearly 1.5 million metric tons of cargo each year. The terminal is located on 100 acres with a dedicated haul road, which provides easy connections to the interstate system (I-93, I-90, and I-95 are all less than two miles from the terminal). The Conley Terminal includes two active container ship berths, Berths 11 and 12, which total approximately 2,000 linear feet of hardened edge. The deep-water berths at Conley Terminal are currently dredged to 45 feet deep, and are served by six low-profile ship-to-shore cranes. The height of the existing cranes and any future equipment on the current Conley Terminal footprint is limited by airspace restrictions associated with Logan Airport runways.

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	
Access	Port Access Channel Width (m)	182.9
	Port Access Water Depths (m)	12.2
	Overhead Draft (m)	Unlimited
	Number of Berths	5
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	304
	Quayside Seabed Suitable for Jacking	U

U = Unknown

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	404,700
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	No
	Width of Ro-Ro Berth (m)	N/A
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	N/A
Cranes	On-site Cranes' Capabilities (t)	51
	Crane Height Restrictions (m)	61
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Highway

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Construction of Storage Structure	Dredging	Aggregate Dumping
Ro-Ro Capability[a]	●	●	●	●	●					
Cranes[b]	●	●	●	●	●	●	●			

BOSTON

Conley Terminal | Boston, Massachusetts | 42° 20’ 25” N, 71° 01’ 21” W

Construction Activity	Land Clearing	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Construction of Storage Structure	Dredging	Aggregate Dumping
Quayside Bearing Capacity[c]		●		●	●				●	●
Storage Capabilities[d]	●		●	●	●			●		

Modifications in italics are assumed to be required based on port classifications

[a] Provide Ro-Ro Capability; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2; improve Ro-Ro Berth Width to 8 m;

[b] Provide On-Site Cranes with 600 t lifting capability

[c] *Improve Quayside Bearing Capacity to 17 t/m^2 and make Quayside Seabed Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2; increase Storage Area to 25,000 m^2*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species, injury, mortality, displacement
- Space use conflicts
- Demand for local labor, goods, services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	There is no mapped eelgrass or shellfish suitable areas. The improvements to water quality in Boston Harbor brought on by the harbor cleanup effort, mainly the upgrade in sewage plant and discharge facilities, have led to significant improvements in benthic resources in areas of the harbor that were once considered heavily polluted by sludge discharges, however the harbor is still representative of industrialized conditions.
Fish & EFH	Boston Harbor, including the Reserved Channel, has been mapped by the National Oceanic and Atmospheric Administration (NOAA) as containing Essential Fish Habitat (EFH); however, the area in the immediate vicinity of the Terminal is unlikely to have habitat functions and values that are capable of supporting a healthy, stable and viable population of fish at any life stage due to its historical and current industrial use.
Air Quality	Boston Harbor is located in the Metropolitan Boston Intrastate Air Quality Control Region (AQCR) and is classified as a non-attainment area for ozone (O_3) and a maintenance area for carbon monoxide (CO). [3] A CO Maintenance area is an area in where the CO levels formerly exceeded the National Ambient Air Quality Standards (NAAQS), but have now been reduced to and meet the NAAQS.
Terrestrial Biota	There are no extensive wetland areas in the Terminal as the majority of the shoreline has been hardened to support Terminal use.
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and NOAA were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The sei whale, which inhabits waters in the northeastern US, was also identified as endangered. [4] The North Atlantic right whale, humpback whale, fin whale, sei whale, sperm whale, and minke whale may all be found seasonally in Massachusetts waters; however, only transient marine mammals are found in the Boston Harbor area during seasonal migrations. Harbor seal, white-side dolphin, harbor porpoise, and gray seal may also be observed rarely. The hawksbill and leatherback turtle are listed as a federally endangered species. The green sea turtle is listed as threatened in Massachusetts. These turtle species are known to occur in Massachusetts coastal waters; however, no turtle species are known to be found in Boston Harbor. [5]

BOSTON

Conley Terminal | Boston, Massachusetts | 42° 20’ 25” N, 71° 01’ 21” W

Resource	Description of Existing Conditions
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover is listed as threatened in Suffolk county. In addition to the piping plover there are many different types of resident, migratory, and coastal birds that could potentially use the areas of Boston Harbor as feeding, nesting or resting areas. The Boston Harbor Islands National Recreation Area was designated as a Massachusetts Important Bird Area (IBA) because the park provides habitat for a significant number of colonial-nesting waterbirds; however, the area is not considered critical habitat. [5] *(Information on bats in this area is not readily available.)*
Water Quality	The Boston Inner Harbor (Segment ID MA70-02), located directly north of Conley Terminal, is listed as impaired, according to the Massachusetts Year 2012 Integrated List of Waters. The Boston Inner Harbor is impaired due to *Enterococcus*, fecal coliform, dissolved oxygen, and Polychlorinated Biphenyls (PCBs) in fish tissue. [6] [7]
Currents & Tides	The dominant currents in the harbor are tidal in origin, although wind driven currents occur during storms. [1] The mean tidal range is 9.5 feet.
Sediment Deposition	The Terminal has an extensive history of industrial and commercial use and consequently has been the location of several releases of oil and hazardous materials. Sediment contaminant concentration levels, in general, are higher in the Inner Harbor, where they are closest to point sources of pollution and where the sediments are fine-grained (compared to coarser grained samples in the Outer Harbor). Metals such as zinc, lead, chromium, copper, arsenic and silver, and organic contaminants such as polychlorinated biphenyls (PCBs), polyaromatic hydrocarbons (PAHs), and pesticides are found in elevated levels in fine-grained surface sediments deposited since industrialization of the area in the Inner Harbor. [8]
Acoustic Environment	Existing sound levels are typical of an urbanized area and include local traffic (Massachusetts Bay Transportation Authority (MBTA) buses), mechanical equipment from the City of Boston building, Logan Airport departing and arriving aircraft, and Interstate 93. Although Massport is not subject to municipal ordinances, the City of Boston’s regulations [9] on construction sound levels state that operation of any construction devices, excluding impact devices, may not exceed 86 dBA during any time period. The Department of Environmental Protection (DEP) has also established a policy (DEP Policy 90--001) for implementing noise regulations (310 CMR 7.10) if: 1) the source increases the broad band sound level by more than 10 dBA above ambient (normally defined as L90); or 2) the source produces a "pure tone" condition.
Critical Habitat	Although there are federally and state listed endangered species in Boston Harbor, the area has not been identified as critical habitat. [5] The area is not a state-designated Area of Critical Environmental Concern (ACEC).
Military Use Areas	Military installations near port: US Coast Guard (USCG) District 1 Headquarters and USCG Base Boston. Nearest Department of Defense (DoD) installations are the Hanscom Air Force Base (Air Force) about 15 mi NW and the Soldier Systems Center (Army) about 16 mi SW. [10]
Land Use & Existing Infrastructure	High and medium intensity developed land with residential area to the southwest of the Terminal. Terminal is just north of Pleasure Bay recreational areas, including Marine Park and Castle Island. The Terminal shares an approximately 600 foot wide channel with Cruiseport Boston and is less than a mile south of Logan Airport runways. [11] [12]
Transportation	About two miles from Interstates 90 and 93 and US highway 1. [12]
Cultural & Historical	Nearby places in the National Register of Historic Places: Fort Independence. [13] Over a dozen known shipwrecks to the east of the terminal and four to the west. [14]
Visual	Varied viewscape with residential and Pleasure Bay recreational areas to the south, industrial areas to the west, a cruise terminal to the north and open waters to the north and east. Six ship-to-shore container cranes are positioned along the port berth. [11] [1]

BOSTON

Conley Terminal | Boston, Massachusetts | 42° 20' 25" N, 71° 01' 21" W

Resource	Description of Existing Conditions
Environmental Justice	Total minorities: Suffolk County 52.3%; MA 24.3%. [15] Low-income: Suffolk County 20.8%; MA 11.4%. [16] Area surrounding port: census block groups in residential areas to the southwest of the Terminal have less than 7% total minority population. The Terminal census block itself has over 40% total minority population. The percent of the population in poverty in the census block groups of the Terminal and surrounding areas is less than 16%. [16]
Commercial Fishing	Commercial landings: No commercial fishing landings at the Terminal. Port of Boston 20.2 million pounds (US rank 63); MA 264.6 million pounds. [17] Commercial fishing engagement low in all the surrounding communities with the exception of Boston itself where it is high. [18] Commercial fishing reliance low in all surrounding communities. [19]
Tourism & Recreation	Employment in tourism-related industries in Suffolk County in 2010: 47,405. [19] Recreational fishing engagement low in all the surrounding communities with the exception of Boston itself where it is medium. [18] Recreational fishing reliance low in all surrounding communities. [18]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (not just Conley Terminal, Sep 12 – Oct 12, 2015): 21-147. [20] Main vessel types to and from port (30 days): high speed craft 30.0%, passenger boats 29.2%, tug boats 16.5%. [20]
Socioeconomic Resources	Population: Suffolk County 735,701. [15] Labor Force: Suffolk County 411,889; employed 389,822; unemployment rate 5.4%. [21] Main sources of fiscal revenues in MA Local Jurisdictions: property taxes 41.5%; intergovernmental revenues 30.9%; charges 11.8 %; utility revenues 7.9 %. [22]

Anticipated Impacts

Potential port modifications to the Conley Terminal necessary to support offshore wind development are anticipated to primarily impact terrestrial and upland resources, with limited impact to marine resources. The area is already an active port in an industrialized setting with degraded water and sediment quality. The potential for reduction or loss of habitat (terrestrial and marine) exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above will not result in any significant noticeable increase in noise to the surrounding communities due to high local noise levels that presently exist. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Road access to the port partially depends on local roads across residential areas. To the extent that construction materials are transported by truck, impacts to traffic may occur. Individual, port-specific air quality and noise analyses and monitoring would likely be required to assess any localized resulting from proposed modifications. Activities on the Reserved Channel shared with Cruiseport Boston would need to be coordinated to minimize interference with current activities. Because of engagement in commercial fishing in some communities, activities should be well coordinated to avoid use conflicts. No disproportionately high and adverse human health or environmental effects to minority or low-income communities are anticipated.

The U.S. Army Corps of Engineers (USACE) is partnering with Massport and the Commonwealth of Massachusetts to conduct the Boston Harbor Deep Draft Navigation Project, which will improve shipping channel depths to allow for a more efficient and safer flow of goods from Post-Panamax container ships as well as larger Cruise Line vessels. This project will deepen the North Entrance Channel from -45 feet Mean Low Water (MLW) to -51 feet MLW and the Main Channel from -40 feet MLW to -47 feet MLW, and will create a 50 foot deep berth at Conley Terminal. This project has already identified and assessed many of the environmental and socioeconomic impacts associated with dredging the surrounding waterways. [8]

Data Sources & Additional Information

1 Conley Terminal, Massport. Port of Boston. [Internet]. [cited 2015 October 10]. Available from: https://www.massport.com/port-of-boston/conley-terminal/.

2 Massport (Massachusetts Port Authority). 10-9-15 MASTER EBC 9th Annual Ocean Resource Management Conference - Update on Dredging in New England. [Internet]. 2015 [cited 2015 October 21]. Available from: http://www.scribd.com/doc/285226011/10-9-15-MASTER-EBC-9th-Annual-Ocean-Resource-Management-

Conference-Update-on-Dredging-in-New-England.

3 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

4 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

5 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

6 MassDEP (Massachusetts Department of Environmental Protection). Massachusetts Year 2012 Integrated List of Waters. [Internet]. 2012 [cited 2015 October 19]. Available from: http://www.mass.gov/dep/water/resources/tmdls.htm.

7 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

8 USACE (U.S. Army Corps of Engineers). Boston Harbor Deep Draft Navigation Improvment Study Final Feasibility Report. 2013. Available from: http://www.nae.usace.army.mil/Portals/74/docs/topics/BostonHarbor/DeepDraftFeasibilityStudy2013.pdf.

9 City of Boston Air Pollution Control Commission. Regulations for the Control of Noise in the City of Boston, City of Boston Air Pollution Control Commission. [Internet]. [cited 2015 October 19]. Available from: http://www.cityofboston.gov/images_documents/noise_reg_tcm3-13127.pdf.

10 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

11 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 September 11]. Available from: http://www.mrlc.gov/eva/viewer.html.

12 Google Earth. [Internet]. [cited 2015 September 10].

13 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 September 10]. Available from: http://www.nps.gov/nr/research/index.htm.

14 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

15 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

16 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

17 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

18 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

19 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

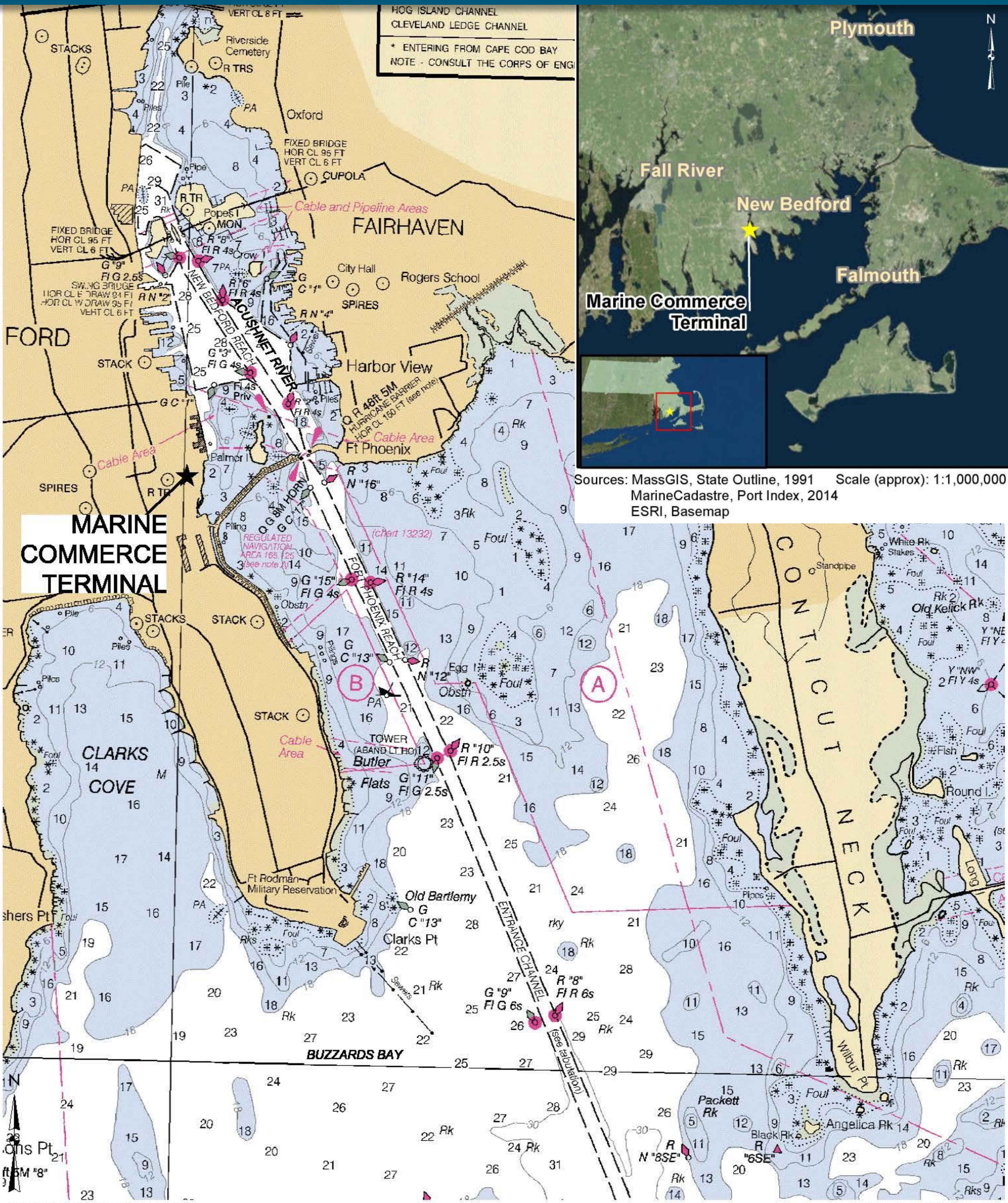
20 MarineTraffic. Automatic Identification System-Port of Boston. [Internet]. [cited 2015 September 10]. Available from: http://www.marinetraffic.com/en/ais/details/ports/131/USA_port:BOSTON.

21 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

22 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 September 10]. Available from: http://census.gov/govs/local/.

NEW BEDFORD

Marine Commerce Terminal | New Bedford, Massachusetts | 41° 38’ 15” N, 70° 54’



Sources: MassGIS, State Outline, 1991 Scale (approx): 1:1,000,000
MarineCadastre, Port Index, 2014
ESRI, Basemap

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 13230_1, 2014

Scale (approx.): 1" = 1000'

NEW BEDFORD

Marine Commerce Terminal | New Bedford, Massachusetts | 41° 38' 15" N, 70° 54' 59" W

Port Overview

Owner:	City of New Bedford (City Agency) Commonwealth of Massachusetts (State Agency) - Marine Commerce Terminal
Operator:	Harbor Development Commission (City Agency); Massachusetts Clean Energy Center (Quasi-public Agency)
Primary Existing Uses:	Commercial Fishing, Shipping, Recreational Boating, Cruises, Ferries & Excursion Boats
Typical Operating Hours:	8:00 AM – 4:00 PM (Flexible)
Terminal Land Area:	28.45 acres
Shortest Distance to Wind Energy Area:	28.5 miles
Closest Lease Area:	Rhode Island/Massachusetts Lease Area – North
Commercial Port Employment:	Over 4,400 people [1]

The Port of New Bedford is a deepwater, commercial port located at the mouth of the Acushnet River, and has direct access into Buzzards Bay, Vineyard Sound, and the Atlantic Ocean. It has three main operating areas: North Port Area, Central Port Area, and South Port Area. The Marine Commerce Terminal (also known as the South Terminal) is a separate terminal within the South Port Area constructed specifically to support the offshore wind industry's construction staging needs. According to the Massachusetts Clean Energy Center, the port has the capacity to support the construction of offshore wind energy projects. The Port's facilities are located in New Bedford Harbor and are protected by a hurricane barrier that is operated and maintained by the U.S. Army Corps of Engineers (USACE). The port is considered a harbor of refuge for vessels in the region.

New Bedford is the number one fishing port in the nation in term of landings value and generates economic activity in excess of $1 billion. In 2013, the 500 vessel fishing fleet landed more than 130 million pounds of products worth $379 million. [2] The Port is home to greater than 30 processors and distributors, ranging in size from high-volume international wholesale to small-scale local retail. [1] [3]

New Bedford Harbor is one of the largest Environmental Protection Agency (EPA) Superfund sites in the country. The Marine Commerce Terminal construction was done under the State Enhanced Remedy Authority and through coordination with and approval from EPA for sampling and removal methods of contaminated sediment. Construction of the terminal included navigational dredging, construction of confined aquatic disposal cells, and the creation/modification of mitigation areas.

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Yes
Access	Port Access Channel Width (m)	36.6
	Port Access Water Depths (m)	9.1
	Overhead Draft (m)	Unlimited
	Number of Berths	1
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	20
	Quayside Length (m)	305
	Quayside Seabed Suitable for Jacking	Yes

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	20
	Storage Area Bearing Capacity (t/m^2)	20
	Size of Storage Area (m^2)	114,323
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	No
	Width of Ro-Ro Berth (m)	N/A
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	N/A
Cranes	On-site Cranes' Capabilities (t)	No
	Crane Height Restrictions (m)	51.8
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

NEW BEDFORD

Marine Commerce Terminal | New Bedford, Massachusetts | 41° 38' 15" N, 70° 54' 59" W

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Drilling	Fill Placement	Fill Compaction	Aggregate Dumping	Paving
Ro-Ro Capability[a]	●	●	●	●	●	●
Cranes[b]	●		●	●		●

[a] Provide Ro-Ro Capability; improve Ro-Ro Berth Width to 8 m; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2
[b] Provide On-Site Cranes with 600 t lifting capability

Impact Producing Factors

- Soil disturbance/erosion
- Noise
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Species injury, mortality, displacement
- Space use conflicts
- Demand for local labor, goods, services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Contaminated sediment conditions in New Bedford Harbor limit the benthic community.
Fish & EFH	The waters surrounding and including New Bedford Harbor are considered to be Important Fish Resource Areas and are classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). The Acushnet River serves as a migratory pathway for anadromous species such as river herring. [4]
Air Quality	New Bedford is located in the Metropolitan Providence Interstate Air Quality Control Region (AQCR) and is in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants except ozone (O_3). [5]
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. There are no extensive wetland areas in the Port of New Bedford as the majority of the shoreline has been hardened to support water dependent uses. Small areas of wetlands are located behind the hurricane barrier, on Palmers Island, and other smaller islands and undeveloped areas within the harbor. [6]
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The sei whale, which inhabits waters in the northeastern US, was also identified as endangered. [7] The hawksbill sea turtle, leatherback sea turtle and green sea turtle have been identified as either threatened or endangered in Bristol County. [8] Marine mammals (especially harbor seals) and sea turtles have been observed in the waters surrounding and including New Bedford Harbor; however, the area is not considered critical habitat. [9] [10]
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover, which is listed as threatened, and roseate tern, which is listed as endangered, have been identified to potentially occur in Bristol county. [8] Areas around New Bedford Harbor are designated as core habitat for terns (Artic, common, and least), and sea ducks. [10] Waterfowl concentrations are at their highest by December, decreasing through March. [11] *(Information on bats in this area is not readily available.)*

NEW BEDFORD

Marine Commerce Terminal | New Bedford, Massachusetts | 41° 38' 15" N, 70° 54' 59" W

Resource	Description of Existing Conditions
Water Quality	New Bedford Harbor (Segment ID MA95-63) is listed as impaired according to the Massachusetts Year 2014 Integrated List of Waters. New Bedford Harbor is impaired for dissolved oxygen, estuarine bioassessments, fecal coliform, total nitrogen, other, and polychlorinated biphenyls (PCBs) in fish tissue. A Total Maximum Daily Load (TMDL) study is currently needed for all impairments except fecal coliform. Surface waters in New Bedford Harbor are classified as "SB", designated as a habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. [12]
Currents & Tides	Water circulation around the Port is influenced by an inflow from the Acushnet River as well as tides and wind. Maximum ebb and flood tide currents are under an average of 4.2 feet per second. The tidal range is 3.5 to 4.0 feet. [13]
Sediment Deposition	There are high levels of contamination throughout the sediments of the harbor that extend into Buzzards Bay, due to the historic discharge of wastes containing PCBs and toxic metals into New Bedford Harbor. This contamination led to New Bedford Harbor being designated as a Superfund Site. Since 2004, the EPA has been dredging to remove the PCBs in contaminated sediments. [14]
Acoustic Environment	The Port is currently an active port in an industrialized area. To fully assess the impacts of noise, a detailed noise and traffic study should be performed prior to modification.
Critical Habitat	Buzzards Bay is classified as a Massachusetts Ocean Sanctuary; however, Buzzards Bay and New Bedford Harbor are not classified as Marine Managed Areas by NMFS. However, all of Buzzards Bay and New Bedford Harbor south of I-95 are classified as priority Habitats of Rare Species. [10] Therefore, one or more federal or state threatened, endangered or species concern species may occur in this area.
Military Use Areas	Military installations near port: Sector Southeastern New England (Coast Guard), Air Station Cape Cod (Coast Guard). [15]
Land Use & Existing Infrastructure	High and medium intensity developed land with residential areas just west of the Marine Commerce Terminal, across JFK Memorial Highway. [16] [17]
Transportation	Access to east-west Interstate 195 and US Hwy 6 and to north-south state highways 140 and 18 though local roads and the JFK Memorial Highway. [16]
Cultural & Historical	Places in the National Register of Historic Places near the Marine Commerce Terminal: Robert C. Ingraham School, Palmer Island Light Station. The New Bedford Whaling National Historic Park is crossed by state highway 18 to the north. The Butler Flats Light is west of the access channel. [16] [18] [19] [20] Six known shipwrecks to the east of the Marine Commerce Terminal (around Palmer Island). [21]
Visual	Developed port areas to the north and south of the Marine Commerce Terminal. Residential areas to the west, across JFK Memorial Highway. [16]
Environmental Justice	Total Minorities: Bristol County 14.7 %; MA 24.3%. [22] Low-Income: Bristol County 12.4%; MA 11.4%. [23] Area surrounding port: Census block group where Marine Commerce Terminal is located and surrounding census block groups > 40% minority and > 25% individuals below poverty level. [24]
Commercial Fishing	Commercial landings: Port of New Bedford 129.8 million pounds (US rank 1); MA 264.6 million pounds. [2] Commercial fishing engagement high in New Bedford. [23] Commercial fishing reliance high in Gosnold and Chilmark. [23] As a result of the widespread PCB contamination and the accumulation of PCBs in marine biota, the Massachusetts Department of Public Health (DPH) established three fishing closure areas in New Bedford Harbor. Area I, which includes the Port of New Bedford, is closed to all fishing: including finfish, shellfish, and lobsters.
Tourism & Recreation	Employment in tourism-related industries in Bristol County in 2010: 20,188. [25] Recreational fishing engagement high in Wareham, Bourne, Falmouth and Edgartown. [23] Recreational fishing reliance high in Bourne, Gosnold and Aquinnah. [23]

NEW BEDFORD

Marine Commerce Terminal | New Bedford, Massachusetts | 41° 38' 15" N, 70° 54' 59" W

Resource	Description of Existing Conditions
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Aug 12 - Sept 11, 2015): 17-56. [26] Main vessel types to and from port (30 days): tug boats 33.9%, fishing vessels 27.6%, high speed craft 23.4%. [26]
Socioeconomic Resources	Population: Bristol County 549,870. [27] Labor force: Bristol County 288,918; employed 267,712; unemployment rate 7.3%. [28] Main sources of fiscal revenues in MA Local Jurisdictions: property taxes 41.5%; intergovernmental revenues 30.9%; charges 11.8 %; utility revenues 7.9 %. [22]

Anticipated Impacts

Potential port modifications to the Port of New Bedford necessary to support offshore wind development are anticipated to be limited to terrestrial and upland resources and, overall, have little impact on existing biological resources, as this area is already an active port in an industrialized setting with degraded water and sediment quality. The potential for reduction or loss of habitat (terrestrial) exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above is not likely to be above existing ambient levels; however, day/night restrictions may be required for certain activities that have the potential to disturb surrounding sensitive communities. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications. Any activity involving the dredging of sediments would likely need to be coordinated with the EPA remediation plan. However, there is no anticipated impact to sediments associated with the port modifications identified above. The Commonwealth of Massachusetts already identified and assessed many of the environmental and socioeconomic impacts of the Port of New Bedford site as part of the Superfund cleanup response associated with development of the Marine Commerce Terminal. Many design revisions and mitigation measures, including traffic impacts to residential neighborhoods, impacts to cultural resources, and conflicts from dredging with fishing, cargo, and recreational vessels have already been employed. No disproportionately high and adverse human health or environmental effects to minority or low-income communities are anticipated. Further NEPA review of any

Data Sources & Additional Information

1 Port of New Bedford. Port of New Bedford. [Internet]. 2015 [cited 2015 October 1]. Available from: http://www.portofnewbedford.org/.

2 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

3 New Bedford Marine Commerce Terminal. [Internet]. Available from: http://www.masscec.com/programs/marine-commerce-terminal-new-bedford.

4 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

5 AAPA (American Association of Port Authorities). Port Communities in Non-Attainment Areas for National Ambient Air Quality Standards. [Internet]. [cited 2015 September 9]. Available from: http://www.aapa-ports.org/Issues/content.cfm?ItemNumber=1278.

6 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

7 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

8 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

9 Buzzards Bay National Estuary Program. Project History and Structure. [Internet]. [cited 2015 September 9]. Available from: http://www.buzzardsbay.org/bbporgch.htm.

10 MORIS (Massachusetts Ocean Resource Information System). Critical Habitat Designations. [Internet]. [cited 2015 September 9]. Available from: http://www.mass.gov/eea/agencies/czm/program-areas/mapping-and-data-management/moris/.

11 Harper D. Birds of New Bedford Harbor. [Internet]. [cited 2015 September 9]. Available from: http://www.danielharper.org/yauu/articles/birds-of-new-bedford-harbor/.

12 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from:

http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

13 NOAA (National Oceanic and Atmospheric Administration). Tides Online and Current Predictions. [Internet]. [cited 2015 September 9]. Available from: http://co-ops.nos.noaa.gov.

14 EPA (U.S. Environmental Protection Agency). Final Determination for the South Terminal Project. [Internet]. 2012 [cited 2015 July 9]. Available from: http://www.masscec.com/content/epa-documents.

15 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

16 Google Earth. [Internet]. [cited 2015 September 10].

17 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 September 11]. Available from: http://www.mrlc.gov/eva/viewer.html.

18 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 September 10]. Available from: http://www.nps.gov/nr/research/index.htm.

19 MHC (Massachusetts Historical Commission). Massachusetts Cultural Resources Information System (MACRIS). [Internet]. [cited 2015 September 11]. Available from: http://mhc-macris.net.

20 NPS (National Park Service). New Bedford Whaling National Historic Park. [Internet]. [cited 2015 September 10]. Available from: http://www.nps.gov/nebe/planyourvisit/upload/2015-NPS-NEBE-Self-Guided-tour-Map-Web.pdf.

21 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

22 USCB (US Census Bureau). State and Local Finances, 2012 Census of Governments. [Internet]. [cited 2015 September 10]. Available from: http://www.census.gov/govs/local/.

23 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

24 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

25 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

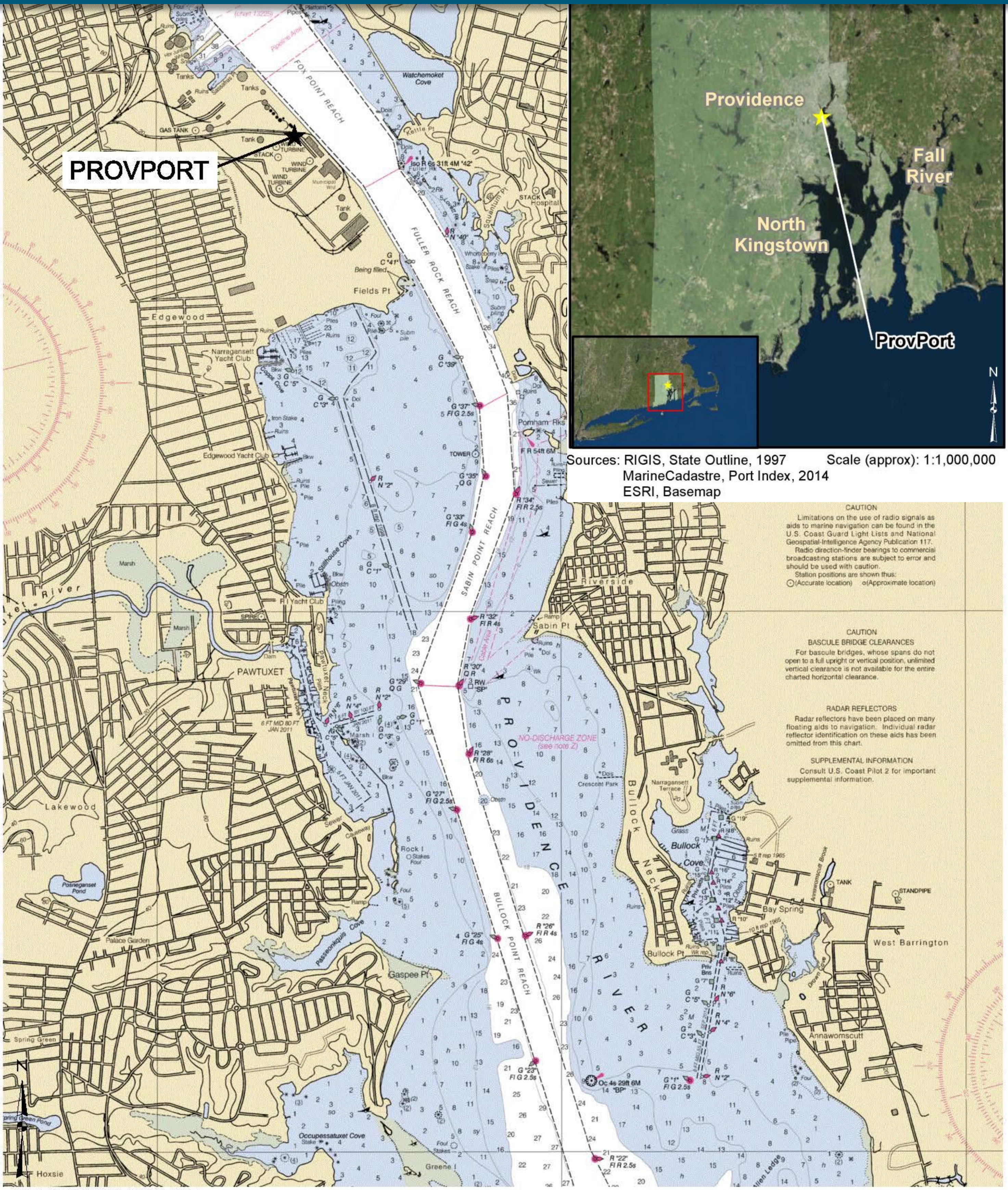
26 MarineTraffic. Automatic Identification System-Port of New Bedford. [Internet]. [cited 2015 September 10]. Available from: http://www.marinetraffic.com/en/ais/details/ports/7378/USA_port:NEW%20BEDFORD.

27 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

28 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

PROVIDENCE

ProvPort | Providence, Rhode Island | 41° 47’ 48” N, 71° 23’ 21” W



NOT FOR NAVIGATIONAL USE

Sources: NOAA Chart 13224_1, 2013

Scale (approx.): 1" = 3000'

PROVIDENCE

ProvPort | Providence, Rhode Island | 41° 47’ 48” N, 71° 23’ 21” W

Port Overview

Owner:	City of Providence (City Agency)
Operator:	Waterson Terminal Services (Private Corporation); ProvPort (Quasi-public Agency)
Primary Existing Uses:	Commercial Shipping for International Bulk; Break Bulk; Cargo
Primary Cargos Handled:	Heavy Machinery; Petroleum; Cement; Chemicals; Scrap Metal [1]
Typical Operating Hours:	Fully secure, 24-hour monitored facility
Port Land Area:	Approximately 105 acres [2]
Shortest Distance to Wind Energy Area:	38.7 miles
Closest Lease Area:	Rhode Island/Massachusetts Lease Area - North
Commercial Port Employment:	2,400 people [2]

ProvPort is a deepwater Port located on the Providence River at the head of Narragansett Bay. The Providence River is a tidal river formed by the junction of the Woonasquatucket and Moshassuck Rivers, which flow from northern Rhode Island. From this confluence, the Providence River flows southerly for 8 mi (12.9 km) before emptying into Narragansett Bay. The Providence ship channel is divided into an entrance channel and six reaches, ranging north to south from Fox Point to Rumstick Neck.

The facility covers more than 105 acres and contains 1.1 thousand meters of berthing space that can serve up to six vessels at the same time. The federal government carried out a $63 million dredge project in the Providence River federal channel in 2005 to bring the controlling depth to 40 feet, further supporting and expanding the capabilities of the Port. [3] The Port services New England and generates an estimated $200 million total economic impact on the region. [2] The Port of Providence is easily accessible to Interstate 95. It also contains three rail spurs that allow direct vessel-to-rail transfers, indoor rail, and alongside rail at the open lay-down area. The rail is connected to all major railroads offering service to anywhere in the US and Canada.

Both operators, Waterson Terminal Services (WTS) and ProvPort, have invested time and money into improving the facility and adding cranes to support demand. WTS states on their website that they are willing to rent or purchase additional equipment for any project through coordination with their marketing department. [4]

Deepwater Wind and General Electric are currently using the Port to assemble 6 MW offshore wind turbine components for the Block Island Wind Farm.

