Bureau of Ocean Energy Management and National Marine Fisheries Service: Essential Fish Habitat Assessment Template for Offshore Wind Energy Projects

TEMPLATE VERSION 1 – February 6, 2023

About this Document

This document provides a template and reusable content for development of National Marine Fisheries Service (NMFS) Essential Fish Habitat (EFH) assessments for offshore wind energy projects from Maine to North Carolina. The EFH assessment should be customized for individual consultations by adding detail where needed and removing sections that do not apply or provide little value. Work with the appropriate NMFS regional office to determine where modifications may be needed. To ensure this tailoring occurs, a limited number of formal check-in points should be established where the contractor demonstrates to BOEM that adequate communication and coordination is occurring with NMFS in development of the EFH assessment.

The check-in points for coordination are:

(1) outline of the EFH Assessment based on tailoring this template to the project,

(2) the base habitat map (benthic and/or pelagic) that will be used for calculating acreages in the EFH Assessment,

(3) the habitat characterization information to be presented in Subsection 3.1.5, including the project-specific habitat table (e.g., the layout of columns and rows) and detailed information that should be provided by text, and

4) the focal species and focal habitats for the EFH Assessment.

If necessary, these check-in points can be amended or combined for a particular project. BOEM should work with their contractor to provide NMFS the information outlined in these 4 check-in points as the EFH assessment is developed. The information should be provided at each stage and early enough to ensure feedback from NMFS can be provided and incorporated into the document. For each check-in point the information should be summarized and submitted to NMFS via email. NMFS will respond via email with any feedback. Follow up discussions should occur as needed.

Why is there a need for an "EFH Assessment template"?

In coordination with NMFS, BOEM is developing a template in order to establish efficiencies in the environmental review and permitting process. The agencies are working through the environmental review process for a high volume of proposed offshore wind energy projects. By standardizing the structure and components of the project EFH assessments, BOEM and NMFS can better ensure that project-level analyses include required information and are consistent across projects.

How will the template be incorporated into project-specific EFH Assessment?

This template is meant as a guide to assist with preparation of a project-specific EFH assessment. To help ensure that this consultation document provides the necessary information and detail for NMFS to evaluate project-level impacts to EFH this template provides the following resources: an overall outline, instructions for each report section, sample content, and reusable content. BOEM will provide this *Annotated EFH Assessment Template* to third-party contractors for the development of EFH assessments.

The *EFH Assessment Template* is a living document that will be revised and adapted through its use to include updated information and to account for new activities, technologies, or effects not currently identified. Any substantial changes to template or reusable content will be shared with NMFS and incorporated into the outline.

What are the components of the EFH Assessment Template?

- Text in a text box indicates guidance on use of template; for informational purposes only.
- Reusable content in blue text is available in Section 1. Introduction, the Habitat Types by Project Component table (Section 3.1.5) the Acoustics tables in Section 5. Adverse Effects.
- Note that Attachments A and B in this document are intended for reference purposes only and should not be included as Appendices to the EFH Assessment

What are the information needs for an EFH assessment?

The first step is to create habitat maps and ensure that they are accepted and agreed upon by NMFS. Detailed maps showing the project extent and types of habitats within the project area (offshore lease area, export cable route(s), and onshore cable corridors) must be provided. NMFS recommends that habitat within the project area be mapped consistent with the most-up-to-date version of "Recommendations for Mapping Fish Habitat[1]."

The following information should be addressed in the EFH assessment (excerpts from 50 CFR 600.920(e)). This includes both the mandatory contents and additional information to ensure a complete EFH assessment for offshore wind project consultations. Please refer to NMFS "Information Needs to Assess Fish Habitat Impacts from Offshore Wind Energy Projects along the U.S. Atlantic[2]" in tandem with this template.

- **Preparation requirement** For any federal action that may adversely affect EFH, Federal agencies must provide NMFS with a written assessment of the effects of that action on EFH.
- **Level of detail** The level of detail in an EFH assessment should be commensurate with the complexity and magnitude of the potential adverse effects of the action. For example, for relatively simple actions involving minor adverse effects on EFH, the assessment may be very brief. Actions that may pose a more serious threat to EFH warrant a correspondingly more detailed EFH assessment.
    - Please note: Offshore wind projects have the potential to result in substantial adverse effects to EFH and warrant a correspondingly more detailed EFH assessment. As a result, they will

[1] https://static1.squarespace.com/static/511cdc7fe4b00307a2628ac6/t/60637e9b0c5a2e0455ab49d5/1617133212147/March292021_NMFS_Habitat_Mapping_Recommendations.pdf
[2] https://media.fisheries.noaa.gov/2022-02/EFH-InfoNeeds-OSW-GARFO.pdf

require an expanded consultation, please see CFR 600.920(i) on page 40 of the EFH Final Rule pdf (see link above) for the expanded consultation procedures. Offshore wind projects will also require all elements of both the "Mandatory contents" and "Additional information," described in the EFH Final Rule and listed in the bullets below.

- **Mandatory contents** This detailed description should include activity levels, frequency, duration, location, and intensity and should reflect the best available information on the activities and how the activities are likely to be carried out (see Appendix A for more detail). The assessment must contain:
    - A description of the action.
    - An analysis of the potential adverse effects of the action on EFH and the managed species.
    - The Federal agency's conclusions regarding the effects of the action on EFH.
    - Proposed mitigation, if applicable.
- **Additional information** If appropriate, the assessment should also include (see Appendix A for more detail):
    - The results of an on-site inspection to evaluate the habitat and the site-specific effects of the project.
    - The views of recognized experts on the habitat or species that may be affected.
    - A review of pertinent literature and related information.
    - An analysis of alternatives to the action. Such analysis should include alternatives that could avoid or minimize adverse effects on EFH.
    - Other relevant information.
        - Please note: Due to the scope and nature of the potential effects of offshore wind energy projects, the additional information listed above is necessary to adequately evaluate the effects of offshore wind energy activities on EFH.

Baseline habitat information Detailed maps showing the extent and types of habitats within the project area (offshore lease area and onshore cable corridors) must be provided. We recommend that habitat within the project area be mapped consistent with the most-up-to-date version of our "Recommendations for Mapping Fish Habitat." NMFS Habitat staff should be consulted prior to the initiation of acoustic and benthic surveys to ensure appropriate mapping methods, data analysis procedures, and habitat classification methods are used to support the EFH consultation.

- NMFS Habitat staff should be consulted prior to the initiation of acoustic and benthic surveys to ensure appropriate mapping methods, data analysis procedures, and habitat classification methods are used to support the EFH consultation. If habitat delineations are not generated with methodologies consistent with NMFS Recommendations for Mapping Fish Habitat, the EFH assessment should be based on multibeam backscatter data. Specifically, multibeam backscatter data should be used to delineate "low," "medium," and "high" return areas. These delineated areas should be classified as follows: 1) low – soft bottom; 2) medium – potentially complex; and 3) high – complex. All impact analyses in the EFH assessment should be based upon these three habitat categories. Benthic features

should also be delineated in the project area, including sand waves, which is a broad term that includes larger features such as ridge and trough complexes. These complexes should be highlighted by delineating the centerlines of the ridge crests and troughs.

- **Analysis of alternatives to the action** Such analysis should include alternatives that could avoid or minimize adverse effects on EFH. This analysis should not be confused with a single maximum impact scenario analysis within an overall Project Design Envelope that is evaluated to fulfill NEPA project impact requirements. Instead, for EFH assessment purposes, it must assess the potential impacts of all possible project design parameters that may actually be selected (e.g., the effects of different turbine foundations or cable burying methods). This analysis should also consider alternate cable routes, turbine locations, landfall locations, and/or port facilities.

- **Assessment of impacts within the scope of the project area** For the purposes of the EFH assessment, impact analyses should be limited to the area of direct and indirect impacts of each project component and/or activity and should be assessed by habitat type. For example, cable installation could result in direct impacts during cable burial activities and indirect impacts through sediment suspension and redeposition. The EFH assessment for cable installation should focus on the area, and habitats, that will be directly impacted through burial activities and the area, and habitats that will be indirectly impacted from sediment suspension and redeposition. The areas, and habitats, outside of the cable installation direct and indirect impact areas should not be considered in the evaluation and assessment of the effects of the impacts from cable installation on EFH. EFH impact analyses should be based upon the potential spatial extent of the effect of the project component or activity, and assessed, as appropriate, for each habitat type occurring within the identified impact area. *While the NEPA impact analyses may focus on the effects of potential habitat impacts (e.g., negligible, minor, etc.) in relation to the extent of available habitat outside the immediate project impact area, such an analysis is not consistent with the EFH regulations and is not appropriate for the EFH consultation.*

- **Assessment of impacts to benthic habitat types and their use by federally managed species** The impact assessment should focus on and evaluate how specific project activities could affect specific habitat types (e.g., depths and substrate types) designated as EFH for managed fish and invertebrate species within the project area and what measures are being taken to avoid, minimize, or mitigate those impacts. The evaluation should consider the use of designated EFH by sensitive life history stages of managed fish and invertebrate species. Note: it is not necessary that this analysis be done for each individual species and life history stage, but instead for groups of species and/or life history stages that share the same habitat type; it should also include primary prey species consumed by managed fish and invertebrate species. An evaluation of the degree of habitat vulnerability to specific project activities should be included. Special attention should be paid to any activities that could affect any Habitat Areas of Particular Concern (HAPCs) designated within the project area as well as habitats and life stages that may be more vulnerable to impacts from the project. The most-up-to-date EFH designations can be accessed using our EFH Mapper[3] and/or downloaded at: https://www.habitat.noaa.gov/application/efhinventory/index.html. The HAPC designations can be viewed, or linked to, within the EFH Mapper and shapefiles downloaded by selecting the link for

[3] https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper

"Habitat Areas of Particular Concern - (HAPC)."[4] (See Section 4 for the best source for EFH designations and locations in South Atlantic waters.) Please note the New England Fishery Management Council approved a new HAPC that overlaps the MA/RI WEA for cod spawning and complex habitat and this HAPC is not included in these maps or downloads.

- **Assessment of pelagic habitat impacts.** The EFH assessment should include an evaluation of impacts to both benthic and pelagic habitats and the species that use them. An evaluation of pelagic habitat impacts should include an assessment of the project on the acoustic environment, existing hydrodynamics and primary productivity in the project area, and water quality, including any potential for disruption of contaminated material.

Quality and sources of information. Information sources used to support all analyses and conclusions should be cited with references to all scientific publications included in the bibliography. The EFH assessment should be based on the best available scientific information.

Contents

[4] https://www.habitat.noaa.gov/application/efhinventory/index.html.