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Yes
Access	Port Access Channel Width (m)	182.9
	Port Access Water Depths (m)	12.2
	Overhead Draft (m)	59.1
	Number of Berths	27
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	U
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	42,000
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	U
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U
Cranes	On-site Cranes’ Capabilities (t)	144
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Blasting	Land Clearing	Pile Driving/ Drilling	Dredging	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Access Capabilities[a]	●		●	●				●	●	
Cranes[b]		●	●		●	●	●	●	●	
Quayside Capabilities[c]			●	●	●	●	●			●
Storage Capabilities[d]		●			●	●	●			●
Ro-Ro Capability[e]		●	●		●	●	●			●

Modifications in italics are assumed to be required based on port classifications

[a] Improve overhead draft to 75 m

[b] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

[c] *Improve Quayside Bearing Capacity to 17 t/m²; Increase Quayside Length to 170 m; Make Quayside Seabed Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m²*

[e] *Improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m²*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Fox Point Reach, located immediately east of the Port, is known as a highly stressed environment with low abundance and diversity of benthic organisms. [5] Quahog are known to inhabit this area and further south in the Providence River; however, shellfishing in this area of the Providence River and Seekonk River is prohibited due to pollutants. [6]
Fish & EFH	The Providence River and the Seekonk River are classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). [7]
Air Quality	Providence is located in the Metropolitan Providence Interstate Air Quality Control Region (AQCR) and is in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants, except for ozone (O_3). [8] The entire state of Rhode Island is designated a non-attainment zone for ozone.
Terrestrial Biota	Most of the area surrounding the Port of Providence is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape include woodlands, forests, grasslands, shrublands, and intertidal shore. [9]

PROVIDENCE

ProvPort | Providence, Rhode Island | 41° 47' 48" N, 71° 23' 21" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The sei whale, which inhabits waters in the northeastern US, was also identified as endangered. [10] Other species commonly found in the waters of Narragansett Bay, Block Island Sound and Rhode Island Sound that could potentially travel into the tidal river: pygmy sperm whale, common minke whale, long-finned pilot whale, harbor porpoise, Atlantic white-sided dolphin, short-beaked dolphin, short-beaked common dolphin, Risso's dolphin, common bottlenose dolphin, harbor seal, gray seal, harp seal, hooded seal, leatherback sea turtle and loggerhead sea turtle. The hawksbill sea turtle, leatherback sea turtle, and the green sea turtle have been identified as endangered or threatened in Providence county. [11] Additionally, Kemp's ridley sea turtle and the West Indian manatee are listed as endangered under the ESA and are commonly observed in Rhode Island waters. [12]
Birds & Bats	Endangered species listings from the USFWS were consulted and no listings were found for Providence county. [11] The upper Providence River provides relatively low quality habitat for birds because of its water depth, lack of forage items, and level of contamination. The area around the Port is highly developed and lacks sufficient intertidal and estuary settings for wading and nesting birds. The depth of the channel near the Port (approximately 12 m) is deeper than that typically inhabited by diving birds. Diving birds, such as scaup, are known to inhabit other areas of the Providence River that are shallower. They dive to about 7.6 m to feed on clams, other invertebrates, fish, and plants. [13] *(Information on bats in this area not readily available.)*
Water Quality	The Providence River (Segment ID RI0007020E-01B), located to the east of ProvPort, is listed as impaired according to the State of Rhode Island 2012 303(d) List of Impaired Waters. The Providence River is impaired due to dissolved oxygen, fecal coliform, and nitrogen. [14] The water quality of the Providence River is currently degraded by upstream industrial, residential, and commercial waste water treatment facility discharges and residential and commercial runoff. This portion of the River is classified as a Class SB1 water; designated for primary and secondary contact recreational activities and fish and wildlife habitat. [15]
Currents & Tides	The Providence River and Seekonk River are both tidal rivers and water circulation is influenced by tides and wind. The mean tidal range by the Port is 4.4 feet. [16]
Sediment Deposition	Sediment in this area adjacent to the Port is a mix of coarser-grained material such as sand, gravel, and cobble, as well as cohesive clay. [5] Studies show elevated levels of metals and petroleum hydrocarbons in the sediments of Providence River and Harbor. [17] The upper and mid regions of the Providence River are in a degraded state with respect to the ability of sediment to support biological populations due to high PCB levels. [18]
Acoustic Environment	Noise in the vicinity of the Terminal includes sounds typical of a marine terminal, including those generated by a variety of large vessels, including tankers, barges, and cargo. Rhode Island Air Quality Control Regulations regulates activities involving dust, odors, construction, noise, and motor vehicle emissions. [13] The areas along the upper Providence River, in the cities of Providence and East Providence, have relatively high levels of background noise, with the urban development and highway traffic in the area, as well as noise generated by large tankers and motorboats. [13]
Critical Habitat	Several marine mammal and sea turtle species listed as endangered or threatened have been observed in the waters of Narragansett Bay, but there are no Federally-listed or proposed threatened and/or endangered species known to occur in the area of the Port.
Military Use Areas	Military installations near port: two military installations at Newport, RI, 25 mi south of Providence, at the entrance of the navigation channel. These are Naval Station Newport (Navy) and Station Castle Hill (Coast Guard). A third installation is a further southwest, Station Point Judith (Coast Guard). [19]

PROVIDENCE

ProvPort | Providence, Rhode Island | 41° 47' 48" N, 71° 23' 21" W

Resource	Description of Existing Conditions
Land Use & Existing Infrastructure	High and medium intensity developed industrial land with the closest residential areas about a third of a mile southwest. Some undeveloped or developed open land exists across the channel in East Providence at distance of less than half a mile to the east. [20] [21]
Transportation	Half a mile from Interstate 95 with access to Interstates 195 and 295. Serviced by rail. [21]
Cultural & Historical	Nearby places in the National Register of Historic Places: none. Over ten known shipwrecks to the south of the port, two to the north. [22]
Visual	View from closest residential areas partially blocked by vegetation. View from I-95 includes three wind turbines in the industrial area. View from channel is of industrial landscape with storage tanks, wind turbines, and warehouses. [21]
Environmental Justice	Total minorities: Providence County 34.5%; RI 24.3%. [23] Low-income: Providence County 17.1%; RI 13.6%. [23] Area surrounding port: census block group where port is located is over 20% total minority. Residential areas to the northwest of the port have over 75% minorities. Census tract including port and surrounding areas is over 16% low-income with residential areas to the northwest over 26% low-income. [24]
Commercial Fishing	Commercial landings: Not available. [25] Commercial fishing engagement is low in all surrounding communities. [26] Commercial fishing reliance is low in all surrounding communities. [26]
Tourism & Recreation	Employment in tourism-related industries in Providence County in 2010: 34,042. [27] Recreational fishing engagement is low in all surrounding communities except high in Warwick (to the south) and medium in Barrington. [26] Recreational fishing reliance is low in all surrounding communities. [26]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 12 – Oct 12, 2015): 1-11. [28] Main vessel types to and from port (30 days): tug boats 78%, tankers 13%. [28]
Socioeconomic Resources	Population: Providence County 627,469. [23] Labor Force: Providence County 322,238; employed 295,871; unemployment rate 8.2%. [29] Main Sources of fiscal revenues in RI local jurisdictions: intergovernmental revenues 27.0%; charges 11.8 %; property taxes 54.8%; utility revenues 4.4%. [30]

Anticipated Impacts

Potential port modifications to the ProvPort necessary to support offshore wind development are anticipated to primarily impact terrestrial and upland resources, with limited impact to marine resources. The area is already an active port in an industrialized setting with degraded water and sediment quality. The potential for reduction or loss of habitat (terrestrial and marine) exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above will not result in any significant noticeable increase in noise to the surrounding communities due to high local noise levels that presently exist. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Road access to the port partially depends on local roads across residential and commercial areas. To the extent that construction materials are transported by truck, impacts to traffic may occur. Individual, port-specific air quality and noise analyses and monitoring would likely be required to assess any localized resulting from proposed modifications. To the extent that there are high and adverse human health or environmental effects to areas to the northwest of the port there may be disproportionately high impacts on low-income communities.

The U.S. Army Corps of Engineers (USACE) conducted an extensive river and harbor maintenance dredging project in the early 2000's, involving the dredging in the channel to restore the authorized 40 foot channel depth and placement of contaminated dredged material in underwater Confined Aquatic Disposal (CAD) cells located directly under the federal channel. This project identified and assessed many of the environmental and socioeconomic impacts associated with dredging the surrounding waterways. [13]

Data Sources & Additional Information

1 World Port Source. Port of Providence. [Internet]. [cited 2015 October 22]. Available from: http://www.worldportsource.com/ports/review/USA_RI_Port_of_Providence_85.php.

2 ProvPort. ProvPort. [Internet]. [cited 2015 October 21]. Available from: http://www.provport.com/.

3 Providence Working Waterfront Alliance. Providence Working Waterfront. [Internet]. [cited 2015 October 22]. Available from: http://providenceworkingwaterfront.org/.

4 Waterson Terminal Services. Port of Providence, Rhode Island. [Internet]. [cited 2015 October 21]. Available from: http://www.watersonllc.com/equipment/equipment_overview/.

5 USACE (U.S. Army Corps of Engineers) New England District. Proposed Change to Ongoing Maintenance Dredging of the Providence River and Harbor Federal Navigation Project, Providence Rhode Island. Draft Environmental Assessment and Finding of No Significant Impact. 2004.

6 RIDEM (State of Rhode Island Department of Environmental Management). Notice of Polluted Shellfishing Ground May 2015. [Internet]. 2015 [cited 2015 October 22]. Available from: http://www.dem.ri.gov/maps/mapfile/shellfsh.pdf.

7 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

8 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

9 RIDEM (State of Rhode Island Department of Environmental Management). Environmental Resource Map. [Internet]. 2015 [cited 2015 October 22]. Available from: http://www.arcgis.com/home/webmap/viewer.html?webmap=b24d6c60ff3a4947a14fbd15a66390c6&extent=-72.3519,41.0712,-70.6655,42.0922.

10 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

11 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

12 Kenney RD, Vigness-Raposa KJ. Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan. Technical Report. NOAA; 2010. Available from: http://seagrant.gso.uri.edu/oceansamp/pdf/appendix/10-Kenney-MM&T_reduced.pdf.

13 USACE (U.S. Army Corps of Engineers) New England District. Providence River and Harbor Maintenance Dredging Project Final Environmental Impact Statement. Concord, MA 2001.

14 RIDEM (State of Rhode Island Department of Environmental Management). State of Rhode Island 2012 303(d) List of Impaired Waters. [Internet]. 2012 [cited 2015 October 21]. Available from: http://www.dem.ri.gov/pubs/303d/303d12.pdf.

15 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

16 NOAA (National Oceanic and Atmospheric Administration). Tides & Currents. [Internet]. 2015 [cited 2015 October 22]. Available from: https://tidesandcurrents.noaa.gov/stationhome.html?id=8454000.

17 Coastal Resources Center. Providence Harbor: Special Area Management Plan. Coastal Resources Management Council; 1983.

18 Latimer JS, LeBlanc LA, Ellis JT, Quinn JG. The Distribution of PCBs in Surface Sediments of Narragansett Bay, Rhode Island. Michigan: Lewis Publishers; 1991. p. 221-248.

19 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

20 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 September 11]. Available from: http://www.mrlc.gov/eva/viewer.html.

21 Google Earth. [Internet]. [cited 2015 September 10].

22 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

23 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

24 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN).

[Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

25 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

26 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

27 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

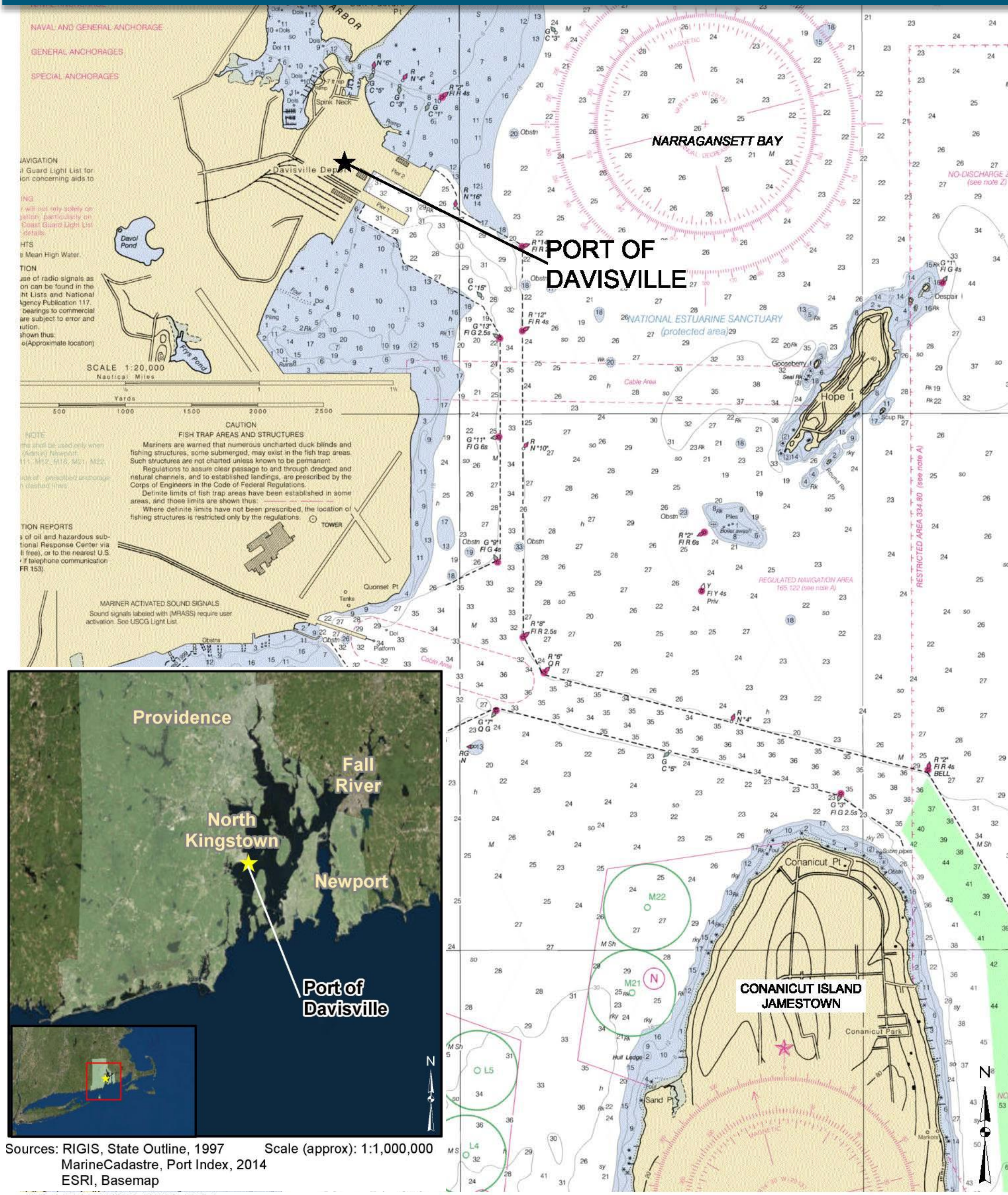
28 MarineTraffic. Automatic Identification System-Port of Providence. [Internet]. 2015 Available from: http://www.marinetraffic.com/en/ais/details/ports/10241/USA_port:PROVIDENCE.

29 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

30 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 September 10]. Available from: http://census.gov/govs/local/.

QUONSET POINT/DAVISVILLE

Port of Davisville | North Kingstown, Rhode Island | 41° 36’ 45” N, 71° 24’ 19” W



Sources: RIGIS, State Outline, 1997 Scale (approx): 1:1,000,000
MarineCadastre, Port Index, 2014
ESRI, Basemap

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 13223_1, 2013

Scale (approx.): 1" = 3000'

QUONSET POINT/DAVISVILLE

Port of Davisville | North Kingstown, Rhode Island | 41° 36’ 45” N, 71° 24’ 19” W

Port Overview

Owner:	Quonset Development Corporation (Quasi-state Agency)
Operator:	Quonset Development Corporation (Quasi-state Agency)
Primary Existing Uses:	Commercial Shipping
Primary Cargos Handled:	Autos, Frozen Seafood [1]
Typical Operating Hours:	7:00 AM – 3:30 PM Monday-Friday [2]
Terminal Land Area:	Approximately 58 acres [1]
Shortest Distance to Wind Energy Area:	21.7 miles
Closest Lease Area:	Rhode Island/Massachusetts Lease Area - North
Commercial Port Employment:	Over 10,000 people [1]

The Port of Davisville is a public port located near the mouth of the Narragansett Bay within the Quonset Business Park (QBP). The Quonset Business Park is over 3,200 acres in size and provides space for business, commerce, recreation, and open space use; with options for tenant expansion.

Environmental remediation associated with Navy base closure at Davisville is ongoing. Land will continue to be transferred from the federal government to QDC once remediation is substantially complete. The Park has direct access to RI Route 4 and I-95; intra-port rail service and direct on-dock rail; freight rail access to Class I carriers; easy access to major airports in Rhode Island, Massachusetts, and Connecticut; corporate aviation facilities available on-site; and the Port has direct intermodal connections. [1]

The Port of Davisville offers four berths and five terminals with 46 acres of laydown and 13 acres of terminal storage. The Port is one of the top ten auto importers in North America as well as home to one of the largest producers of sea frozen fish on the East Coast. [1] In 2012, the Port invested approximately $30 million to improve its facilities and add a 150 MT mobile harbor crane. The Port is equipped to handle a variety of project cargoes and break bulk materials such as wind turbines and the associated equipment. The Port of Davisville also houses NOAA’s oceanic research vessel, Okeanos Explorer.

The Port of Davisville was used for staging work for Deepwater Wind’s five turbine wind energy project off of Block Island, Rhode Island. Quonset will also host the project’s long-term operations and maintenance facility. [3]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Yes
Access	Port Access Channel Width (m)	152.4
	Port Access Water Depths (m)	9.8
	Overhead Draft (m)	59.1
	Number of Berths	2
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	366
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	52,600
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	U
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U
Cranes	On-site Cranes’ Capabilities (t)	150
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway; air

U = Unknown

QUONSET POINT/DAVISVILLE

Port of Davisville | North Kingstown, Rhode Island | 41° 36’ 45” N, 71° 24’ 19” W

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Dredging	Blasting	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Access Capabilities[a]		●	●	●				●	●	
Cranes[b]	●			●	●	●	●	●	●	
Quayside Capabilities[c]		●		●		●	●			●
Storage Capabilities[d]	●				●	●	●			●
Ro-Ro Capability[e]	●			●	●	●	●			●

Modifications in italics are assumed to be required based on port classifications

[a] Improve overhead draft to 75 m

[b] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

[c] *Improve Quayside Bearing Capacity to 17 t/m^2 and Make Quayside Seabed Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2*

[e] *Improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Although Narragansett Bay supports a diverse benthic community, benthic conditions in the waters surrounding the dock are stressed and shellfishing is prohibited due to pollutants. [4]
Fish & EFH	Shellfish and finfish are abundant in the waters off Quonset/Davisville. Narragansett Bay is classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). [5] The general area supports both commercial and recreational fisheries, including: soft shelled clams, quahogs, flounder, scup, striped bass, bluefish, menhaden, lobster, and baitfish.
Air Quality	North Kingstown is located in the Metropolitan Providence Interstate Air Quality Control Region (AQCR) and is in attainment of the National Ambient Air Quality Standards (NAAQS) for most criteria pollutants. [6] The entire state of Rhode Island is a non-attainment area for the 8-hour ozone (O_3) standard.
Terrestrial Biota	Most of the area surrounding Quonset Point/Davisville is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. There are open spaces and ecological communities to the north, south, and west of Quonset Point/Davisville within the QBP. These ecological communities include grasslands, shrublands, and forests. [7]

QUONSET POINT/DAVISVILLE

Port of Davisville | North Kingstown, Rhode Island | 41° 36' 45" N, 71° 24' 19" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The sei whale, which inhabits waters in the northeastern US, was also identified as endangered. [8] Other species commonly found in the waters of Narragansett Bay, Block Island Sound and Rhode Island Sound that could potentially travel into the tidal river: pygmy sperm whale, common minke whale, long-finned pilot whale, harbor porpoise, Atlantic white-sided dolphin, short-beaked dolphin, short-beaked common dolphin, Risso's dolphin, common bottlenose dolphin, harbor seal, gray seal, harp seal, hooded seal, leatherback sea turtle and loggerhead sea turtle. The hawksbill sea turtle, leatherback sea turtle, and the green sea turtle have been identified as endangered or threatened in Washington county. [9] Additionally, Kemp's ridley sea turtle and the West Indian manatee are listed as endangered under the ESA and are commonly observed in Rhode Island waters. [10]
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover, which is listed as threatened, and roseate tern, which is listed as endangered, have been identified to potentially occur in Washington county. The waters adjacent to Quonset Point provide foraging habitat for wintering ducks, including common eider, scoter species, scaup species, American black duck, bufflehead, goldeneye, and merganser species; brant, longtailed duck, and harlequin duck may also occur during the winter. During the summer, gulls and terns may occur in waters adjacent to Quonset Point. [11] Hope Island located in the Bay adjacent to the Quonset serves as a designated bird sanctuary. *(Information on bats in this area not readily available.)*
Water Quality	The portion of the Narragansett Bay, located to the east of Quonset Point/Davisville, is not listed as an impaired waterbody according to the State of Rhode Island 2012 303(d) List of Impaired Waters. [12] Bay waters in the Quonset area are classified by the Rhode Island Department of Environmental Management (RIDEM) as SA, suitable for shellfishing and water contact recreation. The Rhode Island Coastal Resources Management Council classifies the waters around the Port as Type 6. Type 6 waters are industrial waterfronts and commercial navigation channels. [13]
Currents & Tides	The Port is located near the mouth of Narragansett Bay and is influenced by tidal flow and wind. The mean tidal range in this area is 3.71 feet. [14]
Sediment Deposition	Tidal currents in the area are relatively strong as a result of water circulation and wind speed; resulting low sediment accumulation rates. Silt covers most of the seabed surface in the vicinity of the Port, with pockets of sand in specific locations. Sediments in the vicinity of the Davisville and Quonset piers contained elevated mercury, Polychlorinated Biphenyls (PCBs), and DTT (formally known as dichlorodiphenyltrichloroethane) concentrations. [15]
Acoustic Environment	The Terminal is located adjacent to the Quonset State Airport, which is a significant source of noise to the area. [13] Ambient noise levels on-site and construction-related noise levels are regulated by Rhode Island Air Quality Control Regulations.
Critical Habitat	Several marine mammal and sea turtle species listed as endangered or threatened have been observed in the waters of Narragansett Bay, but the area is not listed as critical habitat. According to the US Fish and Wildlife Service, no federally listed threatened or endangered species are known to exist in the vicinity. There are two state-listed threatened species of birds. [13]
Military Use Areas	Military installations near port: RI Air National Guard operates out of Quonset State Airport; two military installations at Newport, RI, 12 mi south of Quonset Point, at the entrance of the navigation channel. These are Naval Station Newport (Navy) and Station Castle Hill (Coast Guard). A third installation is a little further southwest, Station Point Judith (Coast Guard). [16]
Land Use & Existing Infrastructure	High and medium intensity developed industrial land. Undeveloped lands and a marina to the north and northwest, and Quonset State Airport, a former navy base, to the south. The closest residential areas are low density just over a mile to the west. [17] [18]

QUONSET POINT/DAVISVILLE

Port of Davisville | North Kingstown, Rhode Island | 41° 36’ 45” N, 71° 24’ 19” W

Resource	Description of Existing Conditions
Transportation	Access through Davisville Rd and state routes to US highway 1 and Interstates 95 and 295. Intra-port rail service and dockside rail. [18] [1]
Cultural & Historical	Nearby places in the National Register of Historic Places: none. Two known shipwrecks just east of the port. [19]
Visual	Viewscape characterized by large open container and automobile lots with a few warehouses up to two or three stories high. No tall structures. One mobile crane. Area surrounding developed port area and airport area is low density residential interspersed with vegetation. [18]
Environmental Justice	Total minorities: Washington County 8.0%; RI 24.3%. [20] Low-income: Washington County 8.9%; RI 13.6%. [20] Area surrounding port: census block group where port is located is over 40% total minority and is surrounded by blog groups with less than 20% of minorities. Census tract including port and surrounding areas is over 10% low-income. [21]
Commercial Fishing	Commercial landings: Port of North Kingstown 21.7 million pounds (US rank 83); RI 90.0 million pounds. [22] Commercial fishing engagement is high in North Kingstown and low in other surrounding communities. [23] Commercial fishing reliance is low in all surrounding communities. [23]
Tourism & Recreation	Employment in tourism-related industries in Washington County in 2010: 6,834. [24] Recreational fishing engagement is low North Kingstown but high in surrounding communities of Warwick, Portsmouth, and Jamestown. [23] Recreational fishing reliance is low in all surrounding communities. [23]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Davisville, Sep 12 – Oct 12, 2015): 4-57. [25] Main vessel types to and from port (30 days): tug boats 46%, fishing vessels 17%, high speed craft 12%. [25]
Socioeconomic Resources	Population: Washington County 126,627. [20] Labor Force: Washington County 69,539; employed 64,675; unemployment rate 7.0%. [26] Main Sources of fiscal revenues in RI local jurisdictions: intergovernmental revenues 27.0%; charges 11.8 %; property taxes 54.8%; utility revenues 4.4%. [27]

Anticipated Impacts

Potential port modifications to the Quonset Point/Port of Davisville necessary to support offshore wind development are anticipated to occur primarily in terrestrial and upland areas, with minimal impact to marine resources. Overall, potential port modifications will have little impact on existing biological resources, as this area is already an active port classified as an industrialized waterfront along a commercial navigational channel with degraded sediment quality. The potential for reduction or loss of habitat (terrestrial) exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above is not likely to be above existing ambient levels. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications. The addition of cranes may provide visual contrast with the overall low height of structures at the Port and could potentially interfere with airspace for the Quonset State Airport, located adjacent to the south of the Port, requiring coordination with Federal Aviation Administration (FAA). Because of engagement in commercial fishing in some communities, activities should be well coordinated to avoid use conflicts. To the extent that high and adverse human health or environmental impacts occur, minority and low-income populations may be disproportionately affected.

QDC has already identified and assessed many of the environmental and socioeconomic impacts of the Port of Davisville site as part of the Base Redevelopment Plan and environmental remediation associated with Navy base closure at Quonset/Davisville that is ongoing.

Data Sources & Additional Information

1 QBP (Quonset Business Park). Quonset Business Park. [Internet]. 2014 [cited 2015 October 20]. Available from: http://www.quonset.com/.

2 Port of Davisville, Quonset Development Corporation. Rules and Regulations for the Use of the Port of Davisville, Rhode Island, USA Marine Terminals and Associated Facilities. [Internet]. 2015 [cited 2015 December 10]. Available from: http://www.quonset.com/_resources/common/userfiles/file/Port%20of%20Davisville/PoD%20Rules.pdf.

3 Deepwater Wind. Block Island Wind Farm Caps Off Successful First Offshore Construction Season. [Internet]. 2015 [cited 2016 January 5]. Available from: http://dwwind.com/press/block-island-wind-farm-caps-off-successful-first-offshore-construction-season/.

4 RIDEM (State of Rhode Island Department of Environmental Management). Notice of Polluted Shellfishing Ground May 2015. [Internet]. 2015 [cited 2015 October 22]. Available from: http://www.dem.ri.gov/maps/mapfile/shellfsh.pdf.

5 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

6 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

7 RIDEM (State of Rhode Island Department of Environmental Management). Environmental Resource Map. [Internet]. 2015 [cited 2015 October 22]. Available from: http://www.arcgis.com/home/webmap/viewer.html?webmap=b24d6c60ff3a4947a14fbd15a66390c6&extent=-72.3519,41.0712,-70.6655,42.0922.

8 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

9 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

10 Kenney RD, Vigness-Raposa KJ. Marine Mammals and Sea Turtles of Narragansett Bay, Block Island Sound, Rhode Island Sound, and Nearby Waters: An Analysis of Existing Data for the Rhode Island Ocean Special Area Management Plan. Technical Report. NOAA; 2010. Available from: http://seagrant.gso.uri.edu/oceansamp/pdf/appendix/10-Kenney-MM&T_reduced.pdf.

11 Tetra Tech EC I. Block Island Wind Farm and Block Island Transmission System Environmental Report. 2012.

12 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

13 The Louis Berger Group. Quonset State Airport Master Plan Update. Rhode Island Airport Corporation; 2014. Available from: http://www.pvdairport.com/documents/corporate/oqu-masterplan/oqu-ampu-report-chapters.pdf.

14 NOAA (National Oceanic and Atmospheric Administration). Tides & Currents. [Internet]. 2015 [cited 2015 October 22]. Available from: https://tidesandcurrents.noaa.gov/datums.html?id=8454538.

15 The Louis Berger Group, Inc. & Maguire Group, Inc. Quonset Davisville Port and Commerce Park Master Plan. Prepared for the Rhode Island Economic Development Corporation; 2003.

16 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

17 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 September 11]. Available from: http://www.mrlc.gov/eva/viewer.html.

18 Google Earth. [Internet]. [cited 2015 September 10].

19 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

20 US Census Bureau. American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

21 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

22 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

23 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

24 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism

Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

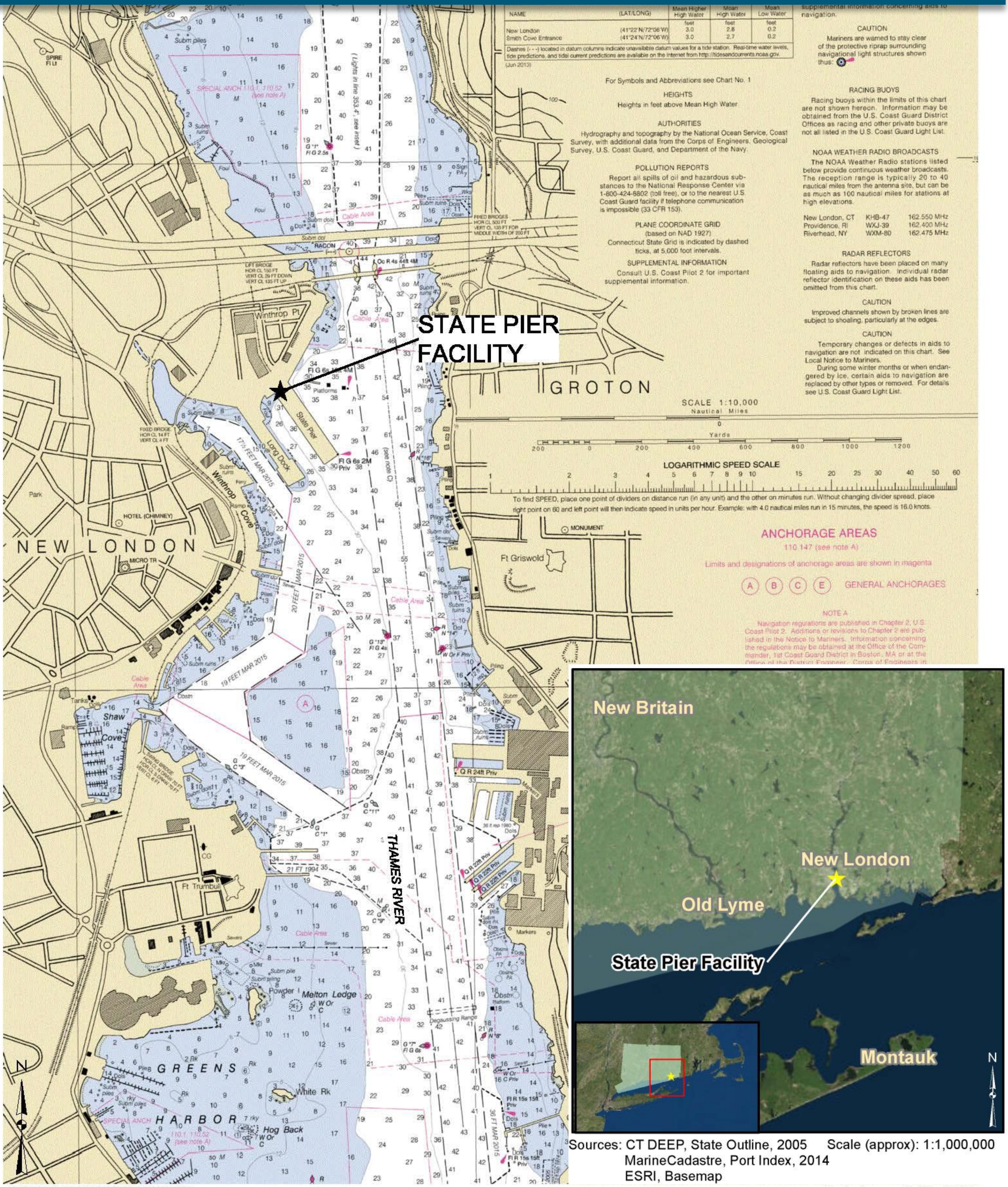
25 MarineTraffic. Automatic Identification System-Port of Davisville. [Internet]. 2015 [cited 2015 September 10]. Available from: http://www.marinetraffic.com/en/ais/details/ports/665/USA_port:DAVISVILLE.

26 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

27 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 September 10]. Available from: http://census.gov/govs/local/.

NEW LONDON

State Pier Facility | New London, Connecticut | 41° 21’ 35” N, 72° 05’ 30” W



Sources: CT DEEP, State Outline, 2005 Scale (approx): 1:1,000,000
MarineCadastre, Port Index, 2014
ESRI, Basemap

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 13213_1, 2013

Scale (approx.): 1" = 1500'

NEW LONDON

State Pier Facility | New London, Connecticut | 41° 21' 35" N, 72° 05' 30" W

Port Overview

Owner:	Connecticut Department of Transportation (State Agency)
Operator:	Logistec Stevedoring Inc. (Private Agency)
Primary Existing Uses:	Commercial Shipping, Military Vessels, Shipbuilding, Fishing, Ferries, Cruises
Primary Cargos Handled:	Lumber; Steel Products; and other Neo-bulk Products (pre-packaged products) [1]
Typical Operating Hours:	8:00 AM – 5:00 PM Monday-Friday [2]
State Pier Facility Land Area:	35 acres [1]
Shortest Distance to Wind Energy Area:	44.1 miles
Closest Lease Area:	Rhode Island/Massachusetts Lease Area - North
Commercial Port Employment:	Not available

State Pier is located in New London, Connecticut approximately 3 miles upriver from the mouth of the Thames River. [3] The State Pier Facility is comprised of two main finger pier structures: the Admiral Harold E. Shear State Pier and Long Dock. Both piers have aprons and are equipped with direct on dock rail connecting them to upland warehouses and the New England Central Railroad (NECR) interchange to serve state, regional, and national locations. [3] In addition to the NECR, the Facility is connected to the Amtrak's Northeast Corridor tracks and Interstate 95. [1] This facility has a high degree of flexibility and can be adapted for various marine activities and operations. [1]

The Thames River is an important harbor of refuge. Vessels of deep draft can find anchorage here in any weather and at all seasons. The main harbor includes Shaw Cove, Greens Harbor, and Winthrop Cove. New London Coast Guard Station and Fort Trumbull State Park are located on the west side of the main channel northward of Greens Harbor. The Thames River is also home to the General Dynamics submarine construction facility, the Naval Submarine Base New London (which is physically located in the Towns of Groton and Ledyard), and the US Coast Guard Academy. Groton and New London are known as the "Submarine Capital of the World". America's tall ship, the US Coast Guard Cutter (USCGC) *Eagle*, is homeported in New London. Year-round passenger and vehicle ferry services to Fishers Island, NY; Block Island, RI; and Orient Point (Long Island), NY are based in downtown New London.

The Thames River has more than 30 wharves and piers. Most of these facilities are used as repair berths, and for mooring recreational craft, fishing vessels, barges, ferries, and government vessels. Depths alongside these facilities range from 10 to 40 feet. New London is also a customs port of entry.

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Yes
Access	Port Access Channel Width (m)	152.4
	Port Access Water Depths (m)	10.6
	Overhead Draft (m)	Unlimited
	Number of Berths	2
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	4.8
	Quayside Length (m)	305
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	141,600
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	No
	Width of Ro-Ro Berth (m)	N/A
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	N/A
Cranes	On-site Cranes' Capabilities (t)	U
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

U = Unknown

NEW LONDON

State Pier Facility | New London, Connecticut | 41° 21’ 35” N, 72° 05’ 30” W

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Dredging	Aggregate Dumping	Utility Tower Extension	Utility Line Moves	Construction of Storage Structure
Quayside Capabilities[a]		●	●	●	●	●	●			
Ro-Ro Capability[b]	●	●	●	●	●		●			
Storage Capabilities[c]	●		●	●	●		●			●
Cranes[d]	●	●			●			●	●	

Modifications in italics are assumed to be required based on port classifications

[a] Improve Quayside Bearing Capacity to 17 t/m^2; *make Quayside Seabed Suitable for Jacking*

[b] Improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2

[c] *Increase Storage Area to 25,000 m^2; Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2*

[d] *Provide On-Site Cranes with 600 t lifting capability; reduce Crane Height Restrictions to 50 m*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	There are several areas in the Thames River that contain oyster beds and hardshell clam beds, which are leased to shellfisherman. However, the entire area is closed to shellfishing due to high coliform levels. The shellfish may be taken to cleaner waters to reside so that any bacteria which may accumulate in the shellfish are purged. [4]
Fish & EFH	The Thames River and Long Island Sound are classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). [5] The river is also utilized by resident and migratory fish as a feeding, spawning and nursery area and is an area of intense recreational fishing. Fish such as winter flounder, tomcod, windowpane flounder, mummichog, striped killifish, menhaden, bluefish, striped bass, mackerel, tautog, weakfish, porgy, whiting, and herring are examples of species that occur in the river at New London. [4]
Air Quality	New London is located in the Eastern Connecticut Intrastate Interstate Air Quality Control Region (AQCR) and is in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants, except ozone (O_3). The entire state of Connecticut is classified as non-attainment for the 8-hour ozone standard. The county is classified as “marginal,” which is the lowest of the classifications for ozone and requires fewer and/or less stringent mandatory air quality planning and control requirements. [6]
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape include scattered wetlands. [7]

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The sei whale, which inhabits waters in the northeastern US, was also identified as endangered. In Long Island Sound, several types of whales have been seen including; fin whale, humpback whale, minke whale and sperm whale. Additional marine mammals that have been seen in Long Island Sound include; gray seals, harbor seals, harp seals and hooded seals. [8] Three sea turtles have been identified as endangered or threatened in New London county including; hawksbill, leatherback and green sea turtles. The green sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, and the loggerhead sea turtle have been observed in Long Island Sound. Therefore, there is the possibility of these animals traveling into the Thames River. [9]
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover, which is listed as threatened, and roseate tern, which is listed as endangered, have been identified to potentially occur in New London county. [9] Fishers Island, located approximately 8 miles southeast of New London, hosts both resident and migratory bird populations. [10] [11] Although no site specific bat information was found it is documented that bat populations in southern Connecticut are drastically declining due to white-nose syndrome. [12]
Water Quality	The mouth of the Thames River (Segment ID CT-E1_014-SB), located southeast of the State Pier Facility, is listed as impaired according to the 2014 State of Connecticut Integrated Water Quality Report. The mouth of the Thames River is impaired due to dissolved oxygen and estuarine bioassessments. The middle segment of the Thames River (Segment ID CT-E1_015-SB), located north of the State Pier Facility, is also listed as impaired due to dissolved oxygen, estuarine bioassessments, and fecal coliform. [13] [14] The Thames River has been classified as an SB surface water resource. Designated uses of Class SB surface waters include habitat for marine fish and aquatic life and wildlife; commercial shellfish harvesting; recreational use; industrial water supply; and navigation. [15]
Currents & Tides	Water circulation around the Port is influenced by primarily by tidal flow and wind with some influence from inflow from the upper portions of the Thames River. The mean tidal range in the Port vicinity is 2.56 ft. [16]
Sediment Deposition	Silts and clayey silts dominate the federal channel and the deep water areas of the river adjacent to the channel. Slightly coarser sandy silts occur in the shallower areas within the Thames River. [17]
Acoustic Environment	Noise is regulated in the city via police patrol, as required by the New London Code and the Zoning Regulations. These ordinances authorize the control of sound amplifying devices, construction activities, and all other operations that may be viewed as a nuisance to neighboring properties or the general public. Motor vehicles and railroad noise are considered to be principal sources of noise. [15]
Critical Habitat	No critical habitat has been identified in the vicinity of the Port. The Port was not identified as having state and federal listed species and significant natural communities present. [18]
Military Use Areas	Military installations near the State Pier Facility: three military installation in New London and Groton, CT, bordering the Thames River. The United States Coast Guard Academy is less than 1 mile north of the port. The New London Submarine Base (Navy) and Marine Safety lab (Coast Guard) are 2 miles north of the port. Coast Guard Station New London and the Coast Guard Research and Development Center are located approximately 1 mile south of State Pier. [19] Vessel transits in the Thames River are restricted when Navy submarines are underway in the river.

NEW LONDON

State Pier Facility | New London, Connecticut | 41° 21' 35" N, 72° 05' 30" W

Resource	Description of Existing Conditions
Land Use & Existing Infrastructure	High and medium intensity developed land with commercial and residential areas surrounding the port in all directions. On the western boarder of the port is the Winthrop Cove Park (several acres in area). To the north is the Gold Star Memorial Bridge. Residences as well as commercial and industrial areas occupy the eastern (opposite) shore of the Thames River. [20] [21]
Transportation	Access to Interstate 95 and US highway 1 just north of the terminal and to State Route 641 to the west. Rail service to the terminal, including on dock rail. [21]
Cultural & Historical	Nearby places in the National Register of Historic Places: there are 39 properties listed in the city of New London, many of which are in the vicinity of the port. The New London's Downton Historic District is just southwest of the port. [22] Two shipwrecks just north of the port. [23]
Visual	Varied viewscapes with some industrial development along the western shore of the Thames River and residences and commercial/industrial areas along the eastern shore. [21]
Environmental Justice	Total minorities: New London County 22.3%; CT 29.5%. [24] Low-income: New London County 8.7%; CT 10.2%. [24] Area surrounding port: Census block group encompassing the port has highest rate of total minority population (> 75%) and the census tract encompassing the port and bordering tracts to the north and west of the port have highest share of individuals below poverty level (> 26 %). [25]
Commercial Fishing	Commercial landings: Port of New London 4.9 million pounds (US rank 101); CT 8.0 million pounds. [26] Commercial fishing engagement medium in New London and low in Groton. [27] Commercial fishing reliance low in surrounding communities. [27]
Tourism & Recreation	Employment in tourism-related industries in New London County in 2010: 10,312. [28] Recreational fishing engagement high in New London and Groton. [27] Recreational fishing reliance low in surrounding communities. [27]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sept 13 – Oct 13, 2015): 40-76. [29] Main vessel types to and from port (30 days): passenger 84.6%, tug boats 5.2%, other 3.3%. [29]
Socioeconomic Resources	Population: New London County 274,090. [24] Labor Force: New London County 137,254; employed 128,000; unemployment rate 6.7%. [30] Main Sources of fiscal revenues in CT local jurisdictions: intergovernmental revenues 29.7%; charges 8.5 %; property taxes 55.1%; utility revenues 4.5%. [31]

Anticipated Impacts

Potential port modifications to the State Pier Facility necessary to support offshore wind development are anticipated to primarily impact terrestrial and upland resources, with limited impact to marine resources. The area is an active port in an urban setting with degraded water and sediment quality. The potential for reduction or loss of habitat (terrestrial and marine) exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above will not result in any significant noticeable increase in noise to the surrounding communities due to high local noise levels that presently exist. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities.

Road access to the port depends largely on State Route 641 which crosses commercial and residential areas, as well as historic districts to the west of the port. To the extent that construction materials are transported by truck, impacts to traffic may occur. Cranes may produce visual impacts against some viewscapes. To the extent that there are high and adverse human health or environmental effects to areas surrounding the port there may be disproportionately high impacts on low-income communities.

The U.S. Army Corps of Engineers (USACE) and U.S. Navy have conducted regular maintenance dredging of the lower Thames River, in which many environmental and socioeconomic impacts associated with dredging have been identified and assessed.

Data Sources & Additional Information

1 Milone & MacBroom. State Pier Needs and Deficiencies Planning Study: New London, Connecticut. [Internet]. 2011 [cited 2015 October 19]. Available from: http://www.ct.gov/dot/lib/dot/documents/dcommunications/MajorProjectUpdates/FINAL_DRAFT_REPORT-March2011.pdf.

2 CBP (U.S. Customs and Border Protection). Locate a Port of Entry. [Internet]. [cited 2015 December 10]. Available from: http://www.cbp.gov/contact/ports.

3 CT Port Authority Working Group. City of New London Port Summary. 2014.

4 New London Planning and Development Commission. Plan of Conservation & Development for the City of New London, Connecticut. 2007. Available from: http://www.ci.new-london.ct.us/filestorage/7495/7518/7664/8618/7685/Combined_PODC_02_09_09.pdf.

5 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

6 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

7 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

8 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

9 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

10 Sargent A. For the Birds - Islanders Join National Migratory Bird Count. [Internet]. [cited 2015 October 29]. Available from: http://fishersisland.net/birds-islanders-join-national-migratory-bird-count/.

11 Long Island Sound Study. Fishers Island. [Internet]. [cited 2015 October 29]. Available from: http://longislandsoundstudy.net/2012/07/fishers-island-coastline/.

12 Wisniewski CD. The Past, Present and Future of White-Nose Syndrome in Bats. Southern Connecticut State University, Department of Biology; 2015. Available from: http://www.nhregister.com/general-news/20150628/scsu-science-team-working-to-save-connecticuts-bats-from-extinction.

13 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

14 CT DEEP (Connecticut Department of Energy & Environmental Protection). 2014 State of Connecticut Integrated Water Quality Report. [Internet]. 2014 [cited 2015 October 21]. Available from: http://www.ct.gov/deep/lib/deep/water/water_quality_management/305b/2014_iwqr_305b_303d_final.pdf.

15 Milone & MacBroom. Environmental Impact Analysis National Coast Guard Museum Pedestrian Overpass. New London, CT: Department of Economic & Community Development; 2014. MMI #2247-06.

16 NOAA (National Oceanic and Atmospheric Administration). Tides Online and Current Predictions. [Internet]. [cited 2015 September 9]. Available from: http://co-ops.nos.noaa.gov.

17 Poppe, L.J., Robinson, A.C., Blackwood, Dann Lewis, R.S., and Cohen-DiGiacomo, M.L. The distribution of surficial sediments in New Haven Harbor, Connecticut, and the New Haven Dumping Grounds, north-central Long Island Sound. USGS; 1998. Open-File Report 98-217.

18 CT DEEP (Connecticut Department of Energy & Environmental Protection). Endangered Species Maps. [Internet]. 2015 [cited 2015 October 20]. Available from: http://www.depdata.ct.gov/naturalresources/endangeredspecies/nddbpdfs.asp.

19 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

20 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 September 11]. Available from: http://www.mrlc.gov/eva/viewer.html.

21 Google Earth. [Internet]. [cited 2015 September 10].

22 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 September 10]. Available from: http://www.nps.gov/nr/research/index.htm.

23 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

24 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

25 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

26 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

27 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

28 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

29 MarineTraffic. Automatic Identification System-Port of New London. [Internet]. 2015 [cited 2015 September 10]. Available from: http://www.marinetraffic.com/en/ais/details/ports/662/USA_port:NEW%20LONDON.

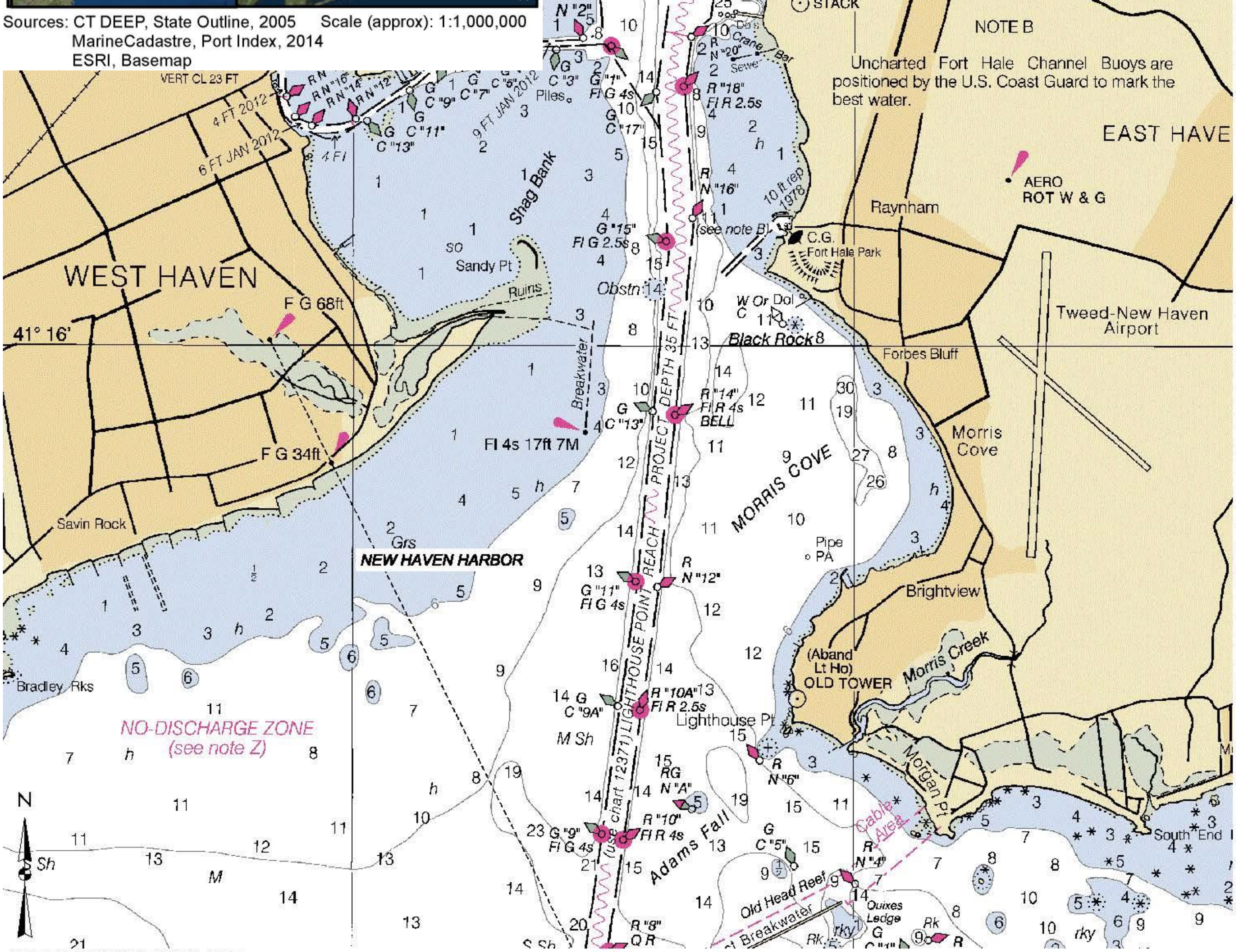
30 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

31 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 September 10]. Available from: http://census.gov/govs/local/.

NEW HAVEN

Gateway Terminal | New Haven, Connecticut | 41° 17’ 40” N, 72° 54’ 21” W

Sources: CT DEEP, State Outline, 2005 Scale (approx): 1:1,000,000
MarineCadastre, Port Index, 2014
ESRI, Basemap



NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 12372_16, 2013

Scale (approx.): 1” = 3000’

NEW HAVEN

Gateway Terminal | New Haven, Connecticut | 41° 17' 40" N, 72° 54' 21" W

Port Overview

Owner:	Connecticut Port Authority (Quasi-public Agency) except Gateway Terminal (Private Corporation)
Operator:	Gateway Terminal (Private Corporation)
Primary Existing Uses:	Commercial Shipping
Primary Cargos Handled:	Petroleum Products; General Bulk; Cargo; Scrap Metal; Metallic Products; Cement; Sand; Stone; Salt; Break Bulk; Project Cargo [1]
Typical Operating Hours:	8:00 AM – 5:00 PM Monday-Friday [2]
Terminal Land Area:	8.9 acres [1]
Shortest Distance to Wind Energy Area:	86.4 miles
Closest Lease Area:	Rhode Island/Massachusetts Lease Area - South
Commercial Port Employment:	Not available

The Port of New Haven is a deepwater, commercial shipping port located in New Haven Harbor on the Connecticut shoreline of Long Island Sound. [1] [3] New Haven Harbor extends for five miles from Long Island Sound to New Haven in the inner harbor. West Haven and East Haven lie on either side of the outer harbor. Principal rivers flowing into the harbor are the Quinnipiac River to the northeast, the Mill River to the north, and the West River to the west. Three breakwaters shelter the harbor entrance. New Haven is a highly urbanized environment and land use around the port facilities in the harbor is predominantly industrial.

The Port of New Haven is the highest volume commercial shipping port on Long Island Sound and is considered the busiest port between Boston and New York City. [1] There are five terminals within the Port of New Haven. The 366 acre port district is primarily comprised of a cluster of privately owned facilities that handle petroleum products, general bulk, cargo, scrap metal, metallic products, cement, sand, stone, salt, break bulk and project cargo. The Port of New Haven is strategically located at the junction of Interstates 95 and 91 with access to freight rail service for the movement of cargo. With a federally authorized channel depth of 35 feet and a width of 400 to 800 feet, New Haven Harbor can accommodate ships ranging from 20,000 to 40,000 deadweight tons. There are five shore cranes, capable of supporting up to 250 tons. [4]

Gateway Terminal is an 8.9 acre, privately owned marine terminal that handles various types of dry and liquid bulk and break-bulk cargoes, and has over 60 acres of storage area. [3]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Y
Access	Port Access Channel Width (m)	121.9
	Port Access Water Depths (m)	10.7
	Overhead Draft (m)	Unlimited
	Number of Berths	12
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	228
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	36,000
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	No
	Width of Ro-Ro Berth (m)	N/A
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	N/A
Cranes	On-site Cranes' Capabilities (t)	250
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

U = Unknown

NEW HAVEN

Gateway Terminal | New Haven, Connecticut | 41° 17’ 40” N, 72° 54’ 21” W

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Dredging	Aggregate Dumping
Ro-Ro Capability[a]	●	●	●	●	●				●
Cranes[b]	●	●	●	●	●	●	●		
Quayside Capabilities[c]		●	●	●	●			●	●
Storage Capabilities[d]	●		●	●	●				●

Modifications in italics are assumed to be required based on port classifications

[a] Improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2

[b] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

[c] *Improve Quayside Bearing Capacity to 17 t/m^2 and make Quayside Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Low species abundance and diversity are seen in areas where macroalgae is present. These macroalgae communities negatively affect small worms, crustaceans, oysters, and large bivalves which are found in the harbor. [5]
Fish & EFH	New Haven Harbor and the Quinnipiac River are classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). The Quinnipiac River serves as a migratory pathway for anadromous species such as alewife, American shad, and blueback herring. [6] [7]
Air Quality	New Haven is located in the Hartford-New Haven-Springfield Interstate Air Quality Control Region (AQCR) and is in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants, except ozone (O_3). The entire state of Connecticut is classified as non-attainment for the 8-hour ozone standard. The county is classified as “marginal,” which is the lowest of the classifications for ozone, requiring fewer and/or less stringent mandatory air quality planning and control requirements than those with higher classifications. [8]
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape are limited to small wetlands. [9]

NEW HAVEN

Gateway Terminal | New Haven, Connecticut | 41° 17' 40" N, 72° 54' 21" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The sei whale, which inhabits waters in the northeastern U.S., was also identified as endangered. In Long Island Sound, south of New Haven Harbor several types of whales have been seen including; fin whale, humpback whale, minke whale and sperm whale. Additional marine mammals that have been seen in Long Island Sound include; gray seals, harbor seals, harp seals and hooded seals. [10] Three sea turtles have been identified as endangered or threatened in New Haven county including; hawksbill, leatherback and green sea turtles. The green sea turtle, leatherback sea turtles, Kemp's ridley sea turtle and the loggerhead sea turtle have been observed in Long Island Sound. Therefore, there is the possibility of these animals traveling into the Harbor. [11]
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover, which is listed as threatened, and roseate tern, which is listed as endangered, have been identified to potentially occur in New Haven county. [11] Piping plovers have been observed at Sandy Point, approximately 3 miles southwest of the Port of New Haven. Primary tern staging areas and habitats for migrating shorebirds have also been identified. Although no site specific bat information was found it is documented that bat populations in southern Connecticut are drastically declining due to white-nose syndrome. [12] [13]
Water Quality	New Haven Harbor (Segment ID CT-C1_013-SB), located west of the Port of New Haven, is listed as impaired according to the 2014 State of Connecticut Integrated Water Quality Report. New Haven Harbor is impaired due to dissolved oxygen, *Enterococcus*, fecal coliform, eutrophication biological indicators, oil and grease, and Polychlorinated Biphenyls (PCBs). The mouth of the Quinnipiac River (Segment ID CT-C1_014-SB), located north of the Port of New Haven and I-95, is also listed as impaired according to the 2014 State of Connecticut Integrated Water Quality Report. The Quinnipiac River is impaired due to dissolved oxygen, *Enterococcus*, eutrophication biological indicators, oil and grease, and Polychlorinated biphenyls (PCBs). [14] [15]
Currents & Tides	Water circulation around the Port is influenced by an inflow from the Quinnipiac River and Mill River as well as tides and wind. The mean tidal range around the Port is 6.14 ft. [16]
Sediment Deposition	Polyaromatic hydrocarbons (PAHs) and metals have been detected in the sediment composites with a general trend of increasing concentrations occurred from outer to inner harbor locations. Sediment in the harbor is predominantly silt material. [17]
Acoustic Environment	(*Information on acoustic environment not readily available*). Connecticut Department of Transportation (ConnDOT) noise construction standards state that the maximum allowable level of noise at the nearest residence or occupied building should not exceed 90 decibels on the "A" weighted scale (dBA).
Critical Habitat	No critical habitat has been identified in the vicinity of the Port. The Port was not identified as having state and federal listed species and significant natural communities present. However, lands across the harbor, to the south, and to the north of the Port have been identified as having state and federal listed species and significant natural communities present. [18] [19]
Military Use Areas	Military installations near port: Sector Long Island Sound/Station New Haven (Coast Guard). Nearby military installations are the Coast Guard Academy (Coast Guard) and the New London Submarine Base (Navy), both about 42 miles east. West Point Military Academy (Army) is about 55 mi northwest. [20]
Land Use & Existing Infrastructure	High and medium intensity developed land with commercial and residential areas to the immediate east of the port along I-95. Some open land (East Shore Park near the entrance to the harbor) south of the terminal and some forested lands to the northeast, across I-95. [21]
Transportation	Access to Interstate 95 and US highway 1. Train service from the north and south. [21]
Cultural & Historical	Nearby places in the National Register of Historic Places: there are 65 properties or districts in the city of New Haven, although not particularly in the port area. [22] Two known shipwrecks west of the port. [23]

NEW HAVEN

Gateway Terminal | New Haven, Connecticut | 41° 17' 40" N, 72° 54' 21" W

Resource	Description of Existing Conditions
Visual	Industrial viewscape at port. View from the closest residential areas partially blocked by vegetation. View from Interstate 95 and across the channel characterized by large storage containers, tanks, warehouses, and several large cranes. [21]
Environmental Justice	Total minorities: New Haven County 33.3%; CT 29.5%. [24] Low-income: New Haven County 12.4%; CT 10.2%. [24] Area surrounding port: Census block group to the west and northwest of the port has highest rate of total minority population (> 75%) and to the west of the port the highest share of individuals below poverty level (> 26 %). [25]
Commercial Fishing	Commercial landings: Not available. [26] Commercial fishing engagement in surrounding communities is low. [27] Commercial fishing reliance high in surrounding communities is low. [27]
Tourism & Recreation	Employment in tourism-related industries in New Haven County in 2010: 25,979. [28] Recreational fishing engagement high in surrounding communities is low. [27] Recreational fishing reliance high in surrounding communities is low. [27]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 13 - Oct 13, 2015): 6-23. [29] Main vessel types to and from port (30 days): tug boats 90%. [29]
Socioeconomic Resources	Population: New Haven County 862,611. [24] Labor Force: New Haven County 455,537; employed 422,625; unemployment rate 7.2%. [30] Main Sources of fiscal revenues in CT local jurisdictions: intergovernmental revenues 29.7%; charges 8.5 %; property taxes 55.1%; utility revenues 4.5%. [31]

Anticipated Impacts

Potential port modifications to the Port of New Haven necessary to support offshore wind development are anticipated to primarily impact terrestrial and upland resources, with limited impact to marine resources. The area is an active port in an urban setting with degraded water and sediment quality. The potential for reduction or loss of habitat (terrestrial and marine) exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above will not result in any significant noticeable increase in noise to the surrounding communities due to high local noise levels that presently exist. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. The Port of New Haven is strategically located at the junction of Interstates 95 and 91 with access to freight rail service; thereby, minimizing any traffic impacts on local roadways. To the extent that there are high and adverse human health or environmental effects to areas to the west or northwest of the port there may be disproportionately high impacts on low-income communities.

The U.S. Army Corps of Engineers (USACE) has conducted regular maintenance dredging of New Haven Harbor, in which many environmental and socioeconomic impacts associated with dredging have been identified and assessed.

Data Sources & Additional Information

1 Port Authority, City of New Haven. The Port of New Haven. [Internet]. [cited 2015 October 19]. Available from: http://www.cityofnewhaven.com/PortAuthority/AboutPNH.asp.

2 CBP (U.S. Customs and Border Protection). Locate a Port of Entry. [Internet]. [cited 2015 December 10]. Available from: http://www.cbp.gov/contact/ports.

3 Gateway Terminal. Gateway Terminal - Gateway to the Northeast. [Internet]. [cited 2015 October 19]. Available from: http://www.gatewayt.com/.

4 ConnDOT (Connecticut Department of Transportation). Connecticut ports - Port of New Haven. [Internet]. 2015 [cited 2015 Oct 28]. Available from: http://www.ct.gov/dot/cwp/view.asp?a=1380&q=259730.

5 Zajac R,AM. Drift Algae in New Haven Harbor and Impacts on Benthic Communities. Report to the Quinnipiac River Fund, New Haven Foundation; 2015. Available from: http://digitalcommons.newhaven.edu/cgi/viewcontent.cgi?article=1024&context=biology-facpubs.

6 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

7 Fuss & O'Neill. Quinnipiac River Watershed Based Plan. December 2013. Available from: http://www.ct.gov/deep/lib/deep/water/watershed_management/wm_plans/quinnipiac/quinnipiac_river_finalwbp.pdf.

8 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

9 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

10 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

11 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

12 Connecticut Audubon. Sandy Point. [Internet]. [cited 2015 October 28]. Available from: http://ct.audubon.org/sandy-point.

13 Wisniewski CD. The Past, Present and Future of White-Nose Syndrome in Bats. Southern Connecticut State University, Department of Biology; 2015. Available from: http://www.nhregister.com/general-news/20150628/scsu-science-team-working-to-save-connecticuts-bats-from-extinction.

14 CT DEEP (Connecticut Department of Energy & Environmental Protection). 2014 State of Connecticut Integrated Water Quality Report. [Internet]. 2014 [cited 2015 October 21]. Available from: http://www.ct.gov/deep/lib/deep/water/water_quality_management/305b/2014_iwqr_305b_303d_final.pdf.

15 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

16 NOAA (National Oceanic and Atmospheric Administration). Tides Online and Current Predictions. [Internet]. [cited 2015 September 9]. Available from: http://co-ops.nos.noaa.gov.

17 USACE (U.S. Army Corps of Engineers). Long Island Sound Dredged Material Management Plan and Environmental Impact Statement - Draft. Concord, MA 2015. Available from: http://www.usace.army.mil/Portals/74/docs/Topics/LISDMMP/LIS-DMMP-Main-Report-PRDraft-August2015.pdf.

18 Connecticut Environmental Conditions Online. Connecticut's Critical Habitats and Open Space. [Internet]. 2012 [cited 2015 October 23]. Available from: http://www.arcgis.com/home/item.html?id=a1bf59798c5b45a98aeaeb97dafd60b9.

19 CT DEEP (Connecticut Department of Energy & Environmental Protection). Endangered Species Maps. [Internet]. 2015 [cited 2015 October 23]. Available from: http://www.depdata.ct.gov/naturalresources/endangeredspecies/nddbpdfs.asp?nddbsel=15.

20 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

21 Google Earth. [Internet]. [cited 2015 September 10].

22 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 September 10]. Available from: http://www.nps.gov/nr/research/index.htm.

23 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html

24 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

25 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

26 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

27 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

28 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

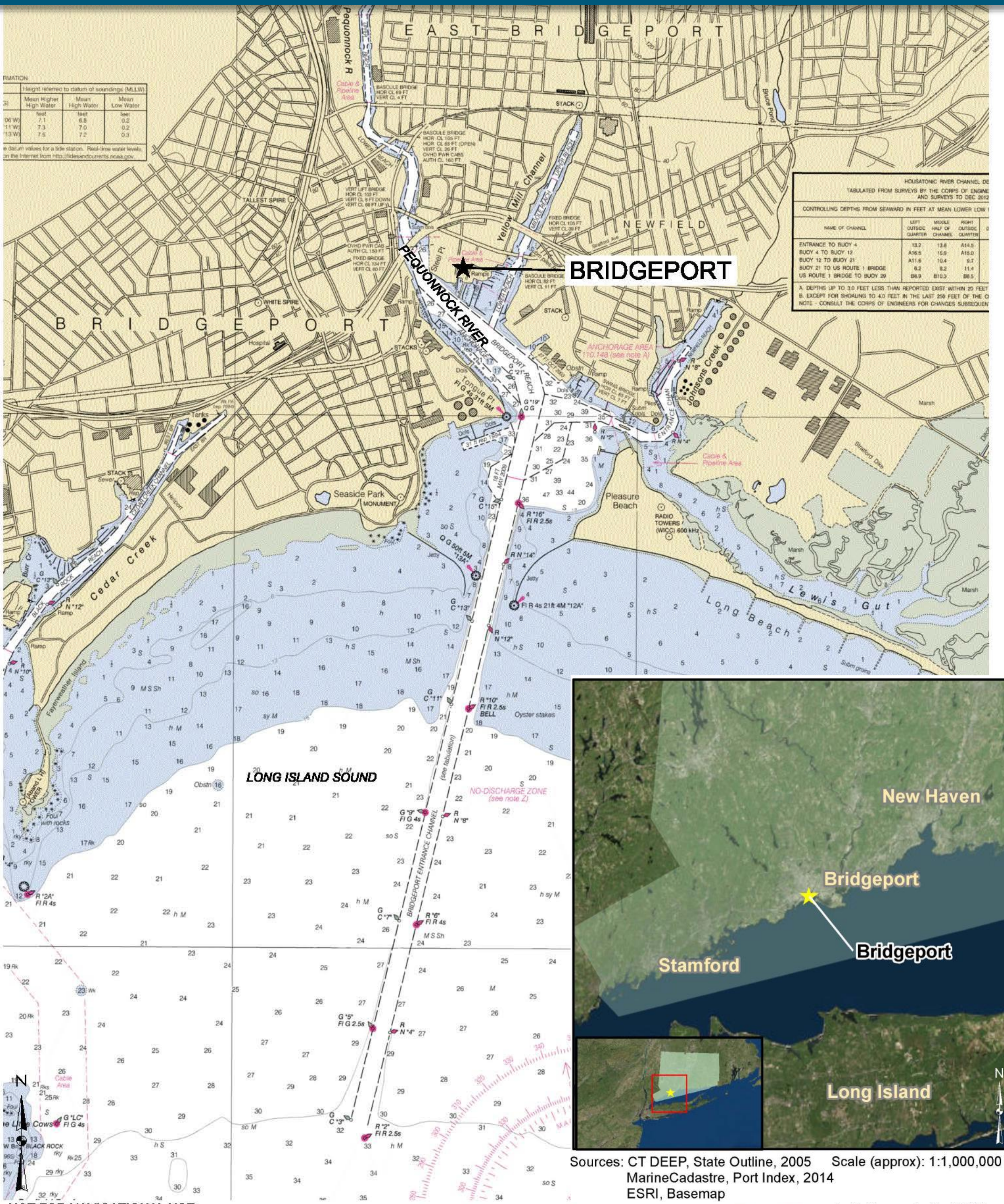
29 MarineTraffic. Automatic Identification System-Port of New Haven. [Internet]. 2015 [cited 2015 September 2015]. Available from: http://www.marinetraffic.com/en/ais/details/ports/21154/USA_port:NEW%20HAVEN.

30 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

31 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 September 10]. Available from: http://census.gov/govs/local/.

BRIDGEPORT

Bridgeport, Connecticut | 41° 10’ 21” N, 73° 10’ 55” W



Sources: CT DEEP, State Outline, 2005
MarineCadastre, Port Index, 2014
ESRI, Basemap

Scale (approx): 1:1,000,000

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 12369_1, 2014

Scale (approx.): 1" = 3000'

BRIDGEPORT

Bridgeport, Connecticut | 41° 10' 21" N, 73° 10' 55" W

Port Overview

Owner:	Bridgeport Port Authority/Connecticut Port Authority (Quasi-public Agency)
Operator:	Bridgeport Port Authority/Connecticut Port Authority (Quasi-public Agency)
Primary Existing Uses:	Commercial Shipping, Ferries, Recreational Boating
Primary Cargos Handled:	Fruit; Sand; Coal; Gravel; Gasoline; Oil; Stone
Typical Operating Hours:	8:00 AM – 5:00 PM Monday-Friday [1]
Terminal Land Area:	52 acres [2]
Shortest Distance to Wind Energy Area:	101.2 miles
Closest Lease Area:	Rhode Island/Massachusetts Lease Area - South
Commercial Port Employment:	Not available

The Port of Bridgeport is located at the mouth of the Pequonnock River, north of Long Island Sound. The Port of Bridgeport is comprised of two natural harbors, Bridgeport and Black Rock, both offering unhindered access to Long Island Sound. A federal channel extends from Long Island Sound to the inner harbor. From Long Island Sound to Tongue Point, the channel is 35 feet deep at mean lower low water (MLLW) and 400 feet wide. It widens to 600 feet at the northwest bend, then narrows to 300 feet at a point 800 feet before the Stratford Avenue Bridge as it heads up the Pequonnock River. There are two breakwaters at the entrance to the main harbor; the eastern breakwater is 3,823 feet long, and the western breakwater is 2,110 feet. A turning basin, 35 feet deep and 18 acres in area, is located east of the main ship channel [2] The highly developed harbor is dominated by industrial, commercial and recreational uses. Bridgeport's shorefront features consist of modified bluffs and escarpments stabilized by control structures such as revetments, bulkheads, or seawalls. [2]

The Port of Bridgeport is the second busiest port in Connecticut, handling over five million tons of cargo per year. [3] The harbor is the home of the Bridgeport Ferry, which transports people and cars between Bridgeport, Connecticut and Port Jefferson, New York. The majority of waterfront facilities in Bridgeport are privately owned and operated, although the Bridgeport Port Authority owns The Water Street Dock and Terminal on the west shore of the harbor and the Bridgeport Regional Maritime Terminal Complex, located on the east shore of Bridgeport Harbor. The Bridgeport Regional Maritime Complex houses the Bridgeport Shipyard facility and provides 1,350 linear feet of waterfront, a 160 foot long pier, a 360 foot long bulkhead, and over 100,000 square feet of assembly and fabrication space. [4]

A major obstruction to navigation in Bridgeport Harbor is the vertical clearance limits imposed by bridge crossings in the inner harbor. Several of the bridges have created navigational obstructions, due to the fact that a number of the bridges are inoperable. There are also a number of sunken vessels, including multiple coal barges, in the waters of Bridgeport Harbor, which pose a hazard to navigation and marine safety. [5] Additionally, parts of the Bridgeport Harbor Federal navigation channel have become quite shallow compared to the authorized depth, limiting navigation. The U.S. Army Corps of Engineers (USACE), in cooperation with state and city officials, are in the process of undertaking a significant dredging program within the next several years.