1. Introduction

a) Provide a brief description of the Magnuson-Stevens Fishery Conservation and Management Act and relevant definitions for the following terms: EFH, waters, substrate, necessary, and adverse effect to EFH **(provided in reusable content below)**.

b) Consultation history

c) Co-action agencies

In the Magnuson-Stevens Fishery Conservation and Management Act (MSA), Congress recognized that one of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Congress also determined that habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States. As a result, one of the purposes of the MSA is to promote the protection of Essential Fish Habitat (EFH) in the review of projects conducted under federal permits, licenses, or other authorities that affect or have the potential to affect such habitat.

The MSA requires Federal agencies to consult with the Secretary of Commerce, through the National Marine Fisheries Service (NMFS), with respect to "any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect any essential fish habitat identified under this Act," 16 U.S.C. § 1855(b)(2). This process is guided by the requirements of the EFH regulation at 50 CFR 600.905. The Bureau of Ocean Energy Management (BOEM) will be the lead Federal agency for the consultation, and will coordinate with any other Federal agencies that may be issuing permits or authorizations for this project, as necessary, for one consultation that considers the effects of all relevant Federal actions, including in offshore and inshore coastal environments (e.g., issuance of permits by the U.S. Army Corps of Engineers (USACE) and/or the U.S. Environmental Protection Agency (EPA)).

USACE intends to utilize this EFH assessment to meet its responsibilities under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. These permits may include the construction of offshore WTGs, scour protection around the base of the WTGs, submarine inter-array cables connecting the WTGs, offshore substations (OSS), inter-array cables connecting the WTGs to the OSS, and installation of export cables from the OSS to the onshore interconnection facilities.

Pursuant to the MSA, each Fishery Management Plan (FMP) must identify and describe EFH for the managed fishery, and the statute defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity" 16 U.S.C. § 1853(a)(7) and § 1802(10). NOAA's regulations further define EFH adding, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish and may include aquatic areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

The EFH final rule published in the Federal Register on January 17, 2002, defines an adverse effect as: “any impact which reduces the quality and/or quantity of EFH.” The rule further states that:

An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH. The EFH final rule also states that the loss of prey may have an adverse effect on EFH and managed species. As a result, actions that reduce the availability of prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat may also be considered adverse effects on EFH. Adverse effects to EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

2. Proposed Action

The description of the proposed action is a critical component of the EFH assessment needed to identify potential stressors resulting from the proposed action. The EFH assessment should “deconstruct” the proposed action—separately describe each activity with relevant methodologies of the proposed project—in order to estimate the probable adverse effects accurately.

Start this section with a clear and concise project overview, including the major project components (e.g., wind farm area, electrical service platforms, and cable areas—as applicable). The introduction to Section 2 should provide a detailed description of the project components within the PDE including, but not limited to; a) number, size, and foundation type and size for Wind Turbine Generators (WTGs), b) number of electrical service platforms (ESPs) c) cable length and d) scour and cable protection, as well as proposed materials and methods for constructing each of these components including site preparation activities. **NOTE: This needs to include the full range of activities reasonably expected to occur within the PDE, NOT the maximum impact scenario for the PDE**. The EFH assessment should include an evaluation of each potential component, or proposed construction method, that is included in the design envelope, and identify and evaluate any measures that may be employed to avoid, minimize, and offset any identified adverse effects. It should also include a description of proposed design parameters for the action to allow evaluation of what might reasonably be constructed. Such analysis should include alternatives and other measures such as best management practices that will be implemented that could avoid or minimize adverse effects on EFH. Detailed specifications should be given in sections 2.2, 2.3 and 2.4 as described below.

For each activity in this section, the narrative should describe exactly what will be done and how it will be done, including the sequencing of sub-activities and the area and extent of sub-activities. A reviewer should be able to read each section and understand what will happen in the field from beginning to end. In other words, walk the reader through, step-by-step (i.e., lead the reader by the nose). The action description should not solely reference the COP to provide information necessary to support the EFH assessment, all relevant details should be included in this section. For additional materials that should be transmitted with the EFH Assessment see Section 10. However, the COP should be cited appropriately as the source of information and the citation should include the document date and version. If the information presented in the EFH assessment differs, or adds details not provided in the COP, the differences and/or additional detail should be noted.

2.1. Project Area

a) Geographic description of the project footprint and brief description of the geographic scope of potential impacts (e.g., acoustic impact area, suspended sediment impact area, etc.) but refer to section 5 for the impact analysis. Note: The project area should include the lease area, cable routes, landing locations, and onshore support facilities (making sure to fully describe both offshore and inshore area).

b) Port facilities, including new and/or expansions or modifications of existing facilities. This should include facilities necessary for the construction and operations and maintenance of the project, as appropriate.

2.2. Construction and Installation

This section should include specifications and basic activity descriptions that should be sufficient for NMFS to understand the activity without having to continuously cross-reference the COP. This description should include details/specifications for each component of the major project component (e.g., turbine diameter, scour protection type and extent for each pile, etc.) and/or activity for all design parameters under consideration in the Project Design Envelope (PDE).

This section should describe exactly what will be done, including the sequencing of sub-activities and the area and extent of sub-activities. A reader should be able to read this section and understand what will happen in the field from beginning to end. Walk the reader through step-by-step.

2.2.1. Installation of WTG/OSS structures and foundations

This subsection should include a description of the number and layout of WTGs/OSS and accompanying map. This section should identify all sizes of wind turbines included in the PDE and evaluate the potential adverse effects that may occur from the construction of each potential design option. Note: if there is a range in the number of potential WTGs all potential layouts should be considered and presented.

Including converter stations as applicable. Note: Include description of the construction timeline and anticipated schedule for construction activities.

2.2.1.1. Seabed preparation/boulder relocation/dredging

All seafloor/seabed preparation activities should be included and described. This should describe the step-by-step process of all activities necessary to prepare the seabed for turbine installation. These include any potential dredge spoil removal and disposal method(s) and location(s) and should include UXO removal. Also include any expected trial runs, grapple runs, boulder relocation, etc. Include the equipment proposed to be used, the extent of area affected by that equipment, and areas where boulder removal is required and the specific areas and habitats where they will be relocated to. A detailed description of any UXO removal techniques should be included.

2.2.1.2. Pile Driving

Include all potential WTG foundation types and sizes considered under the design envelope, and the proposed number and layout of WTGs (if there is a range in the number of potential WTGs all potential layouts should be considered and presented.) Detailed pile driving methodology, including the time of year, time of day, and duration of installation.

2.2.1.3. Installation of scour protection

Include all potential scour protection measures (described in detail), materials, and their spatial extent. Include a step-by-step sequence of scour protection installation, making sure to include where it is stored, how is it deposited, and the type of scour protection used.

2.2.1.4. Vessel activity

This section should describe the type, size, and number of vessels to be used (i.e., derrick barges, spud barges). It should describe in detail how vessels will be anchored/secured to the substrate including weight/size of anchors, anchor chains, anticipated anchor sweep, estimated area of substrate necessary to secure the vessel. A comprehensive anchoring plan (or plans) should be included. A description of how vessels will be deployed and operated during construction, including support vessels, should be provided. This description should include how many vessels will be mobilized and on site for each construction activity/component and note where construction activities may overlap, including overlap with other project components.

2.2.2. Inter-array and offshore/onshore cable installation

Detailed information on all potential cable installation methods and construction schedules, including any site preparation (e.g., boulder relocation, corridor clearing/sweeping, dredging, etc.).

2.2.2.1. Seabed preparation/boulder relocation/dredging

All seafloor/seabed preparation activities should be included and described. This section should describe the step-by-step process of all activities necessary to prepare the seabed for turbine installation. These include any potential dredge spoil removal and disposal method(s) and location(s) and should include UXO removal. Also include any expected trial runs, grapple runs, boulder relocation, etc. Include the equipment proposed to be used, the extent of area affected by that equipment, necessary boulder removal and relocation. A detailed description of any UXO removal techniques should be included.

2.2.2.2. Trenching/cable installation

Onshore and offshore cable connection location(s) and installation methodology. This should not just be limited to onshore, but also any trenching and installation methods used offshore, at landing locations, and onshore connections. This should also discuss in detail water withdrawals associated with cable installation. Also describe if any cables will be left on the seafloor unburied, if so - for how long, timing of installation, etc.

2.2.2.3. Cable Protection

All potential scour protection measures, materials, and their spatial extent. Please include a step-by-step sequence of scour protection installation, making sure to include where it is stored, how it is deposited, and the size and type of scour protection used.

2.2.2.4. Vessel Activity

Anticipated locations and extent of anchoring, including how vessels will be secured to the substrate. This section should describe the type, size, and number of vessels to be used (i.e., derrick barges, spud barges). It should describe in detail how vessels will be anchored/secured to the substrate including weight/size of anchors, anchor chains, anticipated anchor sweep, estimated area of substrate necessary to secure the vessel. A description of how vessels will be deployed and operated during construction, including support vessels, should be provided. This description should include how many vessels will be mobilized and on site for each construction activity/component and note where construction activities may overlap, including overlap with other project components.

2.2.2.5. HDD, If applicable

Description of the duration and location of proposed HDD activity, including location relative to other habitats. Description of sediment and potential change in sediment at exit point. If applicable, include a description of the cofferdam that would be used and any pile driving methods that might be used to install the cofferdam. If a casing pipe will be used, describe any installation methods and acoustic analysis.

2.2.3. Port facilities

Detailed description of all port facilities to be used for the project, including new and/or expansions or modifications of existing facilities. This should include facilities necessary for the construction and operations and maintenance of the project, as appropriate. Any modifications to existing port facilities associated with the project (i.e., dredging, expansion, modification) should be described in detail, clearly identifying the change from existing conditions (e.g., changes in dredge depths, increased pier/float footprint, etc.), and plans associated with these modifications should be provided as an attachment. A step-by-step description of the modifications and timing of construction should be included.

2.2.4. Other activities, as needed

2.3. Operations and Maintenance

All relevant operational and maintenance activities, including cable repair and maintenance methodology (e.g., reburial); and adding/adjusting/shifting, or otherwise changing scour protection as a result of unanticipated geological conditions at the foundation site (e.g., type, extent, etc.). This should describe in detail the area impacted once in operation (e.g., operational noise, EMF, heat from cables, anticipated scour, and AC/DC converter stations). It should also describe maintenance requirements and associated vessel activity and anchoring. When describing power conversion activities please also describe in detail water withdrawal intake velocity, approach velocity, location of intake in the water column, screening used to prevent or reduce entrainment and impingement, and any other fish return or deterrent technologies that may be used to reduce mortality from entrainment and impingement.