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Yes
Access	Port Access Channel Width (m)	121.9
	Port Access Water Depths (m)	10.7
	Overhead Draft (m)	Unlimited
	Number of Berths	4
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	105

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	19,788
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	No
	Width of Ro-Ro Berth (m)	N/A
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	N/A
Cranes	On-site Cranes' Capabilities (t)	100
	Crane Height Restrictions (m)	U

BRIDGEPORT

Bridgeport, Connecticut | 41° 10' 21" N, 73° 10' 55" W

Capability Area	Criteria (units)	
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Highway

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Dredging	Aggregate Dumping	Utility Tower Extension	Utility Line Moves	Construction of Storage Structure
Quayside Capabilities[a]		●	●	●	●	●	●			
Storage Capabilities[b]	●		●	●	●		●			●
Ro-Ro Capability[c]	●	●	●	●	●		●			
Cranes[d]	●	●	●	●	●			●	●	

Modifications in italics are assumed to be required based on port classifications

[a] Improve Quayside Length to 170 m; *Improve Quayside Bearing Capacity to 17 t/m² and make Quayside Seabed Suitable for Jacking*

[b] Increase Storage Area to 25,000 m²*; Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m²*

[c] Provide Ro-Ro Capability; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m²; improve Ro-Ro Berth Width to 8 m

[d] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space us conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Benthic communities in the Bridgeport Harbor federal navigation channels have very low diversity and very low abundance. Dominant species seen in benthic sample collections include polychaetes and amphipods, which are typically opportunistic pioneering species found in recently disturbed or highly stressed environments. Oyster shellfish beds are found in Bridgeport Harbor at the mouth of the Pequonnock River; however, these waters are classified as prohibited areas for the direct harvesting of shellfish. [2]
Fish & EFH	Bridgeport Harbor and Pequonnock River are classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). [6] The Pequonnock River also serves as a migratory pathway for anadromous species such as alewife and blueback herring. [2]
Air Quality	Bridgeport is located in the New Jersey-New York-Connecticut Interstate Air Quality Control Region (AQCR) and is in attainment for all criteria pollutants, except ozone (O_3). The entire state of Connecticut is classified as non-attainment for the 8-hour ozone standard. The county is classified as "marginal," which is the lowest of the classifications for ozone and requires fewer and/or less stringent mandatory air quality planning and control requirements. [7]
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape include open lands, grassed areas, and wetlands.

BRIDGEPORT

Bridgeport, Connecticut | 41° 10' 21" N, 73° 10' 55" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The sei whale, which inhabits waters in the northeastern US, was also identified as endangered. [8] In Long Island Sound, several types of whales have been seen including; fin whale, humpback whale, minke whale and sperm whale. Additional marine mammals common to Long Island Sound include; gray seals, harbor seals, harp seals and hooded seals. [8] The hawksbill sea turtle, leatherback sea turtle and green sea turtle have been listed as either endangered or threatened in Fairfield county. Three of the listed species in addition to the Kemp's ridley sea turtle, have been seen in Long Island Sound. Therefore, there is the possibility of these animals traveling into the Harbor. [9]
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover is listed as threatened in Fairfield county. [9] Several migratory birds have been identified in Bridgeport, specifically at Seaside Park. These include various species of ducks, Canadian Goose, Great Egret, Snowy Egret, Greater Yellowlegs and various species of gulls: Herring Gull, Laughing Gull, Ring-Billed Gull and Great Black-Backed Gull. [5] *(Information on bats in this area is not readily available.)*
Water Quality	Bridgeport Harbor (Segment ID CT-W1_001-SB), located north of Long Island Sound, is listed as impaired according to the 2014 State of Connecticut Integrated Water Quality Report. The Bridgeport Harbor is impaired due to dissolved oxygen, *Enterococcus*, fecal coliform, eutrophication biological indicators, Polychlorinated Biphenyls (PCBs), and Polycyclic Aromatic Hydrocarbons (PAHs). [10] [11] The current water quality classification within Bridgeport Harbor, including Pequonnock River and the tributaries of Johnson Creek, Yellow Mill Creek, and Lewis Gut, fluctuates between SC and SB depending on conditions. SC waterbodies are able to sustain aquatic life and are suitable for secondary recreation (activities with minimal skin contact). These waterbodies are sometimes classified as SB waters which are able to support primary recreation, such as swimming, that have prolonged skin contact. Waters classified as SB are also designated for marine fish habitat, other aquatic life and wildlife habitat, commercial shellfish harvesting, industrial water supply and navigation. Point and non-point sources of pollution prevent the waters within Bridgeport Harbor from consistently achieving Class SB criteria. [2]
Currents & Tides	In addition to inflow from the Pequonnock River, water circulation in Bridgeport Harbor is influenced by tidal flow and wind. The mean tidal range in Bridgeport Harbor is 6.74 feet. [12]
Sediment Deposition	Sediment in Bridgeport Harbor is primarily black organic silt and sediment in the entrance channel to the Harbor is composed mostly of silt with some sand. Bridgeport Harbor has sediment contaminant levels that are comparable to those found in other industrial harbors in the Northeast, including evidence of metal and other organic contaminants. [2]
Acoustic Environment	(*Information on acoustic environment not readily available*). Connecticut Department of Transportation (ConnDOT) noise construction standards state that the maximum allowable level of noise at the nearest residence or occupied building should not exceed 90 decibels on the "A" weighted scale (dBA).
Critical Habitat	Bridgeport Harbor was identified as having state and federal listed species and significant natural communities present; however, no critical habitat has been identified in the vicinity of Bridgeport Harbor. [13] [14]
Military Use Areas	Military installations near port: none in Fairfield County. Closest military installations are the West Point Military Academy (Army) over 40 miles NW; Sector Long Island Sound/Station New Haven (Coast Guard), about 16 miles east; and the New London Submarine Base (Navy) and the Coast Guard Academy (Coast Guard), both about 55 miles east [15]

BRIDGEPORT

Bridgeport, Connecticut | 41° 10' 21" N, 73° 10' 55" W

Resource	Description of Existing Conditions
Land Use & Existing Infrastructure	High and medium intensity developed land with commercial and residential areas to the west of the port and east across the channel along Interstate 95. The closest residential areas are just north of the port, across I-95. [16]
Transportation	The Port is located approximately a quarter mile from Interstate 95 and State Route 130 and approximately one mile from Connecticut Routes 25 and 8. A commuter railroad is also located within the Port. [16] [17]
Cultural & Historical	Nearby places in the National Register of Historic Places: there are 55 properties and historic districts in the city of Bridgeport, although not particularly concentrated around the port. [18] One known shipwreck of significance to the east of the port. [19]
Visual	View from closest residential areas obstructed by vegetation. View from Interstate 95 is a large industrial viewscape, with a red and white smokestack often visible (from an industrial plant, south of the port, on the west side of the channel). [20]
Environmental Justice	Total minorities: Fairfield County 34.5%; CT 29.5%. [21] Low-income: Fairfield County 9.1%; CT 10.2%. [21] Area surrounding port: census block groups for the port and its surroundings are over 75 percent total minority and census tracts for the port and its surroundings are over 25 percent low income. [22]
Commercial Fishing	Commercial landings: not available. [23] Commercial fishing engagement in communities surrounding the port is low. [24] Commercial fishing reliance in communities surrounding the port is low. [24]
Tourism & Recreation	Employment in tourism-related industries in Fairfield County in 2010: 30,435. [25] Recreational fishing engagement in communities surrounding the port is low. [24] Recreational fishing reliance in communities surrounding the port is low. [24]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 13 - Oct 13, 2015): 6-45. [20] Main vessel types to and from port (30 days): passenger 53%, tug boats 13.6%. [20]
Socioeconomic Resources	Population: Fairfield County 926,233. [21] Labor Force: Fairfield County 475,888; employed 446,528; unemployment rate 6.2%. [26] Main Sources of fiscal revenues in CT local jurisdictions: intergovernmental revenues 29.7%; charges 8.5 %; property taxes 55.1%; utility revenues 4.5%. [27]

Anticipated Impacts

Potential port modifications to the Port of Bridgeport necessary to support offshore wind development as a staging port are anticipated to be relatively extensive; however, several terminals/piers that make up the Port of Bridgeport may prove to be suitable for offshore wind O&M ports. Minor modifications would likely be necessary to accommodate O&M port use. Modifications to accommodate staging are anticipated to primarily impact terrestrial and upland resources, with limited impact to marine resources. The area is an active port in an urban setting with degraded water and sediment quality. The potential for reduction or loss of habitat (terrestrial and marine) exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above will not result in any significant noticeable increase in noise to the surrounding communities due to high local noise levels that presently exist. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. The terminals at the Port are strategically located off Interstate 95, minimizing any traffic impacts on local roadways. To the extent that there are high and adverse human health or environmental effects, there may be disproportionately high impacts on minority or low-income communities. The USACE, in cooperation with the state and local agencies, are in the process of undertaking an extensive maintenance dredging project within Bridgeport Harbor. An Environmental Assessment was prepared that identified and assessed many of the environmental and socioeconomic impacts associated with dredging the surrounding waterways. [2]

Data Sources & Additional Information

1 CBP (U.S. Customs and Border Protection). Locate a Port of Entry. [Internet]. [cited 2015 December 10]. Available from: http://www.cbp.gov/contact/ports.

2 USACE (U.S. Army Corps of Engineers) New England District. Draft Environmental Assessment, FONSI and 404(B)(1) Evaluation for Maintenance Dredging and Dredged Material Disposal Facility Construction. Environmental Assessment & FONSI. 2010. Available from: http://www.nae.usace.army.mil/Portals/74/docs/Topics/BridgeportDMMP/DraftEA-FONSI-404.pdf.

3 World Port Source. Port of Bridgeport. [Internet]. [cited 2015 October 22]. Available from: http://www.worldportsource.com/ports/commerce/USA_CT_Port_of_Bridgeport_70.php.

4 Connecticut Economic and Community Development. Bridgeport Port Overview. [Internet]. 2014 [cited 2015 October 27]. Available from: http://www.ct.gov/ecd/lib/ecd/Bridgeport_Port_Authority.pdf.

5 Apex Environmental. City of Bridgeport, Conneticut Harbor Management Plan. City of Bridgeport Harbor Management Commission; 2006. Available from: http://www.bridgeportct.gov/filestorage/89019/89753/95286/103729/TheHarborManagementPlanDecember2009.pdf.

6 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

7 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

8 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

9 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

10 CT DEEP (Connecticut Department of Energy & Environmental Protection). 2014 State of Connecticut Integrated Water Quality Report. [Internet]. 2014 [cited 2015 October 21]. Available from: http://www.ct.gov/deep/lib/deep/water/water_quality_management/305b/2014_iwqr_305b_303d_final.pdf.

11 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

12 NOAA (National Oceanic and Atmospheric Administration). Tides & Currents. [Internet]. 2015 [cited 2015 October 23]. Available from: https://tidesandcurrents.noaa.gov/datums.html?id=8467150.

13 Connecticut Environmental Conditions Online. Connecticut's Critical Habitats and Open Space. [Internet]. 2012 [cited 2015 October 23]. Available from: http://www.arcgis.com/home/item.html?id=a1bf59798c5b45a98aeaeb97dafd60b9.

14 CT DEEP (Connecticut Department of Energy & Environmental Protection). Endangered Species Maps. [Internet]. 2015 [cited 2015 October 23]. Available from: http://www.depdata.ct.gov/naturalresources/endangeredspecies/nddbpdfs.asp?nddbsel=15.

15 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

16 Google Earth. [Internet]. [cited 2015 September 10].

17 Bridgeport Port Authority. Connecticut Port Authority - Talking Points December 1, 2014. 2014.

18 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 September 10]. Available from: http://www.nps.gov/nr/research/index.htm.

19 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

20 MarineTraffic. Automatic Identification System-Port of Bridgeport. [Internet]. 2015 [cited 2015 September 10]. Available from: http://www.marinetraffic.com/en/ais/details/ports/659/USA_port:BRIDGEPORT.

21 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

22 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

23 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

24 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

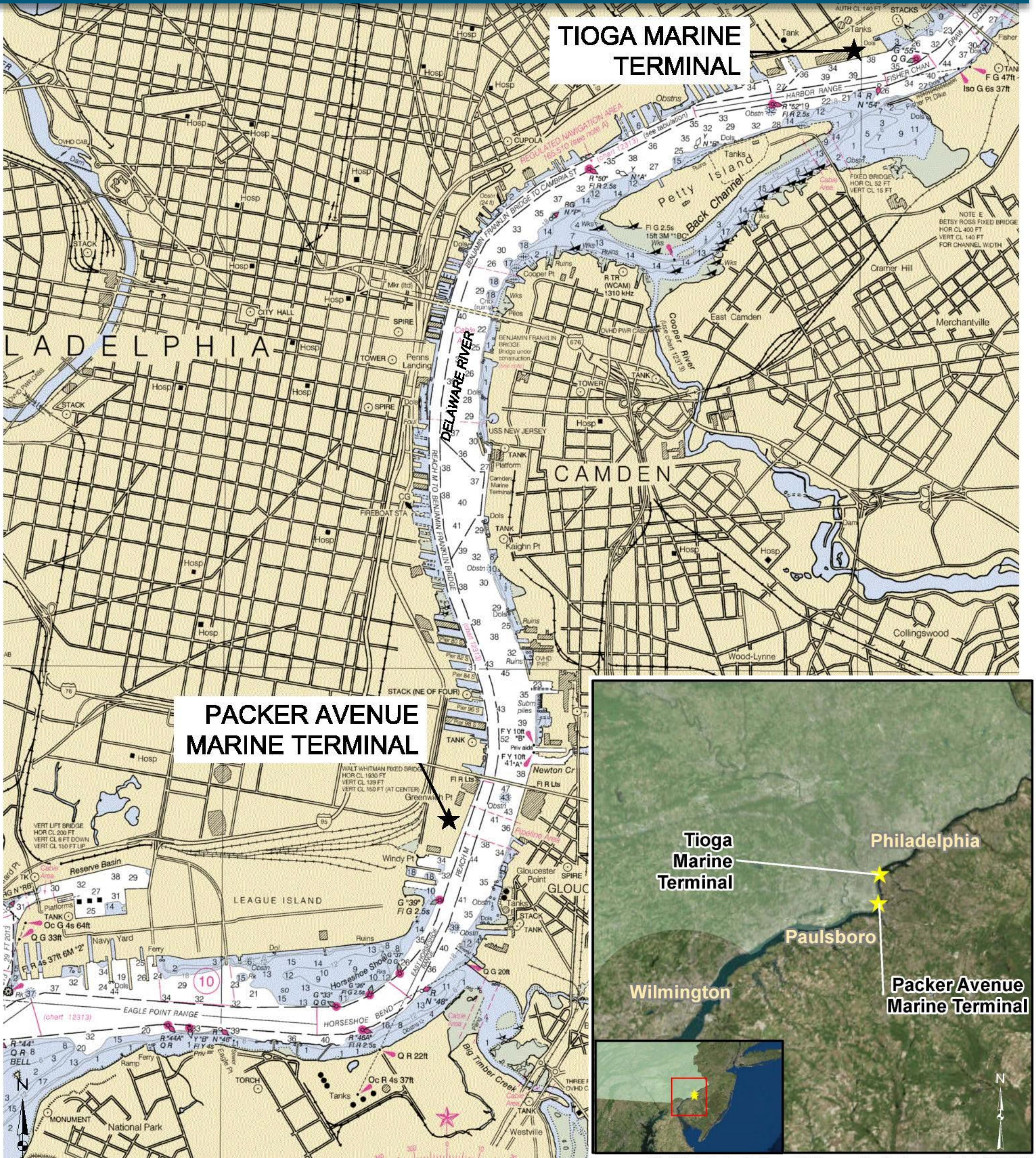
25 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

26 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

27 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 September 10]. Available from: http://census.gov/govs/local/.

PHILADELPHIA

Multiple Terminals | Philadelphia, Pennsylvania | 39° 53' 43" N, 75° 08' 07" W



Sources: PA DOT, State Outline, 2015
MarineCadastre, Port Index, 2014
ESRI, Basemap

Scale (approx): 1:1,000,000

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 12312_1, 2012

Scale (approx.): 1" = 5000'

PHILADELPHIA

Multiple Terminals | Philadelphia, Pennsylvania | 39° 53' 43" N, 75° 08' 07" W

Port Overview

Owner:	Philadelphia Regional Port Authority (PRPA) (State Agency)
Operator:	Greenwich Terminals, LLC (Private Agency) – operates Packer Avenue Marine Terminal; Delaware River Stevedores, Inc. (Private Agency) – operates Tioga Marine Terminal
Terminals at Port of Philadelphia:	Packer Avenue Marine Terminal (Packer); Tioga Marine Terminal (Tioga)
Primary Existing Uses:	Commercial Shipping; Container Handling; Breakbulk [1]
Primary Cargos Handled:	Automobiles; Containers; Breakbulk; Steel; Project Cargo; Frozen Meat; Fruit; Paper; Forest Products [1]
Typical Operating Hours:	8:30 AM – 5:00 PM Monday-Friday [1]
Marine Terminal Land Area:	112 acres (Packer); 116 acres (Tioga) [1]
Shortest Distance to Wind Energy Area:	112.5 miles (average distance of 2 terminals)
Closest Lease Area:	Delaware Lease Area
Commercial Port Employment:	1,945 people [2]

The Port of Philadelphia is presently comprised of two marine terminal facilities—the Tioga Marine Terminal and the Packer Avenue Marine Terminal—and several Pier facilities. Tioga Marine Terminal is the largest of PRPA's terminals, and handles multiple types of cargo, including containers, breakbulk; Roll-On, Roll-Off (Ro-Ro); and heavy lift cargo. The Packer Avenue Marine Terminal handles automobiles, steel, and project cargoes. The various pier facilities operated by PRPA (Piers 38/40, 78/80, 82, 84, and 96/98) are smaller facilities that handle various types of cargo. PRPA also controls a 194 acre waterfront parcel called the Southport Marine Terminal Complex that it is presently the subject of a solicitation for private development interest. [1]

The U.S. Army Corps of Engineers (USACE) Philadelphia District is responsible for maintaining the authorized 40-foot depth in the Delaware River navigation channel from Newbold Island in Bucks County north of Philadelphia. The federal channel serves ports in Paulsboro, Philadelphia, Camden, and Wilmington. [3] Currents play an important role in navigation, as the transit of deep-draft vessels entering the estuary destined for port facilities in the reach from Wilmington to Philadelphia is scheduled to take advantage of flood currents and higher tidal stages, to assure maximum bottom clearance in high shoaling rate areas. [3] The Philadelphia District is in the process of deepening the Delaware River main channel from 40 feet to 45 feet from the Atlantic Ocean to the marine terminals in Philadelphia and Camden. The project is 75% complete, and will be finished by 2017.

PRPA's terminal facilities are located near, and have easy access, to all major trucking routes including I-95 and I-76. Currently, the Port's facilities are serviced by two class-one railroads: CSX and Norfolk Southern. [1]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	Packer	Tioga
Potential Use	Staging Port	Yes	Yes
	Operation & Maintenance (O&M) Port		
Access	Port Access Channel Width (m)	121.9	121.9
	Port Access Water Depths (m)	12.2	10.8
	Overhead Draft (m)	50.6	42.4
	Number of Berths	6	6
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U	U
	Quayside Length (m)	1158	1164

PHILADELPHIA

Multiple Terminals | Philadelphia, Pennsylvania | 39° 53’ 43” N, 75° 08’ 07” W

Capability Area	Criteria (units)	Packer	Tioga
	Quayside Seabed Suitable for Jacking	U	U
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U	U
	Storage Area Bearing Capacity (t/m^2)	U	U
	Size of Storage Area (m^2)	U	U
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes	Yes
	Width of Ro-Ro Berth (m)	U	U
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U	U
Cranes	On-site Cranes’ Capabilities (t)	340	104
	Crane Height Restrictions (m)	U	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway	Rail; highway

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Blasting	Pile Driving/ Drilling	Dredging	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping	Construction of Storage Structure
Access Capabilities[a]		●	●	●				●	●		
Cranes[b]	●		●		●	●	●	●	●		
Quayside Bearing Capacity[c]	●		●	●	●	●	●			●	
Storage Capabilities[d]	●				●	●	●			●	●
Ro-Ro Capability[e]	●		●		●	●	●			●	

Modifications in italics are assumed to be required based on port classifications

[a] Improve overhead draft to 75 m for both terminals

[b] Provide On-Site Cranes with 600 t lifting capacity for both terminals; *Reduce Crane Height Restrictions to 50 m for both terminals*

[c] *Improve Quayside Bearing Capacity to 17 t/m^2 and make Quayside Suitable for Jacking for both terminals*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2 for both terminals; increase storage area to 25,000 m^2 for both terminals*

[e] *Improve Ro-Ro Berth Width to 8 m for both terminals; improve Bearing Capacity of Ro-Ro Berths and Ramps to 10 t/m^2 for both terminals*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

PHILADELPHIA

Multiple Terminals | Philadelphia, Pennsylvania | 39° 53' 43" N, 75° 08' 07" W

Resource	Description of Existing Conditions
Benthic	(*Limited information on benthic environment in immediate area surrounding port*). The Delaware Estuary hosts the world's largest horseshoe crab population. Other important benthic species found in the area include the blue crab and American oyster. [3]
Fish & EFH	The portion of the Delaware River where the Port is located is classified as Essential Fish Habitat (EFH) by NMFS. The shortnose and Atlantic sturgeon are endangered species found in nearshore estuaries and rivers, including the Delaware River and Delaware Bay. Many anadromous fish, including American shad, also utilize the Delaware River for spawning. [4]
Air Quality	The Port Area is within the Metropolitan Philadelphia Interstate Air Quality Control Region (AQCR) (Pennsylvania-New Jersey-Delaware), which is classified as severe non-attainment for ozone (O_3) (composed of nitrogen oxides [NOx] and volatile organic compounds [VOCs]) and as a maintenance area for carbon monoxide (CO). [3] [5] A CO Maintenance area is an area in where the CO levels formerly exceeded the National Ambient Air Quality Standards (NAAQS), but have now been reduced to and meet the NAAQS.
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape include very limited wetlands scattered along the banks of the Delaware River in this vicinity. [6]
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. [7] The North Atlantic right whale, fin whale, and humpback whale have been documented in the Delaware River Estuary. Other species that are occasionally seen in the Delaware Bay include the blue whale, sperm whale, and sei whale. It is unlikely that these species will be found near the Port due to location upriver. Other marine mammals that are known to occur in the Delaware River include bottlenose dolphin, short beaked common dolphin, harbor porpoise and harbor seal. [3] Four federally listed endangered species of turtles including the leatherback, loggerhead, Kemp's ridley, and hawksbill turtles, have been identified in the Delaware River and Estuary. The green sea turtle, which is listed as threatened in NJ, is also known to occur in the Delaware River and Estuary. These species are unlikely to occur near the Port, due to its location upriver. [3]
Birds & Bats	Endangered species listings from the USFWS were consulted. The bald eagle is listed as recovery for Philadelphia county. The second largest population of migrating shorebirds in North America is located in Delaware Bay. [8] Commonly observed species include sanderlings, sandpipers, ruddy turnstones and red knot. [9] At the Bombay Hook National Wildlife Refuge, approximately 60 miles south of the Port, many species of waterfowl and shorebirds have been observed. At the Salem River Wildlife Management Area, approximately 25 miles southeast of the Port, additional bird species have been known to occur including the Ross's goose, orchard oriole, European starling, and common grackle. [10] *(Information on bats in this area is not readily available.)*
Water Quality	The Delaware River (Segment ID's= NJDELAWARE RIVER 2, 8, 14-19) is listed as impaired according to the New Jersey Department of Environmental Protection 2012 Integrated Report – Appendix A. The Delaware River is listed as impaired for chlorodane in fish tissue, DDT (formally known as dichlorodiphenyltrichloroethane) in fish tissue, mercury in fish tissue, deildrein in fish tissue and Polychlorinated Biphenyls (PCBs) in fish tissue throughout the waterway. [11] (Data were used from the New Jersey Department of Environmental Protection [NJ DEP] given the proximity of sites and because data from Pennsylvania was last updated in 2004.)
Currents & Tides	Water circulation at the Port is influenced by the flow of the Delaware River as well as by tidal flow and wind. The limit of salt intrusion during high flow conditions is generally near Wilmington, DE, but can approach the Philadelphia area under low flow conditions. [12] The tidal range at the Benjamin Franklin Bridge in Philadelphia (RM 100) is 5.7 feet. [3]

PHILADELPHIA

Multiple Terminals | Philadelphia, Pennsylvania | 39° 53' 43" N, 75° 08' 07" W

Resource	Description of Existing Conditions
Sediment Deposition	Studies conducted by the USACE in the channels of the Delaware River found the sediments contained a variety of toxins and metals such as PCBs, DDE (formally known as Dichlorodiphenyldichloroethylene), and pesticides. [3]
Acoustic Environment	The area surrounding the port supports a variety of light industrial and commercial uses, as well as residential uses. At the port itself, typical noise includes cranes, equipment, generators, vehicles and miscellaneous tools. [13]
Critical Habitat	There are no critical habitat designations in the state of Pennsylvania along the Delaware River. [14]
Military Use Areas	There are no military installations in Philadelphia County, PA. The closest military installation is the Joint Reserve Base Willow Grove (Navy), which is 16 miles north of the port. [15]
Land Use & Existing Infrastructure	Packer: High and medium intensity developed industrial areas to the north and south of the terminal, along the coast line. High intensity developed residential areas one mile to the northwest. Less developed industrial areas on half a mile to the southwest of the terminal. Medium intensity industrial, commercial, and residential areas to the east, about half a mile from the terminal. The Walt Whitman Bridge borders the terminal to the north. [16] [17] Tioga: High intensity developed industrial areas within the terminal's immediate vicinity. High intensity developed residential and commercial areas less than one mile northwest of the terminal and medium developed residential and commercial areas less than a mile to the east, across the channel. Less developed lands along the shoreline approximately a mile southwest of the port. The Palmyra Cove Nature Park is 2.5 mi to the northeast of the terminal. The Betsy Ross Bridge borders the terminal to the northeast. [16] [17]
Transportation	Packer: Immediate access to I-95 and I-76. Terminal is serviced by rail. [17] Tioga: Immediate access to I-95. Rail on the NE border of the terminal. [17]
Cultural & Historical	Nearby places in the National Register of Historic Places: there are 552 properties or districts in Philadelphia County. [18] Packer: Within Pennsylvania waters, there are two known shipwreck north of the terminal. There are numerous known shipwrecks to the south of the terminal, along the route to the entrance to the navigation channel. [19] Tioga: Within Pennsylvania waters, there is one known shipwreck northeast of the terminal and one known shipwreck southwest of the terminal. In New Jersey waters, across the channel, there are numerous reports of shipwrecks, especially south of the terminal. [19]
Visual	Packer: Industrial viewscapes at the terminal, from both shores of the navigation channel. From the Walt Whitman Bridge, four large cranes and numerous large containers are visible. [17] Tioga: Industrial viewscapes at the terminal. From the Betsy Ross Bridge, cranes and other industrial equipment dominate the viewscape. Industrial equipment at the terminal obstructs views of downtown Philadelphia. [17]
Environmental Justice	Total minorities: Philadelphia County 58.4%; PA 21.0%. [20] Low-income: Philadelphia County 26.5%; PA 13.3%. [20] Packer: Area surrounding terminal: Census block group encompassing the terminal has a total minority population of less than 26 percent, census block groups less than a mile to the north and northeast have over 75 percent total minority populations; the census tract encompassing the terminal has less than 20 percent individuals below poverty level. [21] Tioga: Area surrounding terminal: Census block group encompassing the terminal has a total minority population of less than 26 percent, census block groups less than a mile to the north and northeast have over 75 percent total minority populations; the census tract encompassing the terminal has less than 20 percent individuals below poverty level. [21]
Commercial Fishing	Commercial landings: Not available. [22] Commercial fishing engagement in all surrounding communities is low. [23] Commercial fishing reliance in all surrounding communities is low. [23]
Tourism & Recreation	Employment in tourism-related industries in Philadelphia County in 2012: 36,777. [24] Recreational fishing engagement in all surrounding communities is low. [23] Recreational fishing reliance in all surrounding communities is low. [23]

PHILADELPHIA

Multiple Terminals | Philadelphia, Pennsylvania | 39° 53' 43" N, 75° 08' 07" W

Resource	Description of Existing Conditions
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 28 - Oct 26, 2015): 6-69. [25] Main vessel types to and from port (30 days): cargo 6.78%, passenger 20.0%, tug 63.8%, and tanker 4%. [25]
Socioeconomic Resources	Population: Philadelphia County 1,536,704. [20] Labor Force: Philadelphia County 689,205; employed 634,036; unemployment rate 8.0%. [24] Main Sources of fiscal revenues in PA local jurisdictions: intergovernmental revenues 35.5%; charges 12.2 %; property taxes 27.0%; individual income tax 7.1%. [26]

Anticipated Impacts

Potential port modifications to the Port of Philadelphia necessary to support offshore wind development are anticipated to be relatively extensive, and include increasing the bearing capacity at various points within the terminal. This would have minor impact on existing terrestrial and marine resources due to the industrial setting of the site. Noise associated with the port modifications identified above is not likely to be above existing ambient levels; due to the industrialized nature of the surrounding environment. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications. Chances for relevant socioeconomic impacts are low. No disproportionately high and adverse human health or environmental effects to minority or low-income communities are anticipated.

Data Sources & Additional Information

1 PRPA (Philadelphia Regional Port Authority). Port of Philadelphia. [Internet]. [cited 2015 November 5]. Available from: http://www.philaport.com/index.htm.

2 Economic Development Research Group. Maritime Commerce in Greater Philadelphia: Assessing Industry Trends and Growth Opportunities for Delaware River Ports. PIDC; 2008. Available from: http://www.edrgroup.com/pdf/ports%20-%20final.pdf.

3 USACE (U.S. Army Corps of Engineers). Delaware River Main Stem and Channel Deepening Project Environmental Assessment. Philadelphia District; 2009.

4 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

5 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

6 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 November 5]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

7 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

8 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

9 Delaware Riverkeeper Network & National Wildlife Federation. Delaware River Deepening - Dumped Again. 2007.

10 New Jersey Birding & Wildlife Trails. Salem River Wildlife Management Area. [Internet]. 2010 [cited 2015 November 4]. Available from: http://www.njwildlifetrails.org/PineBarrensTrails/Sites/tabid/1698/Scope/site/Guide/DELBAYSH/Site/10/Default.aspx.

11 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 November 2]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

12 Patrick Center for Environmental Research. Impact of Aquatic Vegetation on Water Quality of the Delaware River Estuary. West Trenton: Delaware River Basin Commission; 1998. Final Report 98-5F. Available from: http://www.state.nj.us/drbc/library/documents/aquaticveg-delestuary1998.pdf.

13 Delaware River Port Authority. BFB Neighbor Advisory. [Internet]. 2015 [cited 2015 Nov 2]. Available from: http://www.drpa.org/travel/bfb_neighborhood_advisory.html.

14 USFWS (U.S. Fish and Wildlife Service). Threatened & Endangered Species Active Critical Habitat Report. [Internet]. [cited 2015 Oct 29]. Available from: http://ecos.fws.gov/crithab/flex/crithabMapper.jsp.

15 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

16 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 October 28]. Available from: http://www.mrlc.gov/eva/viewer.html.

17 Google Earth. [Internet]. [cited 2015 October 28].

18 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 October 28]. Available from: http://www.nps.gov/nr/research/index.htm.

19 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

20 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

21 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

22 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

23 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

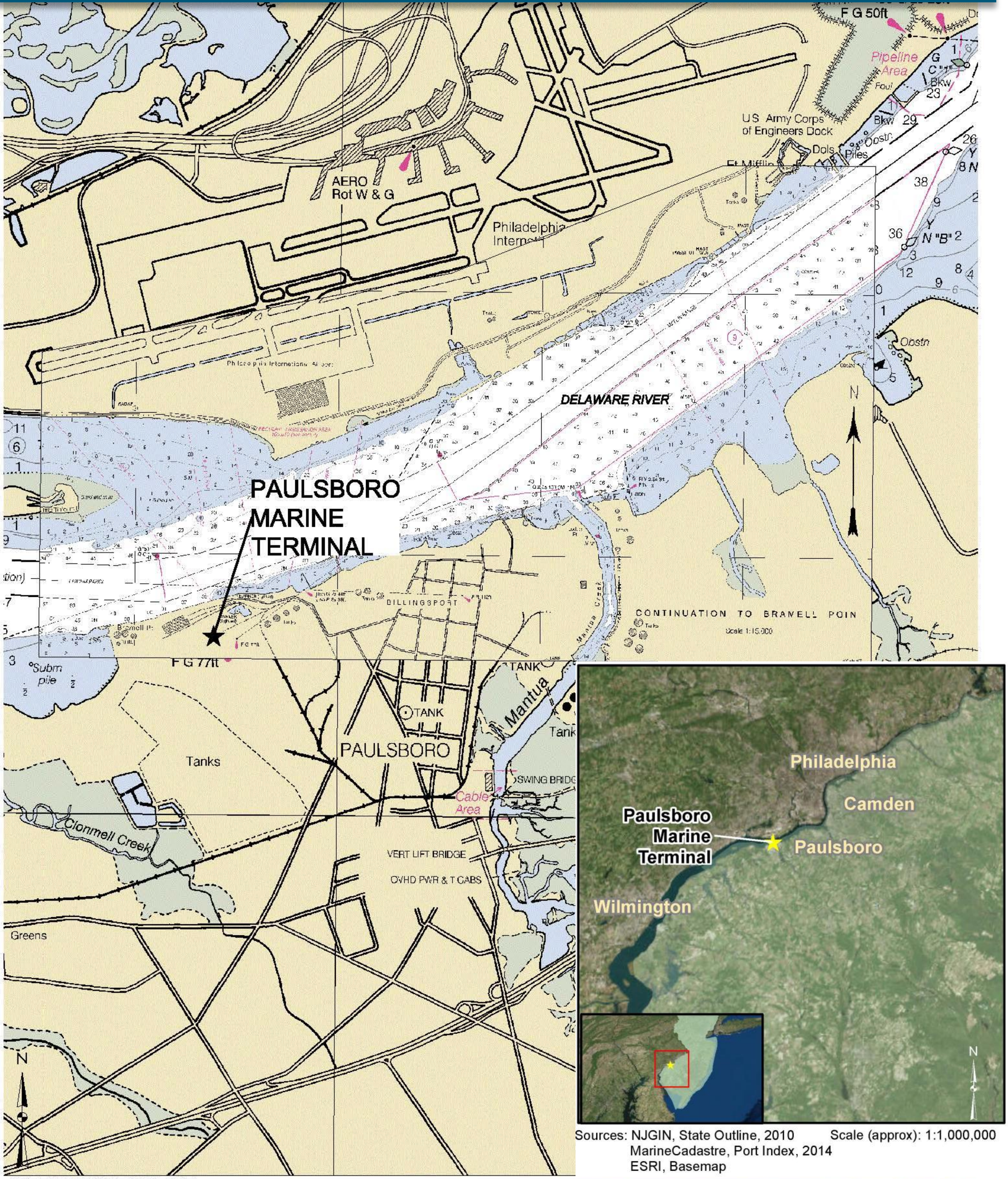
24 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

25 MarineTraffic. Automatic Identification System-Port of Philadelphia. [Internet]. 2015 [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/details/ports/2817.

26 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

PAULSBORO

Paulsboro Marine Terminal | Paulsboro, New Jersey | 39° 50’ 50” N, 75° 14’ 52” W



Sources: NJGIN, State Outline, 2010
MarineCadastre, Port Index, 2014
ESRI, Basemap

Scale (approx): 1:1,000,000

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 12313_2, 2012; 12312_1, 2012

Scale (approx.): 1" = 3000'

PAULSBORO

Paulsboro Marine Terminal | Paulsboro, New Jersey | 39° 50’ 50” N, 75° 14’ 52” W

Port Overview

Owner:	BP leases to Borough of Paulsboro (Private Corporation/City)
Operator:	South Jersey Port Corporation (SJPC) and Holt Logistics
Primary Existing Uses:	Commercial Shipping
Primary Cargos Handled:	Plywood, Steel cargoes, Scrap export and Cocoa beans
Typical Operating Hours:	8:00 AM – 5:00 PM Monday-Friday [1]
Terminal Land Area:	200 acres [1]
Shortest Distance to Wind Energy Area:	101.1 miles
Closest Lease Area:	Delaware Lease Area
Commercial Port Employment:	2,446 people

The Port of Paulsboro is located approximately 15 miles south of Camden on the east banks of the Delaware River in Gloucester County, New Jersey. The port is located across from Philadelphia International Airport, approximately 50 miles upriver of Delaware Bay and approximately 90 miles from the Atlantic Ocean. [2]

Currently, the Port handles traditional cargo; however a portion of the port is being redeveloped to accommodate larger vessels and heavier equipment. The Paulsboro Marine Terminal is the first major terminal to be constructed on the Delaware River in more than 50 years, and is targeted for operation in early 2016. [1] The terminal is located on a 200 acre area that once housed a BP oil terminal and a Dow Chemical plant. While BP has performed an extensive environmental remediation of the site, they are leasing the land to the Borough of Paulsboro for development of the Terminal. Environmental monitoring of the remediation project, as dictated by the New Jersey Department of Environmental Protection (NJ DEP), is expected to continue for many years.

The new facility will contain 2 ship berths and is designed primarily to handle break-bulk cargo, although the port owners have also expressed an interest in attracting offshore wind projects or component manufacturers to the port. [3] The Port designed the quayside for 7.3 t/m^2 with the expectation that additional and less expensive load-spreading techniques would be used to facilitate heavy lifts. [3]

The U.S. Army Corps of Engineers (USACE) Philadelphia District is responsible for maintaining the authorized 40-foot depth in the Delaware River navigation channel from Newbold Island in Bucks County north of Philadelphia. The federal channel serves ports in Paulsboro, Philadelphia, Camden, and Wilmington. [4] The Philadelphia District is in the process of deepening the Delaware River main channel from 40 feet to 45 feet from the Atlantic Ocean to the marine terminals in Philadelphia and Camden. The project is 75% complete, and will be finished by 2017.

Port Classifications   Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	
Access	Port Access Channel Width (m)	243.8
	Port Access Water Depths (m)	12.2
	Overhead Draft (m)	15.2
	Number of Berths	3
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	7.3
	Quayside Length (m)	330
	Quayside Seabed Suitable for Jacking	Yes

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	24
	Storage Area Bearing Capacity (t/m^2)	24
	Size of Storage Area (m^2)	400,000
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	No
	Width of Ro-Ro Berth (m)	N/A
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	N/A
Cranes	On-site Cranes’ Capabilities (t)	180
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Blasting	Dredging	Fill Placement	Fill Compaction	Paving	Aggregate Dumping	Utility Tower Extension	Utility Line Moves
Access Capabilities[a]		●	●	●					●	●
Quayside Bearing Capacity[b]		●			●	●	●	●		
Ro-Ro Capability[c]	●	●			●	●	●	●		
Cranes[d]	●	●			●	●	●		●	●
Onshore Transportation Infrastructure[e]	●	●	●		●	●	●			

Modifications in italics are assumed to be required based on port classifications

[a] Improve overhead draft to 75 m

[b] Improve Quayside Bearing Capacity to 17 t/m^2

[c] Provide Ro-Ro Capability; improve Ro-Ro Berth Width to 8 m; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2

[d] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

[e] Provide Onshore Transportation Infrastructure

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	The Delaware Estuary hosts the world’s largest horseshoe crab population. Other important benthic species found in the area include blue crab and American oyster. [5] *(Information on benthic environment in this area is not readily available*.)
Fish & EFH	The portion of the Delaware River where the Port is located is classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). The shortnose and Atlantic sturgeon are endangered species found in nearshore estuaries and rivers, including the Delaware River and Delaware Bay. Many anadromous fish, including American shad, also utilize the Delaware River for spawning. [6] [7]
Air Quality	The Port Area is within the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Area, which is classified as severe non-attainment for ozone (composed of nitrogen oxides [NOx] and volatile organic compounds [VOCs]) and as a maintenance area for carbon monoxide (CO). [8] [4] A CO Maintenance area is an area in where the CO levels formerly exceeded the National Ambient Air Quality Standards (NAAQS), but have now been reduced to and meet the NAAQS.

PAULSBORO

Paulsboro Marine Terminal | Paulsboro, New Jersey | 39° 50' 50" N, 75° 14' 52" W

Resource	Description of Existing Conditions
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape include wetlands along the banks of the Delaware River. [9]
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. [10] The North Atlantic right whale, fin whale, and humpback whale, have been documented in the Delaware River Estuary. Other species that are occasionally seen in Delaware Bay include the blue whale, sperm whale, and sei whale. It is unlikely that these species will be found near the Port. Other marine mammals that are known to occur in NJ waters and may be found in the upriver portions of the Delaware River include bottlenose dolphin, short beaked common dolphin, harbor porpoise and harbor seal. [4] Four federally listed endangered species of turtles including the leatherback, loggerhead, Kemp's ridley, and hawksbill turtles, have been identified in the Delaware River and the Estuary. The green sea turtle, which is listed as threatened in NJ, is also known to occur in the Delaware River and Estuary. These species could potentially occur near the Port. [4] [11]
Birds & Bats	Endangered species listings from the USFWS were consulted. The Northern long-eared bat is listed as threatened in Gloucester county. The second largest population of migrating shorebirds in North America is located approximately 50 miles downriver from Paulsboro in Delaware Bay. [12] Commonly observed species include sanderlings, sandpipers, ruddy turnstones and red knot. [5] At the Bombay Hook National Wildlife Refuge, approximately 52 miles southwest of the Port, many species of waterfowl and shorebirds have been observed. At the Salem River Wildlife Management Area, approximately 20 miles southeast of the Port, additional bird species have been known to occur including the Ross's goose, orchard oriole, European starling, and common grackle. [13]
Water Quality	The Delaware River (Segment ID's= NJDELAWARE RIVER 2, 8, 14-19) is listed as impaired according to the New Jersey Department of Environmental Protection 2012 Integrated Report – Appendix A. The Delaware River is listed as impaired for chlorodane in fish tissue, DDT (formally known as dichlorodiphenyltrichloroethane) in fish tissue, mercury in fish tissue, deildrein in fish tissue and Polychlorinated Biphenyls (PCBs) in fish tissue throughout the waterway. [14]
Currents & Tides	The Port is located on the Delaware River and Mantua Creek. Water circulation is influenced by the inflow of these waterbodies as well as tidal flow and wind. The mean tidal range at this portion of the Delaware River is 5.64 ft. [15]
Sediment Deposition	The National Coastal Assessment study classified the sediments surrounding the Port as nontoxic; however, studies conducted by the USACE in the channels of the Delaware River found the sediments contained a variety of toxins and metals such as PCBs, DDE (formally known as Dichlorodiphenyldichloroethylene) and pesticides. [4] [16] Sediments in Paulsboro Harbor are classified as primarily medium grain sand some gravel and silt. [17]
Acoustic Environment	The Port is currently an active port in an industrialized area and is located directly across the river from Philadelphia International Airport. The Borough of Paulsboro law states that construction noise (i.e., operating tools and equipment) cannot occur between the hours of 8PM and 7AM Monday through Friday. [18]
Critical Habitat	Currently, there is no designated critical habitat in the state of New Jersey along the Delaware River. [19]
Military Use Areas	Military installations near port: none in Gloucester County, NJ. The closest military installations are the Joint Reserve Base Willow Grove (Navy) over 25 miles north of the port, in Pennsylvania, and Fort Dix (Army) and McGuire Air Force Base (Air Force) both 37 mi east of the port in New Jersey. [20]
Land Use & Existing Infrastructure	High and medium intensity developed land with commercial areas to the east and north of the port. Residential areas border the port to the southeast and east. The RiverWinds Community center and recreational lands are to the east. The Philadelphia International Airport is north of the port, directly across the river from the Port. The port borders undeveloped lands to the west. [21] [2]

PAULSBORO

Paulsboro Marine Terminal | Paulsboro, New Jersey | 39° 50' 50" N, 75° 14' 52" W

Resource	Description of Existing Conditions
Transportation	Access to Interstate 295 via US-130, which travels through residential areas. Rail capabilities are currently being developed including on-dock rail infrastructure. [22] [2] [1]
Cultural & Historical	Nearby places in the National Register of Historic Places: there are 33 properties and historic districts in Gloucester County, although none are located within the Paulsboro borough. [23] One submerged shipwreck to the east of the port and one visible shipwreck to the north of the port. [24]
Visual	Industrial viewscape at the port. View from closest residential areas partially obstructed by vegetation. Refinery equipment at the port is partially visible from all directions. [2]
Environmental Justice	Total minorities: Gloucester County 17.2%; NJ 30.8%. [25] Low-income: Gloucester County 8.1%; NJ 10.4%. [25] Area surrounding port: census block groups to the east and southeast of the port vary from 7 percent total minority to over 75 percent total minority; the census tract for the port and its surroundings are over 26 percent low income, the highest in the vicinity. [26]
Commercial Fishing	Commercial landings: Not available. [27] Commercial fishing engagement in communities surrounding the port is low. [28] Commercial fishing reliance in communities surrounding the port is low. [28]
Tourism & Recreation	Employment in tourism-related industries in Gloucester County in 2012: 6,867. [29] Recreational fishing engagement in communities surrounding the port is low. [28] Recreational fishing reliance in communities surrounding the port is low. [28]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 28 - Oct 26, 2015): 6-52. [30] Main vessel types to and from port (30 days): tug 83.3%, special craft 9.8%, tanker 6.2%. [30]
Socioeconomic Resources	Population: Gloucester County 289,098. [25] Labor Force: Gloucester county 148,835; employed 138,254; unemployment rate 7.1%. [29] Main Sources of fiscal revenues in NJ local jurisdictions: intergovernmental revenues 26.6%; charges 8.5 %; property taxes 55.9%; sewerage charge: 3.3%; utility revenues 2.6%. [31]

Anticipated Impacts

Potential port modifications to the Port of Paulsboro necessary to support offshore wind development are anticipated to be limited to increasing the soil bearing capacity at the quayside, which would have little impact on existing terrestrial and upland resources due to the industrial setting of the site. There is no anticipated impact to sediments or marine resources associated with the port modifications identified above. Noise associated with the port modifications identified above is not likely to be above existing ambient levels; however, day/night restrictions may be required for certain activities that have the potential to disturb surrounding communities. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications.

Road access to the port would depend on local roads neighboring residential areas. To the extent that construction materials are transported by truck, impacts to traffic may occur. To the extent that there are high and adverse human health or environmental effects in the areas surrounding the port, there is potential for a disproportionate impacts on minority or low-income communities.

Under the current BP remediation plan, the environmental and socioeconomic condition of the site has been evaluated. Many design revisions and mitigation measures, including traffic impacts to residential neighborhoods, are being considered as part of the Terminal development project. Additional modifications should be coordinated with the current BP remediation plan.

Data Sources & Additional Information

1 SJPC (South Jersey Port Corporation). Paulsboro Marine Terminal. [Internet]. 2015 [cited 2015 Oct 29]. Available from: http://southjerseyport.com/facilities/paulsboro-marine-terminal/.

2 Google Earth. [Internet]. [cited 2015 October 28].

3 DNV GL. Assessment of Ports for Offshore Wind Development in the United States. Document No. 700694-USPO-R-03; 2014.

4 USACE (U.S. Army Corps of Engineers). Delaware River Main Stem and Channel Deepening Project Environmental Assessment. Philadelphia District; 2009.

5 Delaware Riverkeeper Network & National Wildlife Federation. Delaware River Deepening - Dumped Again. 2007.

6 NJ DEP (New Jersey Department of Environmental Protection). Division of Fish & Wildlife: Delaware River Shad Fishing Report. [Internet]. 2015 [cited 2015 Oct 29]. Available from: http://www.state.nj.us/dep/fgw/del_river_rpt15.htm.

7 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

8 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 November 2]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

9 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

10 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

11 USACE (U.S. Army Corps of Engineers) Philadelphia District. A Supplement Biological Assessment for Potential Impacts to the New York Bight Distinct Population Segment of Atlantic Sturgeon. Biological Assessment. USACE; 2011.

12 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

13 New Jersey Birding & Wildlife Trails. Salem River Wildlife Management Area. [Internet]. 2010 [cited 2015 November 4]. Available from: http://www.njwildlifetrails.org/PineBarrensTrails/Sites/tabid/1698/Scope/site/Guide/DELBAYSH/Site/10/Default.aspx.

14 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 November 2]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

15 NOAA (National Oceanic and Atmospheric Administration). Tides Online and Current Predictions. [Internet]. [cited 2015 September 9]. Available from: http://co-ops.nos.noaa.gov.

16 Delaware River Basin Commission. Delaware Estuary Monitoring Report: Covering Monitoring Developments and Data Collected or Reported during 1999-2003. Monitoring Report. 2004.

17 S.S. Papadopulos & Associates, Inc. Expert Report Paulsboro Terminal Site. Expert Report. Bethesda: State of New Jersey Department of Environmental Protection; 2009. Available from: http://www.nj.gov/dep/nrr/settlements/sspa-paulsboro-report-112009.pdf.

18 Borough of Paulsboro, NJ. Chapter 43 Noise Ordinance. [Internet]. 2000 [cited 2015 November 2]. Available from: http://ecode360.com/11292239.

19 USFWS (U.S. Fish and Wildlife Service) New Jersey Field Office. Frequently Asked Questions about Endangered Species in New Jersey. [Internet]. 2015 [cited 2015 November 2]. Available from: http://www.fws.gov/northeast/njfieldoffice/endangered/esfaq.html#22.

20 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

21 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 October 28]. Available from: http://www.mrlc.gov/eva/viewer.html.

22 Progressive railroading. Rail Developments Emerge at Four U.S. Ports. [Internet]. [cited 2015 October 28]. Available from: http://www.progressiverailroading.com/intermodal/news/Rail-developments-emerge-at-four-US-ports--41070.

23 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 October 28]. Available from: http://www.nps.gov/nr/research/index.htm.

24 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

25 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

26 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

27 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

28 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

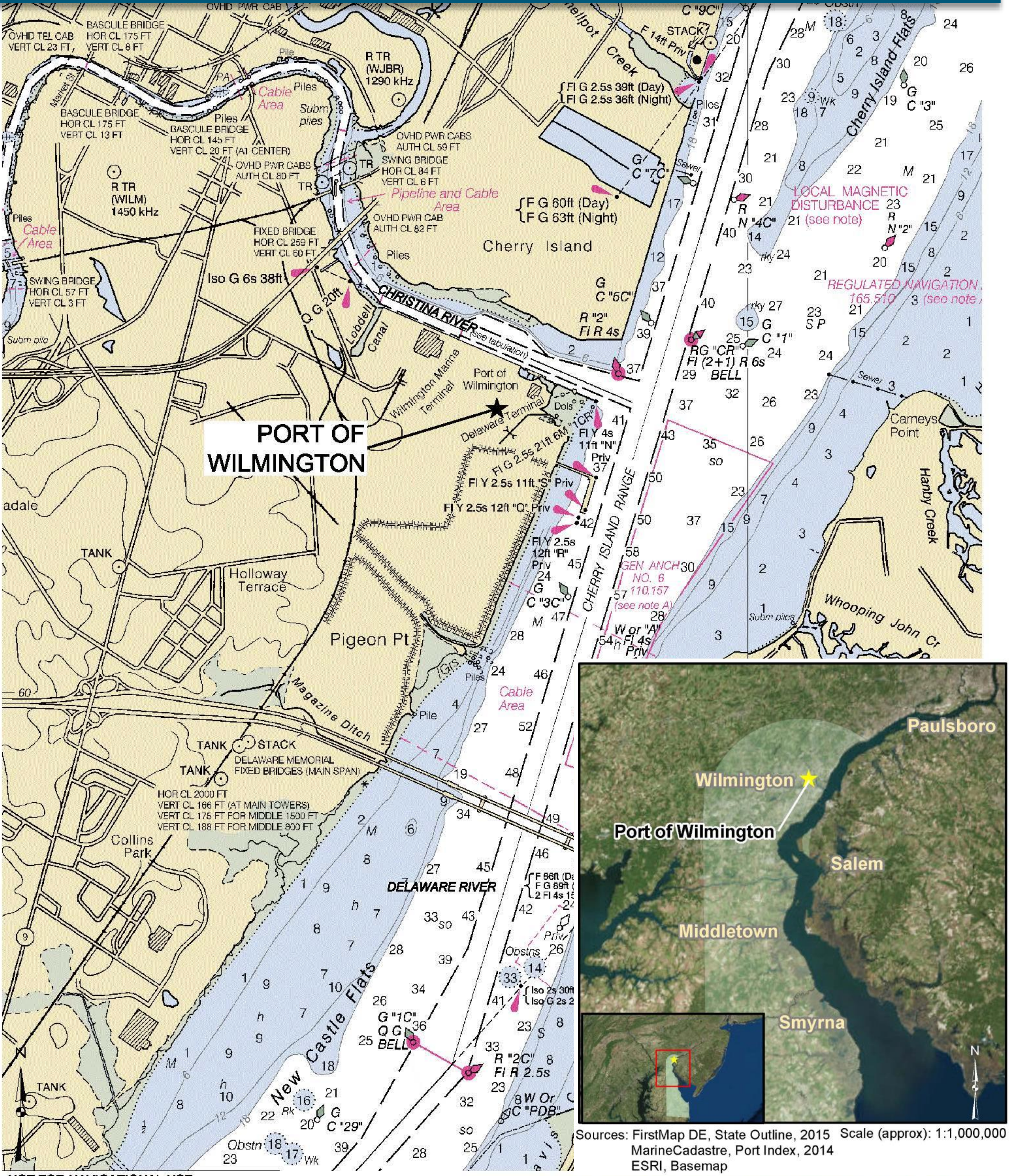
29 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

30 MarineTraffic. Automatic Identification System. [Internet]. [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/index/ports/all.

31 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

WILMINGTON, DE

Wilmington, Delaware | 39° 43’ 00” N, 75° 31’ 18” W



NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 12311_1, 2012

Sources: FirstMap DE, State Outline, 2015
MarineCadastre, Port Index, 2014
ESRI, Basemap

Scale (approx): 1:1,000,000

Scale (approx.): 1" = 3000'

WILMINGTON, DE

Wilmington, Delaware | 39° 43' 00" N, 75° 31' 18" W

Port Overview

Owner:	Diamond State Port Corporation (Quasi-public Agency)
Operator:	Diamond State Port Corporation (Quasi-public Agency)
Primary Existing Uses:	Bulk cargo and containers; Roll-On, Roll-Off (Ro-Ro)
Primary Cargos Handled:	Produce, Steel, Forest products, Dry bulk materials, Petroleum products, and Automobiles [1]
Typical Operating Hours:	Not available
Terminal Land Area:	308 acres
Shortest Distance to Wind Energy Area:	83.1 miles
Closest Lease Area:	Delaware Lease Area
Commercial Port Employment:	Not available

Located at the confluence of the Delaware and Christina Rivers, 65 miles from the Atlantic Ocean, the Port of Wilmington is owned and operated by the Diamond State Port Corporation (DSPC), a corporate entity of the State of Delaware. [1]
The Port of Wilmington covers over 308 acres and is readily accessible to interstate I-95. Rail access to the Port is available via Norfolk Southern and CSX Transportation, with railcar loading docks located next to terminal warehouses. Future expansion is planned to provide more storage capacity for existing and future commercial businesses. [1]

The Port facilities include seven deepwater general cargo berths, a tanker berth, a floating berth for Ro-Ro vessels on the Christina River, and an Auto and Ro-Ro berth on the Delaware River. Cargo handling equipment includes: a new 100-ton mobile harbor crane and two multi-purpose gantry cranes, each with 50-ton capacity and one with 75-ton heavy lift capacity. All cranes are capable of high speed container operations and the handling of breakbulk, bulk and heavy lift cargoes. [1]

The Port of Wilmington covers 306 acres and has 4,000 feet of wharf with an alongside depth of 38 feet. The Delaware River Channel depth is 40 feet at Mean Low Water (MLW), and the Christina River Channel depths correspond to the depths at the berths. Berths 5 through 7 have a depth of 35 feet at MLW, while Berths 1 through 3, the floating berth, the petroleum berth, and the Auto and Ro-Ro berth have a depth of 38 feet at MLW. [1] Dry storage facilities include: nearly 33 acres of open space used for Ro-Ro, containers, steel, wind energy components, and lumber as well as 250,000 sf of dry warehouse space. [1]

The USACE (U.S. Army Corps of Engineers) Philadelphia District is responsible for maintaining the authorized 40-foot depth in the Delaware River navigation channel from Newbold Island in Bucks County north of Philadelphia. The federal channel serves ports in Paulsboro, Philadelphia, Camden, and Wilmington. [2] The Philadelphia District is in the process of deepening the Delaware River main channel from 40 feet to 45 feet from the Atlantic Ocean to the marine terminals in Philadelphia and Camden. The project is 75% complete and will be finished by 2017.

Currents play an important role in navigation, as the transit of deep-draft vessels entering the estuary destined for port facilities in the reach from Wilmington to Philadelphia is scheduled to take advantage of flood currents and higher tidal stages, to assure maximum bottom clearance in high shoaling rate areas. [2]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Yes
Access	Port Access Channel Width (m)	61
	Port Access Water Depths (m)	11.6
	Overhead Draft (m)	11.5
	Number of Berths	7

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	88,000
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	U
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U

WILMINGTON, DE

Wilmington, Delaware | 39° 43’ 00” N, 75° 31’ 18” W

Capability Area	Criteria (units)	
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	935
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Cranes	On-site Cranes’ Capabilities (t)	100
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Dredging	Blasting	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Access Capabilities[a]		●	●	●				●	●	
Cranes[b]	●			●	●	●	●	●	●	
Quayside Bearing Capacity[c]		●		●	●	●	●			●
Storage Capabilities[d]	●				●	●	●			●
Ro-Ro Capability[e]	●			●	●	●	●			●

Modifications in italics are assumed to be required based on port classifications

[a] Improve channel depth to 8.1 m; improve overhead draft to 75 m

[b] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

[c] *Improve Quayside Bearing Capacity to 17 t/m^2 and make Quayside Seabed Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2*

[e] *Improve Ro-Ro Berth Width to 8 m; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	*(Limited information on benthic environment in immediate port area*). The Delaware Estuary hosts the world’s largest horseshoe crab population. Other important benthic species found in the area include the blue crab and American oyster. [3]
Fish & EFH	The portion of the Delaware River where the Port is located is classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). The shortnose and Atlantic sturgeon are endangered species found in nearshore estuaries and rivers, including the Delaware River and Delaware Bay. Many anadromous fish, including American shad, also utilize the Delaware River for spawning. [4] [5] The Delaware River is one of the major striped bass spawning areas along the Atlantic coast. The main spawning grounds are located between Wilmington, DE and Marcus Hook, PA. [2]

WILMINGTON, DE

Wilmington, Delaware | 39° 43' 00" N, 75° 31' 18" W

Resource	Description of Existing Conditions
Air Quality	The Port Area is within the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE Area, which is classified as severe non-attainment for ozone (composed of nitrogen oxides [NOx] and volatile organic compounds [VOCs]) and as a maintenance area for carbon monoxide (CO). [2] A CO Maintenance area is an area in where the CO levels formerly exceeded the National Ambient Air Quality Standards (NAAQS), but have now been reduced to and meet the NAAQS.
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape include wetlands along the banks of the Delaware River. [6]
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. [7] The North Atlantic right whale, fin whale, and humpback whale, have been documented in the Delaware River Estuary. Other species that are occasionally seen in the Delaware Bay include the blue whale, sperm whale, and sei whale. It is unlikely that these species will be found near the Port. Other marine mammals that are known to occur in the Delaware River include bottlenose dolphin, short beaked common dolphin, harbor porpoise and harbor seal. [2] Four federally listed endangered species of turtles including the leatherback, loggerhead, Kemp's ridley, and hawksbill turtles, have been identified in the Delaware River and the Estuary. The green sea turtle, which is listed as threatened in NJ, is also known to occur in the Delaware River and Estuary. These species could potentially occur near the Port. [2]
Birds & Bats	Endangered species listings from the USFWS were consulted. The Northern long-eared bat is listed as threatened in New Castle county. [8] The second largest population of migrating shorebirds in North America is located in Delaware Bay. Commonly observed species include sanderlings, sandpipers, ruddy turnstones, and red knot. [3] At the Bombay Hook National Wildlife Refuge, approximately 37 miles south of the Port, many species of waterfowl and shorebirds have been observed. At the Salem River Wildlife Management Area, approximately 8 miles southeast of the Port, additional bird species have been known to occur including the Ross's goose, orchard oriole, European starling, and common grackle. [9]
Water Quality	The Delaware River (Segment ID's= NJDELAWARE RIVER 2, 8, 14-19) is listed as impaired according to the New Jersey Department of Environmental Protection 2012 Integrated Report – Appendix A. The Delaware River is listed as impaired for chlorodane in fish tissue, DDT (formally known as dichlorodiphenyltrichloroethane) in fish tissue, mercury in fish tissue, deildrein in fish tissue and Polychlorinated Biphenyls (PCBs) in fish tissue throughout the waterway. [10] (Data were used from the New Jersey Department of Environmental Protection [NJDEP] given the proximity of sites and because of the lack of data from the State of Delaware.)
Currents & Tides	Currents play an important role in navigation, as the transit of deep-draft vessels entering the estuary destined for Wilmington is scheduled to take advantage of flood currents and higher tidal stages, to assure maximum bottom clearance in high shoaling rate areas. [2] The limit of salt intrusion during high flow conditions is generally near Wilmington, DE, but can approach the Philadelphia area under low flow conditions. [11] The mean tidal range at the mouth of the Christina River (RM 70) is 5.6 feet. [12]
Sediment Deposition	Sediments in the area are fine-grained. A sediment deposition area is present at the mouth of the Christina River, which lies directly north of the Port. [13] Studies conducted by the USACE in the channels of the Delaware River found the sediments contained a variety of toxins and metals such as Polychlorinated Biphenyls (PCBs), DDE (formally known as Dichlorodiphenyldichloroethylene) and pesticides. [2]
Acoustic Environment	In Wilmington, DE the noise limit for industrial areas is 85 dBA with no time restrictions. [14]
Critical Habitat	There are no critical habitat designations in the state of Delaware along the Delaware River. [15] [16]
Military Use Areas	Military installations near port: No military installations in or near New Castle County, DE. [17]

WILMINGTON, DE

Wilmington, Delaware | 39° 43' 00" N, 75° 31' 18" W

Resource	Description of Existing Conditions
Land Use & Existing Infrastructure	High and medium intensity developed land with commercial and residential areas lie west and north of the port. The Cherry Island Landfill lies directly north of the port and the Delaware Memorial Bridge is about 1 mile south. Undeveloped lands border the port to the southeast and across the channel, to the east. [18] [19]
Transportation	Access to Interstate 495 just west of the port. Port is in the vicinity of intersections between Interstates 495, 295, and 95. Rail service to the terminal. [19]
Cultural & Historical	Nearby places in the National Register of Historic Places: there are 82 properties and districts listed in the City of Wilmington, DE. These include the Bellevue Range Rear Light Station, which is just north of the port. [20] One known shipwreck on the southeast border of the port. [21]
Visual	Varied viewscapes with industrial development at the port and to the south along the Delaware Bridge. To the east, commercial and residential views alternate with undeveloped viewscapes. [19]
Environmental Justice	Total minorities: New Castle County 33.3%; DE 30.0%. [22] Low-income: New Castle County 10.7%; DE 11.7%. [22] Area surrounding port: Census block group encompassing the port has highest rate of total minority population (> 75%) and the census tract encompassing the port has the highest share of individuals below poverty level (> 26 %). [23]
Commercial Fishing	Commercial landings: Not available. [24] Commercial fishing engagement low in all surrounding areas. [25] Commercial fishing reliance low in surrounding communities. [25]
Tourism & Recreation	Employment in tourism-related industries in New Castle County in 2010: 19,905. [26] Recreational fishing engagement low in all surrounding areas. [25] Recreational fishing reliance low in surrounding communities. [25]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 28 – Oct 26, 2015): 4-30. [27] Main vessel types to and from port (30 days): tug 80.1%, passenger 8.2%, cargo 7.4%, search and rescue 1.6%. [27]
Socioeconomic Resources	Population: New Castle County 542,784. [22] Labor Force: New Castle County 282,787; employed 267,094; unemployment rate 5.5%. [28] Main Sources of fiscal revenues in DE local jurisdictions: intergovernmental revenues 42.1%; charges 11.0 %; property taxes 22.4%; utility revenues 12.6%. [29]

Anticipated Impacts

Potential port modifications to the Port of Wilmington, DE necessary to support offshore wind development are anticipated to be relatively extensive, and include increasing the bearing capacity at various points within the terminal. This would have minor impact on existing terrestrial and marine resources due to the industrial setting of the site. Noise associated with the port modifications identified above is not likely to be above existing ambient levels; due to the industrialized nature of the surrounding environment. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications. Cranes may produce visual impacts from the water because of the overall low height of the built environment. To the extent that there are high and adverse human health or environmental effects to areas surrounding the port there may be disproportionately high impacts on minority or low-income populations.

Data Sources & Additional Information

1 Port of Wilmington Delaware. Our Port. [Internet]. [cited 2015 Oct 29]. Available from: http://www.portofwilmington.com/mainframesets/Main_OurPort.htm.

2 USACE (U.S. Army Corps of Engineers). Delaware River Main Stem and Channel Deepening Project Environmental Assessment. Philadelphia District; 2009.

3 Delaware Riverkeeper Network & National Wildlife Federation. Delaware River Deepening - Dumped Again. 2007.

4 NJDEP (New Jersey Department of Environmental Protection). Division of Fish & Wildlife. [Internet]. 2015 [cited 2015 Oct 29]. Available from: http://www.state.nj.us/dep/fgw/del_river_rpt15.htm.

5 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

6 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

7 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

8 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

9 New Jersey Birding & Wildlife Trails. Salem River Wildlife Management Area. [Internet]. 2010 [cited 2015 November 4]. Available from: http://www.njwildlifetrails.org/PineBarrensTrails/Sites/tabid/1698/Scope/site/Guide/DELBAYSH/Site/10/Default.aspx.

10 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 November 2]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

11 Patrick Center for Environmental Research. Impact of Aquatic Vegetation on Water Quality of the Delaware River Estuary. West Trenton: Delaware River Basin Commission; 1998. Final Report 98-5F. Available from: http://www.state.nj.us/drbc/library/documents/aquaticveg-delestuary1998.pdf.

12 NOAA (National Oceanic and Atmospheric Administration). Tides Online and Current Predictions. [Internet]. [cited 2015 September 9]. Available from: http://co-ops.nos.noaa.gov.

13 Sommerfield CK, Madsen JA. Sedimentological and Geophysical Survey of the Upper Delaware Estuary. Delaware River Basin Commission; 2003. Available from: http://www.state.nj.us/drbc/library/documents/survey_upper-del-est.pdf.

14 Municode Library. Article III. - Noise Control and Abatement; Sec. 11-56 Definitions. [Internet]. [cited 2015 November 4]. Available from: https://www.municode.com/library/de/wilmington/codes/code_of_ordinances?nodeId=PTIIWICO_CH11EN_ARTIIINOCOAB.

15 USFWS (U.S. Fish and Wildlife Service). Threatened & Endangered Species Active Critical Habitat Report. [Internet]. [cited 2015 November 3]. Available from: http://ecos.fws.gov/crithab/.

16 USFWS (U.S. Fish and Wildlife Service). Endangered Species - Delaware. [Internet]. 2014 [cited 2015 November 4]. Available from: http://www.fws.gov/endangered/map/state/DE.html.

17 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

18 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 October 28]. Available from: http://www.mrlc.gov/eva/viewer.html.

19 Google Earth. [Internet]. [cited 2015 October 28].

20 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 October 28]. Available from: http://www.nps.gov/nr/research/index.htm.

21 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

22 USCB (US Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

23 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

24 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

25 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

26 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

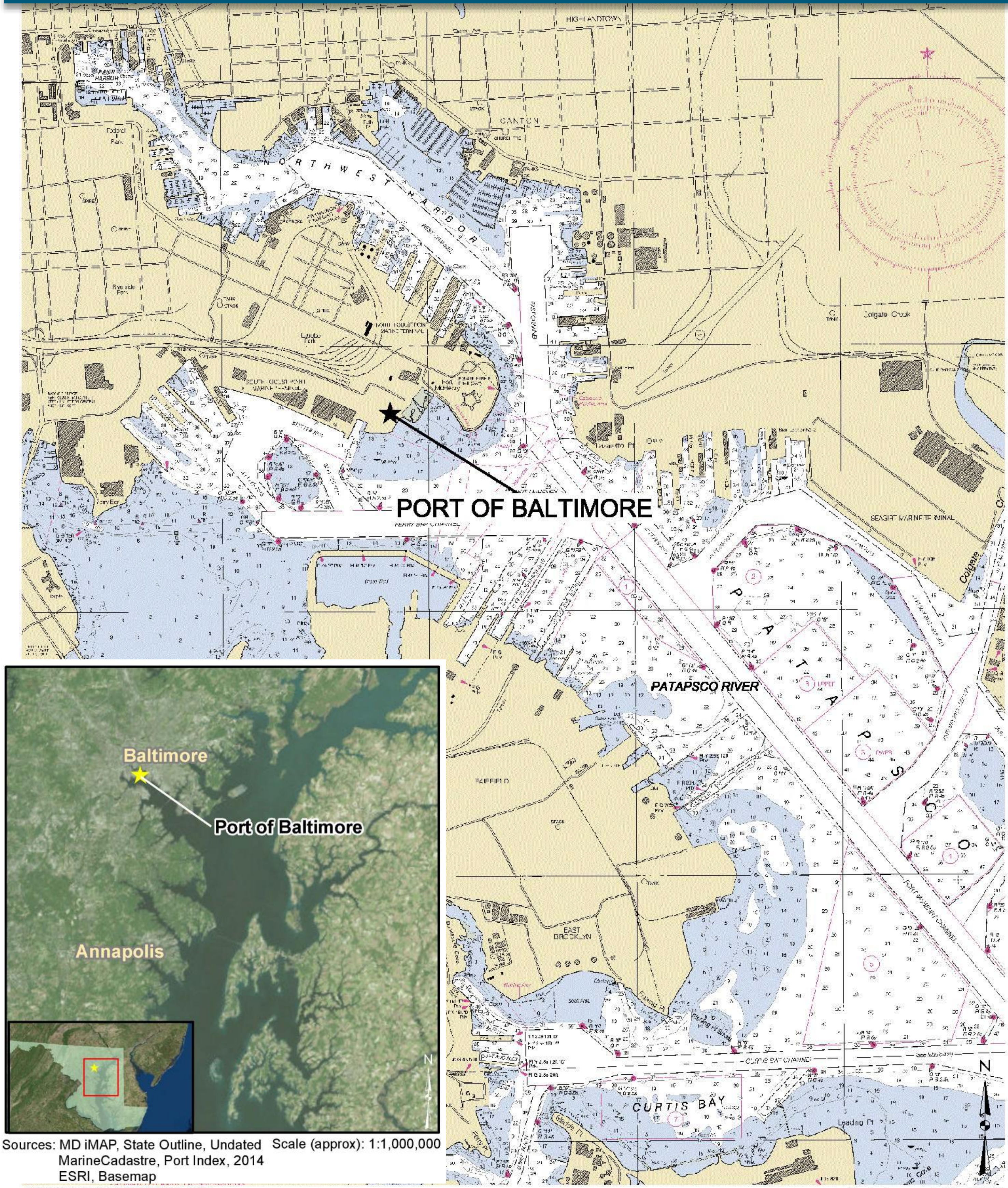
27 MarineTraffic. Automatic Identification System-Port of Wilmington DE. [Internet]. 2015 [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/details/ports/996.