2.4. Project Decommissioning

Provide high-level decommissioning concept, design-service life and expected timeframe of decommissioning (this will help facilitate discussion of climate change later in the document). Note: A supplement to the EFH Assessment is expected to be necessary ahead of the decommissioning phase.

3. Existing Environment

All habitats within the project area should be characterized[5] and delineated[6]. The extent of each habitat type within each project component should be clearly defined and delineated, and appropriately characterized. See "Recommendations for Mapping Fish Habitat" for more information. This section should include the following:

[5] Characterize means to identify and describe the physical and biological components of benthic habitats including benthic features.

[6] Delineate means to indicate the border or boundary of features or areas of interest, typically through the use of polygons. Transitional areas between substrate types are typically encountered. The delineation boundary between soft and hard substrate types should be conservative to ensure hard substrates are fully encompassed within the areas delineated as hard substrate.

- Habitats within and adjacent to the Project Area that may be affected by any phase of the project (Lease area and adjacent habitats, cable route area, landing area [underground from shore], interior area/coastal); and
- A map that depicts delineated habitats within the project area. Reference and summarize data collection and mapping methodologies in this section.
    - In the appendix, provide a detailed description of habitat mapping methodology, including explanations of how survey data were collected and analyzed and how maps were developed with reference to NMFS habitat mapping recommendations.
    - The habitat maps should delineate soft sediment habitats, complex habitats, and benthic features, consistent with NMFS fish habitat mapping recommendations.
    - The delineations should be derived from acoustic survey and benthic sampling data as described in the fish habitat mapping recommendations.
    - The maps should also identify areas of sensitive habitats and habitat features (e.g., rocky habitats, structure-forming taxa, submerged aquatic vegetation, shellfish beds, etc.) both within the project area and those that are adjacent within the potential area of impact (direct and indirect). All HAPCs (e.g., summer flounder, inshore juvenile Atlantic cod, sandbar shark, etc.) in the project area should be identified and delineated consistent with the habitat types described in the HAPC designations as appropriate. This should also include known special offshore areas (e.g., shipwrecks, artificial reefs, or fish havens) that are outside of the project footprint but may be affected by the proposed project (e.g., noise impacts).

Habitats will include the following list and should be described in each of the project components for which they are present, as noted in the table below. See Appendix A for a full crosswalk of CMECS categories with the table categories listed below, including noted habitat types where the CMECS biotic subclasses should be addressed. However, the EFH assessment should not rely on the CMECS biotic classification to characterize fish habitats, please see the Recommendations for Mapping Fish Habitat for the appropriate approach to characterizing the biological component of the listed habitats

a) Rocky (general, to include all: granule-pebble, cobble, boulder, ledge/bedrock). Please note that any data classified using the CMECS Biotic Subclasses Benthic Macroalgae and Attached Fauna should be incorporated into the characterization of rocky habitats.

b) Soft bottom mud (intertidal, shallow-water, and deep). Please note that any data classified using the CMECS Biotic Subclasses Soft Sediment Fauna and Inferred Fauna should be incorporated into the characterization of mud habitats.

c) Soft bottom sand (with and without sand ripple, shoals, waves/ridges). Please note that any data classified using the CMECS Biotic Subclasses Soft Sediment Fauna and Inferred Fauna should be incorporated into the characterization of sand habitats.

d) Submerged Aquatic Vegetation (SAV)

e) Tidal Marsh (e.g., saltmarsh and brackish marsh)

f) Shellfish reefs and beds (e.g., hard clams, Atlantic surfclam, mussels, oysters)

g) Shell accumulations

h) Other biogenic (e.g., cerianthids, corals, emergent tubes – polychaetes). Areas with corals or dense aggregations of epifauna or emergent infauna should be identified and characterized.

i) Pelagic (offshore and estuarine)

j) Habitat for sensitive life stages (i.e., demersal eggs, spawning activity-discrete areas)

k) Habitat Areas of Particular Concern (HAPCs)

3.1. Description of Habitat Types by Project Component

The text in each subsection (3.1.1-3.1.4) should include both the extent (area) of each habitat type (see list a-k above) within each project area and text descriptions of the habitat characteristics, including both physical and biological, within each project area where the habitat is identified and delineated.

The habitat text descriptions and characterizations should include and reference the project specific habitat data that was collected (e.g., seafloor image, benthic grab data, etc.). The text should clearly identify and describe differences in the habitat types within, or between, project areas. For example, the lease area may include multiple different rocky habitats (e.g., pebble and cobble/boulder), the biological and physical characteristics of each rocky habitat type that occurs within the lease area should be provided.

Note the following:

- Subsection 3.1.2: Offshore/onshore export cable – should include a discussion of habitat types within the area for infrastructure associated with the cable.
- Subsection 3.1.3: Port modifications could be combined with 3.1.4: O&M facility, depending on the level of impacts for these two project components.

3.1.1. Lease area

3.1.2. Offshore/onshore export cable

3.1.2.1. Export cable route

3.1.2.2. Landing area

3.1.2.3. Interior coastal

3.1.3. Port modifications

3.1.4. O&M facility

3.1.5. Habitat Areas by Project Component Table

The following table should describe the extent (area) of habitat type (referencing the list a-k above for habitat descriptions) within each project component area. The table should be configured on a project-specific basis in coordination with NMFS (see note about check-in points above). Fill in relevant cells using areal extent where habitat types are present within a project component area.

	Project Component Area					
Habitat Types	Lease area	Offshore/Onshore Export Cable: Export cable route	Offshore/Onshore Export Cable: Landing area	Offshore/Onshore Export Cable: Interior coastal	Port modifications	O&M facility
Rocky (total area that is 5% or greater of all: granule-pebble, cobble, boulder, ledge/bedrock)						
Soft bottom mud (e.g. (intertidal mudflat, shallow-water, and deep)						
Soft bottom sand (e.g., with and without sand ripple, shoals, waves/ridges)						
Submerged Aquatic Vegetation (SAV)						
Tidal Marsh (e.g., saltmarsh and brackish marsh)						
Shellfish reefs and beds (e.g., hard clams, Atlantic surfclam, mussels, oysters)						
Shell accumulations						
Other biogenic (e.g., cerianthids, corals, emergent tubes – polychaetes)						
Pelagic (offshore and estuarine)						
Habitat for sensitive life stages (e.g.., demersal eggs, spawning activity-discrete areas)						
Habitat Areas of Particular Concern (HAPC)						

4. Designated EFH

Include a list of all designated EFH in the project area. Please note this should be a list or table of species and life history stages, with brief descriptions of the habitat requirements, season occurrence, prey species, and spawning behavior, as well as brief descriptions of the extent of each species' designated EFH in the project area. This should not include summaries of either the EFH text description or the species source documents. This section should also address designated HAPCs in the project area, highlight sensitive life history stages and species of particular interest for the specific project area. The assessment should include an evaluation of impacts to both benthic and pelagic habitats and the species that use them. Most EFH designations can be accessed using NMFS EFH Mapper[7], please ensure that you review both the maps as well as the text descriptions that accompany the online viewer as not all EFH designations are mapped, especially those from the South Atlantic Fishery Management Council[8]. EFH from Maine to Florida is designated by the:

- New England Fishery Management Council
- Mid-Atlantic Fishery Management Council
- NOAA Highly Migratory Species Division
- South Atlantic Fishery Management Council

a. In addition to a list of species and life stages with EFH designations in the project area, this section should also identify species and life stages that are expected to be more vulnerable to project effects (i.e., due to the presence of sensitive life stages, dependence upon vulnerable habitats, spawning aggregations, vulnerable stocks, etc.).

b. This section should also identify and describe all designated HAPCs in the project area, including the areal extent of the HAPC within the project area. This should include an evaluation of the habitat characteristics associated with the HAPC designation where applicable.

c. This analysis does not need to be done for each individual species and life history stage, but instead for groups of species and/or life history stages that share the same habitat type(s). The analysis should also include primary prey species consumed by managed fish and invertebrate species as prey are a component of EFH. Prey species to highlight should be consistent with species managed by the Atlantic States Marine Fisheries Commission and identified in EFH supplemental materials (e.g., species life history documents, NEFMC Omnibus Habitat Amendment 2, etc.). As noted in item a, above, species and life stages that are more vulnerable should be noted. These species and life stages may be included as part of species groups for the habitat types, but an individual analysis for these species and life stages should also be completed and included.

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[7] The EFH mapper can be accessed at: https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper or downloaded at: https://www.habitat.noaa.gov/application/efhinventory/index.html. The HAPC designations can be viewed, or linked to, within the EFH Mapper and shapefiles downloaded by selecting the "Habitat Areas of Particular Concern - (HAPC)" link at https://www.habitat.noaa.gov/application/efhinventory/index.html. Please note the New England Fishery Management Council approved a new HAPC that overlaps the MA/RI WEA for cod spawning and complex habitat and this HAPC is not included in these maps or downloads.

[8] Note for EFH designations by the South Atlantic Fishery Management Council please see the August 2021 user guide: SAFMCEFHUsersGuideAugust21.pdf

Note in this section that there is a later discussion of NOAA trust resources (Section 7) that have designated habitats of concern and species of concern. This should include 2 separate tables: 1 table with EFH and 1 table with NOAA trust resources.

5. Adverse Effects

The purpose of the EFH consultation is to promote the protection of EFH. To accomplish this, it is necessary to evaluate the adverse effects of an action on EFH and identify feasible measures to avoid, minimize and otherwise offset these adverse effects. An adverse effect[9] is any impact which reduces the quality and quantity of EFH. The rule further states that: An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

This section should describe the adverse effects of the project on EFH. Adverse effects should be analyzed by first defining the extent of each project impact. This should include an evaluation of the total extent (i.e., area in acres; of the impact and the extent of the impact for each habitat type and sensitive life stages identified in the "existing conditions" section that occurs within the total impact area. (Note: if there is uncertainty contact NMFS as this will need to be addressed with on a project-by-project basis). The effect of the defined impact to each habitat type, and the managed species for which this habitat type has been designated as EFH, should then be evaluated, and analyzed. This analysis should be completed for all potential adverse effects resulting from the project, including both direct/primary and indirect/secondary effects, as well as temporary, permanent, and cumulative, and synergistic adverse effects. In addition, impacts that reduce the availability of prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat are considered an adverse effect on EFH and should be evaluated and included in the analysis. This section should also consider effects anticipated based on the time of year impacts are expected and the seasonality of habitat dynamics and species use. Given the life of the project (25+ years), this section should include a discussion of any adverse effects from project operations, maintenance, and decommissioning that may interact synergistically with effects of climate change; these interactions should be considered where appropriate (e.g., reef effect for invasives).