28 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

29 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

BALTIMORE

Multiple Terminals | Baltimore, Maryland | 39° 13’ 57” N, 76° 33’ 32” W



Sources: MD iMAP, State Outline, Undated
MarineCadastre, Port Index, 2014
ESRI, Basemap

Scale (approx): 1:1,000,000

NOT FOR NAVIGATIONAL USE

Sources: NOAA Chart 12281_1, 2014

Scale (approx.): 1" = 3000'

BALTIMORE

Multiple Terminals | Baltimore, Maryland | 39° 13' 57" N, 76° 33' 32" W

Port Overview

Owner:	Maryland Port Administration (Quasi-public Agency)
Operator:	Maryland Port Administration (Quasi-public Agency); PortsAmerica (Private Corporation) operates Segirt Marine Terminal
Primary Existing Uses:	Commercial Shipping, Cruises
Primary Cargos Handled:	Automobiles; Forest Products; Steel [1]
Typical Operating Hours:	7:00 AM – 4:00 PM [2]
Terminal Land Area:	Up to 1,200 acres
Shortest Distance to Wind Energy Area:	186.7 miles
Closest Lease Area:	Virginia Lease Area (by vessel transit distance)
Commercial Port Employment:	15,000 people [3]

The Port of Baltimore is one of America's busiest deepwater ports. It is located on a 32 square mile area of the Patapsco River and its tributaries, approximately 12 miles northwest of the Chesapeake Bay. The Port is located nearly 150 miles inland from the Atlantic Ocean. [4]

The Port of Baltimore, operated by the Maryland Port Administration (MPA), includes five terminals:

1. Dundalk Marine Terminal (DMT) - a 570 acre multi-use facility capable of handling Roll-On, Roll-Off (Ro-Ro), containers and breakbulk cargo activities.
2. Fairfield/Masonville Marine Terminals (FMMT) - 117 acres focused on Ro-Ro auto processing.
3. South Locust Point Marine Terminal (SLPMT) - 79 acres focused on forest products breakbulk movements
4. North Locust Point Marine Terminal (NLPMT) - a 90 acre multi-use facility capable of handling breakbulk, liquid bulk, Ro-Ro and containerized cargo.
5. Seagirt Marine Terminal (SMT) - a 284 acre international container terminal, which is operated by Ports America under a 50 year concession with the MPA.

The terminals are served by rail and have immediate access to major highways.

The Maryland Port Administration has been working closely with the U.S. Army Corps of Engineers (USACE) in constructing and maintaining a system of channels to allow large, deep draft commercial shipping vessels to call on the Port of Baltimore. In addition to the shipping channels, a number of anchorage areas have been established within the Port of Baltimore for vessels requiring layover for various reasons. The two groups are currently working on implementing a Dredged Material Management Program (DMMP) to ensure that the channels are maintained for navigation. [5] [4]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	
Access	Port Access Channel Width (m)	213
	Port Access Water Depths (m)	15.2
	Overhead Draft (m)	12.8
	Number of Berths	13
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	505
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	5,000,000 [6]
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	U
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U
Cranes	On-site Cranes' Capabilities (t)	86.4
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway,	Rail; highway

BALTIMORE

Multiple Terminals | Baltimore, Maryland | 39° 13' 57" N, 76° 33' 32" W

Capability Area	Criteria (units)		Capability Area	Criteria (units)	
				etc.)	

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Blasting	Pile Driving/ Drilling	Dredging	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Access Capabilities[a]		●	●	●				●	●	
Cranes[b]	●		●		●	●	●	●	●	
Quayside Bearing Capacity[c]			●	●		●	●			●
Storage Capabilities[d]	●				●	●	●			●
Ro-Ro Capability[e]	●		●		●	●	●			●

Modifications in italics are assumed to be required based on port classifications

[a] Improve overhead draft to 75 m

[b] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

[c] *Improve Quayside Bearing Capacity to 17 t/m² and make Quayside Seabed Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m²*

[e] *Improve Ro-Ro Berth Width to 8 m; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m²*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Extensive industrial development in the area and port-related activities have had a severe impact on the biota in the Harbor. Few mollusks and crustaceans can be found in the area, and no oyster bars are known to exist in the Harbor today. The surface layer of fluid mud that exists in most of the Port area provides a poor substrate for many benthic species. The benthic communities that survive in the Port area are not well developed and are primarily comprised of pollution-tolerant species. [4]
Fish & EFH	The Patapsco River is classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). [7] The Patapsco River also serves as a migratory pathway for anadromous species such as American shad, hickory shad, yellow perch, white perch, alewife, and blueback herring. [8]
Air Quality	Baltimore is located in the Metropolitan Baltimore Intrastate Air Quality Control Region (AQCR) and is classified as a non-attainment area for the 1-hour (Severe-15) ozone (O_3) and 8-hour (Moderate) ozone standards as well as the carbon monoxide (CO) (Moderate) standard. [9]

BALTIMORE

Multiple Terminals | Baltimore, Maryland | 39° 13' 57" N, 76° 33' 32" W

Resource	Description of Existing Conditions
Terrestrial Biota	The tidal wetlands that once occupied the area have been virtually eliminated by industrial and commercial development, reducing the quality of environmental resources in the area. The remaining wetlands in Baltimore Harbor consist primarily of patches of phragmites reed, which are less valuable to fish and wildlife. [4]
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. [10] [11] Marine mammals and sea turtles are not typically seen in the waters around the Port. The Port is located approximately 150 miles inland from the Atlantic Ocean. Marine mammals, such as whales and dolphins, and sea turtles are found further south in the lower Chesapeake Bay. There is anecdotal information about sightings of dolphins, seals, manatees, and sea turtles throughout the upper Chesapeake Bay and Patapsco River; however, they are infrequent. [12]
Birds & Bats	Endangered species listings from the USFWS were consulted. The Northern long-eared bat was identified as threatened in Baltimore county. [11] There are two documented colonial waterbird nesting sites located on the shoreline of the Patapsco River. [13] An established colony of black-crowned night herons, nest at Sollers Point near the northern end of the Francis Scott Key Bridge, while herring gulls nest on Sparrows Point. Additionally, a variety of waterfowl species, including mallards, scaup, bufflehead, goldeneye, ruddy duck, canvasback, Canadian geese, and black duck, winter in the Harbor area. [4]
Water Quality	The Patapsco River (Segment ID MD-02130906), has been listed as impaired according to Maryland's Final 2014 Integrated Report of Surface Water Quality. The Patapsco River Lower North Branch (LNB) is impaired due to sulfates and chlorides. This area is also polluted by sewage leaks, stormwater runoff, and trash. All waterbodies within the Patapsco LNB have a designated use, which is to support water contact recreation and protection of aquatic life. [14] [15]
Currents & Tides	In addition to inflow from the Patapsco River, water circulation around the Port is influenced by tidal flow and wind. The mean tidal range at the Port is 1.14 feet. [16]
Sediment Deposition	The bottom sediments in the Chesapeake Bay and the approach channels to Baltimore Harbor are predominantly clayey silt, with some locations of sand-silt-clay. The upper Chesapeake Bay, near the mouth of the Patapsco River, is a zone of sediment deposition in the Harbor. Typical of urban harbors, sediments in the area contain a variety of trace metals and organic contaminants; including Polyaromatic hydrocarbons (PAHs) and DDT (formally known as dichlorodiphenyltrichloroethane). [4]
Acoustic Environment	Noise in the vicinity of the port is caused by equipment on land and aboard ships. In general, the noise level in the Harbor is not disturbing to animal or human users of the area. [4]
Critical Habitat	Although there are federally and state listed endangered species in the Baltimore Harbor area, the area has not been identified as critical habitat. [17]
Military Use Areas	Military installations near port: one military installation in Baltimore, MD; The Surface Forces Logistics (Coast Guard) is 4 miles south of the port, along the Patapsco River. [18] The US Naval Academy is located approximately 20 miles south in Annapolis.
Land Use & Existing Infrastructure	High and medium intensity developed industrial areas surround the Port. The Harbor is highly developed along all shorelines. [19] [20]
Transportation	Approximately 2.5 miles from Interstate 95 and 1.5 miles from Interstate 695 with access to Interstates 395 and 895. Direct rail access to berths, rail serviced by Norfolk Southern. [20] [6]
Cultural & Historical	Nearby places in the National Register of Historic Places: 291 properties and historic districts in the city of Baltimore, including the Fort McHenry National Monument, which is located directly east of the port. [21] There are six known shipwrecks within Baltimore Harbor. [22]
Visual	Industrial viewscapes throughout the Port and harbor. [20]

BALTIMORE

Multiple Terminals | Baltimore, Maryland | 39° 13’ 57” N, 76° 33’ 32” W

Resource	Description of Existing Conditions
Environmental Justice	Total minorities: City of Baltimore 71.9%; MD 45.8%. [23] Low-income: City of Baltimore 27.2%; MD 9.8%. [23] Area surrounding port: census block group for the port show less than 20% total minority population. Surrounding census block groups in residential areas show more than 20% total minority population. The percent of the population in poverty in the census tracts of the terminal and surrounding Port areas is the lowest in the vicinity (<16%). [24]
Commercial Fishing	Commercial landings: Not available. [25] Commercial fishing engagement low in all the surrounding communities. [26] Commercial fishing reliance low in all surrounding communities. [26]
Tourism & Recreation	Employment in tourism-related industries in Baltimore County 2012: 22,273. [27] Recreational fishing engagement low in all the surrounding communities with the exception of Baltimore itself where it is medium. [26] Recreational fishing reliance low in all surrounding communities. [26]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to Port (Oct 04 – Nov 01, 2015): 9-78. [28] Main vessel types to and from port (30 days): tug 54.2%, cargo 9.7%, passenger 8.9%, special craft 8.9%, sailing vessels 6.1%. [28]
Socioeconomic Resources	Population: City of Baltimore 621,445. [23] Labor Force: City of Baltimore 294,340; employed 268,824; unemployment rate 8.4%. [27] Main sources of fiscal revenues in MD Local Jurisdictions: property taxes 27.0%; intergovernmental revenues 29.0%; individual income tax 15.0 %; insurance trust revenues 5.4%. [29]

Anticipated Impacts

Potential port modifications to the Port of Baltimore necessary to support offshore wind development are anticipated to have minimal impact on existing terrestrial and upland resources due to the industrial setting of the site. Minimal dredging at select terminals may be necessary; however, the anticipated impact to sediments or marine resources will be minor; given the ongoing maintenance dredging that occurs within the Harbor and surrounding channels. Noise associated with the port modifications identified above is not likely to be above existing ambient levels; due to the industrialized nature of the surrounding environment. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications. Potential for relevant socioeconomic impacts are low. No disproportionately high and adverse human health or environmental effects to minority or low-income communities are anticipated.

Data Sources & Additional Information

1 World Port Source. Port of Baltimore. [Internet]. [cited 2015 October 29]. Available from: http://www.worldportsource.com/ports/commerce/USA_MD_Port_of_Baltimore_311.php.

2 Maryland Port Administration. Port of Baltimore Operating Hours. [Internet]. 2015 [cited 2015 Oct 30]. Available from: http://www.mpa.maryland.gov/forms/content/ports-america-baltimore-operating-hours-update.

3 Martin Associates. The Economic Impacts of the Port of Baltimore 2010. Prepared for the Maryland Port Administration; 2011.

4 USACE (U.S. Army Corps of Engineers). Baltimore Harbor Anchorages and Channels, Maryland Draft Feasibility Report and Environmental Impact Statement. Baltimore, Maryland: Maryland Port Administration; 1997.

5 Maryland Port Administration. Port of Baltimore Strategic Plan 2015. 2015.

6 Port of Baltimore. Marine Terminals. [Internet]. [cited 2015 December 7]. Available from: http://pobdirectory.com/terminals.php.

7 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

8 Maryland Department of Natural Resources. Patapsco River. [Internet]. [cited 2015 October 29]. Available from: http://dnr2.maryland.gov/fisheries/Pages/hotspots/patapsco.aspx.

9 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

10 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

11 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

12 Baltimore Sun. Manatee in Baltimore harbor? [Internet]. 2010 [cited 2015 October 28]. Available from: http://weblogs.baltimoresun.com/features/green/2010/10/manatee_in_baltimore_harbor.html.

13 Parsons Brinckerhoff. East Coast Marine Highway Initiative M-95 Study Final Report. East Coast Marine Highway Initiative Awarding Authority; 2013. Available from: http://www.portofnewbedford.org/documents/ECMHI%20M-95%20Study%20Final%20Report.pdf.

14 Maryland Department of the Environment. Maryland's Final 2014 Integrated Report of Surface Water Quality. Baltimore, MD 2015. Available from: http://www.mde.state.md.us/programs/Water/TMDL/Integrated303dReports/Documents/Integrated_Report_Section_PDFs/IR_2014/MD_Final_2014_IR_Part_A-E.pdf.

15 EPA (U.S. Environmental Protection Agency. National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

16 NOAA (National Oceanic and Atmospheric Administration). Tides & Currents. [Internet]. [cited 2015 October 29]. Available from: https://tidesandcurrents.noaa.gov/datums.html?id=8574680.

17 USFWS (U.S. Fish and Wildlife Service). Threatened & Endangered Species Active Critical Habitat Report. [Internet]. [cited 2015 Oct 29]. Available from: http://ecos.fws.gov/crithab/flex/crithabMapper.jsp.

18 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

19 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 October 28]. Available from: http://www.mrlc.gov/eva/viewer.html.

20 Google Earth. [Internet]. [cited 2015 October 28].

21 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 October 28]. Available from: http://www.nps.gov/nr/research/index.htm.

22 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

23 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

24 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

25 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

26 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

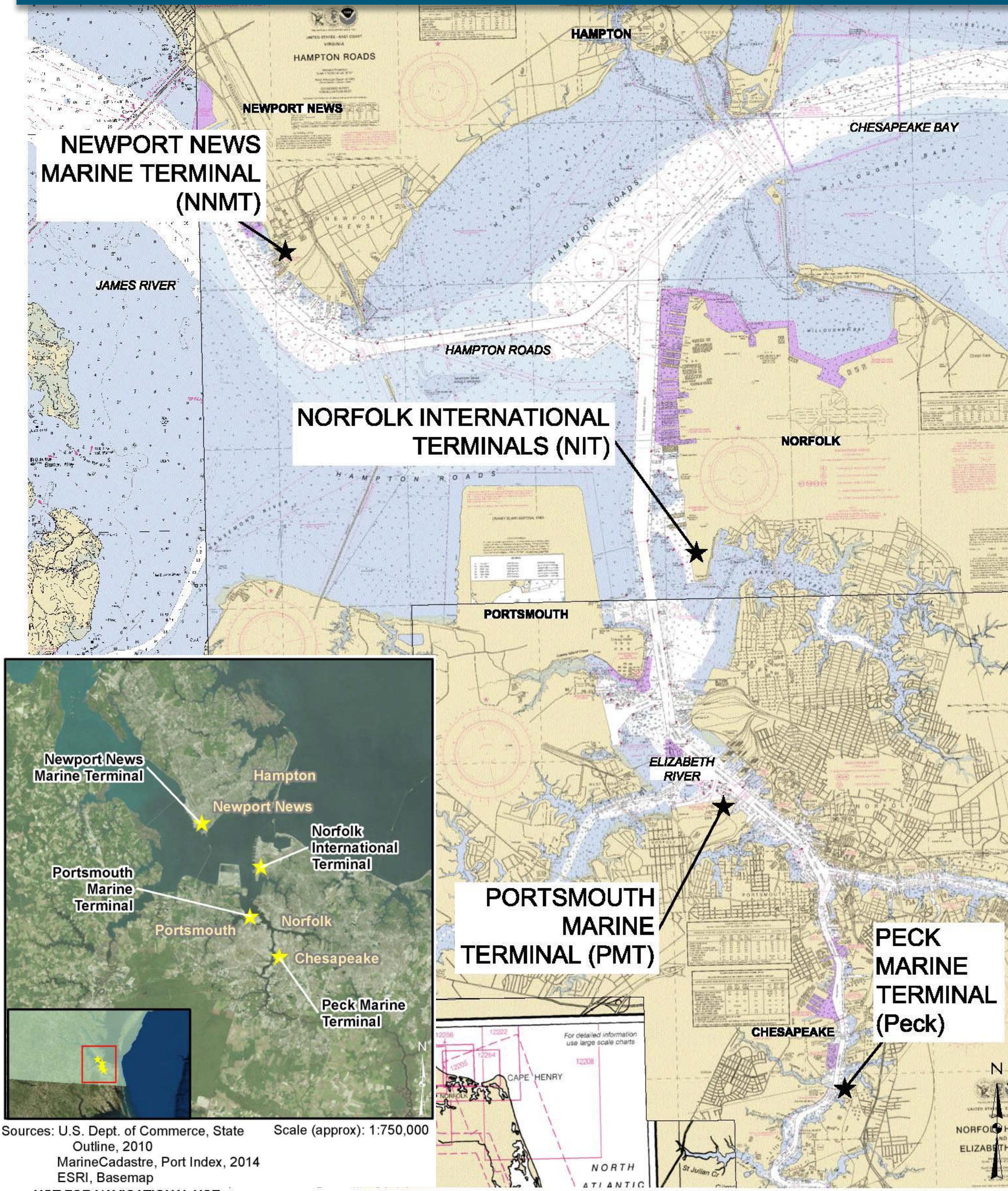
27 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

28 MarineTraffic. Automatic Identification System. [Internet]. [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/index/ports/all.

29 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

HAMPTON ROADS

Multiple Terminals | Hampton Roads, Virginia | 36° 56' 37" N, 76° 23' 09" W



Sources: U.S. Dept. of Commerce, State Outline, 2010
MarineCadastre, Port Index, 2014
ESRI, Basemap

Scale (approx): 1:750,000

NOT FOR NAVIGATIONAL USE

Sources: NOAA Chart 12245_1, 2013; 12253_1, 2012; 12248_1, 2014; 12221_1, 2014; 12207_1, 2014

Scale (approx.): 1" = 10,000'

HAMPTON ROADS

Multiple Terminals | Hampton Roads, Virginia | 36° 56' 37" N, 76° 23' 09" W

Port Overview

Owner:	Virginia Port Authority (State Agency)			
Operator:	Virginia International Terminals, LLC (Private Corporation); The Peck Company (Private Corporation) – operates Peck Marine Terminal			
Terminals at Port of Hampton Roads:	Newport News Marine Terminal (NNMT); Norfolk International Terminals (NIT); Portsmouth Marine Terminal (PMT); Peck Marine Terminal (Peck)			
Primary Existing Uses:	Breakbulk Cargo; Shipbuilding; Military [1]			
Primary Cargos Handled:	Mineral Fuel; Oil; Wood; Cereals; Fertilizers; Miscellaneous Grain Seed Fruit; Food Waste; Animal Feed; Machinery [2]			
	NNMT	**NIT**	**PMT**	**Peck**
Typical Operating Hours	7:00 AM – 11:00 AM, 12:00 PM – 4:00 PM Monday-Friday [3]	5:00 AM – 7:00 PM Monday-Friday; 7:00 AM – 5:00 PM Saturday [3]	5:00 AM – 7:00 PM Monday-Friday [3]	8:00 AM – 5:00 PM Monday-Friday [4]
Land Area	165 acres [2]	567 acres [2]	287 acres [2]	55 acres [5]
Shortest Distance to Wind Energy Area:	Approximately 56.3 miles (average distance of 4 terminals)			
Closest Lease Area:	Virginia Lease Area			
Commercial Port Employment:	374,000 people [2]			

The Port of Hampton Roads is a deep draft port located on the Mid-Atlantic coast, off the lower end of the Chesapeake Bay. The Port is located at the confluence of three tidal rivers – the James, the Nansemond, and the Elizabeth. The Atlantic Ocean Channel (AOC) and Thimble Shoals Channel (TSC) make up the approach channels to the Port of Hampton Roads. The U.S. Army Corps of Engineers (USACE) Norfolk District is responsible for maintaining these Federal navigation channels to ensure safe passage for all vessel traffic. [6]

The Port consists of six terminals spanning across multiple municipalities in Virginia. The terminals highlighted here are the Newport News Marine Terminal (Newport News, VA), Norfolk International Terminals (Norfolk, VA), Portsmouth Marine Terminal (Portsmouth, VA), and Peck Marine Terminal (Chesapeake, VA). The Port is fully authorized and permitted for future marine terminal expansion. [2] The Port also has an expansive intermodal rail and is connected to several major highways and roads, including Interstate 95, Interstate 64, Interstate 564, US Route 460, US Route 17, and US Route 58. [2]

Hampton Roads is also home to multiple large shipyards (both private and US Navy) as well as Naval Station Norfolk, which is the largest naval station in the world. [7]

In 2015, the Virginia Mine Minerals and Energy commissioned three reports to assess the readiness of Virginia ports to support offshore wind energy. [8]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	NNMT	NIT	PMT	Peck
Potential Use	Staging Port	Yes	Yes	Yes	Yes
	Operation & Maintenance (O&M) Port				
Access	Port Access Channel Width (m)	304.8	304.8	304.8	304.8
	Port Access Water Depths (m)	10.7	11	13.1	8.8
	Overhead Draft (m)	12.2	12.2	12.2	15.2
	Number of Berths	9	5	3	1
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U	U	U	U
	Quayside Length (m)	285	305	360	126.5

HAMPTON ROADS

Multiple Terminals | Hampton Roads, Virginia | 36° 56’ 37” N, 76° 23’ 09” W

Capability Area	Criteria (units)	NNMT	NIT	PMT	Peck
	Quayside Seabed Suitable for Jacking	U	U	U	U
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U	U	U	U
	Storage Area Bearing Capacity (t/m^2)	U	U	U	U
	Size of Storage Area (m^2)	61,000	217,000	30,000	80,937
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes	Yes	Yes	No
	Width of Ro-Ro Berth (m)	U	U	U	N/A
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U	U	U	N/A
Cranes	On-site Cranes’ Capabilities (t)	162	72	44	U
	Crane Height Restrictions (m)	U	40	U	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway	Rail; highway	Rail; highway	Rail; highway

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Blasting	Dredging	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Access Capabilities[a]		●	●	●				●	●	
Quayside Capabilities[b]		●		●	Peck	●	●			●
Ro-Ro Capability[c]	●	●			●	●	●			●
Cranes[d]	●	●			●	●	●	●	●	
Storage Capabilities[e]	●				●	●	●			●

Modifications in italics are assumed to be required based on port classifications
Peck denotes Construction Activity only required at the Peck Marine Terminal
[a] Improve overhead draft to 75 m for all terminals
[b] Increase Quayside Length of Peck to 170 m; *Improve Quayside Bearing Capacity to 17 t/m^2 and make Quayside Suitable for Jacking of all terminals*
[c] Provide Ro-Ro Capability for Peck; *Improve Ro-Ro Berth Width to 8 m for all terminals; improve Bearing Capacity of Ro-Ro Berths and Ramps to 10 t/m^2 for all terminals*
[d] Provide On-Site Cranes with 600 t lifting capability for all terminals; *Reduce Crane Height Restrictions to 50 m for all terminals*
[e] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2 for all terminals*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

HAMPTON ROADS

Multiple Terminals | Hampton Roads, Virginia | 36° 56' 37" N, 76° 23' 09" W

Resource	Description of Existing Conditions
Benthic	An assessment of the benthic habitat conducted for the Craney Island Eastward Expansion in Portsmouth, located at the mouth of the Elizabeth River west of Norfolk International Terminals, indicates much of the existing benthic habitat within the area of the Port is degraded. [6] Three commercially important benthic species are found in the vicinity of the Port, including hard clam, blue crab, and oyster. Hard clams constitute a major fishery in Hampton Roads during the summer. [9]
Fish & EFH	The lower Chesapeake Bay and waters around the Port are classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). [10] The James River and tributaries also serve as a migratory pathway for anadromous species such as American shad, blueback herring, alewife, and striped bass. [11]
Air Quality	The Port is located in the Hampton Roads Intrastate Air Quality Control Region (AQCR) and is in attainment for all criteria pollutants, with the exception of the 8-hour ozone (O_3) standard, which is classified as maintenance. An O_3 Maintenance area is an area where the O_3 levels formerly exceeded the National Ambient Air Quality Standards (NAAQS), but have now been reduced to and meet the NAAQS. [12]
Terrestrial Biota	Most of the area surrounding the Port's terminals is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Remnant habitats in this landscape include wetlands, forests, and shrublands/grasslands. [13]
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whales. [14] [15] Within the coastal inshore and offshore waters of the Chesapeake Bay and adjacent Atlantic Ocean, bottlenose dolphins, humpback whales, and short-beaked common dolphins are found. [16] Loggerhead sea turtles and leatherback sea turtles are also found in these waters. These marine mammals and sea turtles have been seen in the harbor and around the Port. [16]
Birds & Bats	Endangered species listings from the USFWS were consulted. [15] Two species that are known to occur in Newport News county are listed including the bald eagle (recovery) and the Northern long-eared bat (threatened). [17] The Piping Plover, a federally and state listed threatened species, is also known to nest on coastal beaches, including Craney Island. Peregrine Falcons nest on bridges and other elevated structures throughout Hampton Roads. [9]
Water Quality	The James River, Nansemond River, Elizabeth River, Hampton Roads Harbor, and several surrounding tributaries (Segment ID VA-G01E-03-PCB) where the Port is located, are classified as impaired according to the Virginia Department of Environmental Quality 2012 Impaired Waters – 303(d) List. These waters are impaired due to Polychlorinated Biphenyls (PCBs). The area is considered not supporting of Fish Consumption Use due to PCBs in several fish species. [18] [19]
Currents & Tides	Water circulation around the Port is influenced by inflow from the James River, Elizabeth River, and the Nansemond River, as well as tides and wind. The mean tidal range in the harbor is 2.43 feet. [20]
Sediment Deposition	The sediment in these waters is considered to be contaminated by metals and PCBs and has resulted in impairment of these waters. Sediments within the Hampton Roads Harbor are classified as fine grain mud, with some very find sand, traces of shell debris and some organic material. The Hampton Roads Planning District Commission sites sediment pollution as one of the main issues facing the Chesapeake Bay. [21] [22]
Acoustic Environment	Highway and local street traffic represent the dominant sources of existing noise in the Hampton Roads port area. In the vicinity of the Norfolk Naval Air Station (NAS), aircraft operations also contribute to the existing noise environment. [9]
Critical Habitat	Known or potential populations of threatened or endangered species, and species of special concern, have been identified in the Port area; however, no critical habitat has been identified in the vicinity of the Port. [17]

HAMPTON ROADS

Multiple Terminals | Hampton Roads, Virginia | 36° 56' 37" N, 76° 23' 09" W

Resource	Description of Existing Conditions
Military Use Areas	Military installations near port: Fort Monroe (Army), Fort Eustis (Army), Naval Station Norfolk (Navy), Naval Support Activity Hampton Roads (Navy), Naval Amphibious Base Little Creek (Navy), Norfolk Naval Shipyard (Navy), Joint Expeditionary Base (Navy), Naval Air Station Oceana (Navy), Sector Hampton Roads (Coast Guard), and Langley Air Force Base (Air Force). [23]
Land Use & Existing Infrastructure	NNMT: High intensity developed land with commercial and industrial areas to the immediate areas north and south of the terminal along the coastline. Residential areas located across Interstate 664 about a third of a mile north and east of the terminal. There are little to no open areas in the immediate vicinity of the terminal. [24] NIT: High intensity developed land with commercial and industrial areas to the immediate areas north and south of the terminal along the coastline. Residential areas located along Virginia State Route 337 less than a mile southeast of the terminal. Some open land (Capt. Slade Cutter Athletic Park) northeast of the terminal and there are no forested lands in the immediate vicinity. [24] PMT: High intensity developed land with commercial, industrial, and residential areas in the immediate areas around the terminal. Residential areas located across US highway 58 less than a mile west and southwest of the terminal. There are little to no open areas in the immediate vicinity of the terminal. [24] Peck: Low and medium intensity developed land with commercial and industrial areas in the immediate area around the terminal. Some open land and forest land to the immediate east and northeast of the terminal, up to and across Interstate 464. [24]
Transportation	NNMT: Access to Interstate 664 to the southeast and US highway 60. [24] NIT: Access to Virginia State Route 337 and US highway 564. [24] PMT: Access to Virginia State Route 164 and US highway 58. [24] Peck: Access to Interstate 464. [24] All four terminals serviced by rail. [24]
Cultural & Historical	NNMT: Nearby places in the National Register of Historic Places: there are 28 properties or districts in the area, although not at the terminal. Three known shipwrecks west of the terminal. [25] [26] NIT: Nearby places in the National Register of Historic Places: there are 59 properties or districts in the City of Norfolk, although none at the terminal. [25] One known shipwreck to the south of the port. One known shipwreck southwest of the terminal near Craney Island Fuel Terminal. One shipwreck northwest of the terminal. [26] PMT: Nearby places in the National Register of Historic Places: there are 24 properties or districts in the city of Portsmouth, although not particularly in the area of the terminal. [25] Ten known shipwrecks south of the port. One known shipwreck west of the terminal before the Virginia State Route 164 bridge. [26] Peck: Nearby places in the National Register of Historic Places: there are 8 properties or districts in the City of Chesapeake, although none at the terminal. [25] Two shipwrecks, both north and northwest of the terminal. [26]
Visual	NNMT: View from the closest residential areas partially blocked by Interstate 664. Industrial viewscape at the terminal characterized by stacks of shipping containers, warehouses, and several large cranes. Coal stacks located due south from the terminal. [24] NIT: Industrial viewscape at terminal. View from the closest residential areas partially blocked by vegetation. View from Virginia State Route 337 and across the railroad tracks characterized by large stacks of shipping containers, vast concrete landscape, and large cranes. [24] PMT: Industrial viewscape at the terminal. View from Virginia State Route 164 characterized by large stacks of shipping containers, vast concrete landscape, and large cranes. View from closest residential areas are obstructed by Virginia State Route 164. [24] Peck: Industrial viewscape at the terminal. View from Interstate 464 characterized by large storage containers, warehouses, several large cranes, and open lands. [24]

HAMPTON ROADS

Multiple Terminals | Hampton Roads, Virginia | 36° 56' 37" N, 76° 23' 09" W

Resource	Description of Existing Conditions
Environmental Justice	NNMT: Total minorities: city of Newport News 49.1%; VA 30.5%. [27] Low-income: city of Newport News 15.2%; VA 11.3%. [27] Area surrounding terminal: Census block group to the east and northeast of the terminal has highest rate of total minority population (> 90%) and to the east of the terminal is the census tract with the highest share of individuals below poverty level (> 75 %). [28] NIT: Total minorities: Norfolk 51.8%; VA 30.5%. [17] Low-income: Norfolk 19.2%; VA 11.3%. [27] Area surrounding terminal: Census block group to the northeast of the terminal has highest rate of total minority population (> 51%) and to the west of the port is the census tract with the highest share of individuals below poverty level (> 60 %). [28] PMT: Total minorities: City of Portsmouth 58.5%; VA 30.5%. [27] Low-income: City of Portsmouth 18.4%; VA 11.3%. [27] Area surrounding terminal: Census block group to the southwest of the port has highest rate of total minority population (> 99%) and to the west of the port the highest share of individuals below poverty level (> 72%). [28] Peck: Total minorities: Chesapeake 49.1%; VA 30.5%. [27] Low-income: Chesapeake 15.2%; VA 11.3%. [27] Area surrounding terminal: Census block group immediately surrounding the port has a total minority population (> 67%) and the share of individuals below poverty level is (> 42%). [28]
Commercial Fishing	Commercial landings (Hampton Roads area): 16.5 million pounds (U.S. rank 20); VA 381.7 million pounds. [29] Commercial fishing engagement in surrounding communities high near NNMT, medium around NIT, low otherwise. [30] Commercial fishing reliance in surrounding communities is low. [30]
Tourism & Recreation	Employment in tourism-related industries in VA Beach-Norfolk-Newport News MSA in 2012: 15,209. [31] Recreational fishing engagement high in surrounding communities is high near NNMT and NIT, low otherwise. [30] Recreational fishing reliance in surrounding communities is low. [30]
Commercial & Recreational Navigation	*(Information on daily vessel arrivals and departures not readily available.)* [32]
Socioeconomic Resources	NNMT: Population: City of Newport News 180,719. [27] Labor Force: City of Newport News 90,692; employed 85,047; unemployment rate 6.2%. [31] NIT: Population: City of Norfolk 242,803. [27] Labor Force: City of Norfolk 112,971; employed 105,789; unemployment rate 6.4%. [31] PMT: Population: City of Portsmouth 95,535. [27] Labor Force: City of Portsmouth 45,364; employed 42,128; unemployment rate 7.1%. [31] Peck: Population: City of Chesapeake 222,209. [27] Labor Force: City of Chesapeake 116,496; employed 110,362; unemployment rate 5.3%. [31] Main Sources of fiscal revenues in VA local jurisdictions: intergovernmental revenues 33%; charges 16%; property taxes 31%; utility revenues 4%. [33]

Anticipated Impacts

Potential port modifications to the Port of Hampton Roads, necessary to support offshore wind development, are anticipated to be limited to increasing the bearing capacity of various points at the Terminal, which would have little impact on existing terrestrial and upland resources due to the industrial setting of the site. Minimal dredging at select terminals may be necessary; however, the anticipated impact to sediments or marine resources will be minor. Noise associated with the port modifications identified above is not likely to be above existing ambient levels; due to the industrialized nature of the surrounding environment. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications.

Because of the many military installations in the area and community engagement in commercial and recreational fishing, activities should be well coordinated to avoid use conflicts. To the extent that there are high and adverse human health or environmental effects to areas to the northeast or east of NNMT, northeast and west of NIT, west and southwest of PMT and surrounding Peck, there may be disproportionately high impacts on minority or low-income communities.

Data Sources & Additional Information

1 World Port Source. Virginia Ports. [Internet]. [cited 2015 October 28]. Available from: http://www.worldportsource.com/ports/index/USA_VA.php.