NOTE: The potential impacts of all possible project design parameters that may actually be selected (e.g., the effects of different turbine foundations or cable burying methods) must be assessed. This analysis should also consider alternate cable routes, turbine size and locations, landfall locations, and/or port facilities as appropriate that are under consideration for the proposed project. This needs to present the full range of adverse effects for each project element presented for the PDE, NOT the maximum impact scenario included in the PDE.

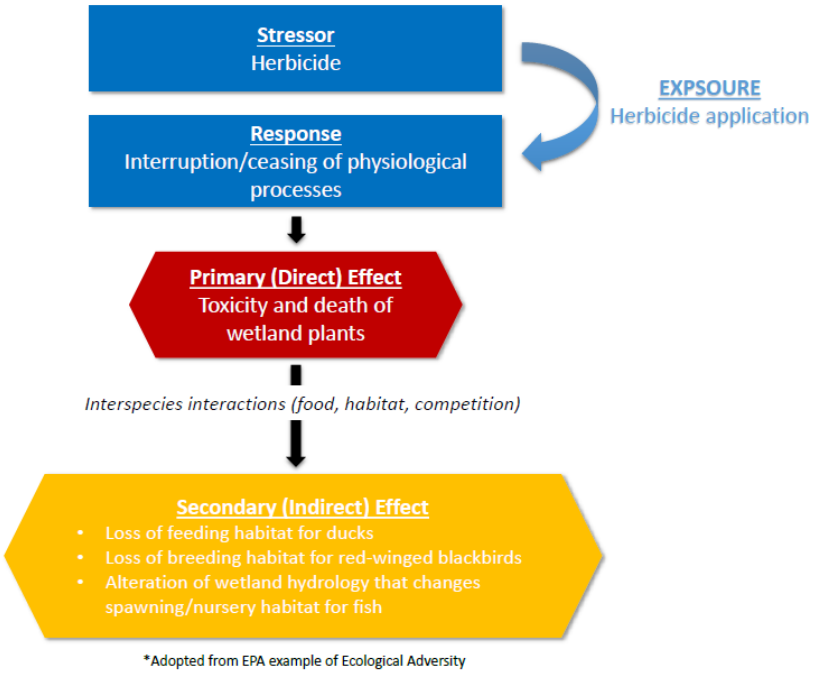
A stressor-exposure-response framework[10], should be used to systematically evaluate impacts to habitats and species. When using this framework remember the following: exposure + response = effect. The

[9] 50 CFR 600.910The EFH final rule published in the Federal Register on January 17, 2002, defines an adverse effect as: "any impact which reduces the quality and/or quantity of EFH."

[10] Stressors are any physical, chemical, or biological alterations (i.e., increase, decrease, or introduction) that can induce an adverse response. Exposure refers to the organisms/habitats that will be exposed to changes in physical,

outline provided below describes the stressor and potential effects, but the exposure and response should also be given for each stressor and effect combination. See Figure 1 below for an example of how to apply the stressor exposure response framework.

Figure 1. Example from EPA Ecological Adversity; Identifying Stressors of Concern



Sections 5.1-5.4 (described in more detail below) should address the following bullets:

- Identify and analyze potential impacts and effects of each project component and activity on specific habitat types/species groups within project impact areas. This should include an evaluation of all potential effects of a project component or activity on designated EFH, inclusive of direct (e.g., pile driving) and indirect (e.g., underwater noise) impacts.
- Evaluate and assess potential impacts and effects to designated EFH habitat types and/or features most vulnerable from each project component and activity. This evaluation should consider the proximity of each project component and activity to vulnerable habitats and features (e.g., rocky habitats, structure-forming taxa, submerged aquatic vegetation, shellfish beds, etc.) identified in the project area.
- Evaluate and assess potential effects to all identified HAPCs (e.g., inshore juvenile Atlantic cod, sand tiger shark, summer flounder) in the project area and all measures proposed to avoid, minimize, and mitigate such adverse effects.

chemical, and/or biological elements (or characteristics). Response is how those organisms/habitats react to those changes.

5.1. Construction & Operation Activities

5.1.1. Installation of WTG/OSS structures and foundations, including converter stations, as applicable

5.1.1.1. Seabed preparation (Boulder re-location/Dredging/grading)

a) Habitat loss/conversion (including loss of infauna/epifauna)—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion (e.g., converting natural seafloor substrates to turbines, cables, and scour protection

b) Sediment suspension/redeposition—Identify the expected duration and spatial extent of suspended sediments and sediment deposition, and the expected impacts to pelagic and benthic resources and habitats within and adjacent to proposed turbine locations and cable corridors. This analysis should be completed for each potential installation method that may be used. Potential impacts to water quality should also be evaluated for impacts to EFH, including potential resuspension of contaminated material from seafloor disturbance. Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.

c) Entrainment—Entrainment should be evaluated if dredging includes the use of a hydraulic dredge

d) Underwater sound (seafloor disturbance/equipment - in-water operations including seabed activities and boulder removal)

- Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during seabed preparation, including a quantitative assessment of the linear and areal extent of sound pressure (show your work and describe the details of your calculation). Also include a qualitative discussion of particle motion. Note that
- Note on the best available science: NOAA Fisheries considers the potential for behavioral impacts on fish from exposure to Lrms greater than 150 dB re 1 µPa from any type of sound source and utilizes the FHWG (2008) [11] interim criteria for injury associated with impact pile driving. However, Popper et al. (2014) L_{rms} values for impairment due to prolonged exposure to continuous sound such as vessels or dredging and peak levels for mortality due to explosives. These guidelines are widely used and recognized as the best available science and NOAA recommends including both sets of criteria for acoustic modeling. Species-specific information based upon the best available science should be included when available and where appropriate, species-specific impact evaluations should be provided for species that may be more sensitive to acoustic impacts (e.g., Atlantic cod), as well as invertebrate species that are not addressed in either FHWG (2008) or Popper et al. (2014) [12].

Note: Maintenance dredging of port and O&M facilities should be included as applicable. This includes an evaluation of changes to existing dredging operations and the timing of dredging operations.

[11] FHWG 2008, https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/ser/bio-fhwg-criteria-agree-a11y.pdf

[12] Popper, A. N., Hawkins, A. D., Fay, R. R., Mann, D. A., Bartol, S., Carlson, T. J., ... & Løkkeborg, S. (2014). Sound exposure guidelines. In ASA S3/SC1. 4 TR-2014 Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI (pp. 33-51). Springer, Cham.

Table 5.1.1.1.1 Acoustic thresholds for impairment or behavior effects of vessels and continuous sounds

Group	Metric	Threshold
Recoverable Injury*		
Fish with swim bladder involved in hearing	$L_{rms,48}$[¤]	170
Temporary Threshold Shift*		
Fish with swim bladder involved in hearing	$L_{rms,12}$[¤]	158
Behavior[§]		
All fish	L_{rms}[¤]	150

[¤] L_{rms} is root-mean-square sound pressure level. $L_{rms,12}$ value represents continuous exposure to L_{rms} of that level for 12 hours. $L_{rms,48}$ value represents continuous exposure to L_{rms} of that level for 48 hours. All have units of $_{dB}$ re 1 µPa. To convert from $L_{rms,12}$ or $L_{rms,12}$ to L_E over the same time period, add 46 dB or 52 dB respectively.
*Popper 2014
[§]Andersson et al. 2007, Wysocki et al. 2007, Mueller-Blenkle et al. 2010, Purser and Radford 2011

5.1.1.1.1. Unexploded Ordinance (UXO) Relocation and/or Removal

a) Habitat loss/conversion
b) Sediment suspension/redeposition
c) Entrainment (if applicable to methods used for removal/relocation)
d) Underwater sound
    - Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during seabed preparation, including a quantitative assessment of the linear and areal extent of sound pressure. Also include a qualitative discussion of particle motion.

Table 5.1.1.2. Acoustic thresholds for mortality, injury, and behavioral effects of the detonation of explosives

Group	Metric[¤]	Threshold
Mortality and Potential Mortal Injury*		
All fish	L_{pk}	229–234
Eggs and larvae	U_{pk}	>13
Recoverable Injury		
Fish without swim bladder	L_E	>216
	L_{pk}	>213

Fish with swim bladder	L_E	203
	L_{pk}	>207
***Behavior*[§]**		
All fish	L_{rms}	150

L_{rms}: root-mean-square sound pressure level with units dB re 1 µPa.
* Popper et al. 2014
§ Andersson et al. 2007, Wysocki et al. 2007, Mueller-Blenkle et al. 2010, Purser and Radford 2011

5.1.1.2. Pile driving

a) Underwater sound (pressure and particle motion)—evaluation of potential sound effect on species likely to occur, sensitive life stages, spawning aggregations, etc. Analyze acoustic effects to species and species behaviors (e.g., spawning and settlement; considering the proposed time of year schedule[13] to relevant life history stages). This analysis should include the areal extent of each impact type (show your work and include the details of your calculation), as well as the linear distance of each impact type from the turbine.

- Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during construction, including a quantitative assessment of the linear and areal extent of sound pressure (show your work and include the details of your calculation). Also include a qualitative discussion of particle motion.

- Note on the best available science: NOAA Fisheries considers the potential for behavioral impacts on fish from exposure to rms sound pressure levels (Lrms) greater than 150 dB re 1 µPa and utilizes the FHWG (2008) [see footnote 11]. interim criteria for injury associated with impact pile driving. However, Popper et al. 2014 ANSI Technical Report is widely used and recognized as the best available science and NOAA recommends including both sets of criteria. Further, species-specific and life stage-specific (e.g., spawning) information based upon the best available science should be included when available, especially for species and life stages that may be more sensitive to acoustic impacts (e.g., Atlantic cod), as well as invertebrate species that are not addressed in either FHWG (2008) or Popper et al. (2014) [see footnote 12].

b) Habitat loss/conversion (area of pile[s])—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion (e.g., converting natural seafloor substrates to turbines, cables, and scour protection).

[13] Note that the proposed schedule should only be considered after evaluating the effects of the action to species and species behaviors. The effect on species and behaviors should be fully evaluated independent of the proposed schedule. Consideration of the project schedule should only be used to evaluate if the identified effects are expected to be avoided/minimized or not. For example, if adverse effects are identified, and the proposed schedule would result in avoidance of those effects, the proposed schedule should be presented as an avoidance and/or minimization measure. Alternatively, if the proposed schedule would result in the adverse effect occurring during periods of sensitive species behavior (e.g., spawning), that should be clearly identified.

Table 5.1.1.3 Acoustic thresholds for various effects of impact pile driving

Group	Metric¤	Threshold
Mortality and Potential Mortal Injury*		
Fish without swim bladder	L_E	>219
	L_{pk}	>213
Fish with swim bladder not involved in hearing	L_E	210
	L_{pk}	>207
Fish with swim bladder involved in hearing	L_E	207
	L_{pk}	>207
Eggs and larvae	L_E	>210
	L_{pk}	>207
Injury†		
Fish Equal or greater than 2 g	L_E	187
	L_{pk}	206
Fish less than 2 g	L_E	183
	L_{pk}	206
Recoverable Injury*		
Fish without swim bladder	L_E	>216
	L_{pk}	>213
Fish with swim bladder	L_E	203
	L_{pk}	>207
Temporary Threshold Shift*		
Fish without swim bladder	L_E	>>186
Fish with swim bladder not involved in hearing	L_E	>186
Fish with swim bladder involved in hearing	L_E	186

Behavior[§]		
All fish	L_{rms}	150

[¤] L_{pk}: zero-to-peak sound pressure level with units $_{dB}$ re 1 µPa; L_{rms}: root-mean-square sound pressure level with units dB re 1 µPa; $L_{E,24}$: sound exposure level calculated over a 24-hour period in units $_{dB}$ re 1 μPa^2s,
*Popper 2014
[†]FHWG 2008
[§]Andersson et al. 2007, Wysocki et al. 2007, Mueller-Blenkle et al. 2010, Purser and Radford 2011

5.1.1.3. Installation of scour protection

a) Habitat loss/conversion (soft to hard; hard to soft)—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion (e.g., converting natural seafloor substrates to turbines, cables, and scour protection
b) Sediment suspension/redeposition from installation—Identify the expected duration and spatial extent of suspended sediments and sediment deposition, and the expected impacts to pelagic and benthic resources and habitats within and adjacent to proposed turbine locations and cable corridors. This analysis should be completed for each potential installation method that may be used. Potential impacts to water quality should also be evaluated for impacts to EFH, including potential resuspension of contaminated material from seafloor disturbance. Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.

5.1.1.4. Vessel activity

a) Habitat loss/conversion (including direct crushing/burial of benthos; loss of infauna/epifauna) from anchoring activities—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion (e.g., converting natural seafloor substrates to turbines, cables, and scour protection). This should be evaluated for each type of habitat that will be impacted.

b) Sediment suspension/redeposition from anchoring activities—Identify the expected duration and spatial extent of suspended sediments and sediment deposition, and the expected impacts to pelagic and benthic resources and habitats from anchoring. This analysis should be completed for each potential anchoring that may be used. Potential impacts to water quality should also be evaluated for impacts to EFH, including potential resuspension of contaminated material from seafloor disturbance. Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.

c) Potential introduction of exotic/invasive species via ballast—Evaluate the potential for expansion and/or introduction of invasive species as a result of vessel activity.

d) Accidental fuel spills

e) Underwater noise

    a) Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during construction, including a quantitative assessment of the linear and areal extent of sound pressure (show your work and include the details of your calculation). Also include a qualitative discussion of particle motion.

b) Note on the best available science: NOAA Fisheries considers the potential for behavioral impacts on fish from exposure to L_{rms} noise greater than 150 dB re 1 µPa from any type of sound source and utilizes the FHWG (2008) [see footnote 11] interim criteria for injury associated with impact pile driving. However, Popper et al. (2014) provides L_{rms} values for impairment due to prolonged exposure to continuous sound such as vessels or dredging and peak levels for mortality due to explosives. These guidelines are widely used and recognized as the best available science and NOAA recommends including both sets of criteria for acoustic modeling both sets of criteria for acoustic modeling. Species-specific information based upon the best available science should be included when available and where appropriate, species-specific impact evaluations should be provided for species that may be more sensitive to acoustic impacts (e.g., Atlantic cod), as well as invertebrate species that are not addressed in either FHWG (2008) or Popper et al. (2014) [see footnote 12].

5.1.2. Inter-array and offshore/onshore cable installation

5.1.2.1. Seabed preparation (including Boulder relocation/dredging/grading)

a) Habitat loss/conversion (including loss of infauna/epifauna; dredge disposal location/side-casting area)—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion (e.g., converting natural seafloor substrates to turbines, cables, and scour protection
b) Sediment suspension/redeposition—Identify the expected duration and spatial extent of suspended sediments and sediment deposition, and the expected impacts to pelagic and benthic resources and habitats within and adjacent to proposed turbine locations and cable corridors. This analysis should be completed for each potential installation method that may be used. Potential impacts to water quality should also be evaluated for impacts to EFH, including potential resuspension of contaminated material from seafloor disturbance. Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.
c) Entrainment—Entrainment should be evaluated if dredging includes the use of a hydraulic dredge
d) Underwater sound (seafloor disturbance/equipment - in-water operations including seabed activities and boulder removal)
    a. Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during construction, including a quantitative assessment of the linear and areal extent of sound pressure. Also include a qualitative discussion of particle motion.

    b. Note on the best available science: NOAA Fisheries considers the potential for behavioral impacts on fish from exposure to Lrms noise greater than 150 dB re 1 µPa from any type of sound source and utilizes the FHWG (2008) [see footnote 11] interim criteria for injury associated with impact pile driving. However, Popper et al. (2014) provides Lrms values for impairment due to prolonged exposure to continuous sound such as vessels or dredging and peak levels for mortality due to explosives. These guidelines are widely used and recognized as the best available science and NOAA recommends including both sets of criteria for based upon the best available science should be included when available and where appropriate, species-specific impact evaluations should be provided for species that may be more sensitive to acoustic impacts (e.g., Atlantic cod), as well as invertebrate species that are not addressed in either FHWG (2008) or Popper et al. (2014) [see footnote 12].

5.1.2.1.1. Unexploded Ordnance (UXO) Relocation and/or Removal

a) Habitat loss/conversion
b) Sediment suspension/redeposition
c) Entrainment (if applicable to methods used for removal/relocation)
d) Underwater sound

- Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during seabed preparation, including a quantitative assessment of the linear and areal extent of sound pressure. Also include a qualitative discussion of particle motion.

5.1.2.2. Trenching/cable installation

a) Habitat loss/conversion (including loss of infauna/epifauna; conversion of hard to soft habitats - "fining" of sediments)—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion (e.g., converting natural seafloor substrates to turbines, cables, and scour protection
b) Entrainment (i.e., eggs/larvae)—Entrainment impacts that may result from each potential trenching methodology (e.g., jet-plow) should be assessed based on site-specific data. Entrainment should also be evaluated if dredging includes the use of a hydraulic dredge
c) Sediment suspension and redeposition—Identify the expected duration and spatial extent of suspended sediments and sediment deposition, and the expected impacts to pelagic and benthic resources and habitats within and adjacent to proposed turbine locations and cable corridors. This analysis should be completed for each potential installation method that may be used. Potential impacts to water quality should also be evaluated for impacts to EFH, including potential resuspension of contaminated material from seafloor disturbance. Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.
d) Underwater sound) (seafloor disturbance/equipment - in-water operations including seabed activities, e.g., jet plow, mechanical plow, etc.)
    a. Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during construction, including a quantitative assessment of the linear and areal extent of sound pressure (show your work and include the details of your calculation). Also include a qualitative discussion of particle motion.

    b. Note on the best available science: NOAA Fisheries considers the potential for behavioral impacts on fish from exposure to Lrms noise greater than 150 dB re 1 µPa from any type of sound source and utilizes the FHWG (2008) [see footnote 11] interim criteria for injury associated with impact pile driving. However, Popper et al. (2014) provides Lrms values for impairment due to prolonged exposure to continuous sound such as vessels or dredging and peak levels for mortality due to explosives. These guidelines are widely used and recognized as the best available science and NOAA recommends including both sets of criteria for acoustic modeling both sets of criteria for acoustic modeling. Species-specific information based upon the best available science should be included when available and where appropriate, species-specific impact evaluations should be provided for species that may be more sensitive to acoustic impacts (e.g., Atlantic cod), as well as invertebrate species that are not addressed in either FHWG (2008) or Popper et al. (2014) [see footnote 12].

5.1.2.3. Cable protection installation (concrete mattresses, etc.)

a) Habitat loss/conversion (including loss of infauna/epifauna)—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion from cables and scour protection (specify cable protection type(s) and expected extent of impacts)
b) Sediment suspension and redeposition-- Identify the expected duration and spatial extent of suspended sediments and sediment deposition, and the expected impacts to pelagic and benthic resources and habitats within and adjacent to proposed turbine locations and cable corridors. This analysis should be completed for each potential installation method that may be used.

5.1.2.4. Vessel activity

a) Habitat loss/conversion (including direct crushing/burial of benthos; loss of infauna/epifauna) from anchoring activities—Evaluate impacts to managed fish and invertebrate species and prey resulting from habitat loss and conversion (e.g., converting natural seafloor substrates to turbines, cables, and scour protection
b) Sediment suspension/redeposition from anchoring activities—Identify the expected duration and spatial extent of suspended sediments and sediment deposition, and the expected impacts to pelagic and benthic resources and habitats within and adjacent to proposed turbine locations and cable corridors. This analysis should be completed for each potential installation method that may be used. Potential impacts to water quality should also be evaluated for impacts to EFH, including potential resuspension of contaminated material from seafloor disturbance. Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.
c) Potential introduction of exotic/invasive species via ballast—Evaluate the potential for expansion and/or introduction of invasive species as a result of vessel activity.
d) Accidental fuel spills
e) Underwater noise

    a. Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species during seabed preparation, including a quantitative assessment of the linear and areal extent of sound pressure. Also include a qualitative discussion of particle motion.

    b. Note on the best available science: NOAA Fisheries considers the potential for behavioral impacts on fish from exposure to Lrms noise greater than 150 dB re 1 µPa from any type of sound source and utilizes the FHWG (2008) [see footnote 11] interim criteria for injury associated with impact pile driving. However, Popper et al. 20144 ANSI Technical Report provides Lrms values for impairment due to prolonged exposure to continuous sound such as vessels or dredging and peak levels for mortality due to explosives. These guidelines are widely used and recognized as the best available science and NOAA recommends including both sets of criteria for acoustic modeling both sets of criteria for acoustic modeling. Species-specific information based upon the best available science should be included when available and where appropriate, species-specific impact evaluations should be provided for species that may be more sensitive to acoustic impacts (e.g., Atlantic cod), as well as invertebrate species that are not addressed in either FHWG (2008) or Popper et al. (2014) [see footnote 12].

5.1.2.5. Horizontal Directional Drilling (HDD) – If Applicable

a) HDD entry/exit—Evaluate temporary benthic impacts from excavation of HDD pits.
b) HDD fluid release—HDD release would result in adverse impacts. A frac-out plan should be included. The frac-out plan should include containing and removing released material.

Underwater sound—Evaluation of acoustic effects and the impacts that may occur to managed fish and invertebrate species from HDD, including a quantitative assessment of the linear and areal extent of sound pressure (show your work and include the details of your calculation). Also include a qualitative discussion of particle motion.

5.1.3. Operation/presence of structures

5.1.3.1. Artificial substrate (WTG/OSS/converter station/turbine scour protection)

a) Community structure changes—Evaluate the potential impacts to existing substrates and habitats (e.g., benthic community disturbances and losses as a result of trenching, boulder relocation, etc.); changes to fish communities/assemblages (e.g., the attraction of structure-oriented species)
b) Invasive species – Evaluate the potential introduction, establishment, or spread of invasive species as a result of the installation of novel substrates and materials (e.g., differentiate impacts by turbines, foundation types, scour protection, cable protection types, etc.).

5.1.3.2. Underwater sound

a) Acoustic effects to species and species behaviors (e.g., spawning and settlement). This section should address not only expected operational noise (e.g., turbines, vessels, etc.), but also address expected and potential maintenance activities (e.g., regularly scheduled maintenance, unexpected failures, etc.).
   - This analysis should include an evaluation of sound pressure and particle motion (spatial extent and general analysis of potential impacts). Quantitative assessment of sound pressure and qualitative discussion of particle motion. See Attachment B for details on calculating areal extent effected areas around WTGs for given radii to thresholds.
   - Note on the best available science: NOAA Fisheries considers the potential for behavioral impacts on fish from exposure to Lrms noise greater than 150 dB re 1 µPa from any type of sound source and utilizes the FHWG (2008) [see footnote 11] interim criteria for injury associated with impact pile driving. However, Popper et al. (2014) provides Lrms values for impairment due to prolonged exposure to continuous sound such as vessels or dredging and peak levels for mortality due to explosives. These guidelines are widely used and recognized as the best available science and NOAA recommends including both sets of criteria for acoustic modeling both sets of criteria for acoustic modeling. Species-specific information based upon the best available science should be included when available and where appropriate, species-specific impact evaluations should be provided for species that may be more sensitive to acoustic impacts (e.g., Atlantic cod), as well as invertebrate species that are not addressed in either FHWG (2008) or Popper et al. (2014) [see footnote 12].

5.1.3.3. Hydrodynamic effects

a) Hydrodynamic effects—An evaluation of potential hydrodynamic impacts from the presence of WTGs, as well as cable and scour protection measures. Focus on potential effects to thermal regimes, larval distribution patterns, primary production, and prey distribution. Direct and indirect impacts of hydrodynamic changes on water temperatures and sediments (e.g., sediment suspension) should be

evaluated for both pelagic impacts (e.g., turbidity) as well as benthic impacts (e.g., scouring, sediment redeposition).

a. Primary production changes
b. Vertical mixing changes
c. Thermal dynamic shifts
d. Bottom shear stress effects
e. Larval distribution patterns

5.1.4. Operation/presence of inter-array and offshore/onshore cables

5.1.4.1. Power transmission (EMF, heat)

a) Migration and movement—evaluate potential habitat impact from EMF, including effects on movements and migrations of managed fish and invertebrate species and their prey
b) Community Structure changes/effect—Evaluate the potential impacts to existing substrates and habitats (e.g., benthic community disturbances and losses, including benthic infauna changes/food sources, as a result of EMF and heat emissions from power transmission including AC and DC if both options are considered in the project action).

5.1.4.2. Cable protection

a) Community structure changes/invasive species—Evaluate the potential impacts to existing substrates and habitats (e.g., benthic community disturbances and losses as a result of trenching, boulder relocation, etc.); changes to fish communities/assemblages (e.g., the attraction of structure-oriented species; and potential for expansion and/or introduction of invasive species as a result of the installation of novel substrates and materials (e.g., differentiate impacts by turbines, foundation types, scour protection, cable protection types, etc.).

5.1.4.3. Power conversion (AC/DC converter station, if applicable)

a) Thermal plume—full evaluation of habitat impacts, including impacts to all life history stages and prey species that may result from thermal plume discharges associated with cooling the converter station.
b) Entrainment/Impingement—full evaluation of habitat impacts, including impacts to all life history stages (with special emphasis on eggs/larvae) and prey species that may result from entrainment or impingement associated with water intake for cooling the converter station. When describing impacts from entrainment/impingement please refer to your activity description in 2.3 to ensure relevant details (e.g., water withdrawal intake velocity, approach velocity, location of intake in the water column, screening size) are included. Relevant Avoidance, Minimization and Mitigation measures should be described in Section 6.

Please note: the analysis of thermal plume and entrainment/impingement impact evaluations should incorporate site-specific information related to hydrodynamics, physical parameters (e.g., temperature), and egg and larvae data. Modeling may be necessary to fully consider the extent of EFH that could be impacted at or around the converter station.

5.1.4.4. Operational Water Quality (vessel and facility operations)

5.1.4.4.1. Vessel Activity

Evaluate the potential resuspension of contaminated material from seafloor disturbance due to vessel activity (e.g., anchoring). Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.

5.1.4.4.2. WTG scour and cable protection

Evaluate the potential resuspension of contaminated material from seafloor disturbance due to scour and cable protection maintenance. Impacts to benthic EFH from redeposition of contaminants into adjacent areas should also be evaluated.

5.1.4.4.3. Power Conversion

5.1.4.4.3.1. Contaminants in discharge

5.1.4.4.3.2. Thermal discharge

5.1.4.4.4. Releases of Marine Debris

5.1.4.4.5. Accidental Spills

Evaluate the potential impacts of vessel accidental spill due to routine and non-routine events (e.g., collision, accidental capsizing, natural events*).*

5.2. Project Monitoring Activities

5.2.1. Marine mammal monitoring

Effects analyses based on methods proposed (e.g., vessel, aircraft).

5.2.2. Acoustics

Effects analyses based on methods proposed (e.g., hydrophones).

5.2.3. Fisheries

Effects analyses based on methods proposed (e.g., varying gear types: trawls/nets, dredges, pots/traps).

5.2.4. Benthos/benthic habitat

Effects analyses based on methods proposed (e.g., benthic grab, SPI/PV, etc.).

5.3. Conceptual Decommissioning

This section should note that a separate EFH consultation will be conducted for the decommissioning phase of the Project. While a full analysis of decommissioning activities is not needed, this section should cover the following:

a) Anticipated vessel activity associated with decommissioning
b) Anticipated treatment of foundation types, scour protection and cables
c) Anticipated effects from proposed treatment on EFH, including discussing effects to EFH from removing turbines that have been in operation for long periods of time. The section should include discussion of effects on all life-history stages from changes in underwater noise, benthic conditions, sediment suspension and deposition.

5.4. Cumulative and Synergistic Effects to EFH

For the project in consideration of the region/WEA. This section should consider overlapping and/or consecutive construction activity for other projects, as well as cumulative benthic and pelagic effects of multiple proposed projects within the region/WEA.

6. Avoidance, Minimization, and Mitigation

6.1. Avoidance and Minimization Measures

a) For all identified adverse impacts to managed fish and invertebrate species EFH and their prey, detailed information on proposed avoidance and minimization measures should be provided. This section should describe all proposed avoidance and minimization measures, including potential alternatives to the proposed project, and the impacts the measures would reduce if employed. Distinction should be made (e.g., separate tables) between developer-proposed measures which are considered components of the project action, any measures that will be imposed by BOEM or any other consulting federal agency (e.g., USACE), and any measures that could be imposed by BOEM or any other consulting federal agency.

b) The effectiveness of all proposed measures that will be included to avoid and minimize adverse impacts to specific habitat types, species or species groups, and prey species should be evaluated and assessed. Information, should be provided on how the minimization measure will be evaluated (including the proposed methodology) to determine it is effective and operating as intended in the field

c) All monitoring plans related to avoiding and minimizing construction related impacts should be provided with the EFH assessment. Any acoustic impact monitoring plan should include measures to ensure target attenuation levels are maintained during construction. If other project specific monitoring (e.g., turbidity) is proposed to avoid and minimize impacts, the applicable monitoring plan should be provided.

6.2. Mitigation and Environmental Monitoring

Including short-term and long-term performance standards for the mitigation

a) In cases where a particular project component or activity is expected to result in an adverse effect to managed species EFH, as a result of short-term, long-term, or permanent impacts that reduces the quantity or quality of EFH, any proposed mitigation, including compensatory mitigation, to offset such impacts should be fully described and presented.

b) Explain how the proposed mitigation is expected to compensate for impacts to managed fish and invertebrate species EFH.

c) Justify conclusions using the best available scientific information.

d) Proposed monitoring to demonstrate the effectiveness of the proposed avoidance and minimization measures, and/or to evaluate short-term, long-term, and permanent impacts to EFH and fisheries resources should be included with the EFH assessment.

e) A benthic monitoring plan should clearly demonstrate that scientifically robust data, capable of detecting changes in the community structure of benthic fauna and juvenile fish species will be collected and evaluated.

f) All proposed fisheries or environmental monitoring plans should be provided.

6.3. Alternative Project Designs that Could Avoid/Minimize Impacts

Provide an analysis of alternatives to the action (similar to Section 5). Such analysis should include alternatives that could avoid or minimize adverse effects on EFH. For example, this would include the habitat impact minimization alternative, larger WTG sizes, alternative cable routes, etc. that are not already being analyzed as a part of the proposed action.

6.4. Adaptive Management Plans

Including triggers for corrective actions and identification of corrective actions.

7. NOAA Trust Resources

This section will include discussion on diadromous fish, shellfish, crustaceans, or their habitats, that are not managed under a federal fisheries management plan. Atlantic States Marine Fisheries Commission manages the fishery and designates habitat for many of the trust-resource species. The evaluations of impacts to NOAA-trust species should be based on the habitat types as appropriate for each species. Note that some of these species, including diadromous fishes, serve as prey for a number of federally managed species and could also be considered a component of EFH pursuant to the MSA – in that case they are considered separately as prey species in the EFH portion of the template.

Trust resource species could include, but are not limited to:

- Alewife
- American eel
- American shad
- Atlantic menhaden
- Blue crab
- Blue mussel
- Blueback herring
- Eastern oyster
- Horseshoe crab
- Non-federally managed hard clams
- Soft-shelled clams
- Striped bass
- Other species, as applicable (e.g., American lobster, red drum, cobia)

8. Conclusions/Determination(s)

a) This should be a text summary of:

1) Project activities that are expected to have adverse effects to managed species EFH, including sensitive and vulnerable life stages and habitat types and HAPCs.
2) proposed avoidance, minimization, and mitigation measures; and

3) the final determination of how the project will affect EFH, as short-term (less than 2 years), long-term (2 years to < life of the project), or permanent (life of the project) effects.

b) A summary table that includes:

1) the effects of individual project activities on specific EFH habitat types, species groups, and life history stages;
2) the avoidance, minimization and mitigative measures; and
3) the anticipated duration (short-term, long-term, permanent) of all remaining adverse effects to EFH may be included to supplement the text.

- This evaluation and determination must be based upon the area of project impact (i.e., the habitat within the area affected by a specific project component and/or activity) and should not consider the extent of similar habitat adjacent to or outside the area of impact. Justify conclusions using the best available scientific information.

9. References

The references should include all cited literature used to support the evaluation and analysis of project impacts and effects to EFH.

10. Appendices

- *INCLUDE DATA COLLECTION AND DETAILED MAPPING METHODOLOGIES.*
- *INCLUDE COP/REPORTS/ETC CITED IN AND USED TO SUPPORT EFH ASSESSMENT*
- *INCLUDE EFH CHECKLIST AND MAPPING RECS - SPECIFY FOR REFERENCE PURPOSES ONLY*
- *INCLUDE TABLE OF* APPLICANT PROPOSED AVOIDANCE AND MINIMIZATION MEASURES
- INCLUDE TABLE OF BOEM PROPOSED AVOIDANCE AND MINIMIZATION MEASURES OUTSIDE OF THE EFH-ASSESSMENT (COPY FROM EIS)

Note that Attachments A, B, and C in this document are intended for reference purposes only and should not be included as Appendices to the EFH Assessment

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

Table A1: Habitat Table Group Referenced Against CMECS (Class, Subclass and Groups)[14]

Habitat Table Group	Class	Subclass	Group(s)
Rocky (general, to include all: granule-pebble, cobble, boulder, ledge/bedrock) *Please note that CMECS Biotic Subclasses Benthic Macroalgae and Attached Fauna should be addressed in the characterization of rocky habitats.*	Substrate Class: Rock Substrate	Substrate Subclass: Bedrock	NA
		Substrate Subclass: Megaclast	NA
	Substrate Class: Unconsolidated Mineral Substrate - with 5% or greater of particles 2 mm to < 4,096 mm	Substrate Subclass: Coarse Unconsolidated Substrate	Substrate Group: Gravels
			Substrate Group: Gravel Mixes
			Substrate Group: Gravelly
Soft bottom mud (intertidal, shallow-water, and deep) *Please note that CMECS Biotic Subclasses Soft Sediment Fauna and Inferred Fauna should be addressed in the characterization of mud habitats.*	Substrate Class: Unconsolidated Mineral Substrate - with < 5% or greater of particles 2 mm to < 4,096 mm	Substrate Subclass: Fine Unconsolidated Substrate - with > 50% of particles < 0.625 mm	Substrate Group: Slightly Gravelly *(please note: this CMECS category label is not used in the Recommendations for Mapping Fish Habitat, but it is incorporated into the classification of the Fine Unconsolidated Substrate substrates)*
			Substrate Group: Sandy Mud
			Substrate Group: Mud
Soft bottom sand (with and without sand ripple, shoals, waves/ridges) *Please note that CMECS Biotic Subclasses Soft*	Substrate Class: Unconsolidated Mineral Substrate - with < 5% or greater	Substrate Subclass: Fine Unconsolidated Substrate - with >/= 50% of particles 0.625 mm to <2 mm	Substrate Group: Slightly Gravelly *(please note: this CMECS category label is not used in the Recommendations for Mapping Fish Habitat, but it is incorporated into the classification of the Fine Unconsolidated Substrate substrates)*

[14] For the most up to date CMECS catalog visit the NOAA Ecological Classification – CMECS website

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

Habitat Table Group	Class	Subclass	Group(s)
Sediment Fauna and Inferred Fauna should be addressed in the characterization of sand habitats.	of particles 2 mm to < 4,096 mm		Substrate Group: Sand
			Substrate Group: Muddy Sand
Submerged Aquatic Vegetation (SAV)	Biotic Class: Aquatic Vegetation Bed	Biotic Subclass: Aquatic Vascular Vegetation	Biotic Group: Seagrass Bed
			Biotic Group: Freshwater and Brackish Tidal Aquatic Vegetation
Tidal Marsh (e.g., saltmarsh and brackish marsh)	Biotic Class: Emergent Wetland	Biotic Subclass: Emergent Tidal Marsh	Biotic Group: Brackish Marsh
			Biotic Group: Freshwater Tidal Marsh
			Biotic Group: High Salt Marsh
			Biotic Group: Low and Intermediate Salt Marsh
		Biotic Subclass: Vegetated Tidal Flats	Biotic Group: Vegetated Freshwater Tidal Mudflat
			Biotic Group: Vegetated Salt Flat and Panne
	Biotic Class: Scrub-Shrub Wetland	Biotic Subclass: Tidal Scrub-Shrub Wetland	Biotic Group: Brackish Tidal Scrub-Shrub
			Biotic Group: Freshwater Tidal Scrub-Shrub
			Biotic Group: Saltwater Tidal Scrub-Shrub
			Biotic Group: Tidal Mangrove Shrubland
	Biotic Class: Forested Wetland	Biotic Subclass: Tidal Forest/Woodland	Biotic Group: Brackish Tidal Forest/Woodland
			Biotic Group: Freshwater Tidal Forest/Woodland

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

Habitat Table Group	Class	Subclass	Group(s)
			Biotic Group: Saltwater Tidal Forest/Woodland
			Biotic Group: Tidal Mangrove Forest
Shellfish reefs and beds (e.g., hard clams, Atlantic surfclam, mussels, oysters)	Substrate Class: Shell Substrate	Substrate Subclass: Shell Reef Substrate	Substrate Group: Clam Reef Substrate
			Substrate Group: Crepidula Reef Substrate
			Substrate Group: Mussel Reef Substrate
			Substrate Group: Oyster Reef Substrate
		Substrate Subclass: Shell Rubble if dominated by living shells	Substrate Group: Clam Rubble
			Substrate Group: Crepidula Rubble
			Substrate Group: Mussel Rubble
			Substrate Group: Oyster Rubble
	Biotic Class: Faunal Bed	Biotic Subclass: Mollusk Reef Biota	Biotic Group: Mussel Reef
			Biotic Group: Oyster Reef
			Biotic Group: Gastropod Reef
		Biotic Subclass: Attached Fauna	Biotic Group: Attached Mussels
			Biotic Group: Attached Oysters
		Biotic Subclass: Soft Sediment Fauna	Biotic Group: Clam Bed
			Biotic Group: Mussel Bed
			Biotic Group: Oyster Bed
			Biotic Group: Scallop Bed
Shell accumulations		Substrate Subclass: Shell Hash	Substrate Group: Clam Hash

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

Habitat Table Group	Class	Subclass	Group(s)
	Substrate Class: Shell Substrate		Substrate Group: Crepidula Hash
			Substrate Group: Mussel Hash
			Substrate Group: Oyster Hash
		Substrate Subclass: Shell Rubble if dominated by non-living shells	Substrate Group: Clam Rubble
			Substrate Group: Crepidula Rubble
			Substrate Group: Mussel Rubble
			Substrate Group: Oyster Rubble
Other biogenic (e.g., cerianthids, corals, emergent tubes – polychaetes) *Areas with corals or dense aggregations of epifuana or emergent infauna should be identified and characterized.*	Biotic Class: Reef Biota	Biotic Subclass: Deepwater/ Coldwater Coral Reef Biota	Biotic Group: Deepwater/Coldwater Stony Coral Reef
			Biotic Group: Deepwater/Coldwater Stylasterid Coral Reef
			Biotic Group: Colonized Deepwater/Coldwater Reef
		Biotic Subclass: Shallow/Mesophotic Coral Reef Biota	Biotic Group: Branching Coral Reef
			Biotic Group: Columnar Coral Reef
			Biotic Group: Encrusting Coral Reef
			Biotic Group: Foliose Coral Reef
			Biotic Group: Massive Coral Reef
			Biotic Group: Plate Coral Reef
			Biotic Group: Table Coral Reef
			Biotic Group: Turbinate Coral Reef
			Biotic Group: Mixed Shallow/Mesophotic Coral Reef
			Biotic Group: Colonized Shallow/Mesophotic Reef

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

Habitat Table Group	Class	Subclass	Group(s)
	Biotic Class: Faunal Bed	Biotic Subclass: Glass Sponge Reef Biota	Biotic Group: Glass Sponge Reef
		Biotic Subclass: Mollusk Reef Biota	Biotic Group: Gastropod Reef
		Biotic Subclass: Worm Reef Biota	Biotic Group: Sabellariid Reef
			Biotic Group: Serpulid Reef
		Biotic Subclass: Attached Fauna	Biotic Group: Attached Corals
		Biotic Subclass: Soft Sediment Fauna	Biotic Group: Diverse Soft Sediment Epifauna
			Biotic Group: Larger Tube-Building Fauna
			Biotic Group: Small Tube-Building Fauna
			Biotic Group: Burrowing Anemones
			Biotic Group: Brachiopod Bed
			Biotic Group: Soft Sediment Bryozoans
			Biotic Group: Hydroid Bed
			Biotic Group: Pennatulid Bed
			Biotic Group: Sponge Bed
			Biotic Group: Tunicate Bed
Pelagic (offshore and estuarine)			
Habitat for sensitive life stages (i.e., demersal eggs,	**Not defined by CMECS but by managed spp. that occur in the project area**		

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

Habitat Table Group	Class	Subclass	Group(s)
spawning activity-discrete areas)			
Habitat Areas of Particular Concern (HAPCs)	**Not defined by CMECS but by managed spp. that occur in the project area**		

*Please note the following substrate classes and groups should not be defined as substrate classes and should be addressed as biotic components under appropriate habitat type (see tables A2 and A3 below):

- Substrate Class: Algal substrate,
- Substrate Class: coral substrate
- Substrate Subclass: shell sand
    - Substrate Subgroup: coquina hash
- Substrate Class: Worm Substrate
    - Substrate Subclass: Sabellariid Substrate
        - Substrate group: Sabellariid Reef Substrate
        - Sabellariid Rubble,
        - Sabellariid Hash
    - Serpulid Substrate
        - Serpulid Reef Substrate
        - Serpulid Rubble
        - Serpulid Hash

Table A2: Table of biotic subclasses that should be addressed in the characterization of rocky habitat (see note under Rocky)

Biotic Subclass	Biotic Group
Benthic Macroalgae	Calcareous Algal Bed
	Canopy-Forming Algal Bed
	Coralline/Crustose Algal Bed
	Filamentous Algal Bed
	Leathery/Leafy Algal Bed
	Mesh/Bubble Algal Bed
	Sheet Algal Bed
	Turf Algal Bed
Attached Fauna	Biotic Group: Attached Sea Urchins
	Biotic Group: Attached Tunicates
	Biotic Group: Attached Starfish
	Biotic Group: Attached Sponges
	Biotic Group: Attached Hydroids
	Biotic Group: Sessile Gastropods
	Biotic Group: Mobile Crustaceans on Hard or Mixed Substrates
	Biotic Group: Attached Crinoids
	Biotic Group: Chitons
	Biotic Group: Attached Bryozoans
	Biotic Group: Brittle Stars on Hard or Mixed Substrates

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

	Biotic Group: Attached Brachiopods
	Biotic Group: Attached Basket Stars
	Biotic Group: Barnacles
	Biotic Group: Attached Anemones
	Biotic Group: Vent/Seep Communities –
	Biotic Group: Attached Tube-Building Fauna
	Biotic Group: Diverse Colonizers
	Biotic Group: Wood Boring Fauna
	Biotic Group: Mineral Boring Fauna

Attachment A: Habitat Table Group Referenced Against CMECS (for reference)

Table A2: Table of biotic subclasses that should be addressed in the characterization of mud and sand habitat (see notes under soft bottom mud and soft bottom sand)

Biotic Subclass	Biotic Group
Soft Sediment Fauna	Larger Deep-Burrowing Fauna
	Small Surface-Burrowing Fauna
	Tunneling Megafauna
	Oligozoic Biota
	Soft Sediment Brittle Stars
	Soft Sediment Crinoids
	Mobile Crustaceans on Soft Sediments
	Echiurid Bed
	Holothurian Bed
	Mobile Mollusks on Soft Sediments
	Sand Dollar Bed
	Starfish Bed
	Burrowing Urchins
	Sea Urchin Bed
	Egg Masses
	Fecal Mounds
	Pelletized, Fluid Surface Layer
	Tracks and Trails

Attachment B: Calculation for Effected Areas around WTGs

BOEM suggests the following when calculating the effected areas around WTGs for given radii to acoustic thresholds:

- For radii less than 60% of the spacing (1111 m for the usual 1 nautical mile spacing), use No Overlap (see formula and figure B1 below)
- For radii greater than 60%, assume Complete Overlap. Using these two formulas will give conservative results, but shouldn't be more 10% over the actual (see formula and figure B2 below)

Note: Include the specifics of your calculation in the document comments

Variables:

d = WTG spacing (usually 1 nautical mile, so 1852 m)

R = radius to the threshold

L = wind farm length (one side of the perimeter of the area covered by WTGs)

W = wind farm width (another side of the perimeter of the area covered by WTGs)

N = total number of WTGs in the wind farm

A = effected area

π = pi, 3.1415...

Formulas:

if R less than or equal to (0.6 x d):

"No Overlap" $A = N \times \pi \times R^2$

otherwise:

"Complete Overlap" $A = (L \times W) + 2 \times R \times (L + W) + (\pi \times R^2)$

Attachment B: Calculation for Effected Areas around WTGs

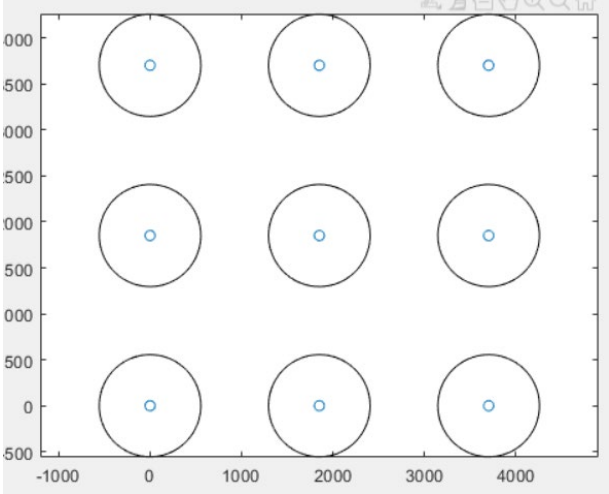


Figure B1. Diagram of "No Overlap" situation

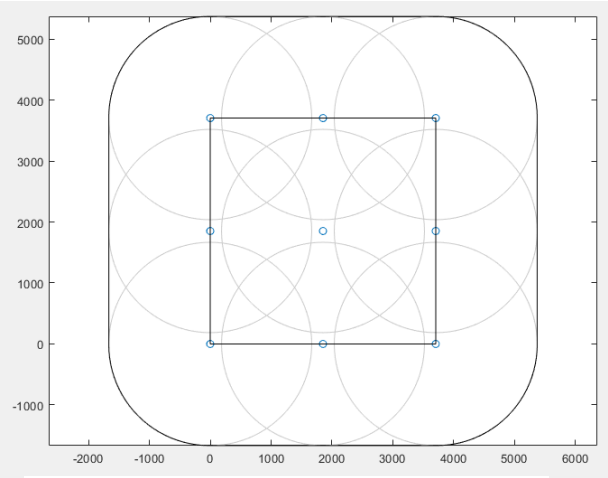


Figure B2. Diagram of "Complete Overlap" situation

Suggested Text Describing the Calculation

In calculating an approximate, but conservative estimate of area of effect, two methods were used.

For areas based on $R_{95\%}$ smaller than 60% of the WTG spacing, the area of a circle of radius $R_{95\%}$ was calculated and that area was multiplied by the total number of WTGs in the Project.

For areas based on $R_{95\%}$ greater than 60% of WTG spacing, the areal footprint of the wind farm was calculated and the area of a border around that, of width $R_{95\%}$ was added.

These calculations provided are conservative in that the produce areas slightly larger than would actually be expected. This assumes that the affected area around each pile was a circle of size $R_{95\%}$. This is an imprecise estimate but is reasonable in the relatively flat Project area.

General Avoidance/Minimization of Potential Impacts to EFH

The following measures may be applied by BOEM to offshore wind energy projects if not already included as part of the proposed action. The following measures are implemented to avoid/minimize impacts to EFH and EFH-designated species. These measures are based on protocols and procedures that were successfully implemented for other offshore wind (OSW) projects. Note that these measures align with existing BOEM recommended best management practices (BMPs)[15] and have been incorporated below where applicable.

- **Ramp-up and Soft-start Procedures** – A ramp-up (High Resolution Geotechnical [HRG] surveys) or soft-start (pile driving) should be used at the beginning of each HRG survey or pile segment during impact pile driving and vibratory pile driving. This approach would provide additional protection to finfish near the project site by allowing them to vacate the area prior to the commencement of pile-driving activities. A soft-start requires an initial incremental increase from low-energy levels with increasing energy from the impact and/or vibratory hammer. The Lessee would implement soft-start techniques for impact pile driving and include an initial set of three strikes from the impact hammer at reduced energy, followed by a 1-minute waiting period.
- **Pile Driving Noise Mitigation and Noise Attenuation Systems** –Noise mitigation and noise attenuation systems would minimize disruption and disturbance to marine life from pile driving. Noise mitigation assumptions for OSW underwater acoustic modeling include soft-starts for each pile, small bubble curtains, big bubble curtains, and hydro sound dampers (HSD). During impact pile driving, one or more noise attenuation systems would be applied to reduce the propagation of impulsive sounds and to decrease the area in which finfish are exposed to injurious or disturbing noise levels.
- **Live and Hard Bottom Impact Monitoring** – The Lessee would develop and implement a monitoring plan for live and hard bottom features that may be impacted by proposed activities. The monitoring plan would also include assessing the recovery time for these sensitive habitats. BOEM recommends that all monitoring reports classify substrate conditions following the Coastal and Marine Ecological Classification Standards (CMECS), including live bottoms (e.g., submerged aquatic vegetation and corals and topographic features. The plan would also include a means of recording observations of any increased coverage of invasive species in the impacted hard-bottom areas. Relevant recommended BMPs include:
    - Minimization of the area disturbed by preconstruction site monitoring and testing activities and installations.
    - Development of a monitoring program to ensure that environmental conditions are monitored during construction, operation, and decommissioning phases. The monitoring program requirements, including adaptive management strategies, would be established at the project level to ensure that potential adverse impacts would be mitigated.
    - Implementation of pre-siting surveys (may use existing data) to identify important, sensitive, and unique marine habitats in the vicinity of the projects; the Lessee would

[15] Described in Attachment A of Guidelines for Information Requirements for a Renewable Energy Construction and Operations Plan (COP) (2016).

then design the project to avoid, minimize, or otherwise mitigate adverse impacts to these habitats.

  - Reduction of scouring action by ocean currents around foundations and to seafloor topography by taking all reasonable measures and employing periodic routine inspections to ensure structural integrity.

- **Live and Hard Bottom Habitat Mapping and Avoidance** – Vessel operators would be provided with maps of sensitive hard-bottom habitat in OSW project area, as well as a proposed anchoring plan that would avoid or minimize impacts on the hard-bottom habitat to the greatest extent practicable. These plans would be provided for all anchoring activity, including construction, maintenance, and decommissioning. Relevant recommended BMPs include:
  - Implementation of appropriate pre-siting surveys to identify and characterize potentially sensitive seafloor habitats and topographic features.
  - Avoidance of location of facilities near known sensitive seafloor habitats, such as coral reefs, hard-bottom areas, and chemosynthetic communities.
  - Avoidance of anchoring on sensitive seafloor habitats.
  - Minimization of seafloor disturbance during construction and installation of the facility and associated infrastructure.
  - Avoidance of hard-bottom habitats, including seagrass communities and kelp beds, where practicable, and restore any damage to these communities.
- **Intake Screens on Pump Intakes for In-shore Hydraulic Dredges** – All hydraulic dredge intakes should be covered with a mesh screen or screening device that is properly installed and maintained to minimize potential for impingement or entrainment of fish species. The screening device on the dredge intake should prevent the passage of any material greater than 1.25" in diameter, with a maximum opening of 1.25"x 6". Water intakes should be positioned at an appropriate depth to avoid or minimize the entrainment of eggs and larvae. Intake velocity should be limited to less than 0.5 ft/sec.
- **Scour and Cable Protection** – To the extent technically and economically feasible, the Lessee must ensure that all materials used for scour and cable protection consist of natural or engineered stone that does not inhibit epibenthic growth. The materials selected for protective purposes should mirror the natural environment and provide similar habitat functions. Relevant recommended BMPs include:

Reduce scouring action by ocean currents around foundations and to seafloor topography by taking all reasonable measures and employing periodic routine inspections to ensure structural integrity