2 Virginia International Terminals, LLC. The Port of Virginia. [Internet]. 2015 Available from: http://www.portofvirginia.com/.

3 The Port of Virginia. Normal operating hours for facilities. [Internet]. 2015 [cited 2015 December 10]. Available from: http://customerservice.portofvirginia.com/link/portal/57066/57076/Article/15/Normal-operating-hours-for-facilities.

4 CBP (U.S. Customs and Border Protection). Locate a Port of Entry. [Internet]. [cited 2015 December 10]. Available from: http://www.cbp.gov/contact/ports.

5 The Peck Company. Peck Marine Terminal. [Internet]. 2015 Available from: http://www.peckmarineterminal.com/.

6 NMFS (National Marine Fisheries Service). Endangered Species Biological Opinion for Maintenance of Chesapeake Bay Entrance Channels and use of sand borrow areas for beach nourishment. U.S. Army Corps of Engineers, Norfolk District; 2012. FINERl2012/01586.

7 Naval Technology. The biggest naval bases in the US. [Internet]. 2013 [cited 2015 December 10]. Available from: http://www.naval-technology.com/features/featurethe-biggest-naval-bases-in-the-us-4144545/.

8 DMME (Virginia Department of Mines Minerals and Energy). DMME Completes Offshore Wind Power Port Readiness Evaluation. [Internet]. 2015 [cited 2016 January 6]. Available from: https://www.dmme.virginia.gov/DE/OffshoreWindPortEvaluation.shtml.

9 Virginia Department of Transportation. Hampton Roads Crossing Study Final Environmental Impact Statement. Federal Highway Administration and Virginia Department of Transportation; 2001. FHWA-VA-EIS-99-01-F. Available from: http://virginiadot.org/projects/resources/studyhro-crossing-feis.pdf.

10 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

11 Virginia Department of Game & Inland Fisheries. Fish Passage Program. [Internet]. [cited 2015 October 28]. Available from: http://www.dgif.virginia.gov/fishing/fish-passage/.

12 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

13 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

14 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

15 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

16 Engelhaupt A, Aschettino J, Jefferson TA, Richlen M, Engelhaupt D. Occurence, Distribution, and Density of Marine Mammals Near Naval Station Norfolk & Virginia Beach, VA: Annual Progress Report. Final Report. Virginia Beach, Virginia August 2015. Available from: http://www.navymarinespeciesmonitoring.us/files/5814/3923/0416/Engelhaupt_A._et_al._2015_-_Norfolk_Surveys__Density_-_Final.pdf.

17 USFWS (U.S. Fish and Wildlife Service). Endangered Species: Project Reviews in Virginia. [Internet]. 2015 [cited 2015 October 28]. Available from: http://fws.maps.arcgis.com/apps/Viewer/index.html?appid=f6e84e675ba1461b8ae6a351adea1429.

18 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

19 Virginia Department Environmenal Quality. Virginia Water Quality Assessment. Integrated Report. Richmond 2014. Available from:

http://www.deq.virginia.gov/Portals/0/DEQ/Water/WaterQualityAssessments/IntegratedReport/2012/ir12_Integrated_Report_All_Final.pdf.

20 NOAA (National Oceanic and Atmospheric Administration). Tides & Currents. [Internet]. 2015 [cited 2015 October 28]. Available from: https://tidesandcurrents.noaa.gov/stationhome.html?id=8638610.

21 Rule JH. Chemical Extractions of Heavy Metals in Sediments as Related to Metal Uptake by Grass Shrimp (Palaemonetes pugio) and Clam (Mercenaria mercenaria). Archives of Environmental Contamination and Toxicology. 1985;14:749-757.

22 Hampton Roads Planning District Commission. Chesapeake Bay Water Quality. [Internet]. [cited 2015 December 2]. Available from: http://www.hrpdcva.gov/departments/water-resources/chesapeake-bay-water-quality/.

23 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

24 Google Earth. [Internet]. [cited 2015 October 28].

25 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 October 28]. Available from: http://www.nps.gov/nr/research/index.htm.

26 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

27 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

28 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

29 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

30 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

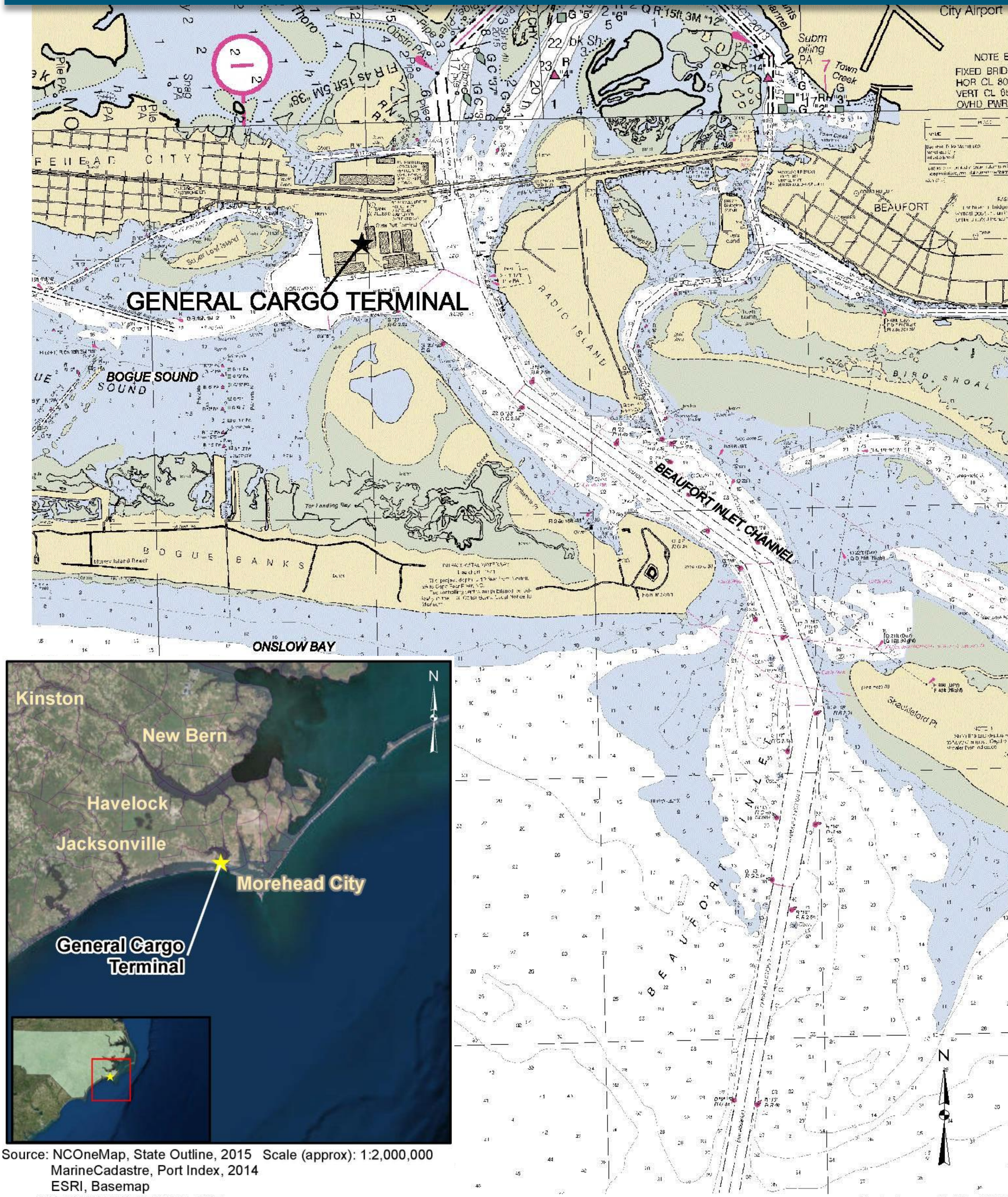
31 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

32 MarineTraffic. Automatic Identification System. [Internet]. [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/index/ports/all.

33 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

MOREHEAD CITY

General Cargo Terminal | Morehead City, North Carolina | 34° 43’ 11” N, 76° 41’ 57” W



Source: NCOneMap, State Outline, 2015 Scale (approx): 1:2,000,000
MarineCadastre, Port Index, 2014
ESRI, Basemap

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 11547_1, 11541_2, 11541_3, 2015

Scale (approx.): 1" = 3000'

MOREHEAD CITY

General Cargo Terminal | Morehead City, North Carolina | 34° 43' 11" N, 76° 41' 57" W

Port Overview

Owner:	North Carolina State Ports Authority (State)
Operator:	North Carolina State Ports Authority (State)
Primary Existing Uses:	Bulk and Breakbulk Shipping
Primary Cargos Handled:	Sulfur Products; Metal Products; Phosphate [1]
Typical Operating Hours:	8:00 AM – 4:00 PM Monday-Friday (General Cargo Terminal) [1]
Land Area:	Over 150 acres [1]
Shortest Distance to Wind Energy Area:	107 miles
Closest Lease Area:	North Carolina Wind Energy Area
Commercial Port Employment:	1,300 people

The Port of Morehead City is a deepwater, commercial port located about four miles from the Atlantic Ocean through Beaufort Inlet. The Port is located within the confluence of the Newport River and Bogue Sound and serves as a significant import and export location for a number of mining and manufacturing firms that are vital to North Carolina's economy. The General Cargo Terminal handles bulk and breakbulk cargo, but does not handle shipping containers. In addition to its commercial significance, the Port is a strategic fast-strike military port for launching forces, equipment, and munitions.

In 2014, 142 ships and 464 barges made port calls at the Port of Morehead City carrying more than 220,000 tons of break bulk and almost 1.6 million tons of bulk cargo, contributing an estimated $1.1 billion to North Carolina's economy [1] [2] The port area has two areas designated as Foreign Trade Zones. [1]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	
Access	Port Access Channel Width (m)	244
	Port Access Water Depths (m)	14.3
	Overhead Draft (m)	Unlimited
	Number of Berths	15
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	12.7
	Quayside Length (m)	1,188
	Quayside Seabed Suitable for Jacking	Yes

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	3.9
	Storage Area Bearing Capacity (t/m^2)	17
	Size of Storage Area (m^2)	225,000
Roll-On, Roll-Off Ro-Ro	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	76
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	3.9
Cranes	On-site Cranes' Capabilities (t)	113
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

U = Unknown

MOREHEAD CITY

General Cargo Terminal | Morehead City, North Carolina | 34° 43' 11" N, 76° 41' 57" W

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Quayside Capabilities[a]		●		●	●			●
Storage Capabilities[b]	●		●	●	●			●
Ro-Ro Capability[c]	●	●	●	●	●			●
Cranes[d]	●	●	●	●	●	●	●	

Modifications in italics are assumed to be required based on port classifications

[a] Improve Quayside Bearing Capacity to 17 t/m^2

[b] Improve Haul Route Bearing Capacity to 10 t/m^2

[c] Improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2

[d] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

Impact Producing Factors

- Soil disturbance/erosion
- Noise
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Species injury, mortality, displacement
- Space use conflicts
- Demand for local labor, goods, services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Shellfish beds and submerged aquatic vegetation (SAV) occur throughout Bogue Sound, providing important habitat for benthic and fish resources. [3]
Fish & EFH	Bogue Sound has extensive eelgrass beds that have been designated as Essential Fish Habitat (EFH) by the South Atlantic Fishery Management Council (SAFMC) for their high value to blue crab, juvenile fish, and shrimp. [3] The Sound also serves to transport larval stages of fishery resources. The State of North Carolina defines Primary Nursery Areas (PNAs) as tidal salt waters that provide essential habitat for the early development of commercially important fish and shellfish. Neither Morehead City Harbor nor Bogue Sound are located within a designated PNA. (15 NC Administrative Code 3B .1405).
Air Quality	Morehead City is located in the Southern Coastal Plain Intrastate Air Quality Control Region (AQCR) and is classified as an attainment area for all criteria pollutants. [4]
Terrestrial Biota	Coastal wetlands in the area include tidal salt marshes along the shorelines of Bogue Sound. Many types of wetland communities are present including smooth cordgrass marsh, needlerush marsh, saltmeadows, and high marsh. The beach and dune community in the area could be considered depauperate in both plants and animals, due to human presence and its constant exposure to salt spray, shifting sands, wind, and sterile soils with low water retention capacity. [5]

MOREHEAD CITY

General Cargo Terminal | Morehead City, North Carolina | 34° 43' 11" N, 76° 41' 57" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. [6] Five species of sea turtles (hawksbill, leatherback, Kemp's ridley, green and loggerhead) and the West Indian manatee are also listed as endangered or threatened for Carteret County. [7] The sea turtles and the West Indian manatee may forage in SAV beds in Bogue Sound during warmer summer months.
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover and the red knot are listed as threatened in Carteret county. The roseate tern is listed as endangered. The shoreline of Bogue Sound supports bird-nesting habitat. Colonially nesting waterbirds (gulls, terns, and wading birds) are commonly found in the area. [7] *(Information on bats in this area is not readily available.)*
Water Quality	The waters closest to the Port in Bogue Sound have been listed as impaired according to the 2014 Category 5 Water Quality Assessments – 303(d) List. Bogue Sound is impaired because of mercury in fish tissue and pathogens. A Total Maximum Daily Load (TMDL) study has been completed for mercury in fish tissue but a TMDL is currently needed for pathogens. The North Carolina Division of Water Quality (NC DWQ) has designated Bogue Sound as Class SA waters, suitable for shellfishing plus primary and secondary recreation and aquatic life propagation. It has also been designated as having Outstanding Resource Waters (ORW) due to its high quality. [8]
Currents & Tides	Morehead City is located within the confluence of the Newport River and Bogue Sound. High tidal flushing occurs through Beaufort Inlet, where tidal currents reach speeds up to 6.8 feet per second. The mean tidal range is about 3.1 feet. [9]
Sediment Deposition	Within the inner harbor, sediment consists predominantly of very fine to fine sands that are derived from Bogue and Back Sounds and the Newport River. Coarser sediments are concentrated in the channels. Dredged material testing conducted on sediments from the Harbor indicate only trace contaminants.
Acoustic Environment	The Port is currently an active port in an industrialized area. A detailed noise and traffic study should be performed prior to modification to fully assess the impacts of noise.
Critical Habitat	USFWS and the National Marine Fisheries Service (NMFS) have proposed designating critical habitat for the threatened loggerhead sea turtle along the beaches surrounding Bogue Sound. [7] State Protected Species (vascular plants and vertebrate animals) are also found on Bogue Banks, on the southern shore of Bogue Sound.
Military Use Areas	Military installations near port: MCAS Cherry Point (US Marine Corps), Camp Lejeune (US Marine Corps), MCAS New River (US Marine Corps). [10]
Land Use & Existing Infrastructure	High and medium intensity developed land with commercial and residential areas to the east and west of the port along US Hwy 70. [11] Port industrial area available for development on Radio Island, across Newport River. [1]
Transportation	Access to Interstates 95 and 40 through US highways 70 and 18 and train service from Norfolk Southern. [1]
Cultural & Historical	Nearby places in the National Register of Historic Places: Morehead City Historic District, Morehead City Municipal Building, Beaufort Historic District. [12] One known shipwreck to the east of the port. [13]
Visual	Industrial viewscape at port. Undeveloped land to the east on Radio Island and to the south on Goat Island and Fort Macon State Park. [14]

MOREHEAD CITY

General Cargo Terminal | Morehead City, North Carolina | 34° 43' 11" N, 76° 41' 57" W

Resource	Description of Existing Conditions
Environmental Justice	Total minorities: Carteret County 13.0%; NC 35.1%. [15] Low-income: Carteret County 14.4%; NC 17.5%. [15] Area surrounding port: Census block group to the northeast of the port has highest rate of total minority population (> 40%) and to the northwest of the port the highest share of individuals below poverty level (> 32 %). [16]
Commercial Fishing	Commercial landings: Port of Beaufort-Morehead City 6.4 million pounds (US rank 76); NC 50.2 million pounds. [17] Commercial fishing engagement high in Morehead City and Beaufort. [18] Commercial fishing reliance high in Beaufort and Harkers Island. [18]
Tourism & Recreation	Employment in tourism-related industries in Carteret County in 2010: 3,762. [19] Recreational fishing engagement high in Morehead City, Beaufort, Atlantic Beach, Harkers Island and Emerald Isle. [18] Recreational fishing reliance high in Harkers Island, Atlantic Beach and Cedar Point. [18]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Aug 14 - Sept 09, 2015): 12-39. [20] Main vessel types to and from port (30 days): pleasure crafts 33.7%, tug boats 21.4%, sailing vessels 14%. [20]
Socioeconomic Resources	Population: Carteret County 67,198. [15] Labor Force: Carteret County 30,894; employed 29,048; unemployment rate 6.0%. [21] Main Sources of fiscal revenues in NC local jurisdictions: intergovernmental revenues 33.2%; charges 25.1 %; property taxes 20.4%; utility revenues 9.8 %. [22]

Anticipated Impacts

Potential port modifications to the Morehead City Port, necessary to support offshore wind development, are anticipated to be [illegible] industrialized setting. The potential for reduction or loss of habitat (benthic and terrestrial) exists, however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above could potentially produce noise above existing ambient levels (i.e., pile driving). Time of year and day/night restrictions may be required for certain activities that have the potential to disturb sensitive communities. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications.

Road access to the port depends largely on US Hwy 70, which crosses commercial and residential areas, as well as historic districts to the east and west of the port. To the extent that construction materials are transported by truck, impacts to traffic may occur as well as to visitation to the nearby historic districts. Cranes may produce visual impacts against some viewscapes. To the extent that port modifications interfere with commercial and recreational fishing, the communities of Beaufort (commercial) and Harkers Island (recreational) have the potential to require communication to minimize user conflicts. To the extent that there are high and adverse human health or environmental effects to areas to the north of the port there may be disproportionately high impacts on minority or low-income communities.

Data Sources & Additional Information

1 Port of Morehead City. [Internet]. Available from: http://www.ncports.com/port-of-morehead-city.

2 North Carolina State Ports Authority. Economic Contribution of the North Carolina Ports. [Internet]. 2014 Available from: http://www.ncports.com/elements/media/files/economic-contribution-north-carolina-ports.pdf.

3 NCDENR (North Carolina Department of Environment and Natural Resources). Submerged Aquatic Habitat (SAV) Mapper. [Internet]. [cited 2015 September 9]. Available from: http://portal.ncdenr.org/web/mf/habitat/SAV.

4 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 15]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

5 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

6 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

7 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

8 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

9 NOAA (National Oceanic and Atmospheric Administration). Tides Online and Current Predictions. [Internet]. [cited 2015 September 9]. Available from: http://co-ops.nos.noaa.gov.

10 Military Bases.com. US Military Bases. [Internet]. [cited 2015 September 10]. Available from: http://militarybases.com/.

11 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 September 11]. Available from: http://www.mrlc.gov/eva/viewer.html.

12 NC SHPO (North Carolina State Historic Preservation Office). GIS Web Service. [Internet]. [cited 2015 September 10]. Available from: http://www.hpo.ncdcr.gov/.

13 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 September 10]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

14 Google Earth. [Internet]. [cited 2015 September 10].

15 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. [cited 2015 September 10]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

16 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 September 10]. Available from: http://www2.epa.gov/ejscreen.

17 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 September 10]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

18 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 September 10]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

19 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies.. OCS Study BOEM 2012-085; 2012.

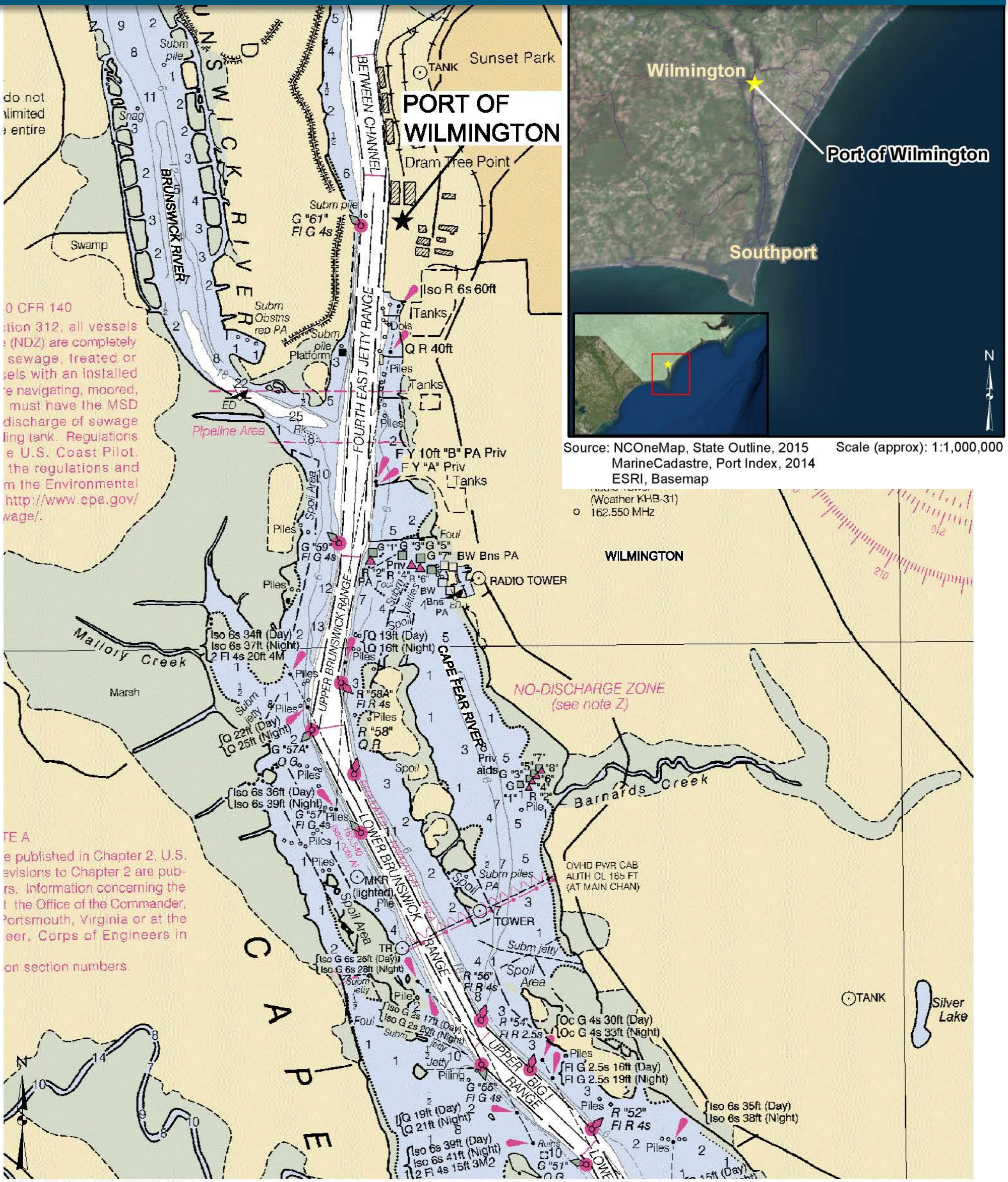
20 MarineTraffic. Port of Morehead City. [Internet]. [cited 2015 September 10]. Available from: http://www.marinetraffic.com/en/ais/details/ports/2766/USA_port:MOREHEAD_CITY.

21 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 September 10]. Available from: http://www.bls.gov/lau/.

22 USCB (U.S. Census Bureau). State and Local Finances, 2012 Census of Governments. [Internet]. [cited 2015 September 10]. Available from: http://www.census.gov/govs/local/.

WILMINGTON, NC

Wilmington, North Carolina | 34° 11’ 31” N, 77° 57’ 15” W



Source: NCOneMap, State Outline, 2015
MarineCadastre, Port Index, 2014
ESRI, Basemap

Scale (approx): 1:1,000,000

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 11537_2, 2015

Scale (approx.): 1" = 3000'

WILMINGTON, NC

Wilmington, North Carolina | 34° 11’ 31” N, 77° 57’ 15” W

Port Overview

Owner:	North Carolina State Ports Authority (State Agency)
Operator:	North Carolina State Ports Authority (State Agency)
Primary Existing Uses:	International seaport; Industry; Food Processing, and Research Center [1]
Primary Cargos Handled:	Containers, Breakbulk, and Bulk Cargoes of Chemicals, Coal, Forest Products, General Merchandise, and Cement [1]
Typical Operating Hours:	8:00 AM – 4:30 PM [2]
Terminal Land Area:	280 acres [3]
Shortest Distance to Wind Energy Area:	35.3 miles
Closest Lease Area:	North Carolina Wind Energy Area
Commercial Port Employment:	250 people [3]

Wilmington, NC is located in New Hanover County in southeastern North Carolina. The Port of Wilmington, NC is located on the Cape Fear River, just above the confluence with the Brunswick River, approximately 26 miles from the Atlantic Ocean.

The Port of Wilmington offers nine berths with a total of almost 6,800 feet of concrete deck and pile wharf and open apron areas of up to 300 feet. The channel depth at the Port is 42 feet at Mean Lower Low Water (MLLW). The depth at Berths 1 and 2 is 38 feet at MLLW, and depth at Berths 3 through 9 is 42 feet at MLLW. The Port of Wilmington is accessible to regional and national highway and rail networks. [2]

The Port controls 150 acres of additional land that is available for development. [2]

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	Yes
Access	Port Access Channel Width (m)	152
	Port Access Water Depths (m)	13.4
	Overhead Draft (m)	12.8
	Number of Berths	9
Quayside Capabilities	Quayside Bearing Capacity (t/m²)	U
	Quayside Length (m)	308
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m²)	U
	Storage Area Bearing Capacity (t/m²)	U
	Size of Storage Area (m²)	305,000
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	U
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m²)	U
Cranes	On-site Cranes’ Capabilities (t)	225
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

U = Unknown

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Blasting	Dredging	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Access Capabilities[a]		●	●	●				●	●	

WILMINGTON, NC

Wilmington, North Carolina | 34° 11’ 31” N, 77° 57’ 15” W

Construction Activity	Land Clearing	Blasting	Dredging	Pile Driving/ Drilling	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Cranes[b]	●			●	●	●	●	●	●	
Quayside Bearing Capacity[c]			●	●	●	●	●			●
Storage Capabilities[d]	●				●	●	●			●
Ro-Ro Capability[e]	●			●	●	●	●			●

Modifications in italics are assumed to be required based on port classifications

[a] Improve overhead draft to 75 m

[b] Provide On-Site Cranes with 600 t lifting capability; *Reduce Crane Height Restrictions to 50 m*

[c] *Improve Quayside Bearing Capacity to 17 t/m^2 and make Quayside Seabed Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2*

[e] *Improve Ro-Ro Berth Width to 8 m; improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	The Cape Fear River is classified as a primary shellfish nursery area; however, the area is closed to harvest due to the presence of metals in these waters. [4]
Fish & EFH	Cape Fear River is classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). [5] Anadromous species such as blueback herring, American shad, hickory shad, alewife, and striped bass, use the Cape Fear River as spawning and nursery areas. Additionally, endangered species such as the Atlantic sturgeon and shortnose sturgeon also use the Cape Fear River as spawning and nursery areas. [6]
Air Quality	The Port of Wilmington is located in the Southern Coastal Plain Intrastate Air Quality Region, and is in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. [7]
Terrestrial Biota	Most of the area surrounding the Port is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. There are more open spaces and forested lands downstream of the Port; including a 173 acre reserve on Bald Head Island, approximately 25 mile south of the Port. [8]

WILMINGTON, NC

Wilmington, North Carolina | 34° 11' 31" N, 77° 57' 15" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. The West Indian manatee was also listed as endangered for New Hanover county. [9] The right whale and humpback whale commonly occur in North Carolina's coastal waters; however, they are rarely seen in the Cape Fear River. Bottlenose dolphin and the harbor porpoise, as well as the manatee have been found within the Cape Fear River system. [6] Four species of sea turtles are listed as either threatened or endangered for New Hanover county including; hawksbill, leatherback, green and loggerhead sea turtles. The green, loggerhead and Kemp's ridley sea turtles are known to nest on the beaches of North Carolina near the mouth of the Cape Fear River and also, occasionally, enter the lower Cape Fear estuary. [10] [6]
Birds & Bats	Endangered species listings from the USFWS were consulted. The Northern long-eared bat and the piping plover are listed as threatened in New Hanover county. [10] A variety of birds are likely to occur seasonally in the area of the Port, since coastal North Carolina is part of the Atlantic Flyway. Bald Head Island, located approximately 25 miles south of the Port, is a common stopover spot. [11] [12]
Water Quality	Both the Cape Fear River (Segment ID NC18-71) and Brunswick River (Segment ID NC18-77) are classified as impaired according to the North Carolina 2014 Category 5 Water Quality Assessments – 303(d) List. Brunswick River is impaired from its origin to the intersection with the Cape Fear River because of depleted dissolved oxygen and mercury in fish tissue. The Cape Fear River is impaired due to dissolved oxygen, mercury in fish tissue, and high pH. Areas of the Cape Fear River south of the Port are impaired for metals other than mercury including; arsenic, nickel and copper among other parameters. [13] Waters are classified as SC, tidal saltwater supporting secondary recreation, fishing, and aquatic life. [4]
Currents & Tides	In addition to the inflow from the Cape Fear River, water circulation in this area is influenced by tidal flow and wind. The mean tidal range is 3.8 feet. Tidal currents reach speeds of 3.4 to 5.1 feet per second around the Port. [2]
Sediment Deposition	*(Limited sediment data available).* Sediments are predominantly silts and clay. [6]
Acoustic Environment	The Port is currently an active port in an industrialized area. Ambient noise at the Port includes heavy equipment, cranes, conveyors, large vehicles and rail transit. The City of Wilmington's noise ordinance requires that daytime noise, be below 75 dbA. Noise levels for nighttime and weekend activities differ. [14] [4]
Critical Habitat	The Lower Cape Fear River Aquatic Habitat Significant Natural Heritage Area (SNHA) includes Cape Fear River from Eagle Island downstream to the mouth of the river at Bald Head Island and supports populations of two Federally and State Endangered animals: manatee and shortnose sturgeon. Also supported is the Federal and State Threatened American alligator. The site also provides important habitat for other animal species that are rare in North Carolina, including Carolina diamondback terrapin. This portion of the river is considered to be of State significance due to the habitat provided to these rare species. [6]
Military Use Areas	Military installations near port: no military installations in New Hanover County, NC. The Military Ocean Terminal Sunny Point (Army) is 14 miles south of Wilmington, NC, near the entrance of the navigation channel. [15]
Land Use & Existing Infrastructure	Medium intensity developed industrial land to the north and south, along the channel, with the closest residential areas about a third of a mile inland, to the east. Some undeveloped or developed open land across the channel less than a third of a mile to the west in Eagle Island and Clarks Island. [16] [17]
Transportation	Immediate access to US Routes 17, 11, 421, which connect to Interstates 40 and 140, 8 miles to the northeast. Port access is also available via US Routes 74, 76, and 421 and Interstate 95. Serviced by rail. [17]

WILMINGTON, NC

Wilmington, North Carolina | 34° 11' 31" N, 77° 57' 15" W

Resource	Description of Existing Conditions
Cultural & Historical	Nearby places in the National Register of Historic Places: 25 historic properties and districts in Wilmington, NC. [18] One known shipwreck to the west of the port. [19]
Visual	View from closest residential areas partially blocked by vegetation. View from channel of industrial landscape with large cranes, storage containers, and warehouses. View of undeveloped land across the channel, to the west of the port. [17]
Environmental Justice	Total minorities: New Hanover County 21.8%; NC 35.1%. [20] Low-income: New Hanover County 16.9%; NC 17.5%. [20] Area surrounding port: two census block groups encompass the port (and surrounding residential areas) and vary from <20% total minority population in the northern block group to 41-75% total minority population in the southern block group. Two census tracts encompass the port (and surrounding residential areas) and vary from <10% individuals below the poverty level in the northern tract to >26% in the southern tract. [21]
Commercial Fishing	Commercial landings: Not available. [22] Commercial fishing engagement is high in Wilmington and low in all surrounding communities. [23] Commercial fishing reliance is low in all surrounding communities. [23]
Tourism & Recreation	Employment in tourism-related industries in New Hanover County in 2010: 13,375. [24] Recreational fishing engagement is high in Wilmington and low in all surrounding communities. [23] Recreational fishing reliance is low in all surrounding communities. [23]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 28 – Oct 26, 2015): 1-12. [25] Main vessel types to and from port (30 days): cargo 68.7%, tanker 15.6%, tug boats 12.5%, special craft 3.1%. [25]
Socioeconomic Resources	Population: New Hanover County 206,403. [20] Labor Force: New Hanover County 109,507; employed 103,164; unemployment rate 5.8%. [26] Main Sources of fiscal revenues in NC local jurisdictions: intergovernmental revenues 36.0%; property taxes 19.4%; hospital charges 15.4%; utility revenues 9.2%. [27]

Anticipated Impacts

Potential port modifications to the Port of Wilmington, NC necessary to support offshore wind development, are anticipated to have minimal impact on existing terrestrial and upland resources due to the industrial setting of the site. Minimal dredging and land clearing may be necessary to enhance bearing capacity in the terrestrial and marine environment; however, the anticipated impact to sediments or marine resources will be minor given the regular maintenance dredging that occurs within the surrounding channels. In addition, the potential for reduction or loss of terrestrial habitat exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above is not likely to be above existing ambient levels due to the industrialized nature of the surrounding environment. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications. Potential for relevant socioeconomic impacts are low. However, because of engagement in commercial fishing in some communities, activities should be well coordinated to avoid use conflicts. To the extent that there are high and adverse human health or environmental effects there may be disproportionately high impacts on minority or low-income communities to the south of the port.

Data Sources & Additional Information

1 World Port Source. Port of Wilmington. [Internet]. [cited 2015 Nov 2]. Available from: http://www.worldportsource.com/ports/review/USA_NC_Port_of_Wilmington_210.php.

2 North Carolina Ports. Port of Wilmington. [Internet]. [cited 2015 October 30]. Available from: http://www.ncports.com/port-of-wilmington/.

3 Wilmington NC Magazine. A look at what the Port of Wilmington means to the Port City. [Internet]. 2014 [cited 2015 Nov 2]. Available from: http://www.wilmingtonncmagazine.com/global-reach.

4 North Carolina State Ports Authority. Cold Storage Facility Port of Wilmington: Administrative Action, Environmental

Assessment and Finding of No Significant Impact. EA and FONSI. Wilmington August 2014.

5 NOAA (National Oceanic and Atmospheric Adminsitration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

6 USACE (U.S. Army Corps of Engineers). Wilmington Harbor Navigation Improvements Study - Feasibility Report and Environmental Assessment. Draft. Wilmington District 2014. Available from: http://www.saw.usace.army.mil/Portals/59/docs/navigation/Dredging/Projects/Wilmington%20Harbor%20Feasibility%20Report%20June%202014.pdf.

7 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 October 30]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

8 The Nature Conservancy. Northeast Habitat Map. [Internet]. [cited 2015 October 28]. Available from: http://tnc.maps.arcgis.com/apps/webappviewer/index.html?id=fa7c93736ec643a39764ea54339df6d8.

9 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

10 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

11 North Carolina Birding Trail. Bald Head Island. [Internet]. 2014 [cited 2015 October 30]. Available from: http://ncbirdingtrail.org/sites/2012/8/1/bald-head-island.html.

12 North Carolina Wildlife Resources Commission. Bat Fact Sheet. [Internet]. 2005 [cited 2015 October 30]. Available from: http://216.27.39.103/Portals/0/Conserving/documents/FactSheets/nongame_bat_hires.pdf.

13 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 30]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

14 City of Wilmington, North Carolina. City of Wilmington Noise Ordinance. [Internet]. [cited 2015 October 30]. Available from: https://www.wilmingtonnc.gov/Portals/0/documents/Police%20Department/documents/Noise%20Ordinance.doc.

15 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

16 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 October 28]. Available from: http://www.mrlc.gov/eva/viewer.html.

17 Google Earth. [Internet]. [cited 2015 October 28].

18 NC SHPO (North Carolina State Historic Preservation Office). GIS Web Service. [Internet]. Undated [cited 2015 October 28]. Available from: http://www.hpo.ncdcr.gov/.

19 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

20 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

21 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

22 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

23 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

24 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

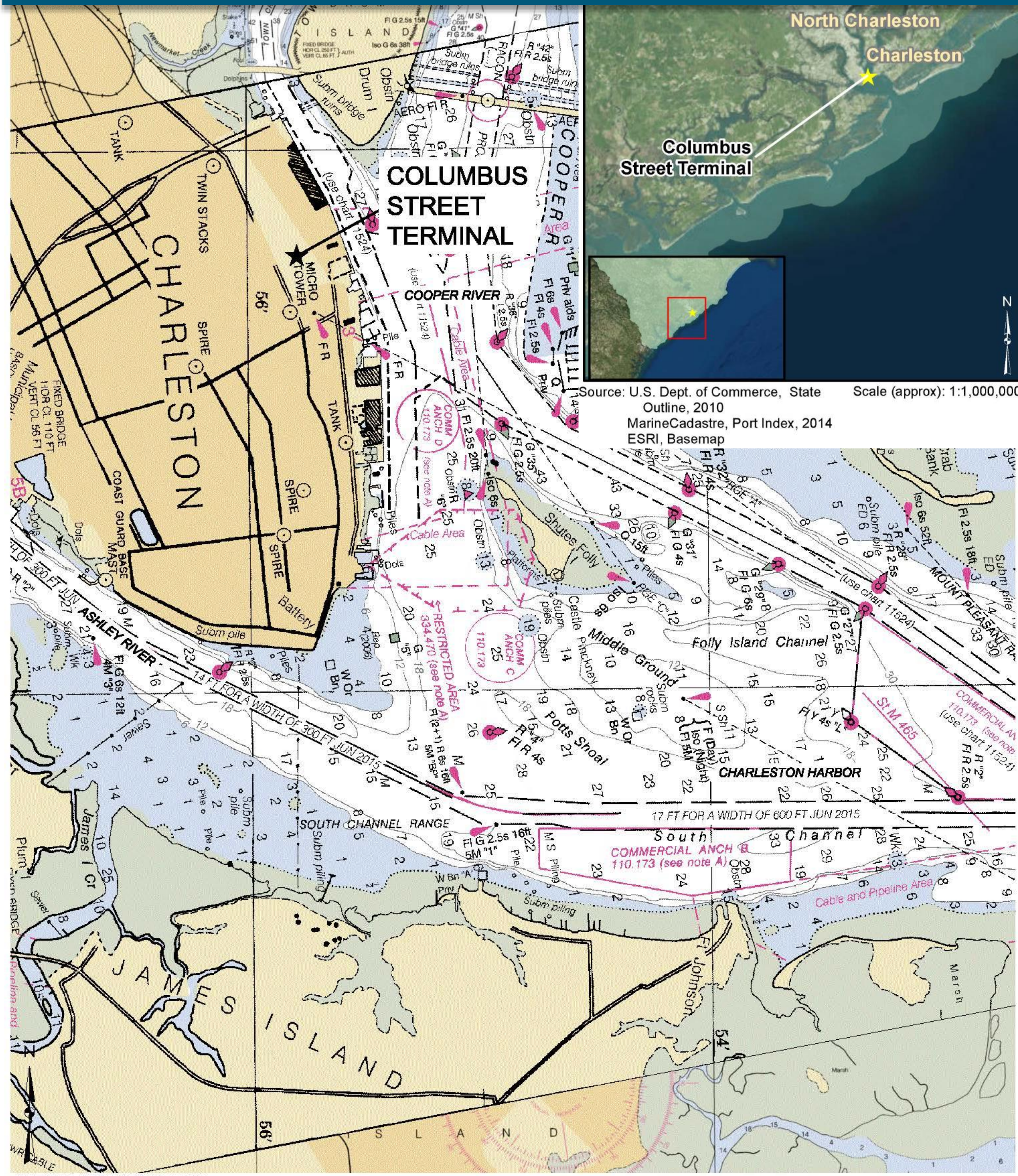
25 MarineTraffic. Automatic Identification System-Port of Wilmington NC. [Internet]. 2015 [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/details/ports/209.

26 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

27 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

CHARLESTON

Columbus Street Terminal | Charleston, South Carolina | 32° 49’ 20” N, 79° 55’ 39” W



NOT FOR NAVIGATIONAL USE

Sources: NOAA Chart 11518_2, 2012; 11524_1, 2015

Scale (approx.): 1" = 3000'

CHARLESTON

Columbus Street Terminal | Charleston, South Carolina | 32° 49' 20" N, 79° 55' 39" W

Port Overview

Owner:	South Carolina Ports Authority (Quasi-public Agency)
Operator:	South Carolina Ports Authority (Quasi-public Agency)
Primary Existing Uses:	Common Breakbulk, Bulk, Rolling Stock, Heavy-Lift, and Project Cargo [1]
Primary Cargo Handled	Paper; Automobiles
Typical Operating Hours:	6:00 AM – 6:00 PM Monday-Friday [1]
Terminal Land Area:	155 acres [1]
Shortest Distance to Wind Energy Area:	111.8 miles
Closest Lease Area:	North Carolina Wind Energy Area
Commercial Port Employment:	187,600 people [1]

The Port of Charleston includes five public terminals owned and operated by the South Carolina Ports Authority; Wando Welch Terminal (WWT), Columbus Street Terminal (CST), Union Pier Terminal (UPT), North Charleston Terminal (NCT) and Veterans Terminal (VT). Columbus Street Terminal (CST) is Charleston's premier combination breakbulk and container terminal. With dockside warehouses, dockside rail access, more than 3,800 feet of berth space, and post-Panamax and Suez-class container cranes, CST is multipurpose facility. The Terminal was recently converted from a container handling facility to a modern, large-scale Roll-On, Roll-Off (Ro-Ro) and project cargo terminal. [1]

The CST is located on the Cooper River side of the Charleston peninsula, downriver of the US Highway 17 Bridge. The terminal is 14.4 nautical miles from the Charleston Harbor entrance. The terminal covers a total of 155 acres and has 3,500 feet of berth. The berths at the terminal are maintained to a depth of -45 feet Mean Low Water (MLW). Access from the terminal to I-26 is via Morrison Avenue and East Bay Street. Existing rail access to this terminal includes an on-terminal intermodal rail yard [2].

The Port of Charleston offers a maintained harbor depth of -45 feet (13.7 meters) MLW throughout the main shipping channel and -47 feet (14.3 m) MLW in the entrance channel. A harbor deepening project is currently underway to take the Port of Charleston's entrance channel to 54 feet and harbor channel to 52 feet Mean Lower Low Water (MLLW).

Port Classifications Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	
Access	Port Access Channel Width (m)	305
	Port Access Water Depths (m)	14.3
	Overhead Draft (m)	Unlimited
	Number of Berths	32
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	U
	Quayside Seabed Suitable for Jacking	U

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	452,842
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	381
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U
Cranes	On-site Cranes' Capabilities (t)	500
	Crane Height Restrictions (m)	U
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

U = Unknown

CHARLESTON

Columbus Street Terminal | Charleston, South Carolina | 32° 49’ 20” N, 79° 55’ 39” W

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Dredging	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Cranes[a]	●	●		●	●	●	●	●	
Quayside Capabilities[b]		●	●	●	●	●			●
Storage Capabilities[c]	●			●	●	●			●
Ro-Ro Capability[d]	●	●		●	●	●			●

Modification in italics are assumed to be required based on port classifications

[a] Provide On-Site Cranes with 600 t lifting capability*; reduce Crane Height Restrictions to 50 m*

[b] *Improve Quayside Bearing Capacity to 17 t/m^2; improve Quayside Length to 170 m; make Quayside Seabed Suitable for Jacking*

[c] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2*

[d] *Improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	Nearshore benthic habitat consists of patchy, hardbottom habitat, including oyster reefs, surrounded by large expanses of sand. Benthic organisms found in the harbor channels include mollusks, polychaetes, oligochaetes, nematodes, and amphipods. Organism and population numbers are not typically as stable or abundant as in surrounding wetlands and mudflats due to disturbance. [3]
Fish & EFH	Charleston Harbor’s tidally influenced reaches and adjacent wetlands are all considered Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). The shortnose and Atlantic sturgeon are endangered species found in the Cooper River. The Cooper River serves as a migratory pathway for anadromous species such as the shortnose sturgeon, Atlantic sturgeon, American shad, blueback herring, hickory shad, and striped bass. [3]
Air Quality	The Port of Charleston is located in the Charleston Intrastate Air Quality Control Region (AQCR) and is in attainment for all National Ambient Air Quality Standards (NAAQS). [3]
Terrestrial Biota	Most of the area in the immediate Port vicinity is developed and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Habitats in the Harbor and adjacent lands include a number of wetlands, marshes, beaches, forests, and shrublands. [3] [4]

CHARLESTON

Columbus Street Terminal | Charleston, South Carolina | 32° 49' 20" N, 79° 55' 39" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. Additionally the West Indian manatee was listed as endangered. Several species of whales could likely be in the vicinity depending on season and suitable habitat conditions including; humpback whales, North Atlantic right whales, Bryde's whales, sperm whales and various species of beaked whales. Also, depending on season and suitable habitat, West Indian manatees, bottlenose dolphins, Atlantic spotted dolphins, harbor seals and hooded seals can occur. [5] Four federally listed species of sea turtle may also occur in the vicinity including the leatherback sea turtle, hawksbill sea turtle, Kemp's ridley sea, green sea turtle, and the loggerhead sea turtle. [3] [6]
Birds & Bats	Endangered species listings from the USFWS were consulted. Both the piping plover and red knot are listed as threatened in Charleston county. The bald eagle (recovery) and Bachman's warbler (endangered) are also listed. [6] Furthermore, several species of shorebirds (American oystercatcher, willet, plovers, sandpipers, gulls/terns), seabirds (pelicans, skimmers, gulls, terns), and migratory birds (sandpipers, avocets) have been identified in the Port vicinity. Additionally, Rafinesque's big-eared bat is also found around the Port. [3]
Water Quality	The Charleston Harbor system is not considered to be impaired under criteria of Section 303(d) of the Clean Water Act except for an area 0.5 miles southeast from the mouth of Shem Creek, which is several miles from the Port. [3] [7]
Currents & Tides	In addition to inflow from the Cooper River and Wando River, water circulation in Charleston Harbor is influenced by tidal flow and wind. Tidal currents near the entrance to the Charleston Harbor are typically 1.69 feet per second and currents near Fort Sumter and Drum Island can reach 6.75 feet per second. The mean tidal range in Charleston Harbor is 5.22 ft. [8] [3]
Sediment Deposition	Sediment in the Port vicinity is predominantly clay, silty sand, and inorganic silt. Sediment quality within Charleston Harbor ranges from poor to good, which is typical of an urban harbor. The sediment surrounding the Port is not considered to be significantly contaminated. [3]
Acoustic Environment	The Port of Charleston an active port in an industrialized area that has operated in an international harbor for centuries. Ambient noise from natural and artificial sources contribute to the typical noise characteristics of a busy harbor.
Critical Habitat	All 11.2 miles of Folly Beach on Folly Island, located to the southeast of the Port, are designated as critical habitat for nesting loggerhead sea turtles. NMFS has proposed a rule to expand critical habitat for the North American right whale to include the Charleston Harbor; however, at the time of this writing this has not taken effect. [3]
Military Use Areas	Military installations near port: There are three military installations in Charleston County, SC. The Naval Hospital Charleston (Navy), about 12.5 miles north; the Naval Weapons Station Charleston (Navy) is 11.5 miles north, and the Joint Base Charleston (Air Force) is 10.5 miles northeast. [9]
Land Use & Existing Infrastructure	High and medium intensity developed land with commercial and residential areas to the northwest and southwest of the port, where the city of Charleston is located. Largely undeveloped islands surround the Charleston peninsula, including Hog Island, Shute's Folly Island, and Drum Island. [10] [4]
Transportation	Route to Interstate 26 runs through residential areas. Train service from the north and dockside rail service. [4] [1]
Cultural & Historical	Nearby places in the National Register of Historic Places: there are 93 properties or districts in the city of Charleston, including Castle Pickney on Shute's Folly Island. [11] Two known shipwrecks north of the port, two known shipwrecks to the east, one known shipwreck to the southwest, and two known shipwrecks to the southeast. [12]

CHARLESTON

Columbus Street Terminal | Charleston, South Carolina | 32° 49' 20" N, 79° 55' 39" W

Resource	Description of Existing Conditions
Visual	Varied viewscapes at the port. Bridge and highway infrastructure blend with vegetative cover and open water to the north and east of the port. View of residential neighborhoods to the west of the port. Viewscape from the residential and commercial center of Charleston includes several large cranes, warehouses, and bridge infrastructure. [4]
Environmental Justice	Total minorities: Charleston County 33.7%; SC 32.8%. [13] Low-income: Charleston County 18.2%; SC 18.1%. [13] Area surrounding port: Census block group to the north of the port has highest rate of total minority population (> 75%) and the census tract encompassing the port and surrounding residential areas has the highest share of individuals below poverty level (> 26 %). [14]
Commercial Fishing	Commercial landings: Not available. [15] Commercial fishing engagement in Charleston is high and medium/low in surrounding communities. [16] Commercial fishing reliance in surrounding communities is low with exception to Folly Beach where it is high. [16]
Tourism & Recreation	Employment in tourism-related industries in Charleston County in 2010: 26,927. [17] Recreational fishing engagement in Charleston is low but is high/medium in surrounding communities. [16] Recreational fishing reliance in surrounding communities is low. [16]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 28 - Oct 26, 2015): 7-61. [18] Main vessel types to and from port (30 days): pleasure craft 47.2%, cargo 21.8%, sailing vessel 18.8%, tug 2.8%. [18]
Socioeconomic Resources	Population: Charleston County 358,736. [13] Labor Force: Charleston County 189,718; employed 179,962; unemployment rate 5.1%. [19] Main Sources of fiscal revenues in SC local jurisdictions: intergovernmental revenues 26.7%; hospital charges 19.0 %; property taxes 25.3%; utility revenues 8.0%. [20]

Anticipated Impacts

Potential port modifications to the Port of Charleston, necessary to support offshore wind development, are anticipated to be limited to increasing the bearing capacity of various points at the Terminal, which would have little impact on existing terrestrial and upland resources due to the industrial setting of the site. Minimal dredging may be necessary; resulting in potential minor impact to marine resources, including patches of hard bottom in the surrounding vicinity. Noise associated with the port modifications identified above is not likely to be above existing ambient levels; due to the industrialized nature of the surrounding environment. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications.

Road access to the port would depend on local roads neighboring residential areas. To the extent that construction materials are transported by truck, impacts to traffic may occur as well as to visitation nearby historic properties and districts. Because of engagement in commercial fishing in some communities, activities should be well coordinated to avoid use conflicts. To the extent that there are high and adverse human health or environmental effects to areas to the west of the port there may be disproportionately high impacts on low-income communities.

Data Sources & Additional Information

1 South Carolina Ports. Columbus Street Terminal. [Internet]. 2015 Available from: http://www.port-of-charleston.com/cargo-facilities-charleston-terminals-columbusStreet.asp.

2 Moffat Nichol. South Carolina State Port Authority 2011 Emissions Inventory Update. South Carolina Ports; 2013. Available from: http://www.port-of-charleston.com/About/Environment/documents/2011_Air_Emissions_Inventory_Update.pdf.

3 USACE (U.S. Army Corps of Engineers) Charleston District. Final Integrated Feasibility Report and Environmental Impact Statement: Charleston Harbor Post 45. Final EIS. Charleston, South Carolina June 2015.

4 Google Earth. [Internet]. [cited 2015 October 28].

5 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

6 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

7 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

8 NOAA (National Oceanic and Atmospheric Administration). Tides Online and Current Predictions. [Internet]. [cited 2015 September 9]. Available from: http://co-ops.nos.noaa.gov.

9 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

10 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 October 28]. Available from: http://www.mrlc.gov/eva/viewer.html.

11 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 October 28]. Available from: http://www.nps.gov/nr/research/index.htm.

12 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

13 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

14 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

15 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

16 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

17 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

18 MarineTraffic. Automatic Identification System-Port of Charleston. [Internet]. [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/details/ports/2177/USA_port:CHARLESTON.

19 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

20 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

SAVANNAH

Multiple Terminals | Savannah, Georgia | 32° 06’ 39” N, 81° 07’ 33” W

Source: U.S. Dept. of Commerce, State Outline, 2015
MarineCadastre, Port Index, 2012
ESRI, Basemap

Scale (approx): 1:750,000

NOT FOR NAVIGATIONAL USE
Sources: NOAA Chart 11514_1, 2014; 11512_1, 2014

Scale (approx.): 1" = 3000'

SAVANNAH

Multiple Terminals | Savannah, Georgia | 32° 06' 39" N, 81° 07' 33" W

Port Overview

Owner:	Georgia Ports Authority (State Agency)
Operator:	Georgia Ports Authority (State Agency)
Terminals at Port of Savannah:	Garden City Terminal; Ocean Terminal
Primary Existing Uses:	Commercial Shipping
Primary Cargos Handled:	Containers, Breakbulk, Automobiles, Refrigerated cargo, steel, Forest and Wood products, and Farm equipment
Typical Operating Hours:	Garden City Terminal: 6:00 AM – 6:00 PM [1]
Terminal Land Area:	Garden City Terminal: 1,200 acres [1] Ocean Terminal: 200 acres [1]
Shortest Distance to Wind Energy Area:	199 miles
Closest Lease Area:	North Carolina Wind Energy Area
Commercial Port Employment:	Not available

The Port of Savanah is located on the Savannah River in Savannah, Georgia. The Port, which is located approximately 17 miles upriver from the Atlantic Ocean [2], includes two terminals—the Garden City Terminal and the Ocean Terminal.

The Garden City Terminal is the fourth-busiest container port in the United States and provides access to 44% of U.S. consumers in 2-3 days. The terminal has almost two miles of uninterrupted berth along the Savannah River, 27 container cranes, and over 4 million square feet of warehouse space. Water depths alongside the berths range between 42 and 48 feet at Mean Low Water (MLW). [1] [3]

The Ocean Terminal is a dedicated breakbulk and Roll-On, Roll-Off (Ro-Ro) facility that handles forest and solid wood products, steel, automobiles, farm equipment, and heavy-lift cargoes. The terminal has over a mile of berths, 82 acres of open storage and 82 acres of paved storage. Water depths alongside the berths are 42 feet at MLW. [1] [3]

Within the harbor limits, the Savannah River is generally divided into two channels by a series of islands. The Savannah River federal channel has an authorized depth of -42 feet MLW and an authorized width of 500 feet. The Savannah Harbor Expansion Project will deepen the federal channel to -47 feet MLW.

Port Classifications   Existing Capabilities

Capability Area	Criteria (units)	
Potential Use	Staging Port	Yes
	Operation & Maintenance (O&M) Port	
Access	Port Access Channel Width (m)	152.4
	Port Access Water Depths (m)	13.4
	Overhead Draft (m)	12.8
	Number of Berths	34
Quayside Capabilities	Quayside Bearing Capacity (t/m^2)	U
	Quayside Length (m)	515
	Quayside Seabed Suitable for Jacking	U

U = Unknown

Capability Area	Criteria (units)	
Storage Capabilities	Haul Route Bearing Capacity (t/m^2)	U
	Storage Area Bearing Capacity (t/m^2)	U
	Size of Storage Area (m^2)	248,920
Roll-On, Roll-Off (Ro-Ro)	Ro-Ro Capability (Yes/No)	Yes
	Width of Ro-Ro Berth (m)	297
	Bearing Capacity of Ro-Ro Berth & Ramps (t/m^2)	U
Cranes	On-site Cranes' Capabilities (t)	156.3
	Crane Height Restrictions (m)	13.7
Transportation	Onshore Transportation Infrastructure (rail, highway, etc.)	Rail; highway

SAVANNAH

Multiple Terminals | Savannah, Georgia | 32° 06' 39" N, 81° 07' 33" W

Potential Port Modifications Necessary to Support Offshore Wind

Construction Activity	Land Clearing	Pile Driving/ Drilling	Blasting	Dredging	Fill Placement	Fill Compaction	Paving	Utility Tower Extension	Utility Line Moves	Aggregate Dumping
Access Capabilities[a]		●	●	●				●	●	
Cranes[b]	●	●			●	●	●	●	●	
Quayside Bearing Capacity[c]		●		●	●	●	●			●
Storage Capabilities[d]	●				●	●	●			●
Ro-Ro Capability[e]	●				●	●	●			●

Modifications in italics are assumed to be required based on port classifications

[a] Improve overhead draft to 75 m

[b] Provide On-Site Cranes with 600 t lifting capability; reduce Crane Height Restrictions to 50 m

[c] *Improve Quayside Bearing Capacity to 17 t/m^2 and make Quayside Seabed Suitable for Jacking*

[d] *Improve Haul Route Bearing Capacity and Storage Area Bearing Capacity to 10 t/m^2*

[e] *Improve Bearing Capacity of Ro-Ro Berth and Ramps to 10 t/m^2*

Impact Producing Factors

- Marine/estuarine sediment disturbance
- Soil disturbance/erosion
- Sediment suspension & deposition
- Noise
- Lighting
- Discharges
- Trash & debris
- Traffic
- Air emissions
- Visible infrastructure
- Aquatic habitat alteration
- Species injury, mortality, or displacement
- Space use conflicts
- Demand for local labor, goods, & services

Description of Existing Environmental & Socioeconomic Conditions & Anticipated Impact

Resource	Description of Existing Conditions
Benthic	*(Limited information available on benthic environment in Port area).* Heavy vessel traffic levels and high shoaling rates, accompanied by regular maintenance dredging, limit the establishment of benthic communities. The taxa collected most often include; polychaetes, malacostracans, gastropods, and bivalves. [4]
Fish & EFH	The Savannah River is classified as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS). Anadromous species, such as American shad, hickory shad, and blueback herring, and striped bass, also use the Savannah River. Endangered species such as shortnose and Atlantic sturgeon are also known to use the estuarine portions of the Savannah River throughout the year. [5] [6]
Air Quality	Savannah is located in the Savannah (Georgia)-Beaufort (South Carolina) Interstate Air Quality Control Region (AQCR) and is in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. [7]
Terrestrial Biota	The land immediately surround the Port is an urban landscape and provides limited wildlife habitat. Wildlife species in the project area are typical for an urban landscape. Across the river from the Port is the Savannah National Wildlife Refuge (SWNR), which provides 29,000 acres of undisturbed habitat for animals, including waterfowl, American alligator, bobcat, and purple gallinule. [4] [8]

SAVANNAH

Multiple Terminals | Savannah, Georgia | 32° 06' 39" N, 81° 07' 33" W

Resource	Description of Existing Conditions
Marine Mammals & Sea Turtles	Endangered species listings from the US Fish and Wildlife Service (USFWS) and the National Oceanic and Atmospheric Administration (NOAA) were consulted. Five whale species that could potentially occur along the entire US Atlantic coast were identified as endangered or threatened: blue whale, fin whale, humpback whale, North Atlantic right whale, and sperm whale. [9] Marine mammals that are known to occur in Chatham County and could potentially be present in the Savannah River estuary include: right whale, sei whale, sperm whale, blue whale, finback whale, false killer whale, humpback whale, and West Indian manatee. [4] The West Indian manatee and five species of sea turtles (hawksbill, leatherback, Kemp's ridley, green and loggerhead) turtles have been identified as threatened or endangered in Chatham county. [10] Although they are known to occur in the Savannah River, their presence upriver is rare. [4]
Birds & Bats	Endangered species listings from the USFWS were consulted. The piping plover and the roseate tern are listed as threatened in Chatham county. [10] The Savannah National Wildlife Refuge (NWR), located across from the Port, contains seasonally flooded wetlands that provide habitat to a variety of migratory waterfowl and shorebirds. [4] *(Information on bats in this area not readily available.)*
Water Quality	The mouth of the Savannah River as it enters the harbor (Segment ID GAR030601090318) is listed as impaired according to Georgia's 2012 305(b)/303(d) List Documents. It is listed as impaired for dissolved oxygen. Approximately 25 miles upstream the Savannah River (Segment ID GAR030601090102) has been classified as impaired for mercury in fish tissue. [11]
Currents & Tides	Water circulation around the Port is influenced by an inflow from the Savannah River as well as tides and wind. The mean tidal range at the Port is 8.14 feet. [12]
Sediment Deposition	*(Limited information available on sediment in the Port area).* Sediments that are dredged annually for maintenance of channels include a mix of sand, silts, and clays. Due to the regular maintenance dredging that occurs, there is little evidence of surficial contamination. [4]
Acoustic Environment	Similar to most major ports, ship traffic, wharf/dock operations (loading and unloading vessels), and natural (wind, storms, biological, etc.) are the main sources of ambient noise. [4] The City of Savannah noise ordinance states that at any time an industrial area must limit noise output to 75 dBA. [13]
Critical Habitat	Critical habitat for several species has been designated around the Port. There is critical habitat designation for the shortnose sturgeon and Carolina heelsplitter (endangered freshwater mussel) in the Savannah River. Also critical habitat for the piping plover and loggerhead sea turtle has been designated in Chatham County. [14] [15] [16]
Military Use Areas	Military installations near port: one military installation in Chatham County, GA; the Hunter Army Airfield (Army) is 7.5 miles south of the Port. [17]
Land Use & Existing Infrastructure	High intensity developed land with industrial areas border the Port to the north, south, and immediately to the west. The Savannah/Hilton Head International Airport is about two miles to the west of the Port. Residential areas in Garden City, GA lie about a third of a mile to the southwest. Undeveloped expanses of land lie across the River and to the east where the Savannah National Wildlife Refuge is located. [18] [2]
Transportation	Port is in the vicinity of the intersection between Interstate 95 and Interstate 516. Accessed to terminal borders residential area. Serviced by rail. [2]
Cultural & Historical	Nearby places in the National Register of Historic Places: 47 properties and districts in Savannah, GA. [19] Five known shipwrecks along the navigation channel leading to the port. [20]
Visual	Varied viewscapes from the Port. To the east, across the channel, Kings Island and the Savannah National Wildlife Refuge provide a naturalistic viewscape. Viewscapes to the north, west, and south of the port are industrial and residential. [2]

SAVANNAH

Multiple Terminals | Savannah, Georgia | 32° 06' 39" N, 81° 07' 33" W

Resource	Description of Existing Conditions
Environmental Justice	Total minorities: City of Savannah 59.0%; GA 24.3%. [21] Low-income: City of Savannah 26.0%; GA 39.3%. [21] Area surrounding port: census block groups on the southern boundary of the port have the highest percentage total minority population (>75%). The census tract encompassing the port and industrial areas to the north has less than 16 percent poverty while the residential areas in Garden City (south of the Port) have greater than 26 percent poverty. [22]
Commercial Fishing	Commercial landings: 1.6 million pounds (US rank 120). [23] Commercial fishing engagement in Savannah is high and low in all surrounding communities. [24] Commercial fishing reliance is low in all surrounding communities. [24]
Tourism & Recreation	Employment in tourism-related industries in Chatham County in 2010: 16,787. [25] Recreational fishing engagement is high in Savannah and low in all the surrounding communities. [24] Recreational fishing reliance low in all surrounding communities. [24]
Commercial & Recreational Navigation	Average daily vessel arrival and departures to port (Sep 28 - Oct 26, 2015): 6-52. [26] Main vessel types to and from port (30 days): cargo 49.2%, tug 22.8%, passenger 9.3%. [26]
Socioeconomic Resources	Population: City of Savannah 139,620. [21] Labor Force: Chatham County 131,738; employed 122,144; unemployment rate 7.3%. [27] Main sources of fiscal revenues in GA Local Jurisdictions: property taxes 23.0%; intergovernmental revenues 27.2%; hospital charges 9.0 %; sales and gross receipts taxes 11%; utility revenues 10.9%. [28]

Anticipated Impacts

Potential port modifications to the Port of Savannah, necessary to support offshore wind development, are anticipated to have minimal impact on existing terrestrial and upland resources due to the industrial setting of the site. Minimal dredging and land clearing may be necessary to enhance bearing capacity of the quayside and berths; however, the anticipated impact to sediments or marine resources will be minor; given the regular maintenance dredging that occurs within the Savannah River. In addition, the potential for reduction or loss of terrestrial habitat exists; however, the habitat is degraded and likely does not support a diverse community of organisms. Noise associated with the port modifications identified above is not likely to be above existing ambient levels due to the industrialized nature of the surrounding environment. Road access to the port depends on local roads across residential areas. To the extent that construction materials are transported by truck, impacts to traffic may occur. Air quality impacts would be the direct result of emissions from vessels, vehicles, and port machinery, as well as fugitive dust from earth moving activities. Individual, port-specific air quality analyses and monitoring would likely be required to assess any localized air quality impacts resulting from proposed modifications. Because of engagement in commercial fishing in some communities, activities should be well coordinated to avoid use conflicts. To the extent that high and adverse human health or environmental impacts occur in neighborhoods east of the site, minority and low-income populations may be disproportionately affected.

Data Sources & Additional Information

1 Georgia Ports Authority. Port of Savannah. [Internet]. [cited 2015 October 30]. Available from: http://www.gaports.com/PortofSavannah.aspx.

2 Google Earth. [Internet]. [cited 2015 October 28].

3 Georgia Ports Authority. The Port of Savannah Fact Sheet. [Internet]. October 2013 [cited 2015 October 30]. Available from: http://www.gaports.com/DesktopModules/TileButtonDownload/Download.ashx?file=/Portals/2/Documents/FactSheets/Port%20of%20Savannah%20-%2010-2013-PR%20-%20FINAL.pdf.

4 USACE (U.S. Army Corps of Engineers) Savannah District. Final Environmental Impact Statement: Savannah Harbor Expansion Project. FEIS. 2012. Available from: http://www.sas.usace.army.mil/Missions/CivilWorks/SavannahHarborExpansion/FinalEnvironmentalImpactStatement.aspx.

5 NOAA (National Oceanic and Atmospheric Administration). Essential Fish Habitat Mapper. [Internet]. [cited 2015 September 1]. Available from: http://www.habitat.noaa.gov/protection/efh/efhmapper/.

6 USACE (U.S. Army Corps of Engineers) Savannah District. Georgia Rivers Supporting Anadromous Fish Habitat. [Internet]. [cited 2015 November 3]. Available from: http://www.sas.usace.army.mil/Portals/61/docs/regulatory/rgpencl3.PDF.

7 EPA (U.S. Environmental Protection Agency). National Ambient Air Quality Standards (NAAQS). [Internet]. [cited 2015 November 5]. Available from: http://www3.epa.gov/ttn/naaqs/criteria.html.

8 USFWS (U.S. Fish and Wildlife Service). Savannah, Georgia and South Carolina. [Internet]. 2014 [cited 2015 November 3]. Available from: http://www.fws.gov/refuge/Savannah/wildlife_and_habitat/index.html.

9 NMFS (National Marine Fisheries Service). Endangered and Threatened Marine Species under NMFS' Jurisdiction. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#mammals.

10 USFWS (U.S. Fish and Wildlife Service). Endangered Species. [Internet]. 2015 [cited 2015 December 7]. Available from: http://www.fws.gov/endangered/.

11 EPA (U.S. Environmental Protection Agency). National Summary of Impaired Waters and TMDL Information. [Internet]. 2015 [cited 2015 October 21]. Available from: http://iaspub.epa.gov/waters10/attains_nation_cy.control?p_report_type=T#imp_water_by_state.

12 NOAA (National Oceanic and Atmospheric Administration). Tides & Currents. [Internet]. 2015 Available from: https://tidesandcurrents.noaa.gov/datums.html?id=8670424.

13 Municode Library. Sec. 9-2034. - Noise disturbance prohibited. [Internet]. [cited 2015 November 4]. Available from: https://www.municode.com/library/ga/savannah/codes/code_of_ordinances?searchRequest=%7B%22searchText%22:%22noise%20blowing%22,%22pageNum%22:1,%22resultsPerPage%22:25,%22booleanSearch%22:false,%22stemming%22:true,%22fuzzy%22:false,%22synonym%22:false,%22co.

14 USFWS (U.S. Fish and Wildlife Service) Southeast Region 4. Critical Habitat Designated for Carolina heelsplitter. [Internet]. 2002 [cited 2015 November 3]. Available from: http://www.fws.gov/southeast/news/2002/r02-053.html.

15 NOAA (National Oceanic and Atmospheric Administration) Fisheries Office of Protected Resources. Shortnose Sturgeon (Acipenser brevirostrum). [Internet]. 2014 [cited 2015 November 3]. Available from: http://www.nmfs.noaa.gov/pr/species/fish/shortnosesturgeon.htm.

16 USFWS (U.S. Fish and Wildlife Service). Threatened & Endangered Species Active Critical Habitat Report. [Internet]. [cited 2015 November 3]. Available from: http://ecos.fws.gov/crithab/.

17 Military Bases.com. US Military Bases. [Internet]. [cited 2015 October 28]. Available from: http://militarybases.com/.

18 MRLC (Multi-Resolution Land Characteristics Consortium). 2014 NLCD Evaluation, Visualization, and Analysis (EVA) Tool. [Internet]. [cited 2015 October 28]. Available from: http://www.mrlc.gov/eva/viewer.html.

19 National Register of Historic Places. Database/Research. [Internet]. [cited 2015 October 28]. Available from: http://www.nps.gov/nr/research/index.htm.

20 NOAA (National Oceanic and Atmospheric Administration) Office of Coast Survey. Wrecks and Obstructions Database. [Internet]. [cited 2015 October 28]. Available from: http://www.nauticalcharts.noaa.gov/hsd/wrecks_and_obstructions.html.

21 USCB (U.S. Census Bureau). American Community Survey, 5-Year Estimates, 2009-2013. [Internet]. 2015 [cited 2015 October 28]. Available from: http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

22 EPA (U.S. Environmental Protection Agency). Environmental Justice Screening and Mapping Tool (EJSCREEN). [Internet]. [cited 2015 October 28]. Available from: http://www2.epa.gov/ejscreen.

23 NMFS (National Marine Fisheries Service). Commercial Fisheries Statistics. [Internet]. 2013 [cited 2015 October 28]. Available from: http://st.nmfs.noaa.gov/commercial-fisheries/index.

24 NMFS (National Marine Fisheries Service). Community Social Indicators. [Internet]. 2009 [cited 2015 October 28]. Available from: http://www.st.nmfs.noaa.gov/humandimensions/social-indicators/map.

25 BOEM (Bureau of Ocean Energy Management). Atlantic Region Wind Energy Development: Recreation and Tourism Economic Baseline Development. Impacts of Offshore Wind on Tourism and Recreation Economies. OCS Study BOEM 2012-085; 2012.

26 MarineTraffic. Automatic Identification System-Port of Savannah. [Internet]. 2015 [cited 2015 October 28]. Available from: http://www.marinetraffic.com/en/ais/details/ports/200.

27 BLS (Bureau of Labor Statistics). Local Area Unemployment Statistics. [Internet]. 2014 [cited 2015 October 28]. Available from: http://www.bls.gov/lau/.

28 USCB (U.S. Census Bureau). State Finances, 2012 Census of Governments. [Internet]. 2012 [cited 2015 October 28]. Available from: http://census.gov/govs/local/.

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Bureau of Ocean Energy Management

As a bureau of the Department of the Interior, the Bureau of Ocean Energy (BOEM) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS) in an environmentally sound and safe manner.

The BOEM Environmental Studies Program

The mission of the Environmental Studies Program (ESP) is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments.