



Cape Cod Bridges Program

Bourne, Massachusetts

Appendix 4.12
Threatened, Endangered, and Protected Species and Habitats Material

SUBMITTED TO:
Secretary of Energy and Environmental Affairs
Executive Office of Energy and Environmental Affairs (EEA)
Massachusetts Environmental Policy Act (MEPA) Office
100 Cambridge Street, Suite 900
Boston, MA 02114

PROPONENT:
The Massachusetts Department of Transportation
Highway Division
10 Park Plaza
Boston, MA 02116

massDOT
Massachusetts Department of Transportation

Submitted August 2025

Table of Contents

1 Introduction 1

2 Biological Assessment for Terrestrial Species 1

3 Biological Assessment for Marine Species 2

4 Essential Fish Habitat Assessment and Fish and Wildlife Coordination Act Consultation Worksheet 3

5 Agency Coordination and Concurrence 4

5.1 Biological Assessment for Terrestrial Species 4

5.2 Biological Assessment for Marine Species 4

5.3 Essential Fish Habitat Assessment and Fish and Wildlife Coordination Act Consultation Worksheet 4

Attachments 5

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
CFR	Code of Federal Regulations
DEIR	Draft Environmental Impact Report
EFH	Essential Fish Habitat
ESA	Endangered Species Act
FHWA	Federal Highway Administration
FWCA	Fish and Wildlife Coordination Act
HAPC	Habitat Area of Particular Concern
MassDOT	Massachusetts Department of Transportation
MEPA	Massachusetts Environmental Policy Act
MMPA	Marine Mammal Protection Act
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
USFWS	U.S. Fish and Wildlife Service

1 Introduction

This Threatened, Endangered, and Protected Species and Habitats Material Appendix includes three attached reports that have been prepared in support of the Draft Environmental Impact Report (DEIR) for the Cape Cod Bridges Program (the Program), in accordance with the following federal and state statutes, regulations, and guidance:

- National Environmental Policy Act (NEPA) of 1969, as amended, 42 United States Code (USC) 4321 et seq.
- *Efficient Environmental Reviews for Project Decisionmaking and One Federal Decision,* 23 USC 139.
- Federal Highway Administration's (FHWA) regulations implementing NEPA, *Environmental Impact and Related Procedures* (23 CFR 771), and corresponding guidance, Technical Advisory (T 6640.8A): *Guidance for Preparing and Processing Environmental and Section 4(f) Documents* (October 30, 1987).
- Certificate of the Secretary of the Office of Energy and Environmental Affairs on the Environmental Notification Form for the Cape Cod Bridges Program (July 7, 2023).
- Massachusetts Environmental Policy Act (MEPA) regulations, 301 Code of Massachusetts Regulation (CMR) 11.00 (as amended, January 6, 2023).

2 Biological Assessment for Terrestrial Species

The Massachusetts Department of Transportation (MassDOT) prepared **Attachment 1, Biological Assessment for Terrestrial Species**, to address the potential impacts of the Program on terrestrial species listed or proposed as endangered or threatened under the Endangered Species Act of 1973 (ESA), and to support the development of the Program DEIR. Pursuant to Section 7 of the ESA, FHWA and MassDOT completed an informal consultation for impacts to species under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) that could result from the Program. Section 7 of the ESA is intended to ensure that, through consultation with the USFWS, federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species, or result in the destruction or adverse modification of critical habitat. **Attachment 1, Biological Assessment for Terrestrial Species**, addresses the potential impacts of the Program on the following ESA-listed and ESA-proposed terrestrial species under the jurisdiction of the USFWS:

- Mammals
  - Northern long-eared bat (*Myotis septentrionalis*)
  - Tricolored bat (*Perimyotis subflavus*)

- Reptiles
  - Northern red-bellied cooter (*Pseudemys rubriventris*) / Plymouth red-bellied turtle (*Pseudemys rubriventris bangsi*)
- Plants
  - Sandplain gerardia (*Agalinis acuta*)
- Insects
  - Monarch butterfly (*Danaus plexippus*)

Based on the analysis conducted for **Attachment 1, Biological Assessment for Terrestrial Species**, FHWA and MassDOT have determined that the Program would have **no effect** on sandplain gerardia and northern red-bellied cooter and the Program is **not likely to adversely affect** the northern long-eared bat and tricolored bat. Program construction could cause direct and indirect impacts on monarch butterflies in the form of direct mortality of individuals and/or permanent and temporary removal or disturbance of breeding or migration habitat. However, FHWA and MassDOT have determined that based upon MassDOT's conservation commitments, the Program is **not likely to jeopardize** the continued existence of the monarch butterfly.

3 Biological Assessment for Marine Species

MassDOT prepared **Attachment 2, Biological Assessment for Marine Species**, to address the potential impacts of the Program on marine species listed as endangered or threatened under the ESA and designated critical habitat. Pursuant to Section 7 of the ESA, FHWA and MassDOT completed informal consultation for impacts to species under the jurisdiction of National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) that could result from the Program. Section 7 of the ESA is intended to ensure that, through consultation with NOAA Fisheries, federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species, or result in the destruction or adverse modification of critical habitat. **Attachment 2, Biological Assessment for Marine Species**, addresses the potential impacts of the Program on the following ESA-listed marine species and designated critical habitat under the jurisdiction of NOAA Fisheries:

- Fin whale (*Balaenoptera physalus*)
- North Atlantic right whale (*Eubalaena glacialis*) (Critical Habitat)
- Green turtle (*Chelonia mydas*)
- Kemp's ridley turtle (*Lepidochelys kempii*)
- Leatherback turtle (*Dermochelys coriacea*)
- Loggerhead turtle (*Caretta caretta*)
- Shortnose sturgeon (*Acipenser brevirostrum*)
- Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*)

Attachment 2, Biological Assessment for Marine Species, includes an acoustic analysis of the Program's in-water construction activities for assessing the Program's potential impacts on species protected under the ESA as well as those protected under the Marine Mammal Protection Act of 1972 (MMPA).

Based upon the analysis conducted for **Attachment 2, Biological Assessment for Marine Species**, FHWA and MassDOT have determined that the Program **may affect, but is not likely to adversely affect** the identified marine species. Additionally, FHWA and MassDOT have determined that the Program is **not likely to adversely affect** physical and biological features associated with critical habitat for the North Atlantic right whale and therefore would not adversely modify or destroy designated critical habitat for the North Atlantic right whale.

4 Essential Fish Habitat Assessment and Fish and Wildlife Coordination Act Consultation Worksheet

MassDOT prepared **Attachment 3, Essential Fish Habitat (EFH) Assessment and Fish and Wildlife Coordination Act (FWCA) Consultation Worksheet**, for review by NOAA Fisheries Greater Atlantic Regional Fisheries Office to address the potential impacts of the Program relative to the following:

- The Magnuson Stevens Fishery Conservation and Management Act, which requires federal agencies to consult with NOAA Fisheries on any action or proposed action authorized, funded, or undertaken by such agency that may adversely affect EFH identified under the Act, pursuant to 50 CFR 600.905.
- The FWCA, which requires federal agencies to consult with NOAA Fisheries when proposed actions might result in modifications to a natural stream or body of water. The FWCA also requires that federal agencies consider the impacts of projects on fish and wildlife, including aquatic resources such as shellfish, diadromous species, and other commercially and recreationally important species that are not federally managed and do not have designated EFH.

There is designated EFH for 29 finfish and invertebrate species within Cape Cod Canal. Additionally, there are two types of Habitat Area of Particular Concern (HAPC): Inshore Juvenile Cod HAPC and Summer Flounder HAPC. In addition to EFH species, the FWCA recognizes 16 NOAA Trust Resources with the potential to be present in the area and therefore exposed to Program impacts. This includes two areas with eelgrass (*Zostera marina*) [submerged aquatic vegetation (SAV)], and areas of shellfish habitat at both bridge sites.

MassDOT has committed to measures for avoiding, minimizing, and mitigating impacts to EFH. Based on the analysis and the proposed avoidance, minimization, and mitigation measures, and in coordination with the FHWA, MassDOT has determined that the **adverse effect on finfish and shellfish species would not be substantial**, meaning that the adverse impacts would be no more than minimal, temporary, or can be alleviated with minor Program modifications or conservation recommendations.

The Program would affect SAV present at the Bourne Bridge site. In coordination with NOAA Fisheries, MassDOT has committed to monitor the SAV beds with photographic surveys before and after

construction, provide the survey results to NOAA Fisheries, and provide compensatory mitigation for impacts to eelgrass beds. MassDOT is developing an Eelgrass Survey and Mitigation Plan and is consulting with the USACE and NOAA Fisheries to pursue the most effective approach to mitigate for the loss of the SAV.

5 Agency Coordination and Concurrence

The following identifies agency coordination regarding the three technical support documents MassDOT submitted to federal agencies. Documentation of agency coordination is included within the attachments for the technical reports.

5.1 Biological Assessment for Terrestrial Species

Based upon its review of the Biological Assessment for Terrestrial Species (**Attachment 1**), on May 2, 2025, MassDOT received a letter of concurrence from Audrey Mayer, Supervisor, New England Field Office, U.S. Department of Interior, Fish and Wildlife Service. USFWS concurred that the Program may affect, but is not likely to adversely affect, the federally endangered northern long-eared bat (*Myotis septentrionalis*) (NLEB), and the tricolored bat (*Perimyotis subflavus*) (TCB), which is proposed to be listed as endangered. USFWS concurred that the Program is not likely to jeopardize the monarch butterfly (*Danaus plexippus*), which is proposed to be listed as threatened. USFWS acknowledged MassDOT's determination that the Program would have no effect on other federally listed species. Further, USFWS indicated it is unaware of any substantial impacts the Program would have on Fish and Wildlife Coordination Act wildlife resources.

5.2 Biological Assessment for Marine Species

Based upon its review of the Biological Assessment for Marine Species (**Attachment 2**), on April 7, 2025, MassDOT received a letter of concurrence from Jennifer Anderson, Assistant Regional Administrator for Protected Resources, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), Greater Atlantic Regional Fisheries Office (NOAA Fisheries). NOAA Fisheries indicated that the proposed action is not likely to adversely affect any NMFS ESA-listed species or designated critical habitat.

5.3 Essential Fish Habitat Assessment and Fish and Wildlife Coordination Act Consultation Worksheet

Based upon its review of the draft Essential Fish Habitat Assessment and Fish and Wildlife Coordination Act Consultation Worksheet (**Attachment 3**), on February 12, 2025, MassDOT received correspondence from Louis A. Chiarella, Assistant Regional Administrator for Habitat and Ecosystem Services, NOAA Fisheries, that the best management practices provided in the EFH Assessment may sufficiently minimize impacts to finfish and shellfish species. NOAA Fisheries provided EFH Conservation Recommendations for anticipated Program impacts to SAV.

MassDOT submitted a final Essential Fish Habitat Assessment and Wildlife Coordination Act Consultation Worksheet on March 6, 2025, incorporating NOAA Fisheries' EFH Conservation Recommendation and proposing an approach to compensatory mitigation of affected SAV. On March 12, 2025, MassDOT provided written concurrence with NOAA Fisheries' recommendation and committed to measures to avoid, minimize and mitigate impacts to EFH, consistent with NOAA Fisheries' recommendations.

Attachments

- Attachment 1. Biological Assessment for Terrestrial Species and Agency Coordination
- Attachment 2. Biological Assessment for Marine Species and Agency Coordination
- Attachment 3. Essential Fish Habitat Assessment and Fish and Wildlife Coordination Act Consultation Worksheet and Agency Coordination

Attachment 1.

Biological Assessment for Terrestrial Species and Agency Coordination





Cape Cod Bridges Program

Bourne, Massachusetts

Biological Assessment for Terrestrial Species

SUBMITTED TO:
United States Fish and Wildlife Service
Northeast Regional Field Office
300 Westgate Center Drive
Hadley, MA 01035

Submitted April 7, 2025

PROPONENT:
The Massachusetts Department of Transportation
Highway Division
10 Park Plaza
Boston, MA 02116

massDOT
Massachusetts Department of Transportation

Table of Contents

1 Introduction 1
1.1 Federal Nexus 1
1.2 Proposed Action 1
1.2.1 Purpose and Need 3
1.2.2 Foundational Documents 4
1.3 Consultation History 4

2 Program Action Area 5

3 Program Details 6
3.1 Program Milestones 6
3.1.1 Sagamore Bridge 7
3.1.2 Bourne Bridge 7
3.2 Site Preparation 7
3.2.1 Tree Clearing 7
3.2.2 Individual Structure Removal 8
3.3 In-Water Construction Methods 8
3.3.1 Temporary Works 9
3.3.2 Dredging 9
3.3.3 New Bridge Construction 9
3.3.4 Existing Bridge Demolition 10
3.4 Traffic Management and Interchange Approach Construction Phasing 10
3.4.1 Sagamore Bridge 10
3.4.2 Bourne Bridge 11
3.4.3 Interchange Approaches 11
3.4.4 Pedestrian and Bicycle Connections 12
3.5 Terrestrial Site Maintenance and Restoration 12
3.6 Program Timeline and Duration 12

4 Federally Listed and Proposed Species 13
4.1 ESA-Listed and Proposed Mammals 13
4.1.1 Northern Long-eared Bat 13
4.1.2 Tricolored Bat 14
4.2 ESA-Listed Reptiles 15
4.2.1 Northern Red-Bellied Cooter 15
4.3 ESA-Listed Plants 16
4.3.1 Sandplain Gerardia 16
4.4 ESA-Proposed Insects 16
4.4.1 Monarch Butterfly 16

5 Environmental Baseline 17

5.1 Bats in the Action Area 17
5.2 Monarch Butterfly in the Action Area 19
6 Conservation and Mitigation Measures 19
7 Effects Analysis 20
7.1 Habitat Alteration 20
7.1.1 Northern Long-eared Bat 20
7.1.2 Tricolored Bat 21
7.1.3 Monarch Butterfly 22
7.2 Effect Determinations for Listed and Proposed Species 23
8 References 24

Figures

Figure 1-1. Cape Cod Bridges Program Action Area 30
Figure 1-2. Approximate Tree Clearing Within Sagamore Bridge Portion of Action Area 31
Figure 1-3. Approximate Tree Clearing Within Bourne Bridge Portion of Action Area 32
Figure 2-1. 2020 Sagamore Bridge Acoustic Survey Locations and Tricolored Bat Detection Locations 34
Figure 2-2. 2020 Bourne Bridge Acoustic Survey Locations and Tricolored Bat Detection Locations 35
Figure 2-3. 2023 and 2024 Bridge and Culvert Inspection Survey Locations 36

Tables

Table 1. Description of Design Parameters of the Recommended Build Alternative 2

Attachments

Attachment 1 – Action Area Figures 29
Attachment 2 – Bat Survey Maps 33
Attachment 3 – IPAC Species List and Determination Key Results 37

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
BA	Biological Assessment
BMP	best management practice
CCAA	Candidate Conservation Agreement with Assurances
CFR	Code of Federal Regulations
DEIS/DEIR	Draft Environmental Impact Statement/Draft Environmental Impact Report
DKey	Determination Key
EA	Environmental Assessment
EOS	Enhancement of Survival
ESA	U.S. Endangered Species Act of 1973
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FR	Federal Register
IPaC	Information for Planning and Consultation
MassDOT	Massachusetts Department of Transportation
MEPA	Massachusetts Environmental Policy Act
MRER	Major Rehabilitation Evaluation Report
NLEB	northern long-eared bat
NOAA Fisheries	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
Program	Cape Cod Bridges Program
TCB	tricolored bat
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

1 Introduction

The Cape Cod Bridges Program (Program) Biological Assessment (BA) for Terrestrial Species (i.e., species under the jurisdiction of the U.S. Fish and Wildlife Service [USFWS]) has been prepared by the Federal Highway Administration (FHWA) and the Massachusetts Department of Transportation – Highway Division (MassDOT) in accordance with Section 7 of the Endangered Species Act of 1973 (16 United States Code [USC] 1531 et seq.; ESA) and implementing regulations (50 Code of Federal Regulations [CFR] part 402).

Section 7 of the ESA requires federal agencies to ensure, through consultation with the USFWS and/or the National Marine Fisheries Service (NOAA Fisheries), that federal actions are not likely to jeopardize the continued existence of any threatened, endangered, or proposed species or result in the destruction or adverse modification of designated or proposed critical habitat. A separate BA has been prepared to address the potential effects of the Program on aquatic species under the jurisdiction of NOAA Fisheries.

1.1 Federal Nexus

The Bourne and Sagamore bridges, which connect Cape Cod to mainland Massachusetts over the Cape Cod Canal, were opened to traffic in 1935 and are owned and operated by the U.S. Army Corps of Engineers (USACE). The proposed Program would be funded, in part, by FHWA and permitted by the USACE – New England District, the U.S. Coast Guard – First District, and the U.S. Environmental Protection Agency – New England Regional Office. In addition to satisfying the USFWS consultation and conferencing requirements under Section 7 of the ESA, this BA may also be considered by the USFWS in support of its evaluation under the Fish and Wildlife Coordination Act (16 USC 2901–2911).

1.2 Proposed Action

The Proposed Action is the Cape Cod Bridges Program Build Alternative, which incorporates the USACE Major Rehabilitation Evaluation Report/Environmental Assessment (MRER/EA) Preferred Alternative of Replacement of Both Highway Bridges with New Bridges with Four Through-Traffic Lanes and Two Auxiliary Lanes (In-Kind Bridge Replacement updated to comply with federal and state highway and design safety standards). The Program proposes to replace the Bourne and Sagamore highway bridges with parallel, twin tied-arch structures supported by delta frames with an approximate 700-foot mainline span length. The replacement bridges will maintain the existing vertical clearance of 135 feet above mean high water and provide a minimum of 500 feet of horizontal channel width consistent with existing conditions. The bridge piers will be located at the waterline adjacent to the Canal Service Roads, within the riprap slope. The pier footprints will be partially above and partially below the high tide line, and some portions will extend below the mean low water line into the subtidal zone. At both the Bourne and Sagamore crossings, the replacement bridge mainline alignment location will be fully offline (outside the footprint of the existing bridge) and inboard of the existing highway bridges, located on the side of the canal between the existing Bourne Bridge and Sagamore Bridge. The twin

deck structures will be approximately 10 feet apart and parallel to each other; each main span will include two through-traffic lanes, one auxiliary lane, and shoulders and barriers in compliance with current MassDOT and FHWA standards and guidelines for highway and bridge design. Additionally, at both canal crossings, the Program will include a reconfiguration of the highway interchange approach networks north and south of Cape Cod Canal to align with the replacement highway bridges. The replacement highway bridges and their interchange approaches will accommodate shared use pedestrian and bicycle paths that connect to the local roadway network on both sides of Cape Cod Canal in the town of Bourne. The project limits for the Program's two proposed bridge replacements are shown in Attachment 1, Figure 1-1.

Table 1 presents a description of the Program elements/design parameters of the recommended Build Alternative: Replacement Highway Bridges Built to Modern Design Standards.

Table 1. Description of Design Parameters of the Recommended Build Alternative

Program Element/Program Design Parameter	Description
Highway Bridges	Replacement of both highway bridges with new bridges with four through-traffic lanes and two auxiliary lanes (In-Kind Bridge Replacement, updated to comply with federal and state highway and design safety standards).
Highway Bridge Cross-Section and Shared Use Path	Each replacement highway bridge would provide four 12-foot-wide through travel lanes (two in each direction), two 12-foot-wide entrance/exit (auxiliary) lanes, a 4-foot-wide left shoulder, and a 10-foot-wide right shoulder. Right and left barriers would be offset an additional 2 feet beyond the limits of the shoulders. Each crossing location would include one bi-directional pedestrian and bicycle shared-use path, separated from vehicular traffic by the shoulder and barrier. The usable width of the shared-use path would be 14 feet wide on the bridge main spans, 20 feet wide on the interchange approaches, and 12 feet wide on the connecting roadways.
Bridge Clearances	The replacement bridges would maintain the existing vertical clearance of 135 feet above mean high water and account for 3 feet of future sea level rise, for a total vertical clearance of 138 feet above mean high water. The replacement bridges would provide a minimum of 500 feet of horizontal channel width to be consistent with existing conditions.
Main Span Length and Bridge Pier Location	The replacement bridges would have a main span length of approximately 700 feet, which would locate the bridge piers at the waterline adjacent to the service road (shoreline piers), into the riprap slope but above the low tide line.

Program Element/Program Design Parameter	Description
Bridge Deck Configuration	Each crossing (Bourne and Sagamore) would have two separate decks (twin structures).
Mainline Alignment	The mainline alignment locations at both crossings would be offline inboard. Both spans of the replacement highway bridge would be located outside the footprint of the existing bridge, approximately 10 feet apart and parallel to each other, and on the side of the canal between the existing bridges. The replacement main spans at the Bourne crossing would be east of Bourne Bridge toward Cape Cod Bay. The replacement main span at the Sagamore crossing would be west of Sagamore Bridge toward Buzzards Bay.
Bridge Type	The replacement bridges would be twin tied-arch bridges with delta frames supporting an approximate 600-foot arch and 700-foot mainline span.
Interchange Approach Network	Interchange approach improvements at each crossing would be as follows: • Sagamore Crossing: Direct Connection to State Road in Sagamore North and Westbound On-Ramp under U.S. Route 6 with Cranberry Highway Extension and Sandwich Road Connector in Sagamore South • Bourne Crossing: Directional Interchange in Bourne North and Diamond Interchange in Bourne South

1.2.1 Purpose and Need

The purpose of the Program is to improve cross-canal mobility and accessibility between Cape Cod and mainland Massachusetts for all road users and to address the increasing maintenance needs and functional obsolescence of the aging Cape Cod Canal highway bridges. The Program is needed to address the following transportation deficiencies:

- Address the deteriorating structural condition and escalating maintenance demands of the Cape Cod Canal highway bridges;
- Address the substandard design elements of the Cape Cod Canal highway bridges, the immediate mainline approaches, and their adjacent interchanges and intersections;
- Improve vehicular traffic operations; and
- Improve accommodations for pedestrians and bicyclists.

1.2.2 Foundational Documents

In accordance with 23 USC 139(f)(4)(E)(ii) and 40 CFR 1501.12, the Program builds upon and references prior, multi-year foundational studies, including:

1. the MassDOT Office of Transportation Planning Cape Cod Canal Transportation Study, which was completed to identify and evaluate existing and future multimodal transportation deficiencies and needs of the existing roadway network around the Cape Cod Canal area; and
2. the USACE Cape Cod Canal Highway Bridges MRER, which was completed to evaluate the current condition of the bridges and determine whether standard operation and maintenance, major rehabilitation, or replacement of either or both bridges would provide the most reliable, fiscally responsible solution for providing long-term vehicular access across Cape Cod Canal.

In coordination with FHWA, MassDOT conducted an independent conceptual screening of the twelve alternatives presented by the USACE in the MRER/EA. MassDOT determined that replacing both bridges with two new adjacent bridges at each crossing location, each providing two through traffic lanes and an auxiliary lane in each direction and built to current design standards, would meet the identified Program Needs to address the escalating bridge maintenance demands and improve traffic operations and accommodations for pedestrians and bicyclists. Based on its ability to fully meet the Program Needs, MassDOT recommended advancing the Four Travel Lanes and Two Auxiliary Lanes Replacement Alternative (Replacement Highway Bridges Built to Modern Design Standards) as presented in the MRER/EA for further consideration. MassDOT's recommendation for Replacement Highway Bridges Built to Modern Design Standards, which concurs with the USACE's Preferred Alternative, was the basis for assessing the Cape Cod Bridges Program design parameters.

1.3 Consultation History

As previously noted, the Program incorporates the USACE Cape Cod Canal Highway Bridges MRER/EA, completed through the issuance of a Finding of No Significant Impact (FONSI), on March 29, 2022. In the MRER/EA, the USACE determined that replacement of the Cape Cod Canal Highway Bridges would have *no effect* to federally listed species whose ranges overlap the Program area, with the exception of the northern long-eared bat (NLEB; *Myotis septentrionalis*) (USACE 2022; Chapman 2019).[1] In its review of the draft MRER/EA, dated November 5, 2019, the USFWS acknowledged that because the USACE's proposed action would largely occur within the footprint of existing developed land, it would be unlikely to have substantial impacts on wildlife or their habitat. Further in the same letter, the USFWS acknowledged the USACE's determination of *no effect* to federally listed species (except the NLEB), including the northern red-bellied cooter (and its now former subspecies, the Plymouth red-bellied

[1] The species listed in the MRER/EA (including USFWS review) as having ranges that overlap the Program area included NLEB, piping plover (*Charadrius melodus*), red knot (*Calidris canutus*), northern red-bellied cooter (*Pseudemys rubriventris*) / Plymouth red-bellied turtle (*Pseudemys rubriventris bangsi*), American chaffseed (*Schwalbea americano*), and roseate tern (*Sterna dougallii dougallii*). The range of the sandplain gerardia (*Agalinis acuta*) was determined to not overlap the Program area.

turtle), American chaffseed, piping plover, red knot, and roseate tern, regardless of the final alternative selected and subsequent design (Chapman 2019). However, the USFWS encouraged the USACE to consider listed and other high priority species during planning and implementation and to pursue any design elements that would minimize impacts and/or provide beneficial impacts to these species or their habitats.

MassDOT is continuing coordination initiated in 2019 by the USACE. Cooperating agency coordination for this phase of the proposed action began in early 2023, soon after FHWA agreed to be the lead Federal Agency for the Program, as requested by MassDOT. An initial meeting with the USFWS was held on April 21, 2023; the USFWS acknowledged that NLEB and tricolored bat (TCB; *Perimyotis subflavus*) were the ESA species that the Program has the potential to affect. Cooperating Agencies meetings, including additional federal and state stakeholders, for the Program were held on the following dates: June 14 and October 17, 2023, and March 29, June 27, and December 4, 2024. These meetings resulted in no changes to the ESA-listed species to be considered for analysis of potential effects. An official species list was obtained through the USFWS Information for Planning and Consultation (IPaC) on September 7, 2024 (Project Code 2024-0141024; Attachment 3).

On September 13, 2024, MassDOT met with the USFWS to evaluate the NLEB and TCB Determination Key (DKey) and associated IPaC review as part of the Section 7 consultation process. The DKey indicated that the Program is outside the scope of the USFWS' and FHWA's *Programmatic Biological Opinion for Transportation Projects in the Range of the Indiana Bat and Northern Long-Eared Bat,* because the Program is anticipated to exceed the maximum allowable clearing limit, defined as clearing of no more than 20 acres of suitable habitat per 5-mile section of road (Attachment 3).

As a result, the Program is pursuing a consultation for NLEB and conference for TCB. On December 12, 2024, the USFWS proposed to list the monarch butterfly (*Danaus plexippus*) as threatened under the ESA. Therefore, the Program is also pursuing a conference for the monarch butterfly herein.[2]

2 Program Action Area

The Action Area is defined under the ESA as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.2). The Action Area includes the Program footprint where work will occur to remove the existing bridges and construct the new bridges, bridge approaches, highway interchange approaches at the four bridge quadrants (Bourne North, Bourne South, Sagamore North and Sagamore South), and pedestrian/ bicycle shared-use paths. The Program Action Area extends across two discrete habitat types: aquatic and terrestrial.

[2] The tricolored bat is proposed for listing as endangered under the ESA; likewise, the monarch butterfly is proposed for listing as threatened under the ESA. Therefore, these species are included for analysis in this BA to enable a conference with the USFWS for determination of potential effects per 50 CFR § 402.10, in coordination with the ESA Section 7 consultation.

The Action Area encompasses the Project Limits, which comprise the construction footprints of the existing and proposed Bourne and Sagamore bridges, the interchange approach networks for the highway bridges, and shared-use paths, and their surrounding areas of disturbance. In addition, the Action Area extends to include the Cape Cod Canal connecting Buzzards Bay in the southwest and Cape Cod Bay in the northeast (Attachment 1, Figure 1-1), as well as the notional routes of Program vessels to and from potential ports (not shown on Figure 1-1).

The Action Area surrounding the Bourne Bridge includes the Route 25 and Route 28 approaches to the Bourne Bridge. North of Cape Cod Canal, roadways include Route 6 (Scenic Highway) and the roadways approaching Belmont Circle, including the Route 25 exit and entrance ramps and portions of the Head of the Bay Road, Main Street, and the Buzzards Bay Bypass. South of the canal, roadways include the Bourne Rotary and approach roadways including Route 28, Sandwich Road, and Trowbridge Road, Veterans Way, and the Bourne Rotary Connector. The Bourne Project Limits also includes the existing pedestrian/bicycle network, provided as off-road trails or on-road accommodations at the bridge site and along the roadways north and south of the canal.

The Action Area surrounding the Sagamore Bridge includes the Route 3 and Route 6 approaches to the Sagamore Bridge. North of Cape Cod Canal (Sagamore North), roadways include the Scenic Highway and Meetinghouse Road approaches, the Route 3/Scenic Highway interchange, and portions of Canal Street and State Road. South of the canal (Sagamore South), roadways include Cranberry Highway and Sandwich Road and Route 6 itself extending south of the Mid-Cape Connector ramps to Route 6. The Sagamore Project Limits also includes the existing pedestrian/bicycle network, provided as off-road trails or on-road accommodations at the bridge site and along the roadways north and south of the canal.

3 Program Details

This section presents an overview of the Program construction relative to potential impacts to species under the jurisdiction of the USFWS, including in-water construction activities. MassDOT has evaluated a range of potential construction scenarios with a construction specialist. MassDOT expects to contract the Program as a Design Build; therefore, the Design Build contractor could propose different means and methods to construct the Program. This BA assesses the potential impacts of the Program based on the currently proposed design to the best of FHWA's knowledge.

3.1 Program Milestones

The replacement bridges will be constructed offline (outside of the existing footprint) and approximately 100 feet inboard of the existing highway bridges. The Sagamore Bridge will be replaced first, followed by the Bourne Bridge. At each site, the inboard main span (inboard bridge) will be constructed first. At the Sagamore Bridge site, this will be the western-most bridge, which will ultimately carry southbound traffic onto Cape Cod. For the Bourne Bridge site, this will be the eastern-most bridge, which will ultimately carry northbound traffic off Cape Cod. After construction of the first

new span, all traffic will be shifted onto it so the existing bridge can be demolished, and the second main span (bridge) can be constructed.

3.1.1 Sagamore Bridge

There are four key milestones for the Sagamore Bridge and interchange network phasing:

- Construct new eastbound mainline and approaches, shift all eastbound and westbound traffic off the existing bridge and onto the new eastbound mainline structure;
- Demolish existing bridge;
- Construct new westbound mainline and highway interchange network approaches, open all westbound traffic to proposed westbound mainline; and
- Open connections to proposed Shared Use Path over the canal and supporting path network.

3.1.2 Bourne Bridge

There are four key milestones for the Bourne Bridge and interchange network phasing:

- Construct new northbound mainline and approaches, shift all northbound and southbound traffic off the existing bridge and onto the new northbound mainline structure;
- Demolish existing bridge;
- Construct new southbound mainline and approaches, open all southbound traffic to proposed southbound mainline; and
- Open connections to proposed Shared Use Path over the canal and supporting path network.

3.2 Site Preparation

3.2.1 Tree Clearing

Tree clearing will be conducted as an initial construction activity consistent with conservation measures listed below. Attachment 1, Figures 1-2 and 1-3, present the approximate areas of proposed tree clearing within the Program limits. Tree clearing will be required for bridge construction and laydown, roadway and shared use path construction, highway and ramp widening, construction of stormwater management basins, and embankment and slope construction. The total approximate acreage of tree removal will be 107.8 acres, divided among for the Program's quadrants as follows:

- Sagamore North: 29.1 acres
- Sagamore South: 16.5 acres
- Bourne North: 21.3 acres
- Bourne South: 40.9 acres

MassDOT will utilize its standard specifications to conduct tree removal, including Clearing and Grubbing, Tree Trimming, Tree Removal, and Stump Removal. In preparation for tree removal, an arborist will develop a tree removal plan. The plan will include inspecting the area of trees to determine the safest option for tree removal, e.g., identifying where trunks fall and options for lowering trees via rope, crane, or bucket, and identifying how tree pieces will be hauled out after cutting to avoid damaging trees that are outside of the designated cut area. When possible, tree removal by climbing is preferred. Tree removal will include removal of all brush, trees, stumps, and roots within the designated area, including dead, dying, and diseased trees and previously fallen trees, branches, uprooted stumps, and other debris. Tree removal equipment can vary based on the size of the area required to be cleared, the terrain type, ease of access, density of vegetation and timeline; however, the following equipment may be used:

- Versatile equipment, such as excavators, bulldozers, skid steer loaders, tractors, and backhoes that can clear land;
- Specialized equipment, such as stump grinders, brush mowers, and string trimmers;
- Mulchers to clear underbrush, small trees, and leftover fencing; mulching attachments can be used with machines like tractors, skid steers, and excavators; and
- Skyline systems, consisting of a series of cables that extract logs out of the forest floor with minimal disturbance to the soil; typically conducted via a helicopter.

3.2.2 Individual Structure Removal

To demolish the existing bridges and construct the new bridges, including the realignment of the mainlines, MassDOT will be acquiring properties and demolishing existing structures. Up to 17 structures are anticipated to be demolished within the Project Limits. The Program will follow Massachusetts Division of Fisheries and Wildlife guidance (MassWildlife 2020) for developing exclusionary measures to ensuring that bats are not present in, or are removed from, the structures and bridge abutments. Prior to structure demolition, building inspections will be conducted and any wildlife found inhabiting them will be removed, as needed, taking measures to avoid harming the individual creatures.

3.3 In-Water Construction Methods

The piers of the new bridges will be constructed within and above the intertidal zone with delta frames that cantilever above the canal. The 600-foot main arch spans of each new bridge will be floated in on barges and raised into place in one piece. Likewise, the main spans of the existing bridges are expected to be lowered in one piece onto construction barges and floated out of the canal. Therefore, long-term in-water construction at both bridge locations will only occur along the shorelines and outside of the navigation channel of the Cape Cod Canal. Float-in and float-out activities will have a larger footprint but will be short in duration.

In each quadrant, in-water construction will be conducted in multiple phases. Work will begin with the temporary installation of supportive or mitigative structures—such as trestles, cofferdams, bulkheads,

bollards, docks, and dolphins—and shoreline riprap removal and dredging to prepare for barge use and construction of the first bridge. This will be followed by construction of the first bridge. After construction of the first bridge, the temporary works enabling demolition will be installed; these are anticipated to include trestles, containment cells, dolphins, and other items similar to the temporary works for bridge construction. Demolition of the existing bridge and piers will occur once the enabling temporary works are in place. Following demolition, additional temporary works to support the construction of the second bridge will be installed; these will be similar in nature to those used for construction of the first bridge. Construction of the second bridge will occur once the temporary works that enable it are in place. Lastly, removal of temporary structures, and restoration of intertidal and subtidal fill/riprap will conclude the in-water construction portion of the Program.

3.3.1 Temporary Works

In preparation for bridge construction and demolition, MassDOT and FHWA propose to remove existing shoreline riprap to allow for installation of sheeting and piles that are needed for the temporary works. The temporary works within each quadrant may include cofferdams constructed of sheeting around the proposed new bridge pier locations; containment cells constructed of sheeting around the demolition zone of the existing bridge piers; sheeting along the approximate high tide line to create upland work areas; sheeting below the high tide line to create a bulkhead for contractor use; docks constructed of sheeting and fill for mooring construction barges; pipe pile-supported trestles to support construction and demolition of the new and existing bridge piers, respectively; and pile-supported dolphins to assist with construction vessel mooring. Pipe piles may be installed in key locations to support the cofferdams surrounding the existing and proposed bridge piers. The shoreline and bulkhead sheeting structures may be reinforced with tiebacks through the sheeting and into land. Riprap may be temporarily placed at the base of the construction trestles to protect them from scour during construction.

3.3.2 Dredging

In-water dredging may be required along the toes of the bulkheads and between the docks to provide sufficient draft for vessels to approach the bulkheads and moor at the docks. Dredging may be conducted using cutterhead suction dredges or clamshell excavation dredges. Temporary fill may be placed between the shoreline and bulkhead sheeting to create the bulkhead and within the dock sheeting to complete the docks. The cofferdams for construction of the new bridge piers are expected be excavated in-the-wet prior to sealing. The cofferdams will subsequently be dewatered prior to pier construction. Water pumped from the cofferdams will be maintained in settling basins prior to being pumped back into the canal.

3.3.3 New Bridge Construction

Each quadrant will have two new permanent canal-side pier structures (eight piers total for the full Program) installed in the intertidal and supratidal riprap zones of each bank. The foundations of each pier are envisioned to consist of eight drilled shafts with steel casings filled with reinforced concrete. Construction of the new bridge piers may be conducted from floating shoreline barges moored to the

temporary dolphins, from land, or from a temporary trestle over the footing and cofferdam. All work on the pier foundations and footings will be contained within the temporary cofferdams. The steel delta frames atop the bridge piers will be erected on site using cranes on work trestles or cranes on land abutting the canal. Once the delta frames are ready to receive them, the main span bridge arches will be floated in and permanently installed over the canal using construction barges over the course of approximately three to five days per bridge. The float-in of the main span arches will require full closure of the Cape Cod Canal throughout the duration of the operation and cannot be halted or paused once commenced. After bridge construction is complete, riprap will be placed on the three waterward sides of the pier bases for protection.

3.3.4 Existing Bridge Demolition

The main spans of the existing bridges are proposed to be cut and lowered onto barges, similar to the float-out process. The lowering and float-out process will occur over the course of approximately three to five days per bridge. The float out will require full closure of the Cape Cod Canal and cannot be halted or paused once commenced.

The existing two concrete pier columns in the intertidal and/or subtidal zones of each quadrant (eight columns program-wide) will be enclosed by a containment cell and demolished into the containment cell. Demolition of the above-water portions of the existing bridge piers may entail cutting or hoe-ramming. Demolition of the bases of the existing concrete bridge piers may include saw-cutting, hoe-ramming, and excavation of the canal bottom to expose the pier base. Demolition will be controlled to minimize debris falling into the canal outside the containment cell. Some demolished materials may be lifted away by crane, and some may be reduced to rubble in the containment cell. Rubble is envisioned to be removed from the containment cell in the wet. The footprints of the existing piers will be restored to the surrounding canal bottom habitat.

3.4 Traffic Management and Interchange Approach Construction Phasing

3.4.1 Sagamore Bridge

To enable the demolition of the existing Sagamore Bridge and construction of the eastbound mainline bridge, all traffic will be shifted onto the proposed westbound mainline built in the preliminary phases. To do this, a combination of temporary crossovers and pavement widening is needed while also maintaining two lanes of traffic in the eastbound and westbound directions. Furthermore, when traffic is on the proposed eastbound mainline structure, the typical section needs to be reduced to two 11-foot lanes in each direction, with two 2-foot shoulders, separated by a temporary median barrier. While all traffic is on this eastbound structure, demolition of the existing bridge and construction of the proposed westbound mainline bridge can occur without conflicts.

3.4.2 Bourne Bridge

To enable the demolition of the existing Bourne Bridge and construction of the southbound mainline bridge, all traffic will be shifted onto the proposed northbound mainline built in the preliminary phases. To do this, a combination of temporary crossovers and pavement widening is needed while also maintaining two lanes of traffic in the northbound and southbound direction. Furthermore, when traffic is on the proposed northbound mainline structure, the typical section needs to be reduced to two 11-foot lanes in each direction, with no shoulder, and separated by a temporary median barrier. This section allows the space for four lanes of traffic and the temporary pedestrian path. While all traffic is on this northbound structure, demolition of the existing bridge and construction of the proposed southbound mainline bridge can occur without conflicts.

3.4.3 Interchange Approaches

The following provides a general approach to construction phasing for Sagamore North, Sagamore South, Bourne North, and Bourne South based on preliminary design. For each quadrant, early action work would include the following: right-of-way takings; mobilization; establishment of lay down areas; utility relocations (including electric, sewer, potable water, gas, and telecommunications); and construction of temporary shared use path connections (where needed), consisting of a minimum 6-foot sidewalk for temporary multimodal access.

Both the Sagamore North quadrant and the Sagamore South quadrant have eleven construction phases. In Phase 1, existing traffic patterns would be maintained, with a potential one-lane traffic and minor lane or shoulder closings at specific locations. Phases 2 through 11 would require revised traffic patterns. For both quadrants, milestone construction points would be reached at the end of Phase 4 and Phase 8. At the end of Phase 4, the U.S. Route 6 eastbound bridge over Cape Cod Canal including approaches must be completed. At the end of Phase 8, the U.S. Route 6 westbound bridge over Cape Cod Canal, including approaches, must be completed. Phases 10 and 11 consist of construction closeout and construction completion.

Five construction phases are proposed for the Bourne North quadrant. In Phase 1, existing traffic patterns would be maintained; lane or shoulder closures may be required on some roadways. Phases 2 through 5 would require revised traffic patterns. Milestone construction points would be reached at the end of Phases 3, 4, and 5. At the end of Phase 3, the northbound mainline would be open and the northbound on-ramp from U.S. Route 6 would be open. At the end of Phase 4, the southbound off-ramp to U.S. Route 6 would be open. At the end of Phase 5, the southbound mainline structure would be open with the final traffic patterns.

Seven construction phases are proposed for the Bourne South quadrant. In Phase 1, existing traffic patterns would be maintained; lane or shoulder closures may be required on some roadways. In Phase 2, existing traffic patterns would be maintained, with some exceptions; lane or shoulder closures may be required on some roadways. Phases 3 through 6 would require revised traffic patterns. Milestone construction points would be reached at the end of Phase 3 and Phase 5. At the end of Phase 3, the northbound mainline would be open. At the end of Phase 5, the southbound mainline would be open. Construction would be completed with the final traffic patterns in Phase 7.

3.4.4 Pedestrian and Bicycle Connections

Maintaining pedestrian and bicycle connectivity during construction is a priority. The phasing for pedestrian and bicycle connectivity has been sequenced to maintain the existing condition until a time when pedestrian and bicycle traffic can be transferred to the proposed bridge. Temporary connections may be required from the new bridge and approach paths to allow pedestrians to travel to and from either side of the canal just as they do in the existing condition. The existing bridge will not be demolished until these temporary and/or new connections to the new bridge is completed.

3.5 Terrestrial Site Maintenance and Restoration

Throughout the duration of construction, MassDOT will incorporate mitigation measures into the Program to minimize adverse effects of land-based disturbance through permits, special provisions, and guidance documents, as well as the MassDOT *Standard Specifications for Highways and Bridges* (MassDOT 2024).

The Program's Construction Stormwater General Permit will contain multiple measures to reduce adverse effects from construction, including, among other control measures, the requirement to stabilize disturbed areas immediately when construction has ceased and will not resume for more than 14 days.

For trees that will not be cleared, MassDOT has issued extensive guidance for tree preservation, including plant protection fencing for public places and staging or other construction activity near desirable vegetation. As applicable, MassDOT will utilize plant protection fencing to minimize impacts to visual natural resources.

Following completion of the land-based construction activities, acquired areas that are not used for the State Highway Layout will be restored to pre-existing conditions to the maximum extent practicable. There will be instances where site restoration could occur following completion of that specific phase of the Program, such as Trowbridge Road and the new entrance to the Upper Cape Regional Technical High School in Bourne South, where the proposed construction will be off-line.

3.6 Program Timeline and Duration

Pending the completion of National Environmental Policy Act environmental reviews and receipt of federal and state permits and approvals, anticipated in spring 2026, MassDOT proposes to initiate the Program's design-build procurement and construction process in fall 2026. Construction activities for replacement Sagamore and Bourne Bridges are expected to occur over eight to ten years, respectively. Construction of replacement Sagamore Bridge will begin first, followed by replacement Bourne Bridge once funding is secured. Bourne Bridge construction would commence one year following commencement of Sagamore Bridge construction. However, timing of construction sequencing depends on funding.

4 Federally Listed and Proposed Species

The Program Action Area occurs in areas that overlap with the ranges of ESA-listed and ESA-proposed species under the jurisdiction of USFWS as listed below:

- Mammals
  - Northern long-eared bat (*Myotis septentrionalis*) (80 Federal Register (FR) 17974 and 87 FR 73488)
  - Tricolored bat (*Perimyotis subflavus*) (87 FR 56381-56393)
- Reptiles
  - Northern red-bellied cooter (*Pseudemys rubriventris*) / Plymouth red-bellied turtle (*Pseudemys rubriventris bangsi*) (45 FR 21828-21833, 1980; 71 FR 58363-58364, 2006; USFWS 2021a)
- Plants
  - Sandplain gerardia (*Agalinis acuta*) (53 FR 34701)
- Insects
  - Monarch butterfly (*Danaus plexippus*) (89 FR 100662-100716)

4.1 ESA-Listed and Proposed Mammals

4.1.1 Northern Long-eared Bat

On April 2, 2015, the USFWS published a Final Rule in the *Federal Register* (80 FR 17974) listing the NLEB as a threatened species under the ESA throughout its geographic range, which includes Massachusetts. On November 30, 2022, the USFWS published a Final Rule reclassifying the NLEB as endangered (87 FR 73488), and the listing became effective on January 30, 2023. Critical habitat has not been designated for this species. The NLEB is currently listed as endangered in the Massachusetts. Listed species in Massachusetts are protected under the Massachusetts Endangered Species Act (M.G.L. c. 131A).

White-nose syndrome is the predominant threat to NLEB, and populations have declined by 97 to 100% across the species' range based on hibernacula counts (USFWS n.d.-a). Other threats to NLEB include wind energy-related mortality, habitat loss, human disturbance during hibernation, pesticide use, and climate change (CBD n.d.-a; USFWS n.d.-a).

The NLEB is distinguished by its long ears, especially when compared to other *Myotis* species. It is a medium-sized bat of approximately 3 to 3.7 inches, with a wingspan of 9 to 10 inches. The fur color ranges from medium to dark brown on the back and tawny to pale brown on the underside (USFWS n.d.-a).

The NLEB is known to use a wide variety of forested habitats for roosting, foraging, and traveling and may also utilize some adjacent and interspersed non-forested habitat such as emergent wetlands and

edges of fields. This species also has been found roosting in structures such as barns and sheds, particularly when suitable roost trees are unavailable. Roosting habitat includes forested areas with live trees and/or snags with a diameter at breast height of at least 3 inches with exfoliating bark, cracks, crevices, and/or other cavities. Trees are considered suitable roost trees if they meet those requirements and are located within 1,000 feet of another suitable roost tree, woodlot, or wooded fencerow (USFWS 2024b).

Winter habitat, or hibernacula, for this species includes underground caves and cave-like structures, such as abandoned or active mines and railroad tunnels. These hibernacula typically have high humidity, minimal air current, large passages with cracks and crevices for roosting, and maintain a relatively cool temperature (0–9° C) (USFWS 2014).

This species breeds in late summer and early fall when large numbers of bats congregate in and near the entrances of caves and mines. Females store sperm during hibernation, and the gestation period ranges between 50 and 60 days. Females give birth to one pup the following spring.

The NLEB is a generalist predator of aerial invertebrates (CBD 2010). Individuals typically emerge at dusk to forage in upland and lowland woodlots and tree-lined corridors, feeding on insects, including moths, flies, leafhoppers, caddisflies, and beetles, which they glean or catch while in flight using echolocation (USFWS 2014). This bat also feeds by gleaning motionless insects from vegetation and water surfaces.

4.1.2 Tricolored Bat

On September 14, 2022, USFWS proposed to list TCB as an endangered species under the ESA throughout its geographic range, which includes Massachusetts (87 FR 56381-56393; USFWS 2022); the USFWS has not yet issued a Final Rule listing for the species. Critical habitat has not been proposed for this species at this time.

Like NLEB, the primary threat to TCB is white-nose syndrome, which has resulted in 90 to 100% declines in TCB winter colony abundance at sites impacted by the disease (USFWS n.d.-b). Other threats include wind energy-related mortality, human disturbance at hibernation and roost sites, habitat loss, pesticide use, and climate change (CBD n.d.-b).

TCB is a small bat species, with an average length of 3.0 to 3.5 inches and weight of 0.16 and 0.28 ounces. TCB are pale yellowish-brown in color with each hair exhibiting a tricolored pattern: dark at the tip, lighter in the middle, and dark at the base (USFWS n.d.-b). TCB's forearms are pink, and hair on its belly is lighter than that on its back. The tragus, a fleshy projection in front of the ear canal, is short and blunt. Its ears are small, and the calcar, or modified toe that supports the tail membrane, is not keeled (Reid 2006).

TCB migrate seasonally between mines and caves in the winter to suitable summer habitat of forests, artificial structures, and open areas (Fujita and Kunz 1984; Perry and Thill 2007). During non-hibernation seasons (spring, summer, and fall), individuals roost among leaf clusters of live or recently dead deciduous hardwood trees (USFWS n.d.-b). This species often forages in patches adjacent to roosting habitat, including forest, fields, and over water (Fujita and Kunz 1984).

Once considered common, TCB are widely distributed in the Northeast, but the population is declining (USFWS n.d.-b). They are believed to be short distance, regional migrants who move from site to site in any direction, moving from hibernation sites to summer sites and between swarming and mating sites. Recently, researchers found that at least some individuals of both sexes also participate in latitudinal migration, but it is more common in males than in females (Fraser et al. 2012).

This species mates in the fall, hibernates in the winter, emerges in the spring, and forms maternity colonies in the summer where the young are born (USFWS n.d.-b). Large numbers of male and female bats congregate in and near the entrances of caves and mines between mid-August and mid-October to mate. Adult females can store sperm in their uterus during the winter with fertilization occurring soon after spring emergence (USFWS n.d.-b).

4.2 ESA-Listed Reptiles

4.2.1 Northern Red-Bellied Cooter

Northern red-bellied cooter, formerly known as Plymouth red-bellied turtle, is federally and stated-listed as endangered. In Massachusetts, this species primarily occurs in coastal plain ponds, river systems, cranberry bogs, and other wetlands in the seaboard lowland section of the New England physiographic province (USFWS 2021a). The USFWS describes their habitat as wetland areas such as "marshes or swamps that are covered often intermittently with shallow water or have soil saturated with moisture (USFWS 2024a)." They rely on aquatic habitats for foraging, basking, and overwintering and require nearby unforested, upland habitats with well-drained soils in proximity to aquatic habitat for nesting (USFWS 2021a). In addition to the need for suitable nesting habitat, northern red-bellied cooters utilize upland habitat to move between aquatic habitats. Female turtles also require adequate upland connectivity between aquatic habitat and suitable nest sites (USFWS 2021a).

Currently, their occurrences are limited to ponds and rivers within Plymouth and eastern Bristol counties—primarily freshwater systems with abundant aquatic vegetation and basking habitat such as vegetation mats, rocks, and logs—and adjacent upland that is open, sparsely vegetated, and well-drained with sandy soils for use as nesting habitat (NHESP 2016). According to the USFWS, most of the known occurrences of northern red-bellied cooters lie within an area bounded by Routes 3, 25, 58, and 44 in Plymouth County (USFWS 2021a), which is outside the Action Area. A current population estimate for this entire area does not exist, but many ponds (Billington Sea Complex, Crooked Pond, East Head Pond Complex, Federal Pond, Great South Complex, Island Pond, Halfway Pond Complex, Sampsons Pond, West Pond Complex, and Wenham Pond) were intensively sampled between 2014 and 2016 and were estimated to have a combined total population of 933 individuals (not including recently released head-started turtles, i.e., those released in 2013–2016) (USFWS 2021a).

Pre-filing consultations with USFWS did not identify concerns for this species in the Action Area (USACE 2019, HNTB 2023). No incidental observations of northern red-bellied cooters were made during the 2020 habitat assessment conducted for the Program (Stantec 2020a).

Given that the Program's Action Area is entirely in Barnstable County, outside of the range of known occurrences of the northern red-bellied cooter, and the lack of suitable habitat for the northern red-

bellied cooter within the Action Area, it is determined that the Program would have *No Effect* on this species. Accordingly, the northern red-bellied cooter will not be analyzed further herein.

4.3 ESA-Listed Plants

4.3.1 Sandplain Gerardia

Sandplain gerardia is federally and stated-listed as endangered. In Massachusetts, it occupies open dry grasslands, including roadsides, pine/oak scrub forest openings, and managed cemeteries with native plant species. It thrives in poor soil conditions and a disturbance regime that provides open areas and low competition conditions (NHESP 2015, USFWS 2024c). The species is often associated with considerable lichen growth and areas of scattered bare soil where little bluestem (*Schizachyrium scoparium*) is present in sandy plains. Sandplain gerardia is a hemiparasite to little bluestem, and it is typically observed with one or more known associated native grassland plant species. Periodic natural or anthropogenic disturbance (e.g., fire, mowing) to suitable sandplain gerardia habitat is important for maintaining appropriate habitat conditions for existing populations.

Pre-filing consultations with USFWS did not identify concerns for the sandplain gerardia in the Program area (USACE 2019, Stantec 2020a, HNTB 2023). The 2020 listed species habitat assessment identified sandplain grassland in the vicinity of the Sagamore Bridge; however, it did not assess the presence of suitable habitat for sandplain gerardia specifically, nor were any incidental observations of this species made while surveying this habitat. The IPaC species list identified sandplain gerardia as potentially occurring within the Action Area; however, in the official IPaC letter dated September 7, 2024 (Project Code 2024-0141024; Attachment 3), the USFWS determined that there are no data to suggest the presence of habitat and/or individuals of this species within the Action Area based on consultation with the Massachusetts Natural Heritage and Endangered Species Program, which conducts annual surveys for state-listed species including the sandplain gerardia. Therefore, it is determined that the Program would have *No Effect* on this species. Accordingly, sandplain gerardia will not be analyzed further herein.

4.4 ESA-Proposed Insects

4.4.1 Monarch Butterfly

On December 12, 2024, USFWS proposed to list the monarch butterfly as a threatened species under the ESA throughout its geographic range, which includes Massachusetts (89 FR 100662-100716; USFWS 2024d); the USFWS has not yet issued a Final Rule. Critical habitat for this species has only been proposed in California.

The eastern North American population of monarch butterfly, which encompasses 70% or more of the species' range in North America, has been generally declining over the last 30 years (USFWS 2024d). The primary threat to this species is the loss and degradation of breeding, migratory, and overwintering habitat, including conversion of native habitat to agriculture, urban development, and logging at overwintering sites in Mexico. Other threats include pesticide exposure and the ongoing

effects of climate change, including vulnerability to changing microclimates and catastrophic events such as severe storms and drought (USFWS 2024d).

Adult monarch butterflies are large and brightly colored, with two sets of 3- to 4-inch bright orange wings surrounded by a black border and covered with black veins. The bright coloring serves as a warning to predators that eating them can be toxic (USFWS 2024d). Adult monarch butterflies are sexually dimorphic, with males having narrower wing venation and scent patches. Caterpillars of this species have black, yellow, and white stripes and reach approximately 2 inches before metamorphosis to a green and gold chrysalis (pupa) (USFWS n.d.-c, USFWS 2024d).

Adult monarch butterflies breed and lay eggs on milkweed (*Asclepias* spp.) host plants, and their caterpillars progress through five instars (i.e., larval molt stages) while feeding exclusively on milkweed (USFWS 2024d). The larva pupates into a chrysalis before emerging one to two weeks later as an adult butterfly. The species produces multiple generations throughout the spring and summer breeding season, with most adults living two to five weeks; however, migrating and overwintering adults enter reproductive diapause (i.e., suspended reproduction) and live six to nine months before migrating to overwintering sites in Mexico (eastern North America population) or California (western North American population) (USFWS n.d.-c, USFWS 2024d).

Monarch butterflies are common throughout Massachusetts, including Cape Cod, during summer months and begin to migrate southward from mid-August through early October (Mass Audubon 2025). Habitat requirements for this species include areas with healthy and abundant milkweed populations during breeding and early life stage development, nectar-providing flowers during breeding and migration, and clean water sources. Habitat may include fields, roadside areas, wetlands, and urban gardens, provided they contain these resources (USFWS n.d.-c). Additionally, this species may migrate over water and may congregate on peninsulas to find the shortest distance over waterbodies (USFS n.d.).

5 Environmental Baseline

This section identifies the environmental baseline for bats and monarch butterfly.

5.1 Bats in the Action Area

Surrounding the developed areas of the Action Area are small and often fragmented forest patches and larger tracts of undeveloped land. The dominant ecological community within the undeveloped land consists of variations of Pitch Pine - Oak Forest/Woodland, which is a matrix forest within the southeastern Massachusetts region that consists of a generally mature forest with overall low species diversity and well drained sandy loam soils. This ecological community may provide suitable roosting and foraging habitat for bats.

To evaluate potential presence of rare bat species in the Action Area during the summer maternity season, MassDOT commissioned an acoustic rare bat presence/absence survey July 20–24, 2020,

following the USFWS March 2020 Range-wide Indiana Bat Summer Survey Guidelines.[3] The Bat Survey Area consisted of the Action Area and included areas along connecting state and local roadways as illustrated in Attachment 2, Figures 2-1 and 2-2. These surveys documented suitable forested roosting habitat for NLEB and TCB; any upland habitat with trees greater than 3 inches diameter at breast height would be considered potentially suitable roosting habitat. The bat acoustic surveys documented the probable presence of TCB; NLEB was not detected (Stantec 2020b). These survey results are valid for a minimum of 5 years (through July 24, 2025). MassDOT anticipates commissioning additional rare bat acoustic presence/absence surveys during the summer of 2025.

In October 2023, MassDOT conducted a survey for bat presence in the concrete abutment structures of both existing bridges using visual survey methods, following recommendations in the USFWS Bridge/ Structure Bat Assessment Form Guidance (USFWS 2021b) (Attachment 2, Figure 2-3). Daytime visual searches of the exterior and interior vaults of all four existing bridge abutment vaults (two per bridge), aided by flashlights and binoculars, documented potential roosting habitat and potential entry points for bats. Evidence of prior bat use, including guano and urine staining, was present in the four abutments associated with the Bourne and Sagamore bridges. Guano samples were collected from each abutment vault; subsequent fecal deoxyribonucleic acid analysis conducted by Northern Arizona University's Bat Ecology and Genetics Lab identified all guano samples as big brown bat (*Eptesicus fuscus*) (Stantec 2023, NAU 2023). Bats were not observed at the time of surveys and rare bat presence was not detected (Stantec 2023). These survey results are valid for 2 years (through October 16, 2025).

In August 2024, visual inspections for roosting bats and bat habitat at three bridges and four outflow culverts within the Action Area were conducted, following recommendations in the USFWS Bridge/Structure Bat Assessment Form Guidance (USFWS 2021b) (Attachment 2, Figure 2-3). During the inspections, biologists used flashlights and binoculars to search gaps, crevices, and other locations on bridge and culvert structures that could potentially hold roosting bats. No bats, bat vocalizations, guano, or staining were observed at any of the bridges or culverts during the inspections (Stantec 2024). Potential suitable roosting habitat for bats is limited at these bridges, as the concrete is largely exposed to the elements and unlikely to provide thermal protection. Similarly, visual inspections of the bridges' guardrails indicated they were solid (i.e., absent of any cracks or crevices) and unlikely to provide suitable roosting habitat. Limited areas of potential roosting bat habitat within gaps between sections of concrete or metal and in the expansion joints of all three bridges were observed (Stantec 2024). These survey results are valid for 2 years (through August 20, 2026).

In summary, the bridge spans, consisting of tall, open structures exposed to high winds, appear to provide little to no potential suitability in terms of bat day roosting habitat, based on informal visual assessments conducted in association with presence/absence surveys. Bat surveys and bat deoxyribonucleic acid analysis conducted for the Program did not detect NLEB within the Project Survey Area, which encompassed the Action Area. The USFWS does not maintain any public records of

[3] United States Fish and Wildlife Service (USFWS). 2020. Range-wide Indiana Bat Survey Guidelines. U.S. Fish and Wildlife Service, Region 3, Bloomington, MN. 64 pp. Available at https://www.fws.gov/sites/default/files/documents/Range-wide-Indiana-bat-survey-guidelines-March-23-2020.pdf.

maternity colonies or hibernacula for TCB, although acoustic rare bat presence/absence surveys in the Action Area documented probable presence of this species.

5.2 Monarch Butterfly in the Action Area

Monarch butterflies can traverse anywhere within the Action Area, including aquatic habitats. Suitable habitats for foraging and reproduction within the Action Area are primarily limited to roadsides and other undeveloped, unforested portions of the Action Area, as habitat requirements for this species include areas with nectar-providing flowers for foraging and healthy and abundant milkweed populations during breeding and early life stage development. Suitable habitat is also likely present adjacent to the Action Area, including within utility rights-of-way that cross the Action Area and within the Joint Base Cape Cod lands south of the Action Area.

6 Conservation and Mitigation Measures

The Program will follow the USFWS April 1, 2015, directive, *Acceptable Management Practices for Bat Control Activities in Structures* (USFWS 2015) and the USFWS March 2024 *Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines* (USFWS 2024b). The Program will employ multiple mitigation measures, minimization measures, and best management practices (BMP) to reduce impacts to federally listed and proposed species with the potential to occur in the Action Area, including the following:

1. The Program will avoid removing trees within 0.25 miles of known NLEB or TCB hibernation sites, year-round, and will avoid removing known roost trees and suitable roost trees within 0.25 miles of a known NLEB and/or TCB roost during the pup season (June 1 through August 15). No known NLEB or TCB hibernation sites or roost trees are located within 0.25 miles of the Action Area.
2. Time of year restrictions on tree clearing will be implemented during the duration of Program construction. Trees will not be cleared during the summer occupancy period from March 15 through November 30 on the Cape side of the canal and from April 15 through October 31 on the mainland side of the canal, thus avoiding direct impacts to NLEB and TCB.
3. Depending upon the proposed method and timing of the demolition of existing structures and bridges, to prevent potential NLEB and/or TCB entry into the structures and abutments during the winter, current entry points will be sealed following Massachusetts Division of Fisheries and Wildlife guidance (MassWildlife 2020) in the late summer period when juvenile bats typically disperse and before the start of the hibernation period.
4. To prevent potential NLEB and/or TCB entry into structures that require demolition associated with Program construction, building inspections, and, if necessary, exclusionary measures as discussed in Measure #3 above, will be implemented prior to demolition.

5. In-water construction activities with potential to cause acoustic impacts (i.e., impact or vibratory pile driving and rotary drilling) will not occur from March 1 through August 31 of any year.
6. Vessels transiting within Cape Cod Canal and between Cape Cod Canal, Buzzards Bay, Cape Cod Bay, and supply ports, will operate at speeds not to exceed 10 knots, thereby potentially reducing collisions with bats and monarch butterflies traveling over the waterway.
7. Following construction completion, cleared areas will be revegetated to the maximum extent possible, using native plant species to provide suitable habitat for bat species, pollinators, and other native species.
8. The Program will implement conservation mowing practices consistent with the intent and recommendations outlined in published BMPs for monarch butterflies, such as following recommended times of year for mowing (e.g., October 1 – May 1 in Massachusetts); refraining from mowing entire parcels and mowing after native plants at sites have completed blooming and dispersing seed; using a minimum cutting height (e.g., 10–12 inches) when mowing; using a flushing bar and mowing at reduced speeds to allow wildlife to escape prior to mowing, and only mowing once or twice per year (Cardno, Inc. 2020; Monarch Joint Venture 2025).
9. MassDOT will implement conservation mowing methods on MassDOT rights-of-way. Conservation mowing utilizes BMPs during grassland habitat management to reduce impacts to and restore breeding and/or foraging habitat for pollinator species such as monarch butterflies.

7 Effects Analysis

This section details potential effects of the Program on the listed and proposed species with the incorporation of the conservation and mitigation measures and BMPs identified in Section 6.

7.1 Habitat Alteration

The Program will result in clearing of approximately 107.8 acres in total of suitable summer bat habitat (i.e., upland trees/forest) within the construction limits of disturbance, including both bridges and interchange approach networks. Attachment 1, Figures 1-2 and 1-3 present the approximate tree clearing areas within the Sagamore and Bourne Bridge portions of the Action Area, respectively. As indicated in Section 6, following construction completion, cleared areas will be revegetated to the maximum extent possible, using native plant species to provide suitable habitat for bat species and pollinators, including monarch butterflies.

7.1.1 Northern Long-eared Bat

Suitable summer habitat for this species is present within and adjacent to the Action Area; however, no known roost trees are located within or adjacent to the Action Area. In addition, no NLEB winter hibernacula are expected to be affected by the Program.

As described in Section 5.1, acoustic surveys did not document probable presence of the species within the Action Area and no maternity colonies have been documented within the Action Area. Therefore, no NLEB maternity colony impacts are anticipated as a result of habitat alteration associated with construction of the new bridges. In addition, NLEB take is not anticipated as a result of demolition activities. Regardless, to prevent potential NLEB entry into the existing bridge abutments during the winter, depending upon the proposed method and timing of the existing bridge demolition, current entry points would be sealed with appropriate one-way bat exit structures in the late summer period, when juvenile bats typically disperse and before the start of the hibernation period.

All tree clearing will occur during the inactive seasons, as outlined in Section 6. The chance that NLEB may be directly affected by tree removal activities outside the summer occupancy activity period is discountable since individuals are more likely to roost singly or in smaller groups during this time, and the dispersed nature greatly reduces the risk. When NLEB are roosting individually or in smaller groups, it is easier for bats to flush (respond by flying away) when disturbed.

Impacts to NLEB due to tree clearing, should they occur, would be indirect in the form of loss of 107.8 acres of suitable summer roosting habitat. However, all 107.8 acres to be cleared are within 1,000 feet of suitable summer roosting habitat that would remain intact. This suitable summer roosting habitat is generally less fragmented, farther from roadways and developed land and, thus, ostensibly higher quality habitat (e.g., Berthinussen and Altringham 2012, Altringham and Kerth 2016). Forested habitat near the Action Area includes the large areas of Camp Edwards and Red Brook Wildlife Management Areas, as well as smaller parks and forested areas within and adjacent to the Action Area. Given that surveys did not document probable presence of NLEB within the Action Area and the availability of suitable habitat within 1,000 feet of the habitat proposed for clearing, should NLEB be present in the Action Area, surveys notwithstanding, impacts to NLEB resulting from the loss of the potential roosting habitat would be discountable.

7.1.2 Tricolored Bat

Suitable summer habitat for this species is present within and adjacent to the Action Area; however, no known roost trees are located within or adjacent to the Action Area. In addition, no winter hibernacula are expected to be affected by the Program.

Acoustic surveys conducted for the Program indicated probable presence of TCB within the Action Area (Stantec 2020). Clearing of the 107.8 acres of suitable summer roosting habitat would occur during the inactive seasons, as outlined in Section 6, thus avoiding direct impacts on TCB. The chance that TCBs may be adversely affected by tree removal activities outside the pup season activity period is discountable since TCB individuals that are capable of flight switch roosts regularly and are expected to be able to flush when disturbed. Any TCBs seeking roosts in former forested areas after clearing would only expend a minimal amount of energy to find an alternate roost, as suitable habitat is available within 1,000 feet of all tree clearing areas. To prevent potential TCB entry into the existing bridge abutments during the winter, depending upon the proposed method and timing of the existing bridge demolition, current entry points would be sealed with appropriate one-way bat exit structures in the

late summer period when juvenile bats typically disperse and before the start of the hibernation period, as indicated in Section 6.

Program construction during the bats' active season could either cause TCB to avoid the areas of elevated noise and lighting, or could have little to no effect, if present. Bats may habituate to continuous or repeating anthropogenic noise disturbances (Luo et al. 2014) and may adjust echolocation call structure to avoid interference from ambient background noise (Schaub et al. 2008) and thus may remain within the Action Area during the active season in spite of construction noise.

According to the Program's noise and vibration assessment, construction-induced vibration is estimated to exceed 80 dBA within 157 feet of the impact pile driving (Cape Cod Bridges Program DEIS/DEIR, Noise and Vibration Technical Report). Approximately 21 acres of forested habitat within the Action Area is expected to remain after tree clearing, less than 3 acres of which are located within 157 feet of the bridges where most of the construction noise (e.g., bridge demolition, pile driving) would occur. This represents less than 15 percent of the available area of forested habitat in the Action Area. Further, construction noise from pile driving is not expected to occur during most of the active season and would entirely avoid the pup season (June 1 through August 15), as pile driving activities are limited to occur from September 1st through the end of February.

This species converges at hibernacula in the fall to mate and remains within hibernacula during the winter months (USFWS n.d.-b) when most of the pile driving is expected to occur. There are no records of winter hibernacula within the Action Area; therefore, winter construction noise within the Action Area is not expected to impact TCB.

If any TCB individuals were to avoid the small areas of elevated noise and light during the active season, or if they were to switch roosting areas as a result of the loss of 107.8 acres of suitable habitat, given the availability of adjacent suitable summer habitat, any resulting effects to TCB are anticipated to be too small to be meaningfully measured or detected and therefore insignificant.

7.1.3 Monarch Butterfly

Suitable habitat for monarch butterfly may occur along the roadsides and other undeveloped, unforested portions of the Action Area. Suitable habitat is also likely present adjacent to the Action Area, including within utility rights-of-way that cross the Action Area and within the Joint Base Cape Cod lands south of the Action Area. Vegetation clearing in the Action Area during Program construction may cause incidental take of monarch butterflies through temporary and permanent removal or disturbance of breeding or foraging habitat, or through direct mortality of the butterflies. Temporary noise associated with Program construction may be a potential stressor to this species, as demonstrated by stress responses (i.e., short-term elevated heart rate) in monarch caterpillars when exposed to simulated highway noise (Davis et al. 2018). However, chronic noise exposure in monarch caterpillars may lead to habituation or desensitization to anthropogenic noise thereby reducing responses to noise in adult monarch butterflies (Davis et al. 2018). Consequently, the effects of the Program's construction noise to adult monarch butterflies migrating, breeding, or foraging on land or migrating over waterbodies associated with the Program would be too small to be meaningfully measured or detected and therefore insignificant.

MassDOT has enrolled in the Nationwide Candidate Conservation Agreement with Assurances for the Monarch Butterfly (CCAA; Cardno, Inc. 2020). The CCAA is a voluntary agreement between the USFWS and, among others, state departments of transportation intended to provide a net conservation benefit to monarch butterflies and to address the potential effects on monarch butterflies and their populations of approved maintenance and construction activities within energy and transportation lands. Through enrollment in the CCAA, MassDOT will implement conservation measures that are designed to create, enhance, restore, sustain, or maintain habitat that supports monarch butterfly breeding and/or foraging on a portion of MassDOT lands.

MassDOT will conduct conservation mowing practices throughout MassDOT lands enrolled in the CCAA, which represent 8% of MassDOT's total owned lands—the minimum required for participation in the CCAA. MassDOT conservation mowing practices will be consistent with the intent and recommendations outlined in published BMPs for monarch butterflies, such as following recommended times of year for mowing (e.g., October 1 – May 1 in Massachusetts); refraining from mowing entire parcels and mowing after native plants at sites have completed blooming and dispersing seed; using a minimum cutting height (e.g., 10–12 inches]) when mowing; using a flushing bar and mowing at reduce speeds to allow wildlife to escape prior to mowing, and only mowing once or twice per year (Cardno, Inc. 2020; Monarch Joint Venture 2025).

In return for MassDOT's voluntary conservation measures, USFWS will issue to MassDOT an Enhancement of Survival (EOS) Permit under Section 10(a)(1)(A) of the ESA. The EOS Permit will go into effect as of the listing date of the monarch butterfly, should a listing occur. Under the EOS Permit, incidental take of monarch butterflies would be authorized for the conservation measures and construction activities associated with the Program. The premise of the CCAA is that benefits from implementation of the conservation measures included in the CCAA outweigh potential adverse effects on monarch butterflies, including injury or death of individuals, resulting from Program construction.

7.2 Effect Determinations for Listed and Proposed Species

Based on the analyses provided in Sections 7.1.1 and 7.1.2, all effects of the Program, when added to baseline conditions of listed and proposed bats in the Action Area, as described in Sections 3 and 6, and accounting for the proposed conservation and mitigation measures discussed in Section 6, are determined to be discountable or too small to be meaningfully measured or detected and therefore insignificant. Therefore, FHWA has determined the Cape Cod Bridges Program is ***not likely to adversely affect*** the NLEB and TCB.

Program construction may cause direct and indirect impacts on monarch butterflies in the form of direct mortality of individuals and/or permanent and temporary removal or disturbance of breeding or migration habitat. However, as detailed in Section 7.1.3, with MassDOT's impending enrollment in the CCAA, conservation commitments made by MassDOT that benefit monarch butterflies are expected to result in a net gain of habitat and/or species population numbers. Therefore, the Cape Cod Bridges Program ***is not likely to jeopardize*** the continued existence of the monarch butterfly. Accordingly, no conference with the USFWS is required with respect to the monarch butterfly.

As detailed in Section 4.2, the Program's Action Area is outside of the range of known occurrences of northern red-bellied cooter and does not contain suitable habitat for this species. As detailed in Section 4.3, the USFWS determined that there are no data to suggest the presence of habitat and/or individuals of sandplain gerardia within the Action Area. Therefore, it is determined that the Program would have ***No Effect*** on northern red-bellied cooter or sandplain gerardia, and consultation with the USFWS is not required for these species.

The best scientific and commercial data available have been used to complete this analysis. The concurrence of the USFWS with these determinations is hereby requested.

8 References

Altringham, J.D., and G. Kerth. 2016. Bats and Roads. In C.C. Voigt & T. Kingston (Eds.), *Bats in the Anthropocene: Conservation of Bats in a Changing World* (pp. 1-606). Springer, International Publishing.

Berthinussen, A., and J. Altringham. 2012. The effect of a major road on bat activity and diversity. *Journal of Applied Ecology* 49(1):82–89.

Cardno, Inc. 2020. Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy and Transportation Lands. An integrated Candidate Conservation Agreement with Assurances (CCAA) and Candidate Conservation Agreement (CCA). Prepared for The Monarch CCAA/CCA Development Advisory Team and the Energy Resources Center at the University of Illinois at Chicago. March. Available at: https://www.fws.gov/sites/default/files/documents/Final_CCAA_040720_Fully%20Executed.pdf. Accessed January 2025.

Center for Biological Diversity (CBD). 2010. Petition to List the Eastern Small-footed Bat (*Myotis leibii*) and Northern Long-eared Bat (*Myotis septentrionalis*) as Threatened or Endangered Under the Endangered Species Act. Prepared for the U.S. Department of the Interior, Secretary of the Interior. January.

CBD. n.d.-a. Northern Long-eared Bat. Available at: https://www.biologicaldiversity.org/species/mammals/northern_long-eared_bat/index.html. Accessed September 2024.

CBD. n.d.-b. Tricolored Bat. Available at: https://www.biologicaldiversity.org/species/mammals/tricolored_bat/index.html. Accessed September 2024.

Chapman, Thomas R. 2019. Ref: Major Rehabilitation Evaluation Report and Environmental Assessment for the Bourne and Sagamore Highway Bridges (Bourne, MA). [Letter to Wendy Gendron, US

Army Corps of Engineers.] USFWS New England Field Office. December 23. In: U.S. Army Corps of Engineers. 2020. Major Rehabilitation Evaluation Report, Cape Cod Canal Highway Bridges. Appendix E Agency Coordination. Available at: https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MRERAppendixE.pdf. Accessed February 2025.

Davis, A.K., H. Schroeder, I. Yeager, and J. Pearce. 2018. Effects of simulated highway noise on heart rates of larval monarch butterflies, *Danaus plexippus*: implications for roadside habitat suitability. *Biol. Lett*. 14: 20180018.

Fraser, E.E., L.P. McGuire, J.L. Eger, F.J. Longstaffe, and M.B. Fenton. 2012. Evidence of Latitudinal Migration in Tri-colored Bats, *Perimyotis subflavus*. *PLoS One* 7(2): e31419. doi:10.1371/journal.pone.0031419.

Fujita, M.S., and T.H. Kunz. 1984. *Pipistrellus subflavus*. *Mammalian Species* 228, pp. 1–6, https://doi.org/10.2307/3504021.

HNTB Corporation (HNTB). 2023. Meeting Summary: Introductory Coordination Meeting with USFWS. Participants: MassDOT, FHWA, USFWS, USACE, HNTB. April 21, 2023.

Luo, J., B.M. Clarin, I.M. Borissov, and B.M. Siemers. 2014. Are Torpid Bats Immune to Anthropogenic Noise? Journal of Experimental Biology 217: 1072-1078. https://doi.org/10.1242/jeb.092890. Accessed February 2025.

Mass Audubon. 2025. Butterfly Atlas Species Accounts: Monarch *Danaus Plexippus*. Available at: https://www.massaudubon.org/nature-wildlife/insects-arachnids/butterfly-atlas/find-a-butterfly?id=116. Accessed January 2025.

Massachusetts Division of Fisheries and Wildlife (MassWildlife). 2020. Massachusetts Homeowner's Guide to Bats. Produced by Massachusetts Division of Fisheries and Wildlife. 7th Edition. Available at: https://www.mass.gov/doc/massachusetts-homeowners-guide-to-bats/download. Accessed January 2025.

Massachusetts Department of Transportation (MassDOT). 2024. Commonwealth of Massachusetts Department of Transportation Standard Specifications for Highways and Bridges. 2024 Edition Division I.

Massachusetts Natural Heritage and Endangered Species Program (NHESP). 2015. Sandplain gerardia fact sheet. Available at: https://www.mass.gov/doc/sandplain-gerardia/download. Accessed March 2024.

NHESP. 2016. Northern red-bellied cooter fact sheet. Available at: https://www.mass.gov/doc/northern-red-bellied-cooter- factsheet/download. Accessed March 2024.

Monarch Joint Venture. 2025. Mowing and Management: Best Practices for Monarchs. Available at: https://mjv.nyc3.cdn.digitaloceanspaces.com/documents/MowingForMonarchsUpdated.pdf. Accessed January 2025.

Northern Arizona University (NAU). 2023. Species Identification Report. Bat Ecology & Genetics Lab, School of Forestry, NAU, P.O. Box 15018 Flagstaff, AZ. 86011.

Perry, R.W., and R.E. Thill. 2007. Tree roosting by male and female eastern pipistrelles in a forested landscape. *Journal of Mammalogy* 88:974–981.

Reid, F. 2006. A Field Guide to Mammals of North America North of Mexico. United States: Houghton Mifflin.

Schaub, A., J. Ostwald, and B.M. Siemers. 2008. Foraging bats avoid noise. *Journal of Experimental Biologist* 211:3174–3180

Stantec Consulting Services Inc. (Stantec) 2020a. Bourne and Sagamore Bridge Improvement Projects – Rare, Threatened, and Endangered Species Habitat Assessment. Conducted for Massachusetts Department of Transportation. December 16. MassDOT Project No. 14-33419.

Stantec. 2020b. Northern Long-eared Bat (NLEB) Presence/Absence Survey. Cape Cod, Massachusetts. Conducted for Massachusetts Department of Transportation – Highway Division. July 20-24, 2020. MassDOT Project No. 608193.

Stantec. 2023. Technical Memo: Bat Bridge Inspection Sagamore and Bourne. Prepared for: Massachusetts Department of Transportation – Highway Division. October 30.

Stantec. 2024. Technical Memo: Cape Cod Bridges Program (DOT Project # 608020 and #613678) Routes 3 and 25 Bridges and nearby Culvert Bat Habitat Inspection. September 5.

USACE. 2019. Email conversation between Rosemarie A. Bradley, Marine Biologist. USACE New England District and Susi von Oettingen, Endangered Species Biologist. USACE New England Field Office. March 26, 2019 – April 1, 2019.

USACE. 2022. Environmental Assessment and Finding of No Significant Impact for Major Rehabilitation Evaluation Cape Cod Canal Highway Bridges Massachusetts. U.S. Army Corps of Engineers, New England District, Concord, Massachusetts. March. Available at: https://www.nae.usace.army.mil/Portals/74/docs/Topics/Cape%20Cod%20Canal%20Bridges/Reports/MRER-Env-Assessment-March2022-FONSI-FINAL.pdf. Accessed February 2025.

United States Fish and Wildlife Service (USFWS). n.d.-a. Northern Long-eared Bat. Available at: https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis. Accessed September 2024.

USFWS. n.d.-b. Tricolored Bat. Available at: https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus. Accessed September 2024.

USFWS. n.d.-c. Monarch. Available at: https://www.fws.gov/species/monarch-danaus-plexippus. Accessed January 2025.

USFWS. 2014. Northern Long-Eared Bat Interim Conference and Planning Guidance. USFWS Regions 2, 3, 4, 5, & 6. January.

USFWS. 2015. Acceptable Management Practices for Bat Control Activities in Structures- A Guide for Nuisance Wildlife Control Operators. U.S. Fish and Wildlife Service, White-nose Syndrome Conservation and Recovery Working Group. Hadley, MA.

USFWS. 2021a. Species Status Assessment (SSA) Report for the Massachusetts Population of the Northern Red-bellied Cooter (*Pseudemys rubriventris*). Version 1.0. U.S. Fish and Wildlife Service Northeast Region. Hadley, MA.

USFWS. 2021b. Bridge/Culvert and Structure Bat Assessment Form Guidance, Federal Transportation Agency/State Department of Transportation (DOT) Preliminary Guidelines for Using the Bridge/Culvert and Structure Bat Assessment Form. Available at: https://www.fws.gov/sites/default/files/documents/appendix-d-bridge-culvert- bat-assessment-form-guidance-february-2021.pdf.

USFWS. 2022. Endangered and Threatened Wildlife and Plants; Endangered Species Status for Tricolored Bat. A Proposed Rule by the Fish and Wildlife Service on 09/14/2022. Available at: https://www.federalregister.gov/documents/2022/09/14/2022- 18852/endangered-and-threatened-wildlife-and-plants-endangered-species-status-for- tricolored-bat.

USFWS. 2024a. Plymouth red-bellied turtle species account. Available at: https://www.fws.gov/species/plymouth-red-bellied-turtle-pseudemys- rubriventris-bangsi. Accessed March 2024.

USFWS. 2024b. Range-wide Indiana Bat and Northern Long-eared Bat Survey Guidelines. U.S. Fish and Wildlife Service, Region 3, Bloomington, MN. 95 pp.

USFWS. 2024c. Sandplain gerardia species account. Available at: https://www.fws.gov/species/sandplain-gerardia-agalinis-acuta. Accessed March 2024.

USFWS. 2024d. Endangered and Threatened Wildlife and Plants; Threatened Species Status with Section 4(d) Rule for Monarch Butterfly and Designation of Critical Habitat. A Proposed Rule by

the Fish and Wildlife Service on 12/12/2024. Available at: https://www.federalregister.gov/documents/2024/12/12/2024-28855/endangered-and-threatened-wildlife-and-plants-threatened-species-status-with-section-4d-rule-for-monarch-butterfly-and-designation-of-critical-habitat. Accessed January 2025.

United States Forest Service (USFS). n.d. Monarch Butterfly: Migration and Overwintering. Available at: https://www.fs.usda.gov/wildflowers/pollinators/Monarch_Butterfly/migration/index.shtml. Accessed February 2025.

Attachment 1 – Action Area Figures

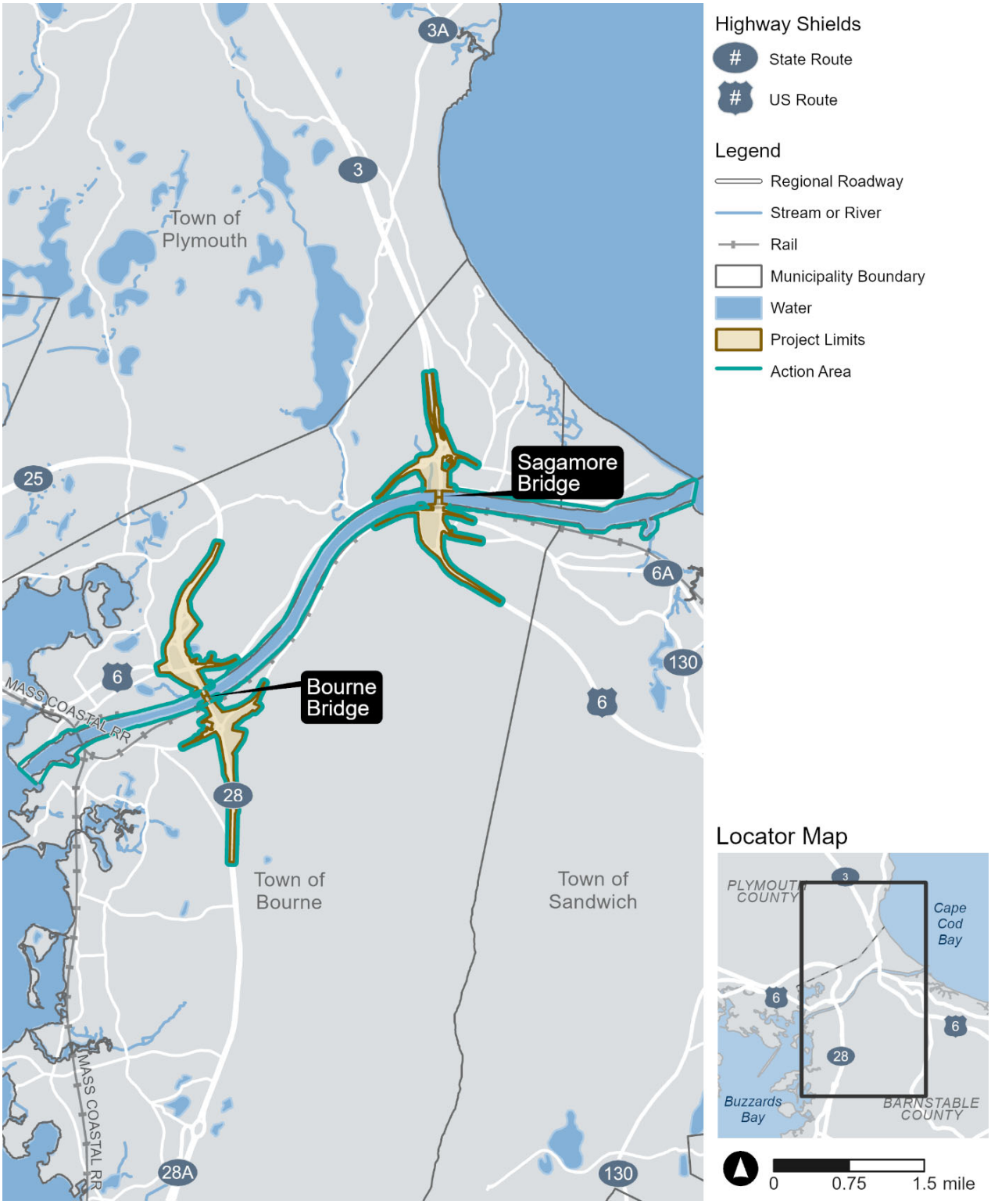


Figure 1-1. Cape Cod Bridges Program Action Area

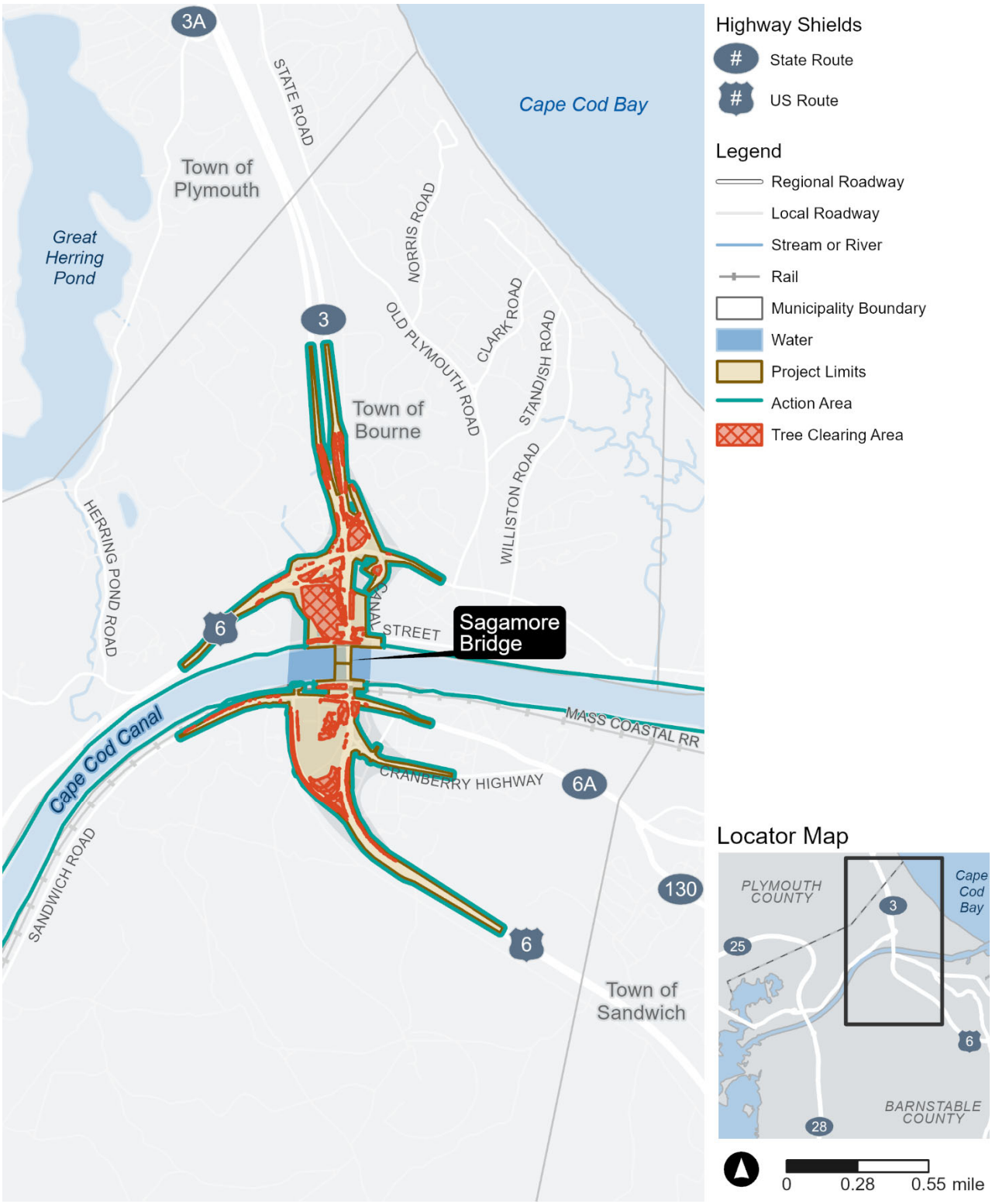


Figure 1-2. Approximate Tree Clearing Within Sagamore Bridge Portion of Action Area

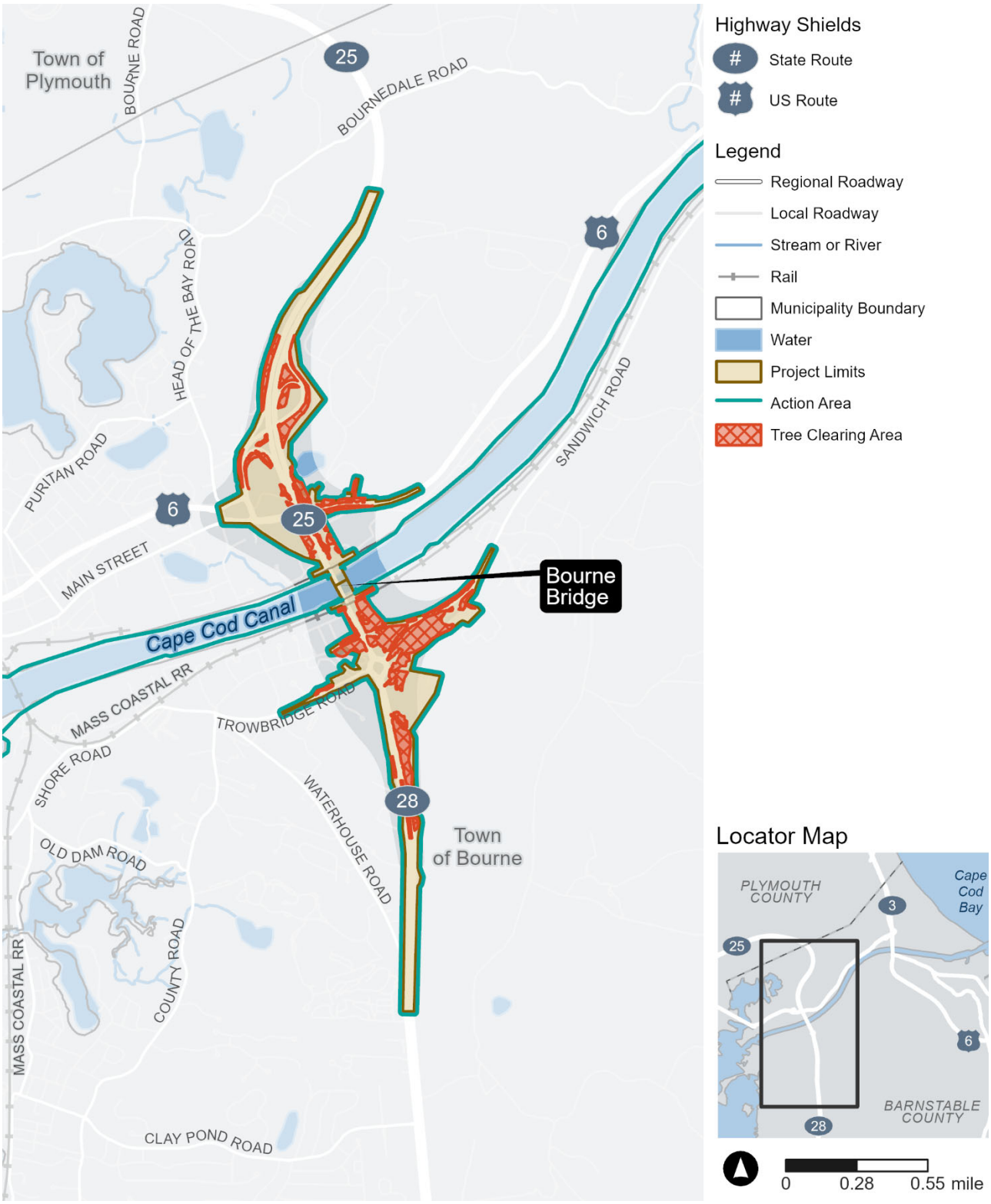


Figure 1-3. Approximate Tree Clearing Within Bourne Bridge Portion of Action Area

Attachment 2 – Bat Survey Maps

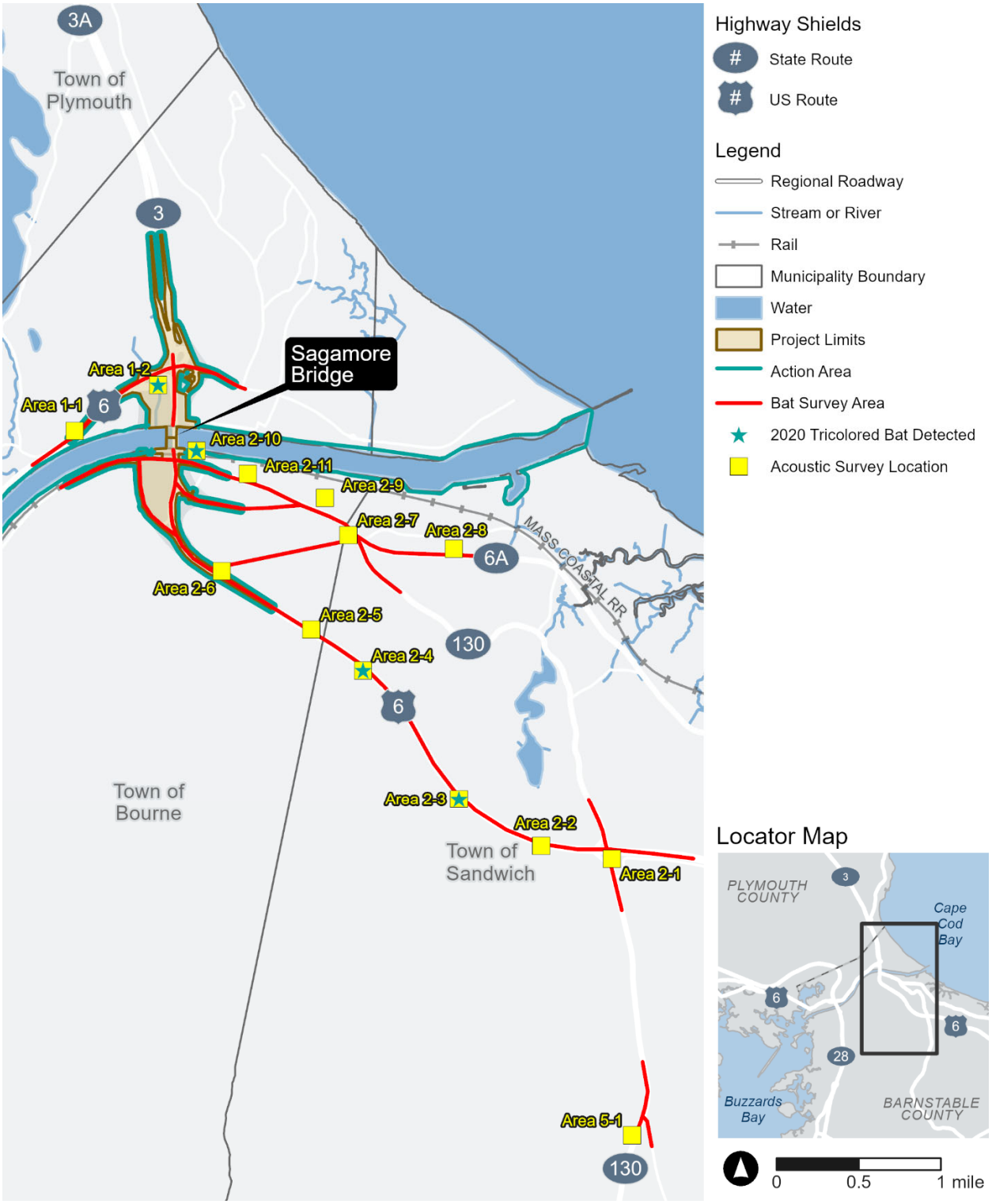


Figure 2-1. 2020 Sagamore Bridge Acoustic Survey Locations and Tricolored Bat Detection Locations

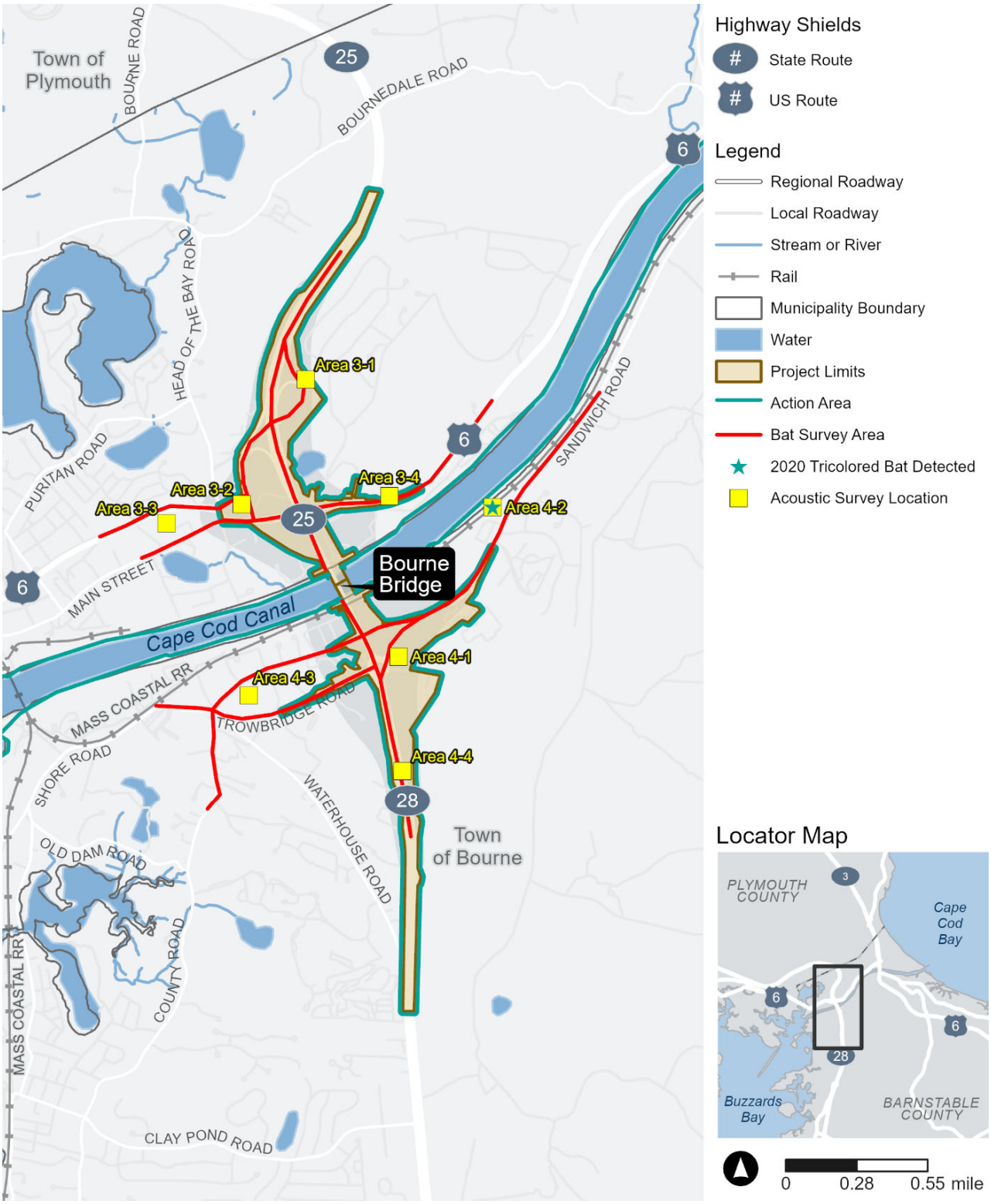


Figure 2-2. 2020 Bourne Bridge Acoustic Survey Locations and Tricolored Bat Detection Locations

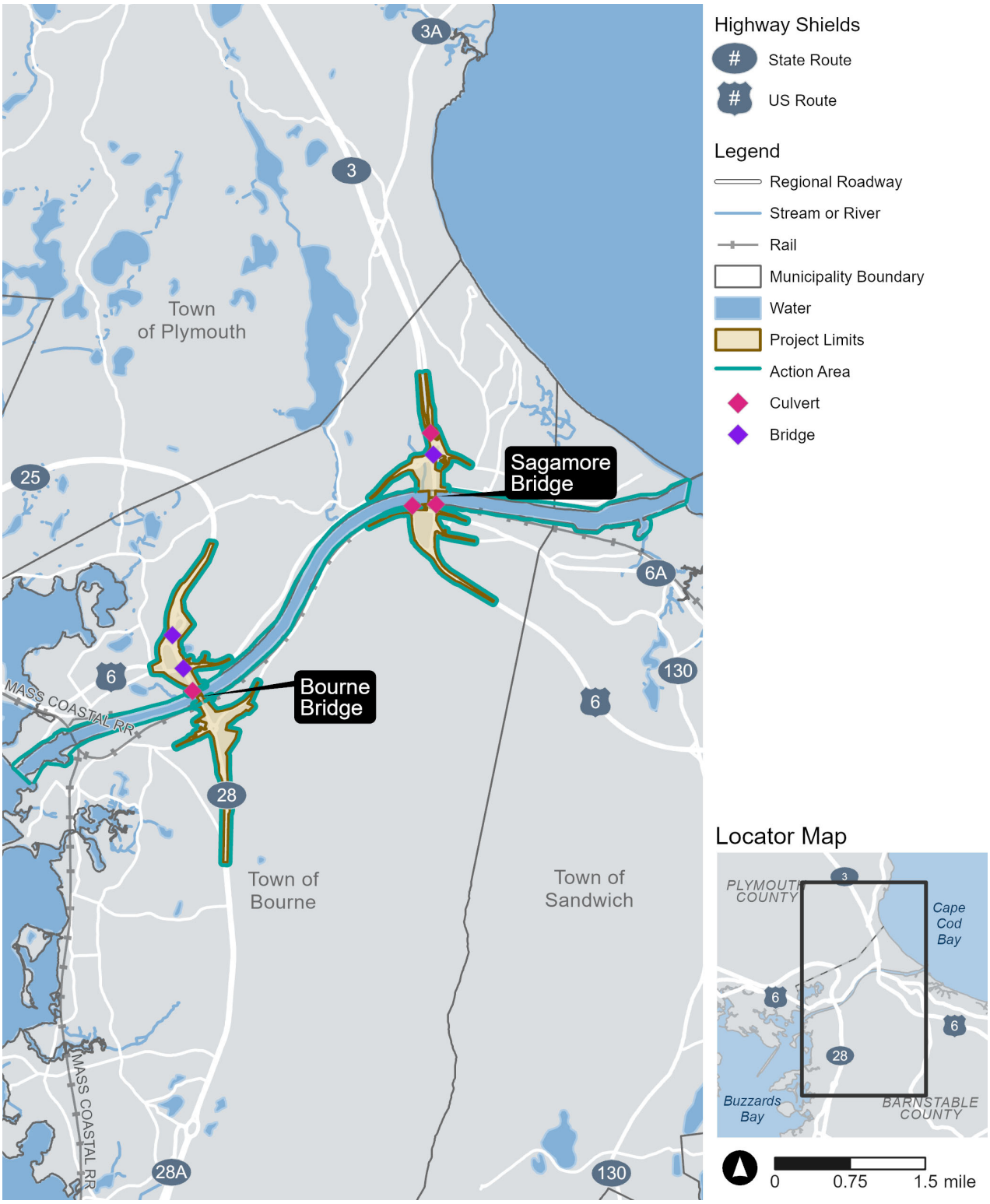


Figure 2-3. 2023 and 2024 Bridge and Culvert Inspection Survey Locations

Attachment 3 – IPAC Species List and Determination Key Results

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
Phone: (603) 223-2541 Fax: (603) 223-0104

In Reply Refer To: 09/07/2024 17:44:30 UTC
Project Code: 2024-0141024
Project Name: 608020/613678 - BRIDGE REPLACEMENTS, B-17-005, (SAGAMORE BRIDGE) & B-17-004 (BOURNE BRIDGE)

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

Updated 4/12/2023 - Please review this letter each time you request an Official Species List, we will continue to update it with additional information and links to websites may change.

About Official Species Lists

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Federal and non-Federal project proponents have responsibilities under the Act to consider effects on listed species.

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested by returning to an existing project's page in IPaC.

Endangered Species Act Project Review

Please visit the "**New England Field Office Endangered Species Project Review and**

Consultation" website for step-by-step instructions on how to consider effects on listed species and prepare and submit a project review package if necessary:

https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review

NOTE Please do not use the **Consultation Package Builder** tool in IPaC except in specific situations following coordination with our office. Please follow the project review guidance on our website instead and reference your **Project Code** in all correspondence.

Northern Long-eared Bat - (**Updated 4/12/2023**) The Service published a final rule to reclassify the northern long-eared bat (NLEB) as endangered on November 30, 2022. The final rule went into effect on March 31, 2023. You may utilize the **Northern Long-eared Bat Rangewide Determination Key** available in IPaC. More information about this Determination Key and the Interim Consultation Framework are available on the northern long-eared bat species page:

https://www.fws.gov/species/northern-long-eared-bat-myotis-septentrionalis

For projects that previously utilized the 4(d) Determination Key, the change in the species' status may trigger the need to re-initiate consultation for any actions that are not completed and for which the Federal action agency retains discretion once the new listing determination becomes effective. If your project was not completed by March 31, 2023, and may result in incidental take of NLEB, please reach out to our office at newengland@fws.gov to see if reinitiation is necessary.

Additional Info About Section 7 of the Act
Under section 7(a)(2) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to determine whether projects may affect threatened and endangered species and/or designated critical habitat. If a Federal agency, or its non-Federal representative, determines that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Federal agency also may need to consider proposed species and proposed critical habitat in the consultation. 50 CFR 402.14(c)(1) specifies the information required for consultation under the Act regardless of the format of the evaluation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/service/section-7-consultations

In addition to consultation requirements under Section 7(a)(2) of the ESA, please note that under sections 7(a)(1) of the Act and its implementing regulations (50 CFR 402 et seq.), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Please contact NEFO if you would like more information.

Candidate species that appear on the enclosed species list have no current protections under the

ESA. The species' occurrence on an official species list does not convey a requirement to consider impacts to this species as you would a proposed, threatened, or endangered species. The ESA does not provide for interagency consultations on candidate species under section 7, however, the Service recommends that all project proponents incorporate measures into projects to benefit candidate species and their habitats wherever possible.

Migratory Birds

In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see:

https://www.fws.gov/program/migratory-bird-permit

https://www.fws.gov/library/collections/bald-and-golden-eagle-management

Please feel free to contact us at **newengland@fws.gov** with your **Project Code** in the subject line if you need more information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat.

Attachment(s): Official Species List

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New England Ecological Services Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5094
(603) 223-2541

PROJECT SUMMARY

Project Code: 2024-0141024

Project Name: 608020/613678 - BRIDGE REPLACEMENTS, B-17-005, (SAGAMORE BRIDGE) & B-17-004 (BOURNE BRIDGE)

Project Type: Bridge - Replacement

Project Description: 608020 - BOURNE- BRIDGE REPLACEMENT, B-17-005, (ARF) (SAGAMORE BRIDGE), US 6 OVER THE CAPE COD CANAL, SANDWICH ROAD (ROUTE 6A) AND MCR/MBTA RAILROAD, INCLUDES REPLACEMENT OF B-17-027 ROUTE 3 OVER US 6 (CAPE COD BRIDGES PROGRAM PHASE I)

613678 - BOURNE- BRIDGE REPLACEMENT, B-17-004 (BOURNE BRIDGE) ROUTE 28 OVER THE CAPE COD CANAL, SANDWICH ROAD (ROUTE 6A) AND MCR/MBTA RR, B-17-019 (45L) ROUTE 28 OVER US 6 AND B-17-026 (457) ROUTE 28 ON/OFF RAMP OVER ROUTE 25 (CAPE COD BRIDGES PROGRAM PHASE II)

Plymouth Redbelly Cooter: After consulting with the Massachusetts Natural Heritage and Endangered Species Program (NHESP), it was determined that there is no data to suggest the presence of habitat and/or individuals at this project location.
Sandplain Gerardia: After consulting with the Massachusetts Natural Heritage and Endangered Species Program (NHESP), it was determined that there is no data to suggest the presence of habitat and/or individuals at this project location.
Tricolored Bat: Proposed Endangered Species only. The project action will not jeopardize the continued existence of a proposed species.
Monarch Butterfly: Candidate Species only, no conservation measures at this time.

BOURNE- CAPE COD CANAL NEW BRIDGE CONSTRUCTION BOURNE - BRIDGE REPLACEMENT, B-17-004 (BOURNE BRIDGE), ROUTE 28 OVER THE CAPE COD CANAL, SANDWICH ROAD (ROUTE 6A) AND MCR/MBTA RAILROAD, B-17-019 (45L) ROUTE 28 OVER US 6 AND B-17-026 (457) ROUTE 28 ON/OFF RAMP OVER ROUTE 25

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.759088399999996,-70.59314334920569,14z



Counties: Barnstable County, Massachusetts

ENDANGERED SPECIES ACT SPECIES

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9045	Endangered
Tricolored Bat *Perimyotis subflavus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10515	Proposed Endangered

REPTILES

NAME	STATUS
Plymouth Redbelly Turtle = Plymouth Redbelly Cooter *Pseudemys rubriventris bangsi* There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/451	Endangered

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Sandplain Gerardia *Agalinis acuta* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8128	Endangered

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: Massachusetts Department of Transportation
Name: Hana Isihara
Address: 10 Park Plaza
City: Boston
State: MA
Zip: 02116
Email hana.l.isihara@dot.state.ma.us
Phone: 6178964454

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Highway Administration

IPaC **U.S. Fish & Wildlife Service**

Endangered Species Act Review

EVALUATING: FHWA, FRA, FTA PROGRAMMATIC CONSULTATION FOR TRANSPORTATION PROJECTS AFFECTING NLEB OR INDIANA BAT

Qualification interview

The following questions will determine whether this key applies to your project and provide guidance to help you make appropriate determinations for the species covered by this key.

1. Is the project within the range of the Indiana bat[1]? 001

   [1] See Indiana bat species profile

   ☑ **Automatically answered**
   No

2. Is the project within the range of the northern long-eared bat[1]? 002

   [1] See northern long-eared bat species profile

   ☑ **Automatically answered**
   Yes

3. Which Federal Agency is the lead for the action? 003

   ☑ A) Federal Highway Administration (FHWA)

4. Are *all* project activities limited to non-construction[1] activities only? (examples of non-construction activities include: bridge/abandoned structure assessments, surveys, planning and technical studies, property inspections, and property sales) 004

   [1] Construction refers to activities involving ground disturbance, percussive noise, and/or lighting.

   ☑ No

5. Does the project include *any* activities that are **greater than** 300 feet from existing road/rail surfaces[1]? 005

[1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

☑ Yes

6. Are *all* project activities **greater than** 300 feet from existing road/rail surfaces[1]? 006

[1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

☑ No

7. Does the project include *any* activities **within** 0.5 miles of a known Indiana bat and/or NLEB hibernaculum[1]? 007

[1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

☑ No

8. Is the project located **within** a karst area? 010

☑ No

9. Is there *any* suitable[1] summer habitat for Indiana Bat or NLEB **within** the project action area[2]? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat) 012

[1] See the Service's summer survey guidance for our current definitions of suitable habitat.

[2] The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Section 402.02). Further clarification is provided by the User's Guide for the Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat.

☑ Yes

10. Will the project remove *any* suitable summer habitat[1] and/or remove/trim any existing trees **within** suitable summer habitat? 013

[1] See the Service's summer survey guidance for our current definitions of suitable habitat.

☑ Yes

11. Will the project clear more than 20 acres of suitable habitat per 5-mile section of road/rail? 014

☑ Yes

EVALUATION PROGRESS

Your project is outside of the scope of the programmatic consultation for this key because the maximum acreage cleared for any given project addressed in this programmatic range-wide consultation is approximately 20 acres of suitable habitat (generally per 5-mile section of road/rail), unless approved by a local USFWS Field Office on case-by-case basis that the effects of the action fit in the programmatic. Please contact the appropriate U.S. Fish and Wildlife Service office for additional assistance with your project.

IPaC **U.S. Fish & Wildlife Service**

Endangered Species Act Review

EVALUATING: FHWA, FRA, FTA PROGRAMMATIC CONSULTATION FOR TRANSPORTATION PROJECTS AFFECTING NLEB OR INDIANA BAT

Qualification interview

The following questions will determine whether this key applies to your project and provide guidance to help you make appropriate determinations for the species covered by this key.

1. Is the project within the range of the Indiana bat[1]? 001

   [1] See Indiana bat species profile

   ☑ **Automatically answered**
   No

2. Is the project within the range of the northern long-eared bat[1]? 002

   [1] See northern long-eared bat species profile

   ☑ **Automatically answered**
   Yes

3. Which Federal Agency is the lead for the action? 003

   ☑ A) Federal Highway Administration (FHWA)

4. Are *all* project activities limited to non-construction[1] activities only? (examples of non-construction activities include: bridge/abandoned structure assessments, surveys, planning and technical studies, property inspections, and property sales) 004

   [1] Construction refers to activities involving ground disturbance, percussive noise, and/or lighting.

   ☑ No

5. Does the project include *any* activities that are **greater than** 300 feet from existing road/rail surfaces[1]? 005

[1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

☑ Yes

6. Are *all* project activities **greater than** 300 feet from existing road/rail surfaces[1]? 006

[1] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.

☑ No

7. Does the project include *any* activities **within** 0.5 miles of a known Indiana bat and/or NLEB hibernaculum[1]? 007

[1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

☑ No

8. Is the project located **within** a karst area? 010

☑ No

9. Is there *any* suitable[1] summer habitat for Indiana Bat or NLEB **within** the project action area[2]? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat) 012

[1] See the Service's summer survey guidance for our current definitions of suitable habitat.

[2] The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR Section 402.02). Further clarification is provided by the User's Guide for the Range-wide Programmatic Consultation for Indiana Bat and Northern Long-eared Bat.

☑ Yes

10. Will the project remove *any* suitable summer habitat[1] and/or remove/trim any existing trees **within** suitable summer habitat? 013

[1] See the Service's summer survey guidance for our current definitions of suitable habitat.

☑ Yes

11. Will the project clear more than 20 acres of suitable habitat per 5-mile section of road/rail? 014

☑ No

12. Have presence/probable absence (P/A) summer surveys[1][2] been conducted[3][4] **within** the suitable habitat located within your project action area? 017

[1] See the Service's summer survey guidance for our current definitions of suitable habitat.

[2] Presence/probable absence summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate distance from hibernacula) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

[3] For projects within the range of either the Indiana bat or NLEB in which suitable habitat is present, and no bat surveys have been conducted, the transportation agency will assume presence of the appropriate species. This assumption of presence should be based upon the presence of suitable habitat and the capability of bats to occupy it because of their mobility.

[4] Negative presence/probable absence survey results obtained using the summer survey guidance are valid for a minimum of two years from the completion of the survey unless new information (e.g., other nearby surveys) suggest otherwise.

☑ Yes

test_report.txt

13. Did the presence/probable absence (P/A) summer surveys detect Indiana bats and/or NLEB[1]? 018

[1] P/A summer surveys conducted within the fall swarming/spring emergence home range of a documented Indiana bat hibernaculum (contact local Service Field Office for appropriate home range) that result in a negative finding requires additional consultation with the local Service Field Office to determine if clearing of forested habitat is appropriate and/or if seasonal clearing restrictions are needed to avoid and minimize potential adverse effects on fall swarming and spring emerging Indiana bats.

☑ No

14. Were the P/A summer surveys conducted **within** the fall swarming/spring emergence range of a documented Indiana bat hibernaculum[1]? 019

[1] Contact the local Service Field Office for appropriate distance from hibernacula.

☑ No

15. Does the project include activities **within documented NLEB habitat**[1][2]? 030.Q

[1] Documented roosting or foraging habitat – for the purposes of this consultation, we are considering documented habitat as that where Indiana bats and/or NLEB have actually been captured and tracked using (1) radio telemetry to roosts; (2) radio telemetry biangulation/triangulation to estimate foraging areas; or (3) foraging areas with repeated use documented using acoustics. Documented roosting habitat is also considered as suitable summer habitat within 0.25 miles of documented roosts.)

[2] For the purposes of this key, we are considering documented corridors as that where Indiana bats and/or NLEB have actually been captured and tracked to using (1) radio telemetry; or (2) treed corridors located directly between documented roosting and foraging habitat.

☑ No

16. Will the removal or trimming of habitat or trees occur **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors? 034.Q

☑ Yes

17. What time of year will the removal or trimming of habitat or trees **within** suitable but **undocumented NLEB** roosting/foraging habitat or travel corridors occur? 035

☑ B) During the inactive season

18. Will *any* tree trimming or removal occur **within** 100 feet of existing road/rail surfaces? 043

☑ Yes

19. Will *any* tree trimming or removal occur **between** 100-300 feet of existing road/rail surfaces? 044

☑ Yes

20. Will *any* tree trimming or removal occur **greater than** 300 feet from existing road/rail surfaces? 045.Q

☑ No

21. Are *all* trees that are being removed clearly demarcated? 047

☑ No

22. Will the removal of habitat or the removal/trimming of trees include installing new or replacing existing **permanent** lighting? 049

☑ Yes

23. Does the project include maintenance of the surrounding landscape at existing facilities (e.g., rest areas, stormwater detention basins)? 050.Q

☑ No

24. Does the project include wetland or stream protection activities associated with compensatory wetland mitigation? 053

☑ Yes

25. Does the project include slash pile burning? 055

☑ No

26. Does the project include *any* bridge removal, replacement, and/or maintenance activities (e.g., any bridge repair, retrofit, maintenance, and/or rehabilitation work)? 057

☑ Yes

27. Is there *any* suitable habitat[1] for Indiana bat or NLEB **within** 1,000 feet of the bridge? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat) 058

[1] See the Service's current summer survey guidance for our current definitions of suitable habitat.

☑ Yes

28. Has a bridge assessment[1] been conducted **within** the last 24 months[2] to determine if the bridge is being used by bats? 059

[1] See User Guide Appendix D for bridge/structure assessment guidance

[2] Assessments must be completed no more than 2 years prior to conducting any work below the deck surface on all bridges that meet the physical characteristics described in the Programmatic Consultation, regardless of whether assessments have been conducted in the past. Due to the transitory nature of bat use, a negative result in one year does not guarantee that bats will not use that bridge/structure in subsequent years.

☑ Yes

test_report.txt

29. Did the bridge assessment detect *any* signs of Indiana bats and/or NLEBs roosting in/under the bridge (bats, guano, etc.)[1]? 060

[1] If bridge assessment detects signs of *any* species of bats, coordination with the local FWS office is needed to identify potential threatened or endangered bat species. Additional studies may be undertaken to try to identify which bat species may be utilizing the bridge prior to allowing *any* work to proceed.

Note: There is a small chance bridge assessments for bat occupancy do not detect bats. Should a small number of bats be observed roosting on a bridge just prior to or during construction, such that take is likely to occur or does occur in the form of harassment, injury or death, the PBO requires the action agency to report the take. Report all unanticipated take within 2 working days of the incident to the USFWS. Construction activities may continue without delay provided the take is reported to the USFWS and is limited to 5 bats per project.

☑ No

30. Will the bridge removal, replacement, and/or maintenance activities include installing new or replacing existing **permanent** lighting? 088.Q

☑ Yes

31. Does the project include the removal, replacement, and/or maintenance of *any* structure other than a bridge? (e.g., rest areas, offices, sheds, outbuildings, barns, parking garages, etc.) 089

☑ Yes

32. Is there *any* suitable habitat[1] for Indiana bat or NLEB **within** 1,000 feet of the structure? (includes any trees suitable for maternity, roosting, foraging, or travelling habitat) 090

    [1] See the Service's current summer survey guidance for our current definitions of suitable habitat.

    ☑ Yes

33. Has a structure assessment[1] been conducted **within** the last 24 months[2] to determine if bats are using the structure(s)? 091

    [1] Structure assessment for occupied buildings means a cursory inspection for bat use. For abandoned buildings a more thorough evaluation is required (See User Guide Appendix D for bridge/abandoned structure assessment guidance).

    [2] Assessments must be completed no more than 2 years prior to conducting any work on the structures, regardless of whether assessments have been conducted in the past. Due to the transitory nature of bat use, a negative result in one year does not guarantee that bats will not use that structure in subsequent years.

    ☑ Yes

    test_report.txt

34. Did the structure assessment detect *any* signs of Indiana bats and/or NLEBs roosting in/under the structure (bats, guano, etc.)[1]? 092

    [1] If bridge assessment detects signs of *any* species of bats, coordination with the local FWS office is needed to identify potential threatened or endangered bat species. Additional studies may be undertaken to try to identify which bat species may be utilizing the bridge prior to allowing *any* work to proceed.

    ☑ No

35. Will the structure removal, replacement, and/or maintenance activities include installing new or replacing existing **permanent** lighting? 108.Q

    ☑ Yes

36. Will the project involve the use of **temporary** lighting *during* the active season? 110

    ☑ Yes

37. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **temporary** lighting will be used? 111

☑ Yes

38. Will the project install *any* new or replace any existing **permanent** lighting in addition to the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities? 117

☑ Yes

39. Is there *any* suitable habitat **within** 1,000 feet of the location(s) where **permanent** lighting (other than the lighting already indicated for habitat removal (including the removal or trimming of trees) or bridge/structure removal, replacement or maintenance activities) will be installed or replaced? 118

☑ Yes

40. Does the project include percussives or other activities (**not including tree removal/trimming or bridge/structure work**) that will increase noise levels above existing traffic/background levels? 119.Q

☑ No

41. Are *all* of the project activities that will be conducted **greater than** 0.5 miles of a known Indiana bat and/or NLEB hibernaculum[1] and **greater than** 300 feet from the existing road/rail surface[2] limited to one or more of the following activities: 126.Q

- maintenance of the surrounding landscape at existing facilities (e.g., rest areas, stormwater detention basins);
- wetland or stream protection activities associated with compensatory wetland/stream mitigation that will not clear suitable habitat (i.e. tree removal/trimming);
- involves slash pile burning;
- within an area with negative presence/probable absence (P/A) summer surveys[3];
- limited to activities that **DO NOT** cause any stressors to the bat species, including, but not limited to those described in the BA/BO (i.e. do not involve habitat removal, tree removal/trimming, bridge or structure activities, temporary or permanent lighting, or use of percussives) (e.g., lining roadways, unlighted signage , rail road crossing signals, signal lighting, and minor road repair such as asphalt fill of potholes, etc.))?

[1] For the purpose of this consultation, a hibernaculum is a site, most often a cave or mine, where bats hibernate during the winter (see suitable habitat), but could also include bridges and structures if bats are found to be hibernating there during the winter.

[2] Road surface is defined as the actively used [e.g. motorized vehicles] driving surface and shoulders [may be pavement, gravel, etc.] and rail surface is defined as the edge of the actively used rail ballast.
(example activities include road line painting)

[3] See the Service's summer survey guidance for our current definitions of suitable habitat.

- [x] No, the project includes additional activities that would be conducted beyond 300' from the road/rail surface and beyond 0.5 miles from a hibernaculum

EVALUATION PROGRESS

Your project is outside of the scope of the programmatic consultation for this key because your project is not limited to exempted activities greater than 300 feet from the road/rail surface (and greater than 0.5 miles from a hibernaculum). Please contact the appropriate U.S. Fish and Wildlife Service office for additional assistance with your project.

Agency Coordination

United States Department of the Interior

FISH AND WILDLIFE SERVICE

New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
https://www.fws.gov/office/new-england-ecological-services

May 2, 2025

David Paulson
Environmental Services
MassDOT Highway Division
10 Park Plaza, Suite 7130
Boston, MA 02116

RE: Cape Cod Bridges Program Biological Assessment
In reply refer to TAILS # 2020-I-0427 and Project Code #2024-0141024

Dear David Paulson:

This responds to your request, dated March 27, 2025, and received in our office on the same date, for our concurrence with your determination that the Massachusetts Department of Transportation's (MassDOT) Cape Cod Bridges Replacement Program project (Project) may affect, but is not likely to adversely affect, the federally endangered northern long-eared bat (*Myotis septentrionalis*) (NLEB), and the tricolored bat (*Perimyotis subflavus*) (TCB), which is proposed to be listed as endangered. The MassDOT has requested concurrence that the Project is not likely to jeopardize the monarch butterfly (*Danaus plexippus*), which is proposed to be listed as threatened. The MassDOT determined the Project would have no effect on other federally listed species. Your request and our response are made pursuant to section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884, as amended; 16 U.S.C 1531, et seq.) (ESA). We understand the MassDOT is acting as a non-Federal representative of the Federal Highway Administration (FHWA) for the purpose of consultation under section 7.

The biological assessment included with your request also referenced the Fish and Wildlife Coordination Act (16 U.S.C. 661-666(e))(FWCA). The FWCA established an authority for the U.S. Fish and Wildlife Service (Service) to assist, and cooperate with, Federal agencies in minimizing impacts of projects on wildlife resources. We are unaware of any substantial impacts the Project would have on wildlife resources under the Service's jurisdiction in the project area. This does not preclude future evaluation and recommendations by the Service, should the project description change.

The MassDOT proposes to replace the Bourne and Sagamore bridges that connect Cape Cod to the mainland in the town of Bourne, Massachusetts. The replacement program will construct two new bridges immediately adjacent to the two existing bridges, and then dismantle the old bridges. Each new bridge will be a parallel, twin tier-arch structure with delta frames. The bridges will be wider and longer than the existing bridges to improve traffic safety and add pedestrian and bicycle lanes. Construction activities are expected to occur starting in 2026 and last eight to ten years. These activities will have an impact footprint larger than the existing bridges at landfall and traffic interchanges on both sides of Cape Cod Canal, and along State Routes 25 and 28 (Bourne Bridge) and State Route 3 and US Route 6 (Sagamore Bridge). Tree clearing, structure removal, construction light and noise, and roadside vegetation clearing could potentially impact individuals and habitats of several federally listed and proposed listed species.

Northern long-eared bats and tricolor bats:

The action area contains several small, fragmented patches of pitch pine – oak forest/woodland that may provide suitable roosting and foraging habitat for both bat species. Acoustic surveys of the action area by the MassDOT in 2020 indicated a probable presence of TCB in both areas, but NLEB was not detected. The MassDOT plans to commission additional acoustic surveys in the action area in the summer 2025. In October 2023 and August 2024, the MassDOT conducted visual surveys of all existing bridge structures and vaults for evidence of use by bats and collected guano samples. No bats were observed using the structures, and all guano samples found in or near these structures were identified as big brown bat (*Eptesicus fuscus*). No known roost trees for either NLEB or TCB are located within or adjacent to the action area. In addition, no NLEB or TCB winter hibernacula are expected to be affected by the Project.

The Project will result in clearing of approximately 107.8 acres in total of suitable summer bat habitat (i.e., upland trees/forest) within the action area, specifically within and along the interchange approach networks to both bridges. All 107.8 acres to be cleared are within 1,000 feet of suitable summer roosting habitat that would remain intact. Up to 17 structures may need to be demolished, and these structures (along with bridge abutments) may provide shelter or roosting habitat for bats. Lights and noise associated with construction activities (particularly noise from pile driving) may also cause bats to flush from nearby trees and seek roosting and foraging elsewhere. Acoustic surveys recorded probable detections of TCB in the action area, and TCB could be impacted by noise from pile driving.

The MassDOT would implement these measures to avoid adverse effects to the NLEB and TCB from the proposed project:

- Avoid removing trees within 0.25 miles of known NLEB or TCB hibernation sites, year-round, and avoid removing known roost trees and suitable roost trees within 0.25 miles of a known NLEB and/or TCB roost during the pup season (June 1 through August 15). No known NLEB or TCB hibernation sites or roost trees are located within 0.25 of the Action Areas.
- Time of year restrictions on tree clearing will be implemented during the duration of Project construction. Trees will not be cleared during the summer occupancy period from March 15

through November 30 on the Cape side of the canal and from April 15 through October 31 on the mainland side of the canal.
- To prevent potential NLEB and/or TCB entry into structures and abutments during the winter, current entry points will be sealed with appropriate one-way bat exit structures in the late summer period, when juvenile bats typically disperse and before the start of the hibernation period.
- Prior to structure demolition, building inspections will be conducted and any wildlife found within them will be removed and, if necessary, exclusionary measures (see above bullet) will be installed prior to demolition.
- In-water construction activities with potential to cause acoustic impacts (e.g., pile driving) will not occur from March 1 through August 31 of any year.
- Vessels transiting within Cape Cod Canal and between Cape Cod Canal, Buzzards Bay, Cape Cod Bay, and supply ports, will operate at speeds not to exceed 10 knots, reducing collision risk with bats and monarch butterflies traveling over the waterway.

Monarch butterfly:

Monarch butterflies are common throughout Massachusetts and Cape Cod during summer months and migrate through the area from mid-August through early October. Habitats supporting the milkweed plants that the species requires for its life cycle can be found in fields, roadside areas, wetlands, and urban gardens. Suitable habitats are limited to roadsides and other undeveloped, unforested portions in and adjacent to the Project's action area.

Vegetation clearing in the action area during construction may affect monarch butterflies through temporary and permanent removal or disturbance of breeding or foraging habitat, or through direct mortality. The MassDOT is enrolled in the Nationwide Candidate Conservation Agreement with Assurances (CCAA) for the monarch butterfly and will implement its conservation measures that are designed to create, enhance, restore, sustain, or maintain the species' breeding and/or foraging habitat. Noise associated with construction activities may be a potential stressor to monarch caterpillars, although individuals exposed to chronic noise may become habituated or desensitized.

The MassDOT would implement these measures to avoid adverse effects to the monarch butterfly from the proposed project:

- Following construction completion, cleared areas will be revegetated to the maximum extent possible, using native plant and tree species to provide suitable habitat for bat species, pollinators (such as monarch butterflies), and other native species.
- Conservation mowing practices consistent with Best Management Practices (BMPs) for monarch butterflies will be implemented, such as: following recommended times of year for mowing (e.g., October 1 – May 1 in Massachusetts); refraining from mowing entire parcels and mowing after native plants at sites have completed blooming and dispersing seed; using a minimum cutting height (e.g., 10–12 inches) when mowing; using a flushing bar and mowing at reduced speeds to allow wildlife to escape prior to mowing, and only mowing once or twice per year.

- The MassDOT will implement conservation mowing methods on the MassDOT rights-of-way. Conservation mowing utilizes BMPs during grassland habitat management to reduce impacts to and restore breeding and/or foraging habitat for pollinator species such as monarch butterflies.

We concur with your determination that the proposed Project may affect, but is not likely to adversely affect, the NLEB and TCB, and not likely to jeopardize the monarch butterfly, because:

- All tree clearing will occur during the inactive seasons; the chance that NLEB or TCB may be directly affected by tree removal activities outside the summer occupancy season is discountable because any NLEB of TCB in the project area would have moved to hibernacula or the adjacent swarming/staging habitat and would not be present during tree removal.
- Higher quality summer roosting habitat (in the form of larger forest patches away from roadways and developed areas) is supported in proximity to the tree clearing areas on Camp Edwards and the Red Brook Wildlife Management Area. Loss of 107.8 acres of summer habitat is insignificant or discountable because NLEB and TCB are capable of switching roosting sites and can move to these larger, higher quality forested areas.
- Acoustic surveys did not document probable presence of NLEB within the action area, and thus impacts to NLEB resulting from the loss of potential roosting habitat would be discountable. Acoustic surveys did document probable presence of TCB within the action area, but the chance that TCBs may be adversely affected by tree removable is discountable because tree removal will be limited to a time of year when TCB is not present.
- Pile driving activities are limited to occur from September 1 through the end of February, entirely outside of the pup season from June 1 through August 15. In the brief period between September 1 and leaving the area for their hibernacula, bats remaining in the project area may be affected by light and noise from construction activities to the point of dispersing to forest patches away from the activities. We expect this response to be rare and do not expect this effect to occur repeatedly. Bats are known to safely flush from one roosting to another. For these reasons, any resulting effects to TCB from construction activities are anticipated to be too small to detect and therefore insignificant.
- Construction noise impacts to adult monarch butterflies migrating, breeding, or foraging on land or migrating over waterbodies within the action area would be too small to be meaningfully measured or detected and therefore insignificant.
- The MassDOT's enrollment in the CCAA for monarch butterflies and implementation of its conservation practices is expected to result in a net gain of habitat and/or species population numbers in the state, and therefore is not likely to jeopardize the continued existence of the monarch butterfly.

Further consultation with us under section 7 of the ESA is not required at this time. If any of the criteria at 50 CFR 402.16(a)[1] are met, reinitiation of consultation is required, and the MassDOT or FHWA should contact us immediately and suspend activities that may affect those species

[1] https://www.ecfr.gov/current/title-50/chapter-IV/subchapter-A/part-402/subpart-B/section-402.16

until the appropriate level of consultation is completed with our office. Thank you for your cooperation, and please contact Audrey Mayer of this office at 603-496-5181 or audrey_mayer@fws.gov if you have questions or need further assistance.

Sincerely,

AUDREY MAYER

Digitally signed by AUDREY MAYER
Date: 2025.05.02 09:58:01 -04'00'

Audrey Mayer
Supervisor
New England Field Office

cc: Reading file
david.j.paulson@dot.state.ma.us
timothy.dexter@state.ma.us
john.simkins@dot.gov

Attachment 2.

Biological Assessment for Marine Species and Agency Coordination

February 27, 2025

Ms. Jennifer Anderson
Assistant Regional Administrator for Protected Resources
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
Protected Resources Division
55 Great Republic Drive
Gloucester, MA 01930

Subject: Biological Assessment for Cape Cod Bridges Program Bourne, Massachusetts Bridge Replacement

Dear Ms. Anderson,

The Massachusetts Department of Transportation (MassDOT), as a non-federal designee on behalf of the U.S. Federal Highway Administration (FHWA), requests your written concurrence with our determination of effects for the proposed replacement of the Cape Cod Bridges Program on federally listed species and designated critical habitat in accordance with section 7(a)(2) of the Endangered Species Act of 1973 (as amended), codified in 50 CFR §402.02 and §402.14.

With this letter, MassDOT submits its biological assessment containing a description of the proposed action, the species addressed, discussion of effects, and our effect determinations for the following federally listed species and designated critical habitat:

- Fin Whale (*Balaenoptera physalus*)
- North Atlantic Right Whale (*Eubalaena glacialis*) (Critical Habitat)
- Green Turtle (*Chelonia mydas)*
- Kemp's Ridley Turtle (*Lepidochelys kempii*)
- Leatherback Turtle (*Dermochelys coriacea*)
- Loggerhead Turtle (*Caretta caretta*)
- Shortnose Sturgeon (*Acipenser brevirostrum*)
- Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

MassDOT has made the determination that the proposed action *may affect, but is not likely to adversely affect* the species listed above. Likewise, the proposed action is not likely to adversely affect physical and biological features associated with North Atlantic Right Whale Critical Habitat, and therefore will not adversely modify or destroy, designated Critical Habitat for North Atlantic Right Whale.

We appreciate your review and assistance with this consultation process. Please contact me at 857-262-3378 or David.J.Paulson@dot.state.ma.us should you have any questions.

Sincerely,

David Paulson

David J. Paulson
Enclosure





Cape Cod Bridges Program

Bourne, Massachusetts

Biological Assessment for Marine Species

SUBMITTED TO:
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
Protected Resources Division
55 Great Republic Drive
Gloucester, MA 01930

PROPONENT:
The Massachusetts Department of Transportation
Highway Division
10 Park Plaza
Boston, MA 02116

February 27, 2025

massDOT
Massachusetts Department of Transportation

Table of Contents

1 Introduction 1
1.1 Federal Nexus 1
1.2 Proposed Action 2
1.2.1 Purpose and Need 4
1.3 Program Area and Setting 4
1.4 Consultation History 5

2 Program Action Area 5

3 Federally Listed and Proposed Species and Designated Critical Habitat 6
3.1 ESA-Listed Whales 8
3.1.1 Fin Whale 8
3.1.2 North Atlantic Right Whale 9
3.1.3 Whales in the Action Area 10
3.2 ESA-Listed Sea Turtles 10
3.2.1 Green Turtle 10
3.2.2 Kemp's Ridley Turtle 11
3.2.3 Leatherback Turtle 12
3.2.4 Loggerhead Turtle 13
3.2.5 Sea Turtles in the Action Area 13
3.3 ESA-Listed Fishes 14
3.3.1 Atlantic Sturgeon 14
3.3.2 Shortnose Sturgeon 15
3.3.3 Sturgeon in the Action Area 16
3.4 Critical Habitat for North Atlantic Right Whale 17

4 Environmental Baseline 18
4.1 Aquatic Habitat Characterization 18
4.1.1 Canal Substrate 18
4.1.2 Canal Flora and Fauna 19

5 Program Details 20
5.1 Construction Methods 20
5.2 Temporary Works 21
5.3 New Bridge Construction 22
5.4 Existing Bridge Demolition 22
5.5 Area Restoration 23
5.6 Summary of Program Construction Components 23
5.7 Construction Vessels and Barges 31
5.8 Program Timeline and Duration 32
5.9 Conservation and Mitigation Measures 32

6 Effects Analysis 36
6.1 Noise / Underwater Sound 37
6.1.1 Marine Mammals and Sea Turtles 38
6.1.2 Atlantic Sturgeon and Shortnose Sturgeon 47
6.2 Vessel Strikes 51
6.2.1 Marine Mammals and Sea Turtles 51
6.2.2 Atlantic and Shortnose Sturgeon 54
6.3 Water Quality / Turbidity 55
6.3.1 Marine Mammals and Sea Turtles 56
6.3.2 Atlantic Sturgeon and Shortnose Sturgeon 56
6.4 Entrainment/Entrapment 57
6.4.1 Marine Mammals and Sea Turtles 57
6.4.2 Atlantic Sturgeon and Shortnose Sturgeon 58
6.5 Habitat Alteration 59
6.5.1 Marine Mammals and Sea Turtles 62
6.5.2 Atlantic Sturgeon and Shortnose Sturgeon 62
6.6 North Atlantic Right Whale Critical Habitat 63
7 Effects Determinations 65
8 References 66

Figures

Figure 1-1. Cape Cod Bridges Program Proposed Project Limits 76
Figure 1-2. Cape Cod Study Area in Relation to Project Limits 77
Figure 1-3. Fin Whale Observations in the Cape Cod Study Area 1977-2021 78
Figure 1-4. North Atlantic Right Whale Observations in Cape Cod Study Area 1967-2023 79
Figure 1-5. Sea Turtle Sightings in the Cape Cod Study Area 1966 to 2021 80
Figure 1-6. North Atlantic Right Whale Critical Habitat (Unit 1) 81
Figure 1-7. Location of the Program Study Area Relative to Major Oceanographic Features and Circulation Patterns that Contribute to the Formation of North Atlantic Right Whale Critical Habitat Physical and Biological Features (NOAA 2015a). 82
Figure 1-8 North Atlantic Right Whale Management Areas with Respect to Locations of Cape Cod Bridges and Potential Program Ports 83
Figure 3-1. Acoustic Impact Areas to Low Frequency Cetaceans for the Bourne Bridge Site 96
Figure 3-2. Acoustic Impact Areas to Low Frequency Cetaceans for the Sagamore Bridge Site 97
Figure 3-3. Acoustic Impact Areas to Sea Turtles for the Bourne Bridge Site 98
Figure 3-4. Acoustic Impact Areas to Sea Turtles for the Sagamore Bridge Site 99
Figure 3-5. Acoustic Impact Areas to Fishes for the Bourne Bridge Site 100
Figure 3-6. Acoustic Impact Areas to Fishes for the Sagamore Bridge Site 101

Tables

Table 1. Description of Design Parameters of the Recommended Build Alternative 2
Table 2. Program Construction Components and Temporary and Permanent Impacts [1, 2] 25
Table 3. Estimation of Vessels Employed in Day-to-Day Marine Operations for the Program[1] 31
Table 4. ESA-Listed Marine Species in the Study Area in Relation to Proposed TOYs and BMPs 36
Table 5. Marine Mammal Acoustic Thresholds[1, 2] 39
Table 6. Sea Turtle Hearing Thresholds 40
Table 7. Fish Hearing Thresholds (FHWG 2008) 48
Table 8. Program-wide Summary of Impacts on Benthic Habitat[1] 61
Table 2-1. Distances (meters) to Marine Mammal Auditory Impact Thresholds from Program Construction Activity 85
Table 2-2. Distances (meters) to Sea Turtle Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals) 89
Table 2-3. Distances (meters) to Marine Mammal and Sea Turtle Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sound Signals) for Concurrent Pile Driving 91
Table 2-4. Distances (meters) to Fish Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals) 92
Table 2-5. Distances (meters) to Fish Auditory Impact Thresholds from Maximum Concurrent Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals). 94

Attachments

Attachment 1 – Study Area Figures 75
Attachment 2 – Acoustic Impact Tables 84
Attachment 3 – Acoustic Impact Area Figures 95

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AIS	Automatic Identification System
BA	Biological Assessment
CFR	Code of Federal Regulations
dB	Decibel
DPS	Distinct Population Segment
EEZ	Exclusive Economic Zone
ESA	US Endangered Species Act of 1973

Acronym/Abbreviation	Definition
FHWA	US Federal Highway Administration
FR	Federal Register
GARFO	Greater Atlantic Regional Fisheries Office
GOM	Gulf of Maine
HTL	High tide line
MA	Massachusetts
MassDOT	Massachusetts Department of Transportation
ME	Maine
mg/L	Milligrams Per Liter
MHW	Mean high water
MLW	Mean low water
MMPA	Marine Mammal Protection Act of 1972
MRER	Major Rehabilitation Evaluation Report
NAO	North Atlantic Oscillation
NARW	North Atlantic Right Whale
NH	New Hampshire
NOAA	National Oceanic and Atmospheric Administration
NOAA Fisheries	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
OBIS	Ocean Biodiversity Information System
OPR	Office of Protected Resources
PBF	Physical and Biological Feature
Peak	Peak Sound Pressure Levels
Program	Cape Cod Bridges Program
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
RMS	Root-Mean-Square
SAR	Stock Assessment Report
SELcum	Cumulative Sound Exposure Levels
SPL	Sound Pressure Level

Acronym/Abbreviation	Definition
TL	Transmission Loss
TOY	Time of Year
TSS	Total Suspended Solids
USACE	US Army Corps of Engineers
USC	United States Code
USFWS	US Fish and Wildlife Service
ZOI	Zone of Influence

1 Introduction

The Cape Cod Bridges Program Biological Assessment for Marine Species has been prepared in support of the Draft Environmental Impact Statement/Draft Environmental Impact Report (DEIS/DEIR) for the Cape Cod Bridges Program, in accordance with the following federal and state statutes, regulations, and guidance: National Environmental Policy Act (NEPA), 42 United States Code (USC) 4321 et seq.; the Council of Environmental Quality (CEQ) regulations implementing NEPA, 40 Code of Federal Regulations (CFR) Parts 1500–1508, issued April 20, 2022 and effective May 20, 2022; the Federal Highway Administration's (FHWA's) issued regulations, Environmental Impacts and Related Procedures (23 CFR 771) and corresponding guidance, Technical Advisory (T 6640.8A): Guidance for Preparing and Processing Environmental and Section 4(f) Documents (October 30, 1987); the Certificate of the Secretary of the Office of Energy and Environmental Affairs (EEA) on the Environmental Notification Form (ENF) for the Cape Cod Bridges Program, July 7, 2023; and the Massachusetts Environmental Policy Act (MEPA) regulations, 301 Code of Massachusetts Regulation (CMR) 11.00 (as amended, January 6, 2023).

1.1 Federal Nexus

The purpose of this Biological Assessment (BA) is to address the potential effects of the Cape Cod Bridges Program (Program) on species listed as endangered or threatened under the Endangered Species Act of 1973 (ESA), designated critical habitat, and to support the development of the Program DEIS/DEIR pursuant to NEPA. FHWA and Massachusetts Department of Transportation – Highway Division (MassDOT) are pursuing informal consultation under Section 7 of the ESA to impacts on species under the jurisdiction of National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NOAA Fisheries) that may result from the proposed Program. Section 7 of the ESA is intended to ensure that, through consultation with NOAA Fisheries, federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species, or result in the destruction or adverse modification of critical habitat. This BA addresses the potential effects of the Cape Cod Bridges Program on species under the jurisdiction of NOAA Fisheries.

This BA includes an acoustic analysis of the Program's in-water construction activities (Attachment 2) for assessing the Program's potential effects on species protected under the ESA as well as those protected under the Marine Mammal Protection Act of 1972 (MMPA). The presence of and impacts on marine mammal species protected under the MMPA are discussed in a separate memorandum, independent of this ESA Section 7 consultation. FHWA's decision on whether to pursue an MMPA authorization is pending further coordination with NOAA Office of Protected Resources.

1.2 Proposed Action

The Proposed Action is the Cape Cod Bridges Program Build Alternative, which incorporates the U.S. Army Corps of Engineers' (USACE) Major Rehabilitation Evaluation Report/Environmental Assessment (MRER/EA) Preferred Alternative of Replacement of Both Highway Bridges with New Bridges with Four Through-Traffic Lanes and Two Auxiliary Lanes (In-Kind Bridge Replacement updated to comply with federal and state highway and design safety standards). The Program proposes to replace the Bourne and Sagamore highway bridges with parallel, twin tied-arch structures supported by delta frames with an approximate 700-foot mainline span length. The replacement bridges will maintain the existing vertical clearance of 135 feet above mean high water (MHW) and provide a minimum of 500 feet of horizontal channel width consistent with existing conditions. The bridge piers will be located at the waterline adjacent to the Canal Service Roads, within the riprap slope. The pier footprints will be partially above and partially below the high tide line (HTL), and some portions will extend below the Mean Low Water line (MLW) into the subtidal zone. At both the Bourne and Sagamore crossings, the replacement bridge mainline alignment location will be offline (outside the footprint of the existing bridge) and inboard of the existing highway bridges, located on the side of the canal between the existing Bourne Bridge and Sagamore Bridge. The twin deck structures will be approximately ten feet apart and parallel to each other; each main span will include two through-traffic lanes, one auxiliary lane, and shoulders and barriers in compliance with current MassDOT and FHWA standards and guidelines for highway and bridge design. Additionally, at both canal crossings, the Program will include a reconfiguration of the highway interchange approach networks north and south of Cape Cod Canal to align with the replacement highway bridges. The replacement highway bridges and their interchange approaches will accommodate shared use pedestrian and bicycle paths that connect to the local roadway network on both sides of Cape Cod Canal in the town of Bourne. The Program's proposed Project Limits for the two bridge replacements are shown in Attachment 1, Figure 1-1.

Table 1 presents a description of the Program elements/design parameters of the recommended Build Alternative: Replacement Highway Bridges Built to Modern Design Standards.

Table 1. Description of Design Parameters of the Recommended Build Alternative

Program Element/ Program Design Parameter	Description
Highway Bridges	Replacement of Both Highway Bridges with New Bridges with Four Through-Traffic Lanes and Two Auxiliary Lanes (In-Kind Bridge Replacement, updated to comply with federal and state highway and design safety standards).

Program Element/ Program Design Parameter	Description
Bridge Highway Cross-Section and Shared Use Path	Each replacement highway bridge would provide four 12-foot-wide through travel lanes (two in each direction), two 12-foot-wide entrance/exit (auxiliary) lanes, a 4-foot-wide left shoulder, and a 10-foot-wide right shoulder. Right and left barriers would be offset an additional 2 feet beyond the limits of the shoulders.
	Each crossing location would include one bi-directional pedestrian and bicycle shared-use path (SUP), separated from vehicular traffic by the shoulder and barrier. The usable width of the shared-use path would be 14-feet-wide on the bridge main spans, 20-feet-wide on the interchange approaches, and 12-feet-wide on the connecting roadways.
Bridge Clearances	The replacement bridges would maintain the existing vertical clearance of 135 feet above mean high water and account for 3 feet of future sea level rise, for a total vertical clearance of 138 feet above mean high water.
	The replacement bridges would provide a minimum of 500 feet of horizontal channel width to be consistent with existing conditions.
Main Span Length and Bridge Pier Location	The replacement bridges would have a main span length of approximately 700 feet, which would locate the bridge piers at the waterline adjacent to the service road (shoreline piers), into the riprap slope but above the low tide line.
Bridge Deck Configuration	Each crossing (Bourne and Sagamore) would have two separate decks (twin structures).
Mainline Alignment	The mainline alignment locations at both crossings would be offline inboard. Both spans of the replacement highway bridge would be located outside the footprint of the existing bridge, approximately 10 feet apart and parallel to each other, and on the side of the canal between the existing bridges. The replacement main spans at the Bourne crossing would be east of Bourne Bridge toward Cape Cod Bay. The replacement main span at the Sagamore crossing would be west of Sagamore Bridge toward Buzzards Bay.
Bridge Type	The replacement bridges would be twin tied-Arch bridges with delta frames supporting an approximate 600-foot arch and 700-foot mainline span.
Interchange Approach Network	Interchange approach improvements at each crossing would be as follows: • Sagamore Crossing: Direct Connection to State Road in Sagamore North and Westbound On-Ramp under U.S. Route 6 with Cranberry Highway Extension and Sandwich Road Connector in Sagamore South; • Bourne Crossing: Directional Interchange in Bourne North and Diamond Interchange in Bourne South.

Henceforth in this Biological Assessment, references to the Program shall be considered to imply the Proposed Action. The in-water activities of the Program within the footprint encompassing the existing and proposed Bourne and Sagamore Bridges include temporary installation of cofferdams, bulkheads, barge slips, pile support platforms, and dolphins to support the permanent installation of proposed bridge sections and the removal of the existing bridge materials.

1.2.1 Purpose and Need

The purpose of the Program is to improve cross-canal mobility and accessibility between Cape Cod and mainland Massachusetts for all road users and to address the increasing maintenance needs and functional obsolescence of the aging Cape Cod Canal highway bridges. The Program is needed to address the following transportation deficiencies:

- Address the deteriorating structural condition and escalating maintenance demands of the Cape Cod Canal highway bridges;
- Address the substandard design elements of the Cape Cod Canal highway bridges, the immediate mainline approaches, and their adjacent interchanges and intersections;
- Improve vehicular traffic operations; and
- Improve accommodations for pedestrians and bicyclists.

In accordance with 23 USC 139(f)(4)(E)(ii) and 40 Code of Federal Regulations (CFR) 1501.12, the Program builds upon and references prior, multi-year foundational studies, including:

1. the USACE Cape Cod Canal Highway Bridges MRER, which was completed to evaluate the current condition of the bridges and determine whether standard operation and maintenance, major rehabilitation, or replacement of either or both bridges would provide the most reliable, fiscally responsible solution for providing long-term vehicular access across Cape Cod Canal; and
2. the MassDOT Office of Transportation Planning Cape Cod Canal Transportation Study, which was completed to identify and evaluate existing and future multimodal transportation deficiencies and needs of the existing roadway network around the Cape Cod Canal area.

1.3 Program Area and Setting

The Cape Cod Canal (41.763° N latitude, -70.569° W longitude), a 17.4-mile sea level navigable waterway with an 8.1-mile-long land cut in southeastern Massachusetts, was constructed in 1914 as a navigable commercial waterway and is now managed by the USACE. It connects Cape Cod Bay to the northeast and Buzzards Bay to the southwest and is part of the Atlantic Intracoastal Waterway. The canal is a highly dynamic area with extremely strong tidal currents and shifting shoals that form in

various locations throughout the canal (USACE 2015a). It is frequently trafficked by commercial and recreational vessels (approximately 14,000 vessels per year) and receives routine maintenance dredging due to frequent sand depositional features (most recently in 2016 and 2023; [USACE 2023]).

The canal banks slope dramatically towards the canal channel, which is maintained by the USACE at an authorized minimum depth of 32 feet below mean low water (MLW). General Program area in-water habitat conditions include a tidal saline environment, maximum canal flow velocity of 5.2 miles per hour, a total approach channel length of 9.3 miles, an approximate canal width of 680 feet (USACE 2023), and a minimum navigation channel width of 480 feet.

1.4 Consultation History

As previously noted, the Program incorporates the USACE's Cape Cod Canal Highway Bridges MRER/ Environmental Assessment (MRER/EA), completed through the issuance of a Finding of No Significant Impact (FONSI) on March 29, 2022. During a MRER/EA coordination meeting between NOAA Fisheries and USACE on May 20, 2019, biologists from the two agencies discussed the need to consider potential effects on ESA listed marine species, including the two whale species, four sea turtle species, and two sturgeon species identified and described in Section 3.0. The coordination concluded that replacement of the Cape Cod Canal highway bridges would be pursued under an informal ESA Section 7 consultation (Bradley 2019, NMFS 2019).

Cooperating agency coordination for the Program began in June 2023, soon after FHWA agreed to be the lead Federal Agency for the Program in January 2023, as requested by MassDOT. Cooperating Agency meetings for the Program have been held on the following dates: June 14 and October 17, 2023; and March 29 and June 27, 2024. In addition, FHWA and MassDOT have conducted additional coordination meetings with NOAA's Office of Protected Resources (OPR), including a meeting on August 1, 2024, to review the Program's proposed ESA Section 7 consultation process and a meeting on August 14, 2024, to discuss marine mammal occurrence within Cape Cod Canal and potential authorization requirements under the Marine Mammal Protection Act. NOAA OPR's initial guidance was that MMPA authorization would not be necessary for the Program. FHWA's decision on whether the Program requires further action in compliance with the MMPA is still being determined. These meetings did not result in any changes to the ESA listed species to be considered for analysis of potential effects.

2 Program Action Area

The Action Area is defined under the ESA as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR §402.2). The Action Area

includes the Program footprint where work will occur to remove the existing bridges and construct the new bridges, bridge approaches, highway interchange approaches at the four bridge quadrants (Bourne North, Bourne South, Sagamore North, and Sagamore South), and pedestrian/bicycle shared use path. The Program Action Area extends across two discrete habitat types: aquatic and terrestrial. For the purposes of this consultation, only the aquatic portion of the Action Area is pertinent; therefore, within the remainder of this report, references to the Action Area refer exclusively to the aquatic portion of Action Area. The potential effects of the Program on ESA-listed species in the terrestrial portion of the Action Area will be addressed through the Section 7 consultation process with the U.S. Fish and Wildlife Service.

The Program Action Area includes the waterway underneath the two existing bridges that cross the Cape Cod Canal—the Bourne Bridge to the southwest and the Sagamore Bridge to the northeast—and their planned replacement bridge structures. In addition, the Action Area includes the waters surrounding the two bridges where the marine environment will be exposed to increased underwater sound pressure levels (SPL) and turbidity from in-water construction activities as well as from transits and operations of vessels associated with the Program in delivering the replacement bridge components and construction supplies and removing existing bridge components. Considered transits include vessels that will transport equipment or materials for the Program, barges that will separately deliver the two new bridge spans (floating on water) to the Program site and remove the two existing bridge spans from the Program area, and all fleet vessels' return trips to their ports via either Buzzards Bay or Cape Cod Bay. The Action Area encompasses the possible vessel transit routes for the Program fleet that is to be employed in marine operations originating from a list of potential ports ranging from Portland, Maine (ME) to Portsmouth, New Hampshire (NH), to Weymouth, New Bedford, or Somerset / Fall River, Massachusetts (MA), and the surrounding underwater area ensonified by their noise.

To support the analysis of the Program's potential effects on ESA-listed marine species, this BA has defined the area in which the vast majority of Program activities and effects will occur—spanning Buzzards Bay, Cape Cod Canal, and Cape Cod Bay—as the Cape Cod Study Area (Attachment 1, Figures 1-2 through 1-5). The Cape Cod Study Area excludes vessel transits to/from ports.

3 Federally Listed and Proposed Species and Designated Critical Habitat

NOAA Fisheries has jurisdiction over marine and estuarine species, including whales, sea turtles, and diadromous and catadromous fish species. The Program is within the range of eight species listed or proposed for listing by NOAA Fisheries under the ESA, and within Critical Habitat designated for one species. Therefore, consultation with NOAA Fisheries under ESA Section 7 is required.

- Whales
  - Fin Whale (*Balaenoptera physalus*) (35 Federal Register (FR) 18319, 1970; Recovery plan: NOAA Fisheries 2010)
  - North Atlantic Right Whale (*Eubalaena glacialis*) (35 FR 18319, 1970; 2008 Revised 73 FR 12024; Recovery plan: NOAA Fisheries 2005)
- Sea Turtles
  - Green Turtle (*Chelonia mydas)* (81 FR 20057; Recovery plan: *NOAA Fisheries & USFWS* 1991)
  - Kemp's Ridley Turtle (*Lepidochelys kempii*) (35 FR 18319, 1970; Recovery plan: NOAA Fisheries et al. 2011)
  - Leatherback Turtle (*Dermochelys coriacea*) (35 FR 8491, 1970; Recovery plan: NOAA Fisheries & USFWS 1992)
  - Loggerhead Turtle (*Caretta caretta*) (43 FR 32800, 1978; 76 FR 58868; Recovery plan: NOAA Fisheries & USFWS 2008)
- Fish
  - Shortnose Sturgeon (*Acipenser brevirostrum*) (32 FR 4001; Recovery plan: NOAA Fisheries, 1998)
  - Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) (77 FR 5880 and 77 FR 5914)

Critical habitats are areas that contain features essential to the conservation and/or recovery of an ESA-listed plant or animal and that may require special management and protection; the protected species themselves may not always occupy those areas. NOAA Fisheries considers physical and biological features (PBF) needed for life processes in designating critical habitat, which may include but are not limited to breeding/rearing sites, cover/shelter, areas protected from disturbance, and other areas that provide important nutritional and physiological resources. These features are called primary constituent elements and are defined in the Final Rule for critical habitat designations, when applicable.

- Critical Habitat
  - North Atlantic Right Whale (81 FR 4837)

3.1 ESA-Listed Whales

3.1.1 Fin Whale

The fin whale (*Balaenoptera physalus*) is the second largest whale on earth and was listed as endangered under the ESA in December 1970 (35 FR 18319). Fin whales can commonly be seen within the US Exclusive Economic Zone (EEZ), which is the zone seaward of and adjacent to the territorial sea including the contiguous zone, and extending 200 nautical miles from the territorial sea baseline (33 CFR 2.30), and over the continental shelf, but nonetheless, the species still has not recovered and has remained a federally endangered throughout its range since December 1973 it when the ESA was passed into law. They are distributed worldwide with populations in all ocean basins and within both temperate and polar regions. They are found in deep waters offshore, migrating from the Arctic or Antarctic feeding areas in summer and found year-round in a wide range of locations, with densities of individuals varying across seasons. There is evidence of adult and juvenile wintering areas in Stellwagen Bank and the eastern perimeter of Georges Bank (Figure 1-3), yet fin whales can be in the area year-round (NOAA 2022).

New England and—further north, outside the Action Area—the Gulf of St. Lawrence are major feeding areas for fin whales. Foraging areas include Maine to Cape Cod, Massachusetts, with greatest densities from March through August and lower densities from September to November. Particularly important foraging areas include Massachusetts Bay and especially Stellwagen Bank, Great South Channel, and waters off Cape Cod in the 40-to-50-meter (131.2 to 164 feet) contour, western Gulf of Maine (GOM), and eastern perimeter of Georges Bank (Figure 1-3) (NOAA 2023b). Fin whales feed by taking in large gulps of water with expandable pleats in their throats to primarily feed on krill, squid, and schooling fish such as herring, capelin, and sand lance; then the water is pushed through hundreds of baleen plates in their mouths to filter feed on plankton.

NOAA Fisheries manages marine mammal species as individual stocks by region. The fin whale is divided into four regional stocks, three of which are in the Pacific and one of which is in the Atlantic, known as the Greater Atlantic Region (which encompasses the Program Action Area). Fin whale populations within the Greater Atlantic Region from Nova Scotia and Newfoundland, Canada, to Cape Hatteras, North Carolina, along the east coast of the United States are considered to be of the western North Atlantic Stock, yet a full understanding of their stock boundaries remains uncertain. The best population estimate currently available of the North Atlantic stock is 6,802 individuals, as reported in the Draft 2023 fin whale Stock Assessment Report (SAR), with observed human-caused mortality averaging to 2.05 annually primarily attributed to incidental fishery interactions and vessel collisions (NOAA 2024). Note that this is likely a lower bound as it represents a minimum estimate (NOAA 2024). The biggest threats posed to fin whales are vessel strikes or collisions (NOAA 2024).

3.1.2 North Atlantic Right Whale

The North Atlantic right whale (NARW) (*Eubalaena glacialis*) was federally listed as endangered under the ESA in December 1970 (35 FR 18319); the listing was revised in April 2008 (73 FR 12024), and the species status remains federally endangered. The NARW is one of the world's most critically endangered populations of large whales (Clapham et al. 1999; NMFS 2017; IUCN 2020). As a result, the NARW is considered a strategic stock under the Marine Mammal Protection Act of 1972 (MMPA; 16 USC 1361) due to the imbalance of human-caused mortality and serious injury exceeding the potential biological removal level, illustrating that anthropogenic risks exceed natural causes and including its listing under ESA (NOAA 2023a).

The NARW's range has been recorded as far south as the Gulf of Mexico and as far north as Newfoundland. In the Northeast, adults and juveniles forage from Maine to Cape Cod, Massachusetts, with most sightings in Massachusetts in spring and summer before their northerly migration, although there is increasing evidence of overwintering in Cape Cod Bay (Attachment 1, Figure 1-4) from November to the end of January (NOAA 2022). Their year-round presence in the GOM and use of the eastern seaboard has been documented from passive acoustic methods (Bort et al. 2015; Morano et al. 2012).

The NARW are baleen whales that use their baleen plates to primarily filter feed on krill and copepods, especially large calanoid copepods such as *Calanus finmarchicus* (Kenney et al. 2001) in habitats from Canada to New England. Their feeding success is dependent on the availability of dense patches of *Calanus finmarchicus* (NOAA 2023a). The GOM and adjacent Scotian Shelf contain all the known feeding areas for the critically endangered NARW (Kenney et al. 2001), and it is likely that all of the NARW in the North Atlantic visit the GOM each year. However, Simard et al. (2019) noted a shift in NARW populations toward the Gulf of St. Lawrence, likely in response to the changing distribution of food resources due to climate change. Habitats that occasionally have significant numbers of NARW include Jeffrey's Ledge in the western GOM off the coast of northern Massachusetts and New Hampshire (Kenney et al. 2001).

Similar to the fin whale, NOAA Fisheries manages the NARW as part of the western North Atlantic Stock within the Greater Atlantic Region. The Draft 2023 Marine Mammal SAR assessed the estimated population of this NARW stock, using a hierarchical state-space Bayesian open population model, to have a median abundance value of 340 individuals and a minimum population estimate of 337 non-calf individuals (as of December 31, 2021) (NOAA 2024).

The primary threats to NARW's recovery are human-caused factors—including entanglement with fishing gear and vessel strikes—and unusual mortality events, such as in 2017, which saw an increase in strandings along the North Atlantic shores (NOAA 2024). The 2023 Draft SAR reported that human-

related mortality and serious injury exceed the population's potential biological removal, highlighting why they are considered imperiled (NOAA 2024).

3.1.3 Whales in the Action Area

NOAA's Greater Atlantic Regional Fisheries Office (GARFO) ESA Section 7 Mapper, an interactive geographic information system web application, illustrates locations with habitat supportive of ESA-listed species (NOAA Fisheries 2022a). The mapper indicates potential presence of NARW and fin whale in the eastern third of Cape Cod Canal, from Sagamore Bridge east into Cape Cod Bay, and in Buzzards Bay up to the Canal entrance.

Despite the potential for ESA-listed whales to be present, the occurrence of the fin whale and the NARW in the Cape Cod Study Area is infrequent. In the August 14, 2024, meeting about the MMPA, NOAA Fisheries' OPR noted that it is a rare event for these whales to enter the Canal (three instances were reported in news articles since 2001 [Brown et al. 2002, Cape Cod Times 2023, CBS Boston 2023]) such that, were another instance to occur, it would be considered unexpected and the reporting would be widely publicized by captains in the Canal (Personal communication, Benjamin Laws, NOAA Fisheries OPR, August 14, 2024). Cetacean observations in the Ocean Biodiversity Information System Spatial Ecological Analysis of Megavertebrate Populations database (Halpin et al. 2009) indicate that whales in the Action Area are concentrated in Massachusetts Bay and the GOM. Fin whale observations in the Cape Cod Study Area from 1977–2021 (Halpin et al. 2009) were concentrated on the eastern side of Cape Cod Bay and did not include any records in the Canal nor Buzzards Bay, as illustrated in Attachment 1, Figure 1-3. Similarly, the Ocean Biodiversity Information System (OBIS) did not include any records of NARW observations in the Canal or Buzzards Bay; however, NARW observations were scattered around Cape Cod Bay, with 10–33 observations between 1967 and 2023 recorded near the eastern mouth of the Canal (Halpin et al. 2009), as shown in Attachment 1, Figure 1-4. Based on the available scientific data and regulatory guidance received, these two ESA-listed whales are unlikely to occur within the Cape Cod Canal during Program activities.

3.2 ESA-Listed Sea Turtles

3.2.1 Green Turtle

The green turtle was initially listed under the ESA in July 1978 (43 FR 32800) as threatened, except for the coastal breeding populations of both Florida and Mexico. Subsequently, this listing was removed and replaced with 81 FR 20057, when a total of 11 distinct population segments (DPS) of green turtles were differentiated and listed as either threatened or endangered. As a result, the North Atlantic DPS of green turtles was distinguished and listed under the ESA as threatened in April 2016. This DPS extends from the Atlantic coasts of Central and North America due east to Africa and Europe's coasts.

Green turtles are found throughout the world, nesting in more than 80 countries and living off the coasts of over 140 countries. They primarily feed on algae and seagrass, both of which contribute to the green-colored fat for which they were named.

Juvenile and adult green turtles migrate north and arrive in mid-Atlantic waters at the beginning of June and head south at the end of November as the water temperatures cool, likely migrating to their nearest domestic natal nesting beaches in Georgia, South Carolina, North Carolina, and Texas. The NOAA Fisheries Green Turtle Status Review Team identified 73 nesting sites for the Green turtle North Atlantic DPS that include multiple beaches; of note are four regions that support high concentrations of the North Atlantic DPS nesting, including Costa Rica, Mexico, Florida US, and Cuba with Costa Rica hosting the largest concentration of nesting sites including approximately 79 percent of the population (Seminoff et al. 2015). The NOAA Fisheries ESA Section 7 Mapper indicates that the Cape Cod Canal may include adults and juveniles migrating and foraging from Cape Cod to Virginia Bank (NOAA 2022a). NOAA Fisheries characterizes the green turtle's presence as likely in Cape Cod Bay from June to October/November and in Buzzards Bay from May to November (NOAA Fisheries 2023a). However, sea turtles are not expected to be present in the Canal as they typically migrate from May through the end of October (personal communication, Zack Jylkka, GARFO, May 20, 2019). While there have been sightings of green turtles in Cape Cod Bay in December or January as water temperatures drop, these sightings are considered rare (Massachusetts Division of Fisheries and Wildlife 2019). Rare sightings in the October through January timeframe would likely be of cold stunned individuals.

Major threats to green turtles include entanglement or bycatch in commercial and recreational fishing gear, vessel strikes, contaminants, and marine debris, loss of nesting sites from natural disasters and sea-level rise, and temperature changes resulting from climate change (Seminoff et al. 2015). A 2015 population estimate for this DPS of green turtles was approximately 132,264, with most of these individuals from the Costa Rica nesting sites (Seminoff et al. 2015).

3.2.2 Kemp's Ridley Turtle

The ESA listed Kemp's ridley turtles as endangered in December 1970 (35 FR 18319). While primarily found in the Gulf of Mexico, both juvenile and adult Kemp's ridley sea turtles migrate north to Nova Scotia and the eastern Atlantic in the spring as water temperatures warm, arriving in mid-Atlantic waters in May. As the waters cool in the fall, the trend is reversed, with most sea turtles leaving the area by the end of November. As a result, migrating and foraging adults and juveniles may be present in Cape Cod Canal, Buzzards Bay, and throughout the Action Area west and south of the Canal from May to November; and may be present in Cape Cod Bay and throughout the Action Area north of the Canal from June to November (NOAA Fisheries 2022a). Occasionally, these turtles get caught in Cape Cod Bay during the cold-stunning season from mid/late October to December/January (personal communication Zack Jylkka, GARFO, May 20, 2019; NOAA Fisheries 2022a). Kemp's ridleys are found

throughout the Gulf of Mexico and the US Atlantic coast from Florida to New England where they prefer muddy or sandy habitat.

Similar to other sea turtles, Kemp's ridleys lay eggs in nests they excavate on the beach, yet they are only one of two species that perform arribada nesting, where thousands of individuals gather offshore and return to their natal beaches to lay their eggs all at one time. Hatchlings enter the ocean and begin swimming offshore, where they catch the currents and either remain in the Gulf of Mexico or travel to the Atlantic Ocean in the Gulf Stream. Juveniles are associated with Sargassum algae for resting, refuge, and feeding until they reach about eight inches, a duration of approximately one to two years. Adult females migrate to and from nesting beaches in Texas and Mexico, while adult males intermittently migrate to feeding or nesting areas or not at all.

Threats to the recovery of Kemp's ridley turtles include bycatch in fishing gear, direct egg harvest, loss and degradation of nesting habitat, predation of eggs and hatchlings, vessel strikes, ocean pollution and marine debris, and climate change.[1] In 2012, their population was estimated to be 188,713 nesting females (NOAA 2015b).

3.2.3 Leatherback Turtle

Leatherback turtles (*Dermochelys coriacea*) were ESA listed as endangered in June 1970 (35 FR 8491). They are the largest turtles in the world and the only species without a hard shell or scales with tough skin. Leatherbacks have an exceptional diving capacity of almost 4,000 feet (1,219.2 meters).[2] Since they are at the highest risk of extinction at this time, NOAA Fisheries has identified leatherback as one of nine "Species in the Spotlight" to highlight the agency's commitment of resources to the recovery of this species.

Leatherback sea turtles have the most extensive range of any reptile, with reports of circumnavigation of the world's oceans. Critical habitat for leatherback turtles was established in March 1979 in St. Croix (44 FR 17710) within the US Virgin Islands. This was revised in 2012 to include the US west coast of California from Point Arena to Point Arguello and from Cape Flattery, Washington, to Cape Blanco, Oregon, totaling an increase of approximately 41,914 square miles (108,558 square kilometers [km^2]) of marine habitat to aid in the recovery of this species (77 FR 41700) including leatherback migration pathway conditions that separate the quality and quantity of their prey, which is primarily jellyfish, siphonophores, pyrosomes, and salps.

In general, juvenile and adult leatherback sea turtles migrate north in the spring as water temperatures warm, arriving in mid-Atlantic waters in May. Both adult and juvenile leatherbacks may be present

[1] https://www.fisheries.noaa.gov/species/kemps-ridley-turtle
[2] https://www.fisheries.noaa.gov/species/leatherback-turtle

migrating and foraging in Cape Cod Canal, Buzzards Bay and the throughout the Action Area west and south of the Canal from May to November; and may be present in Cape Cod Bay and throughout the Action Area north of the Canal and Cape Cod from June to November (NOAA Fisheries 2022a). As waters cool in the fall, the trend is reversed, with most sea turtles leaving the mid-Atlantic area by the end of November (NOAA Fisheries 2022a). Occasionally, these turtles get caught in Cape Cod Bay during the cold-stunning season from mid/late October to December/January (personal communication, Zack Jylkka, GARFO, May 20, 2019; NOAA Fisheries 2022a).

The biggest threats to leatherback turtles are from humans by entanglement in fishing gear, hunting, and direct harvest of their eggs, loss and degradation of nesting habitat from coastal development, vessel strike, marine debris, and climate change.[2]

3.2.4 Loggerhead Turtle

The ESA listed Northwest Atlantic DPS of loggerhead turtles (*Caretta caretta*) were designated as threatened in July 1978 (43 FR 32800). They feed on shellfish including whelks and conch, which they are able to consume due to their strong jaws and their signature large heads. The Northwest Atlantic DPS of loggerheads live in US coastal waters as juveniles and adults and nest on beaches along the Gulf of Mexico, Atlantic coast of Florida, South Carolina, Georgia, and North Carolina. Adult and juvenile loggerhead turtles may be present migrating and foraging in Cape Cod Canal, Buzzards Bay and throughout the Action Area west and south of the Canal from May to November; and may be present in Cape Cod Bay and throughout the Action Area north of the Canal and Cape Cod from June to the end of November (NOAA 2022a). During unseasonably cold ocean temperatures, these turtles can get caught in Cape Cod Bay during the cold-stunning season from Mid/late October to December/January (personal communication, Zack Jylkka, GARFO May 20, 2019; NOAA Fisheries 2023a).

Threats to this species are primarily human-caused, such as bycatch in fishing gear, entanglement in marine debris, vessel strikes, and barriers to nesting from coastal development and erosion control (Conant et al. 2009). Population estimates in the US are based on approximately 100,000 nests a year (NOAA Fisheries 2024a).

3.2.5 Sea Turtles in the Action Area

As noted in Sections 3.2.1, 3.2.2, 3.2.3, and 3.2.4, juveniles and adults of all four ESA-listed sea turtle species could be present in Cape Cod Bay and the Action Area northward between June and November, with occasional cold-stunned turtles in Cape Cod Bay as late as December/January; and could be present in the Cape Cod Canal, Buzzards Bay, and the Action Area to the south and west between May and November (NOAA Fisheries 2022a; NOAA Fisheries 2023a). However, sea turtles are not expected to be present in the Canal (personal communication, Zack Jylkka, GARFO, May 20, 2019).

Sea turtle sightings that were recorded in the Cape Cod Study Area from 1966-2021 are displayed in Attachment 1, Figure 1-5. There were 17 specific records in the OBIS, managed by Duke University, during this period, including one record of a leatherback turtle within Buzzards Bay and two in Cape Cod Bay, three records of a Kemp's ridley turtle inside Buzzards Bay, and nine within Cape Cod Bay, one record of a loggerhead turtle within Cape Cod Bay, and one green turtle in Cape Cod Bay. The majority of sightings in the Cape Cod Study Area were in Cape Cod Bay, with no records of sightings in the Cape Cod Canal (Halpin et al. 2009).

3.3 ESA-Listed Fishes

3.3.1 Atlantic Sturgeon

Currently, 34 waterbodies along the New England/Mid-Atlantic region of the US East Coast seasonally contain Atlantic sturgeon; of this total, 15 waterbodies have known spawning events or habitats suitable for spawning (NOAA Fisheries 2023b). On February 6, 2012, NOAA Fisheries listed five DPS of Atlantic sturgeon under the ESA: the Chesapeake Bay, New York Bight, Carolina, and South Atlantic DPSs were listed as endangered; the GOM DPS was listed as threatened (77 FR 5880). Critical habitat for these Atlantic Sturgeon DPSs was designated on September 18, 2017 (82 FR 39160).

Atlantic sturgeon are large, slow-growing demersal fish that are late to mature and have been recorded to reach up to 16 feet in length and 800 pounds (NOAA Fisheries 2024b). Atlantic sturgeon are anadromous: they spawn in freshwater but spend many years in marine waters (Bain 1997). Atlantic sturgeon in the northern portion of their geographic range reach sexual maturity between 11 and 21 years, and spawning intervals range from one to five years in males and two to five years in females. Atlantic sturgeon generally spawn in the spring in mid-Atlantic and northeast US rivers (ASSRT 2007). Adult female Atlantic sturgeon typically emigrate downstream to the ocean quickly after spawning, while males remain in the lower river and nearshore estuarine environments through early to late fall before emigrating to open ocean (ASSRT 2007, Bain 1997, NOAA Fisheries 2023b). Early life stages of Atlantic sturgeon remain in their natal estuary for the first months to years of their lives before emigrating to open ocean as subadults (ASSRT 2007). Subadult Atlantic sturgeon remain in the marine environment for upwards of ten years until they reach sexual maturity (Bain 1997). Adults remain in marine waters throughout the inter-spawning period, which ranges from three to five years (Bain 1997).

The marine range for all five Atlantic sturgeon DPSs includes marine waters, coastal bays, and estuaries from the Labrador Inlet in Labrador, Canada to Cape Canaveral, Florida. Although marine habitat use by adult and subadult Atlantic sturgeon is not well described (Altenritter et al. 2017, Bain 1997, Stein et al. 2004), data from the coast of the northeast US suggest they frequently inhabit gravel and sand substrates near bays, inlets, and river mouths at depths of between approximately 33 and 164 feet (10

to 50 meters) (Stein et al. 2004). This habitat preference is likely related to forage availability in the benthos within these depths and habitat types (Stein et al. 2004, Bain 1997). The diet of adult and subadult Atlantic sturgeon includes mollusks, gastropods, amphipods, decapods, isopods, and fish (ASSRT 2007). Further studies indicate Atlantic sturgeon move to deeper habitats further offshore during winter months (Beardsall et al. 2016, Taylor et al. 2016). Additionally, Atlantic sturgeon are known to undertake extensive migrations northward and southward along the eastern coast of the US while at sea (Altenritter et al. 2017, ASSRT 2007).

3.3.2 Shortnose Sturgeon

The shortnose sturgeon was listed as endangered under the Endangered Species Preservation Act, the precursor to the ESA, on March 11, 1967 (32 FR 4001). The species has remained listed since the enactment of the ESA in 1973 and its subsequent amendments. Per Section 4(f) of the ESA, a Recovery Plan for shortnose sturgeon was prepared by NOAA Fisheries in 1998 (NOAA Fisheries 1998). The most significant threats to shortnose sturgeon are poor water quality, dredging, water removal from rivers, dams that block access to spawning areas or lower portions of the rivers, and unintended capture by commercial fisheries (NOAA Fisheries 2023c). Critical habitat has not been designated for the shortnose sturgeon.

Shortnose sturgeon are a slow-growing demersal fish with a late age at maturation; they have been recorded to live over 30 years and measure up to 4.5 feet (1.4 meters) in length and 60 pounds (27.2 kilograms) in weight. As demersal fish, they feed on benthic insects, crustaceans, mollusks, and polychaetes (SSSRT 2010). Historically, shortnose sturgeon occupied coastal rivers across a distribution extending from New Brunswick, Canada, south to the St. Johns River in northeast Florida (NOAA Fisheries 2023c). Presently, shortnose sturgeon occupy a much-reduced number of bays and rivers compared to their historic distribution, with a large gap of 250 miles separating the northern and mid-Atlantic metapopulation from the southern metapopulation. Early research suggested that shortnose sturgeon behave as freshwater amphidromous species: spawning and spending most of their lives in freshwater with only a short period spent in saline water during the early larval development stage (Kieffer and Kynard 1993). More recent work in the GOM suggests that shortnose sturgeon movements between river systems can be extensive and over long distances (Fernandes et al. 2010; Johnston 2016; Wippelhauser et al., 2015, Zydlewski et al., 2011). For example, shortnose sturgeon from the Merrimack River in northern Massachusetts were documented as having traveled upwards of 322 miles (200 kilometers (km)) to the Kennebeck River in the midcoastal region of Maine. While in marine waters, shortnose sturgeon are thought to remain in shallow waters close to shore (NOAA Fisheries 2023c).

3.3.3 Sturgeon in the Action Area

Available information on the distribution of Atlantic sturgeon indicates that any individuals in the Action Area would most likely be from the GOM DPS, with a small chance of individuals from the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs occurring in the Action Area (Damon-Randall et al. 2012). The GOM DPS is comprised of Atlantic sturgeon that spawn in the Androscoggin, Kennebec, and Penobscot rivers of the midcoastal and downeast regions of Maine, the Piscataqua River, which empties into the Atlantic Ocean at Portsmouth, New Hampshire, and the Merrimack River in northern Massachusetts (NOAA Fisheries 2022b). Atlantic sturgeon designated critical habitat does not overlap the Program's Action Area.

Scientific records documenting Atlantic sturgeon or shortnose sturgeon presence in the Cape Cod Canal have not been located during research for this document and the Massachusetts Natural Heritage and Endangered Species Program does not list either species as occurring within the Cape Cod Canal (Massachusetts Division of Fisheries and Wildlife 2015a, 2015b). Atlantic sturgeon spawn in freshwater and hatched individuals typically do not leave their natal estuary prior to reaching the subadult stage (ASSRT 2007); therefore, eggs, larvae, young of year, and juvenile Atlantic sturgeon are not expected to occur in the Action Area. Foraging and migrating Atlantic sturgeon adults and subadults could be present in the Cape Cod Canal portion of the Program's Action Area, with the greatest potential for occurrence during spring or fall months. However, their presence is likely to be uncommon and transient as individuals migrate north or south along the East Coast of the United States. The Cape Cod Canal is generally a high-current area; therefore, the likelihood that adults or subadult Atlantic sturgeon would remain in the canal to forage for any extended period is low (USACE 2015a). As adult and subadult Atlantic sturgeon often occur near the mouths of rivers or embayments when in the marine environment (Stein et al. 2004), foraging or migrating Atlantic sturgeon adults and subadults could be present in the vicinity of the Program's construction vessels transiting to and from the Cape Cod Canal from ports along the northeast US coast. Adult and subadult Atlantic sturgeon are present in many of the rivers that empty into the Atlantic Ocean adjacent to the potential ports of origin of the Program construction vessels. These include the Presumpscot, Scarborough, and Saco Rivers near Portland, Maine; the Piscataqua River, near Portsmouth, New Hampshire; the Charles River, near Weymouth, Massachusetts; the North River, the mouth of which is approximately halfway between Weymouth and the eastern entrance to the Cape Cod Canal; the Taunton River, which empties into Narragansett Bay at Fall River, Massachusetts; and Narragansett Bay, which is adjacent to Fall River, Massachusetts (NOAA Fisheries 2023b). Additionally, migrating adults or subadults could transit past or through the shipping lanes of the Program's construction vessels.

Eggs, larvae, young of year, and juvenile shortnose sturgeon are not known to migrate beyond their natal rivers (SSSRT 2010) and therefore would not occur in the Program's Action Area. Adult shortnose

sturgeon could be briefly present in the Cape Cod Canal portion of the Program's Action Area between April 1 and November 30; however, their presence is likely to be uncommon and transient, consisting of individuals migrating to or from relatively nearby river systems primarily during the late spring or late fall months. Adult shortnose sturgeon are present in the Presumpscot and Saco rivers near Portland, Maine; the Piscataqua River adjacent to Portsmouth, New Hampshire, and potentially in Narragansett Bay near Fall River, Massachusetts (NOAA Fisheries 2023d). Like Atlantic sturgeon, adult shortnose sturgeon could be present in the vicinity of construction vessels transiting to and from the Cape Cod Canal from ports along the northeast US coast during the same periods.

3.4 Critical Habitat for North Atlantic Right Whale

NOAA Fisheries designated two areas in the North Atlantic Ocean as Critical habitat for the NARW (81 FR 4837) on February 26, 2016. The areas designated as critical habitat are located in the GOM and Georges Bank region (Unit 1) and off the Southeast US coast (Unit 2). These areas contain the PBFs necessary for the species' survival, as they provide important feeding, nursery, and calving habitat for the North Atlantic population of northern right whales (breeding and feeding grounds). Critical habitat Unit 1, the Northeastern US Foraging Area, contains 29,763 nm^2 [102,084 km^2] of marine habitat extending from the US northeastern EEZ boundary with Canada, south into Cape Cod Bay, Massachusetts, and offshore approximately 80 nautical miles southeast of Providence in the easternmost corner of the peninsula (Attachment 1, Figure 1-6).

The following PBFs of foraging habitat have been identified in the Final Rule as essential to the conservation of the species: (1) The physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate *Calanus finmarchicus* for right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes (Attachment 1, Figure 1-7); (2) Low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing[3] *C. finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins; (3) Late stage *C. finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region; and (4) Diapausing *C. finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region.

The Cape Cod Canal is not considered part of the GOM and, therefore, does not overlap with NARW's critical habitat. However, some of the likely transit routes of Program construction vessels may overlap with the portion of NARW critical habitat Unit 1 that occurs within the western extents of the GOM. Program construction vessels are not anticipated to travel as far east as Georges Bank, Jordan Basin,

[3] Diapausing is a period of physiologically enforced dormancy between periods of activity.

Wilkinson Basin, or Georges Basin. Therefore, only PBFs 1, 3, and 4 have the potential to be affected by the Program and are considered in the effects analysis.

4 Environmental Baseline

4.1 Aquatic Habitat Characterization

4.1.1 Canal Substrate

Historically, the Cape Cod Canal was carved through a combination of quaternary deposits. The soft and course sediments that naturally occur in the canal are a result of eroded glacial-lake deposits, outwash deposits, and till (Olcott r1995). Sediment sampling throughout the canal between 1972 and 2001 indicates the bottom substrate of the canal consists predominantly of medium to fine-grained sand with less than one percent silt (USACE 2015a). Shoaling of the sands is common in the canal, primarily surrounding the Sagamore Bridge and eastward of the bridge, due to the prevalence of high tidal currents that pass through the canal (USACE 2023). Therefore, periodic maintenance dredging, typically at an average interval of approximately five to six years since 1979, is conducted in the canal by the USACE (USACE 2015a).

Surficial qualitative visual surveys of the intertidal and shallow subtidal zones of the canal shorelines of each bridge were conducted in 2024 (Stantec 2024). Results of these surveys align with previous pre-dredge studies. Substrate on the north shoreline at the Sagamore Bridge between the riprap slope and the existing bridge piers consisted of high accumulation of coarse sandy sediment interspersed with pebble, gravel, and cobble. Subtidal sediments similarly consisted of coarse sand interspersed with gravel and cobble. Substrate on the south shoreline at the Sagamore Bridge was comprised of a higher percentage of fine sand and silt than on the north side of the canal, but still consisted primarily of course sand. The full extent of the intertidal zone between the riprap slope and the existing piers on both sides of the canal at the Sagamore Bridge was primarily coarse sand, mixed with some fine sand, surrounding and/or covering riprap, boulders, cobble, and the pier bases.

The 2024 qualitative survey (Stantec 2024) described the substrate on the north and south shorelines of the canal at the Bourne Bridge similar to the shorelines at the Sagamore Bridge. The intertidal zone of the shoreline on the north side of the canal was documented as almost entirely cobble, with sand filling the spaces between the cobble. The subtidal area was documented as silty-sand, coarse sand, and cobble. The intertidal zone on the south side of the canal was documented as gravelly-sand, cobble, and marine shell hash extending to the bridge pier. The subtidal zone was documented to consist primarily of cobble with deep scours adjacent to the bridge piers consisting of course sand and shell hash.

4.1.2 Canal Flora and Fauna

The benthic and epifaunal communities of the canal are characterized as mixtures of the Cape Cod Bay and Buzzards Bay biological communities, with the area surrounding the Bourne Bridge more similar to the Buzzards Bay community and that surrounding the Sagamore Bridge more similar to the Cape Cod Bay community (USACE 2015a). Fish commonly occurring in the canal include striped bass (*Morone saxatilis*), black sea bass (*Centropristis striata*), bluefish (*Pomatomus altatrix*), mackerel (*Scomber scrombrus*), bonito (*Sarda sarda*), tautog (*Tautoga onitis*), scup (*Stenotomus chrysops*), cod (*Gadus morhua*), summer flounder (*Paralichthys dentatus*), and winter flounder (*Pseudopleuronectes americanus*). Alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) also have been documented to migrate through the canal to reach the Herring River, on the north side of the canal, and subsequently Great Herring Pond to spawn (USACE 2015a). The Herring River is a stream-sized waterbody that connects Great Herring Pond and Little Herring Pond to the Cape Cod Canal by way of a fish ladder. This river does not support sturgeon spawning.

The 2024 qualitative survey of the intertidal and shallow subtidal zones of the canal shorelines of each bridge documented diverse algal species, juvenile fish, bivalves, crustacea, and other invertebrates as well as complex and sensitive habitats indicative of a thriving marine ecosystem (Stantec 2024). The shorelines on either side of the canal at the Sagamore Bridge were documented to contain northern rock barnacles (*Semibalanus balanoides*) and common periwinkle (*Littorina littorea*) on the riprap in the upper intertidal zone. Brown algal species such as bladder wrack (*Fucus vesiculosus*) and knotted wrack (*Ascophyllum nodosum*), green algae such as dead man's fingers (*Codium fragile*), filamentous red algae (*Rhodophyta* sp.), juvenile eastern oysters (*Crassostrea virginica*), and high densities of blue mussels (*Mytilus edulis*) were documented attached to the hard substrates of the lower intertidal zone. The subtidal zone was documented to contain sea lettuce (*Ulva lactuca*), bladder wrack, and red and brown algae. Additionally, sugar kelp (*Saccharina latissima*) and tunicates (*Didemnum* spp.) were intermittently documented throughout the subtidal and a juvenile American lobster (*Homarus americanus*) was observed.

The shorelines on either side of the canal of the canal at the Bourne Bridge were documented as containing similar suites of species in the intertidal and subtidal zones as at the Sagamore Bridge. These consisted of northern rock barnacles, eastern oysters, frequent common periwinkles, bladder wrack, knotted wrack, and red and brown filamentous algae throughout the subtidal zone. Additional species documented at the Bourne Bridge included orange and white tunicates in the upper intertidal zone and northern quahog ("cherry stones"; *Mercenaria mercenaria*) clappers in the lower intertidal zone. The subtidal zone was documented as containing red and brown filamentous algae, intermittent short sugar kelp fronds, and sea lettuce among patches of reg algae in the subtidal zone.

No saltmarsh habitat is known to be present along the shorelines of the canal and none was observed during the 2024 qualitative shoreline survey (Stantec 2024). Likewise, documentation from the USACE (2015) indicates there is no submerged aquatic vegetation (e.g., eelgrass [*Zostera marina*]) present within the canal. However, the 2024 qualitative shoreline survey documented eelgrass on the north shoreline of the canal at the Bourne Bridge (Stantec 2024). A follow-up survey conducted during the growing season for eelgrass documented eelgrass beds on both the north and south sides of the canal at the Bourne Bridge (Stantec 2024). The survey documented two separate eelgrass beds on the north side of the canal and east of the Bourne Bridge at depths of approximately 3 feet to 15 feet in mixed sediments of silty-sand and sporadic cobble. Both beds were documented to be of moderate to high density with, at most, light epiphyte coverage of brown filamentous algae. The larger of the two eelgrass patches measured approximately 1,446 square feet in area and the smaller bed measured approximately 899 square feet in area. The survey documented one eelgrass patch on the south side of the canal of low density and measuring approximately 100 square feet in area. The survey also recorded isolated eelgrass sprigs in low densities waterward of the bridge pier. The eelgrass on the north side of the canal was growing in substrate comprised of sandy-gravel and cobble, including shell hash and mixed green and red algae (Stantec 2024).

5 Program Details

5.1 Construction Methods

As noted in Section 1.2, the replacement bridges will be constructed offline (outside of the existing footprint) and inboard of the existing highway bridges. The Sagamore Bridge will be replaced first, followed by the Bourne Bridge. At each bridge site, the inboard span will be constructed first. For the Sagamore Bridge, this will be the western-most bridge, which will ultimately carry southbound traffic onto Cape Cod. For the Bourne Bridge, this will be the eastern-most bridge, which will ultimately carry northbound traffic off Cape Cod. After construction of the first new span, the existing bridge will be demolished, followed by construction of the second new span.

The piers of the new bridges will be constructed within and above the intertidal zone with delta frames that cantilever above the canal. The 600-foot main arch spans of each new bridge will be floated in on barges and raised into place in one piece. Likewise, the main spans of the existing bridges are expected to be lowered in one piece onto construction barges and floated out of the canal. Therefore, long-term in-water construction at both bridge locations will only occur along the shorelines and outside of the navigation channel of the Cape Cod Canal. Float-in and float-out activities will have a larger footprint but will be short in duration.

The Program is divided into four quadrants, each representing an area of active construction: Sagamore North, Sagamore South, Bourne North, and Bourne South. In each quadrant, in-water construction will be conducted in multiple phases. Work will begin with the temporary installation of supportive or mitigative structures such as trestles, cofferdams, bulkheads, bollards, docks, and dolphins as well as shoreline riprap removal and dredging to prepare for barge use and construction of the first bridge. This will be followed by construction of the first bridge. After construction of the first bridge, the temporary works enabling demolition will be installed; these are anticipated to include trestles, containment cells, dolphins, and other items similar to the temporary works for bridge construction. Demolition of the existing bridge and piers will occur once the enabling temporary works are in place. Following demolition, additional temporary works to support the construction of the second bridge will be installed; these will be similar in nature to those used for construction of the first bridge. Construction of the second bridge will occur once the temporary works that enable it are in place. Lastly, removal of temporary structures, and restoration of intertidal and subtidal fill/riprap will conclude the in-water construction portion of the Program.

MassDOT has evaluated a range of potential construction scenarios with a construction specialist. MassDOT expects to contract the Program as a Design Build and, therefore, the Design Build contractor could propose different means and methods to construct the Program. This BA assesses the potential impacts of the Program based on the currently proposed design to the best of FHWA's knowledge.

5.2 Temporary Works

In preparation for bridge construction and demolition, MassDOT and FHWA propose to remove existing shoreline riprap to allow for installation of sheeting and piles that are needed for the temporary works. The temporary works within each quadrant may include cofferdams constructed of sheeting around the proposed new bridge pier locations; containment cells constructed of sheeting around the demolition zone of the existing bridge piers; sheeting along the approximate high tide line to create upland work areas; sheeting below the high tide line to create a bulkhead for contractor use; docks constructed of sheeting and fill for mooring construction barges; pipe pile-supported trestles to support construction and demolition of the new and existing bridge piers, respectively; and pile-supported dolphins to assist with construction vessel mooring. Pipe piles may be installed in key locations to support the cofferdams surrounding the existing and proposed bridge piers. The shoreline and bulkhead sheeting structures may be reinforced with tiebacks through the sheeting and into land. Riprap may be temporarily placed at the base of the construction trestles to protect them from scour during construction.

In-water dredging may be required along the toes of the bulkheads and between the docks to provide sufficient draft for vessels to approach the bulkheads and moor at the docks. Dredging may be

conducted using cutterhead suction dredges or clamshell excavation dredges. Temporary fill may be placed between the shoreline and bulkhead sheeting to create the bulkhead and within the dock sheeting to complete the docks. The cofferdams for construction of the new bridge piers are expected be excavated in-the-wet prior to sealing. The cofferdams will subsequently be dewatered prior to pier construction. Water pumped from the cofferdams will be maintained in settling basins prior to being pumped back into the canal.

While it is anticipated that most temporary works will not be contained, depending upon the contractor's means and methods, some of the work could be contained within the same containment cell that is used for pier demolition (described in Section 5.4), including the portion of the temporary trestle that overlaps with the existing pier and some of the trestle supporting structure such as driven piles or columns resting on the remaining footings of the existing pier.

5.3 New Bridge Construction

Each quadrant will have two new permanent canal-side pier structures (eight piers total for the full Program) installed in the intertidal and supratidal riprap zones of each bank. The foundations of each pier are envisioned to consist of eight drilled shafts with steel casings filled with reinforced concrete. Construction of the new bridge piers may be conducted from floating shoreline barges moored to the temporary dolphins, from land, or from a temporary trestle over the footing and cofferdam. All work on the pier foundations and footings will be contained within the temporary cofferdams. The steel delta frames atop the bridge piers will be erected on site using cranes on work trestles or cranes on land abutting the canal. Once the delta frames are ready to receive them, the main span bridge arches will be floated in and permanently installed over the canal using construction barges over the course of approximately three to five days per bridge. The float-in of the main span arches will require full closure of the Cape Cod Canal throughout the duration of the operation and cannot be halted or paused once commenced. After bridge construction is complete, riprap will be placed on the three waterward sides of the pier bases for protection.

5.4 Existing Bridge Demolition

The main spans of the existing bridges are envisioned to be cut and lowered onto barges, similar to the float-out process. The lowering and float-out process will occur over the course of approximately 3 to 5 days per bridge. The float out will require full closure of the Cape Cod Canal and cannot be halted or paused once commenced.

The existing two concrete pier columns in the intertidal and/or subtidal zones of each quadrant (eight columns program-wide) are envisioned to be enclosed by a containment cell and demolished into the containment cell. Demolition of the above-water portions of the existing bridge piers may entail

cutting or hoe-ramming. Demolition of the bases of the existing concrete bridge piers may include saw-cutting, hoe-ramming, and excavation of the canal bottom to expose the pier base. Demolition will be controlled to minimize debris falling into the canal outside the containment cell. Some demolished materials may be lifted away by crane, and some may be reduced to rubble in the containment cell. Rubble is envisioned to be removed from the containment cell in the wet. The footprints of the existing piers will be allowed to recover to the surrounding canal bottom habitat.

5.5 Area Restoration

Upon completion of construction, all temporary support structures will be removed, and the areas will be restored to pre-construction conditions to the maximum extent practicable. The fill placed against the various temporary works will be excavated, and areas previously excavated will have fill returned to match the pre-construction contours. The temporary riprap at the base of the construction trestles will be removed. Pending review and confirmation by the USACE, all temporary works will be removed or cut off 2 feet (0.6 m) below the mudline, including sheeting used to construct the cofferdams, barge docks, and bulkheads, and the pilings used to construct the mooring dolphins and support the cofferdams. Sheeting and pipe piles may be removed using a vibratory pile driver or by torch cutting below the mudline. Torch cutting the sheeting and pipe piling will require in-water excavation to reach below the mudline. Once all temporary works are removed, the canal bottom will be dredged to prepare the areas for final riprap installation. Riprap initially removed to allow installation of the temporary works will be returned to the quadrants to complete the Program area restoration. The riprap condition upon completion of the Program is anticipated to be similar to the existing riprap condition, except that additional riprap may be added around the new piers for protection, and riprap piled around the existing piers is expected to be removed.

5.6 Summary of Program Construction Components

Table 2 provides estimated sizes of the Program components described in Sections 5.1 through 5.5, and their construction work footprints, based on conceptual/preliminary design. The construction components and methods incorporate a range of construction scenarios evaluated in consultation with a construction specialist. MassDOT expects to contract the Program as Design-Build; the Design-Build team could propose different construction means and methods.

The construction work footprints and impacts presented in Table 2 are overlapping in space and are not mutually exclusive. Therefore, the impacts cannot be summed to determine total benthic habitat impact; summation of the individual values would overestimate total benthic habitat impact. These high-level rounded numbers are intended to show general impact quantities per component and are provided for context on the relative potential temporary and permanent impacts of different Program components considered singly.

For a summary of impacts, refer to Section 6.5 and Table 8, which describe and quantify the temporary and permanent square footages of benthic habitat impacts, and the net impacts after removal of the existing and temporary structures.

Table 2. Program Construction Components and Temporary and Permanent Impacts [1, 2]

Construction Component	Element Type	Count or Volume per Quadrant	Count or Volume Program-Wide	Construction Method	In-Water Impact per Quadrant (SF)[†]	In-Water Impact Program-Wide (SF)[†]	In-Water Impact per Quadrant (SF)[†]	In-Water Impact Program-Wide (SF)[†]
					Temporary		Permanent	
Piling								
Cofferdams 180’ x 100’ (for construction of new bridge piers)	18” steel sheeting	750	3,000	Vibratory and impact pile driver	1,275	5,100	--	--
Cofferdams 120’ x 100’ (for demolition of existing bridge piers)								
Cofferdam Support Piles (bridge pier construction and demolition)	36” steel pipe piles	24	96	Impact pile driver	150	600	--	--
Shoreline stabilization (600’) sheeting	18” steel sheeting	400	1,600	Vibratory and impact pile driver	900	3,600	--	--
Bulkhead (600’) sheeting	18” steel sheeting	400	1,600	Vibratory and impact pile driver	900	3,600	--	--
Barge dock (80’ x 30’) sheeting	18” steel sheeting	250	1,000	Vibratory and impact pile driver	420	1,680	--	--

Construction Component	Element Type	Count or Volume per Quadrant	Count or Volume Program-Wide	Construction Method	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†
					Temporary		Permanent	
Construction trestles pipe pile	36” steel pipe piles	140	560	Impact pile driver	1,000	4,000	--	--
Mooring dolphins	36” steel pipe piles	54	216	Impact pile driver	400	1,600	--	--
Mooring dolphins pile templates	12” steel H-piles	300	1,200	Vibratory pile driver	150	600	--	--
Dredging and Fill								
Excavation within cofferdams	Excavation	14,000 yd^3	56,000 yd^3	Mechanical excavation	25,500	102,000	--	--
Excavation between Barge Docks	Excavation	1,000 yd^3	4,000 yd^3	Mechanical excavation	3,000	12,000	--	--
Excavation along bulkhead	Excavation	4,000 yd^3	16,000 yd^3	Mechanical or cutter suction dredge	20,000	80,000	--	--
Excavation surrounding sheeting and piles to allow torch-cutting removal	Excavation	4,500 yd^3	18,000 yd^3	Mechanical or cutter suction dredge	17,755	71,020	--	--

Construction Component	Element Type	Count or Volume per Quadrant	Count or Volume Program-Wide	Construction Method	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†
					Temporary		Permanent	
Existing shoreline riprap removal	Excavation	10,000 yd^3	40,000 yd^3	Mechanical excavation	24,000	96,000	--	--
Bulkhead fill	Fill	15,000 yd^3	60,000 yd^3	Mechanical placement	12,000	48,000	--	--
Barge dock fill	Fill	2,800 yd^3	11,200 yd^3	Mechanical placement	4,800	19,200	--	--
Construction trestle riprap placement	Fill	3,000 yd^3	12,000 yd^3	Mechanical placement	14,000	56,000	--	--
Existing pier footprint return to open water	Excavation	850 yd^3	3,400 yd^3	Removal of existing bridge piers	--	--	-2,000	-8,000

Construction Component	Element Type	Count or Volume per Quadrant	Count or Volume Program-Wide	Construction Method	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†
					Temporary		Permanent	
New bridge piers	8’ diameter drilled shafts	8 shafts per pier; 2 piers per quadrant	64 drilled shafts	Shaft drilling, obstruction excavation, rock socket drilling to 170’ depth (assumes 150’ in soil, 20’ in bedrock), concrete shaft cap in tidal zone	--	--	3,844* (Sagamore North) 4,032* (Sagamore South) 2,294* (Bourne North) 3,070* (Bourne South)	13,241*
New bridge pier riprap	Fill	21,000 yd^3	84,000 yd^3	Mechanical placement	--	--	24,000	96,000

Notes:

[1] The impacts presented in this table are overlapping in space and are not mutually exclusive; therefore, summation of the individual values would overestimate total benthic habitat impact. They are provided for context on the relative potential temporary and permanent impacts of different Program components, considered singly. Refer to Table 8 for total temporary and net benthic habitat impacts.

[2] The construction components and methods incorporate a range of construction scenarios evaluated in consultation with a construction specialist. MassDOT expects to contract the Program as Design-Build; the Design-Build team could propose different construction means and methods.

† Impacts provided in this table are based on the anticipated construction work footprint for individual components, estimated per conceptual/preliminary design.

* Per-quadrant square footages for the new bridge piers are provided for Sagamore North, Sagamore South, Bourne North, and Bourne South, respectively. Due to rounding, the Program-wide value does not match the sum of these individual quadrants.

Key: SF = square feet; yd^3 = cubic yards

This Page Intentionally Left Blank

5.7 Construction Vessels and Barges

MassDOT estimates that the Program will require as many as four work barges and two delivery barges in each quadrant at any time during daily marine-based construction activities. Each work or delivery barge may require a dedicated tug. Up to four support launch vessels may also be required in each quadrant. Work barges are anticipated to be spud barges with six spuds per barge. The estimated number and sizes of the types of construction vessels required for day-to-day marine-based construction activities are provided in Table 3.

Table 3. Estimation of Vessels Employed in Day-to-Day Marine Operations for the Program[1]

Quantity Per Construction Quadrant	Description Program-wide at Any Time During Construction	Size (feet)
4	Work barges (6 spuds per barge)	40x80
2	Delivery barges	60x180
6	Tugs	65 to 105 length overall
4	Support launches	To be Determined
16	**Total vessels per Quadrant**	**40x80 and larger**

Note:
[1] This table does not include vessels required for arch float-in and float-out.

Additional vessels will be required for the float-in of replacement bridge main spans over three to five days and the float-out for demolition of the existing bridge main spans over three to five days (total of six float-in or float-out operations for the entire Program). These short-duration activities will require a different configuration of barges and support vessels and will be separate from the daily marine-based operations. While the specific size and number of vessels has not yet been determined, MassDOT estimates that each float-in or float-out operation will require two large barges in the canal, with an approximate size of 60 feet by 160 feet each. Up to six tugs of the sizes shown in Table 3 could be required to control the barges during float-in and float-out; up to eight support launches may also be used. Additional work barges of the type shown in Table 3 are expected to be required during float-in and float-out as well. The float-in and float-out operations are exclusive of day-to-day operations.

5.8 Program Timeline and Duration

Construction activities for the Sagamore and Bourne replacement bridges are expected to occur over the course of eight to ten years, respectively, for each replacement bridge. Construction of the Sagamore Bridge will begin first, followed by the Bourne Bridge once funding is secured. It is currently planned that construction of the Bourne replacement bridge will commence one year following commencement of Sagamore replacement bridge construction. However, timing of construction sequencing is dependent upon funding. Construction in both the north and south quadrants at the respective bridge sites is anticipated to occur concurrently.

In-water construction activities with the potential to cause acoustic impacts or protected species entrainment (i.e., vibratory or impact pile driving, rotary drilling, and dredging) will only occur between September 1 and February 28 each year. Construction support vessels operations and activities conducted in the dry (i.e., within dewatered cofferdams), or above the HTL will occur any time of year. In-water temporary impacts, including turbidity and increased vessel traffic associated with the Program are expected to last approximately six years for each bridge, with potential for acoustic impacts limited to the TOY described above.

The following estimated durations of Program elements are based on evaluations conducted in coordination with a construction specialist; durations may vary based on the Design-Build team's construction means and methods or based on contract packaging. Construction of the in water temporary works, drilled shafts, and substructures at the canal delta piers will require approximately two years for each new span, totaling eight years for the whole Program, given that each new crossing will consist of two main spans. Construction of the delta frames using cranes on work trestles or cranes on land near the shoreline will require approximately one year for each new main span, totaling four years for the full Program, given that each new crossing will consist of two new main spans. Four canal closures, each lasting approximately three to five days, will be required to allow float-in of the new bridge arches. Demolition of the existing bridge arch spans will require approximately nine months per bridge and demolition of the existing piers will require six months per bridge. Two canal closures, each lasting approximately three to five days, will be required to allow float-out of the existing deconstructed bridge arches.

5.9 Conservation and Mitigation Measures

The Program will employ multiple mitigation measures, minimization measures, and best management practices (BMPs) to reduce impacts on federally listed species or critical habitats with potential to occur in the vicinity of the Program, including the following:

1. In-water construction activities (excluding vessel traffic) will be confined to the Cape Cod Canal, which will allow for early detection of ESA-listed species through regular communication with canal operators and users during in-water construction activities.
2. Cofferdams, fabricated from steel sheet piling, will be used to allow in-the-dry construction of the new bridge piers and demolition of the existing bridge pier columns.
3. A fisheries biologist or protected species observer (PSO), with written approval by NOAA Fisheries, will be onsite during cofferdam construction. Before a partially erected cofferdam is completed, a snorkel/diver visual assessment will be completed to confirm no protected species are present within.
4. In-water construction activities with potential to cause acoustic impacts (i.e., impact or vibratory pile driving and rotary drilling) will not occur from March 1 through August 31 of any year. Construction support vessel operations and activities conducted in the dry (i.e., within dewatered cofferdams) or above the HTL will occur any time of year.
5. Dredging outside of cofferdams will not occur from March 1 through August 31 of any year; once cofferdams are installed, work within the cofferdams can occur at any time of year.
6. An equipment ramp-up or soft start will be implemented every time a sound source (e.g., impact or vibratory pile driver, rotary drill) is initiated or resumed following a prolonged interval of sound inactivity (more than 30 minutes) to allow time for species in the vicinity to respond to sound introduced and leave the area before actions such as pile driving begin. The ramp-up or soft start procedure will adhere to the following protocol, when technically feasible:
    a. Impact pile driving will commence with an initial set of three strikes by the hammer at 40% energy, followed by a one-minute wait period, then two subsequent 3-strike sets at 40% energy, with one-minute waiting periods, before initiating continuous impact driving.
    b. Vibratory pile driving will be initiated for 15 seconds at reduced energy followed by a one-minute waiting period. This sequence of 15 seconds of reduced energy driving, one-minute waiting period will be repeated two additional times, followed immediately by pile-driving at full rate and energy.
7. Dredging equipment speeds will be slow and cautious, following guidance in *Engineering and Design, Dredging and Dredged Material Management* (USACE 2015b).
8. All temporary works, including sheeting used to construct the cofferdams, barge docks, and bulkheads, and the pilings used to construct the mooring dolphins and support the cofferdams,

will be removed or cut off to 2 feet (0.6 meter) below the mudline, pending review and confirmation by the USACE.

9. Vessels transiting within Cape Cod Canal and between Cape Cod Canal, Buzzards Bay, Cape Cod Bay, and supply ports, or within a NARW Seasonal Management Area[4] (Attachment 1, Figure 1-8) will operate at speeds not to exceed 10 knots. In that regard, the contractor will be aware of predicted conditions before departing. For unanticipated conditions, a vessel may operate at a speed necessary to maintain safe maneuvering speed instead of the required less than 10 knots. This alternative speed is justified only when the vessel is in an area where oceanographic, hydrographic, and/or meteorological conditions severely restrict the maneuverability of the vessel, and the need to operate at such speed is confirmed by the vessel captain. If a deviation from the 10-knot speed limit is necessary, the reasons for the deviation, the speed at which the vessel is operated, the latitude and longitude of the area, and the time and duration of such deviation will be entered into the logbook of the vessel. The captain of the vessel will attest to the accuracy of the logbook entry by signing and dating it. The intent of this condition is to reduce the potential for vessel collisions with endangered turtles and whales.
10. A PSO or marine mammal/turtle observer, with written approval from the NOAA Fisheries, will be present aboard vessels and/or onsite, operating in accordance with the Program's Marine Mammal and Sea Turtle Monitoring and Mitigation Plan. The PSO will have direct communication with the vessels' captains via radio or cell phone, if applicable.
    a. The PSO will be present for construction vessel transits in Cape Cod Canal to and from the bridge sites from January 1st through March 15th of any year.
    b. The PSO will be present for in-water construction activities producing acoustic effects, consisting of impact pile driving, vibratory pile driving, and rotary drilling.
    c. The PSO will have stop work authority if marine mammals, sea turtles, or sturgeon are observed entering or within the exclusion zone.[5] The PSO will have the authority to halt marine operations until the animal has been observed leaving the exclusion zone or 30 minutes have passed since the animal(s) was/were last sighted within the exclusion zone

[4] NARW Seasonal Management Areas are blocks of ocean along the east coast of the U.S. Atlantic seaboard in which NOAA Fisheries has established regulations to implement speed restrictions of no more than 10 knots applying to all vessels 65 feet (19.8 m) or greater in length overall during certain times of year in efforts to mitigate vessel strike risk to whales.

[5] A pre-construction acoustic assessment has been completed as part of this BA to establish precautionary safety and behavioral radii to inform the exclusion zones for marine mammals and sea turtles and the isopleth distances for injurious and behavioral impacts on fishes (as detailed in Section 6.1).

(defined in Section 6.1.1.2 and Attachment 2, Tables 2-1, 2-2, and 2-3, and shown in Attachment 3, Figures 3-1 through 3-4).

d. The PSO will be required to record their name in the logbook and be on the lookout for marine mammals and sea turtles for the duration of the trip and/or specific activity.

11. For all transit operations in Cape Cod Canal or underwater noise producing activities (e.g., pile driving and drilling) outside of cofferdams, the vessel Captain or approved observer will implement the following approaches:

    a. Check https://portal.nrwbuoys.org/ab/dash/ or https://www.nefsc.noaa.gov/psb/surveys before the marine operation for the Program to determine the potential presence of whales in the area.

    b. Report whale and turtle sightings to the NOAA Fisheries Northeast Marine Mammal and Sea Turtle Stranding and Entanglement Hotline at (866) 755-NOAA as soon as possible and within 24 hours. Report sturgeon sightings to (844) STURG-911 within 48 hours. Include the following details:

        i. Date, time, coordinates of vessel

        ii. Visibility, weather, sea state

        iii. Vector of sighting (distance, bearing)

        iv. Duration of sighting

        v. Species and number of animals

        vi. Observed behaviors (feeding, diving, breaching, etc.)

    c. Report any interactions with ESA-listed species immediately to the NOAA Fisheries GARFO incidental take account (nmfs.gar.incidental-take@noaa.gov), NOAA Fisheries 24-hour Stranding Hotline, or US Coast Guard via CH-16; and immediately report any injured or dead marine mammals to NOAA Fisheries GARFO incidental take account, nmfs.gar.incidental-take@noaa.gov.

    d. Avoid harassment of or direct impact to turtles or whales except when precluded by safety considerations. If harassment of or direct impact to ESA-listed species were to occur, contact NOAA Fisheries GARFO incidental take account (nmfs.gar.incidental-take@noaa.gov) and the GARFO ESA Section 7 account (nmfs.gar.esa.section7@noaa.gov). Following contact with NOAA, reinitiation of consultation would be required.

12. Any active construction activity will be temporarily shut down if a NARW is sighted at any distance from the stations on the Cape Cod Canal shoreline or aboard vessel(s) until the NARW leaves the area, excluding the float-in and float-out of the bridge main spans.
13. Detections of NARW will be reported within 12 hours to NOAA Protected Resources Division, Gloucester, MA at (978) 281-9328.
14. If a cold-stunned sea turtle is discovered, the Massachusetts Audubon Wellfleet Bay Wildlife will be contacted at (508) 349-2615 x6104 as soon as possible, and the work at the construction site will be delayed or vessel transit route will be altered for four hours to avoid the stunned turtle.

Table 4 presents a summary table of the ESA-listed marine species and their occurrence in the Cape Cod Study Area, along with the proposed TOYs and BMPs that the Program will incorporate to minimize impacts.

Table 4. ESA-Listed Marine Species in the Study Area in Relation to Proposed TOYs and BMPs

	Month	January	February	March	April	May	June	July	August	September	October	November	December
ESA-Listed Species	Shortnose Sturgeon												
	Atlantic Sturgeon												
	North Atlantic Right Whale	MD	MD	HD	HD	MD							MD
	Fin Whale	MD			HD	HD	MD						MD
	Green Sea Turtle	Cold Stunned									Cold Stunned		
	Kemp's Ridley Sea Turtle	Cold Stunned									Cold Stunned		
	Leatherback Sea Turtle	Cold Stunned									Cold Stunned		
	Loggerhead Sea Turtle	Cold Stunned									Cold Stunned		
Time of Year Restrictions / Best Management Practices	No Dredging or In-Water Work with Potential Adverse Acoustic Impacts†			March 1 – August 31									

Key: Migrating/Foraging; Overwintering; Restrictions; Cold Stunned — Cold water temperatures leading to stunned turtles; HD — Whale presence in relatively high densities for the species; MD — Whale presence in relatively medium densities for the species

Notes: ESA = Endangered Species Act of 1973; PSO = Protected Species Observer; kt = knot

† Construction support vessel operations and activities conducted in the dry (i.e., within dewatered cofferdams), or above the high tide line will occur any time of year.

Atlantic marine mammal density source: Roberts, J.J., B.D. Best, L. Mannocci, E. Fujioka, P.N. Halpin, D.L. Palka, L.P. Garrison, K.D. Mullin, T.V.N. Cole, C.B. Khan, W.M. McLellan, D.A. Pabst, G.G. Lockhart. 2016. Habitat-based cetacean density models for the U.S. Atlantic and Gulf of Mexico. *Scientific Reports 6*: 22615. doi: 10.1038/srep22615

6 Effects Analysis

The Program Action Area overlaps the known and expected range of NARW and fin whales; green, Kemp's ridley, leatherback, and loggerhead sea turtles; and Atlantic and shortnose sturgeon. The Program Action Area also overlaps NARW designated critical habitat. These species are potentially susceptible to Program-related hydroacoustic impacts due to noise/underwater sound, discussed in Section 6.1. Additional effects analyzed include vessel strikes (Section 6.2); water quality/turbidity (Section 6.3); entrainment/entrapment (Section 6.4); ; and habitat alteration (Section 6.5). . Section 6

details potential effects of the Program on the listed species and designated critical habitat with the incorporation of the conservation and mitigation methods outlined in Section 5.9.

6.1 Noise / Underwater Sound

The term "underwater sound," as used in this BA, refers to the introduction of anthropogenic sound into the marine environment. Given the importance of a functional acoustic environment to numerous species of marine life, especially marine mammals, and their life functions, the introduction of anthropogenic sound, if unmitigated, can result in potentially harmful effects on marine wildlife.

Underwater sound produced during in-water construction activity has the potential to disturb marine mammals, sea turtles, and fishes (Richardson et al. 1995; McCauley et al. 2000, Caltrans 2020), and there is concern that high levels of sound may cause temporary or permanent hearing impairment to some species or individual marine mammals and sea turtles. However, the levels at which hearing impairment might occur are well above levels that are produced by all but the strongest sound sources such as pile driving and seismic air guns (Southall et al. 2007). There is also concern that lower levels of sound may cause changes in the behavior of some species. Short-term and long-term studies of passive acoustic data in conjunction with observations of marine life behavior have shown a wide range of impacts of anthropogenic underwater sound on marine life. Impulsive sounds (e.g., impact pile driving) are known to be substantially more damaging to hearing than continuous sounds (e.g., vibratory pile driving, drilling). However, continuous sounds are more likely to mask important auditory information, such as environmental navigation cues and mating calls, as well as other conspecific social calls, which may have greater behavioral effects.

Various types and levels of underwater sound are produced during in-water construction activities from the Proposed Action, including pier demolition, dredging, in-water excavation, riprap management, removal of and installation of dolphins, bollards, piles, pipe piles, and sheet pile driving (from impulsive and non-impulsive sources). However, this analysis focuses on underwater noise from pile driving and drilling activities, which produce SPLs that can impact listed species and may extend kilometers from the point of origin before reaching ambient levels. The extent of above-ambient sound levels depends on several variables, including the pile size, installation method, energy output to drive or drill the pile, water depth, bathymetry, sediment composition, and currents. Due to underwater sound during in-water construction activities having a degree of environmental effect, they require monitoring and mitigation.

An important mitigation measure during in-water pile diving (impact and vibratory) and drilling activities is to establish minimum distances to regulatory sound thresholds to prevent injury and

behavioral disturbance (NMFS 1995, NOAA 1998, FHWG 2008, DoN 2017).[6] Thus, a thorough evaluation of the bridge construction materials, sizes, and methods of installation or demolition was conducted using the NOAA Fisheries acoustic thresholds for protected marine mammals, sea turtles, and fishes and the NOAA Fisheries User Spreadsheet Tool (Version 2.2) (NOAA Fisheries 2020a, NMFS 2022). The analysis applies proxy sound source levels for similar construction materials and equipment to the specifications in the Program design. The analysis results with calculations derived from the NOAA Fisheries User Spreadsheet Tool (Version 2.2) focus on the pile driving activities, which are largest sound producing construction activities for this Program and provide the most conservative estimate of potential sound impacts on aquatic species. Other construction activities such as vessel noise and dredging or excavation would produce smaller underwater sound signatures and do not require modeling (personal communication, Roosevelt Mesa, August 1, 2024).

6.1.1 Marine Mammals and Sea Turtles

6.1.1.1 Acoustic Thresholds Methods

NOAA Fisheries and the Bureau of Ocean Energy Management (BOEM) have advised that sound-generating survey equipment operating below 180 kHz has the potential to cause acoustic harassment to marine mammals (frequencies above 180 kHz are generally outside of the hearing ranges of marine mammals). Under the MMPA, Level A harassment is defined as any act of pursuit, torment, or annoyance that "has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as any act of pursuit, torment, or annoyance that "has the potential to disturb a marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering." This BA considers and discusses Level A and Level B harassment to assess the injurious (onset of permanent threshold shift [PTS]) and behavioral effects, respectively, on ESA-listed marine mammals and sea turtles.

NOAA Fisheries published underwater thresholds for the onset of PTS and temporary threshold shift for marine mammals in its 2018 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (NOAA Fisheries 2018). Following the release of the guidance document, NOAA Fisheries published a User Spreadsheet and Manual for Optional User Spreadsheet Tool (Version 2.2) in December 2020 (NOAA Fisheries 2020a). NOAA Fisheries has defined the PTS onset thresholds for impulsive and non-impulsive sound sources for five defined marine mammal hearing groups low-frequency cetaceans (baleen whales); mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales); high-frequency cetaceans (true porpoises, Kogia, river

[6] Due to the prevalence of high currents in the Cape Cod Canal, bubble curtains would not be effective as a noise attenuation method and are therefore not proposed as a mitigation method for the Project.

dolphins, cephalorhynchid*, Lagenorhynchus cruciger* & *L. australis*); phocid pinnipeds underwater (true seals); and otariid pinnipeds underwater (sea lions and fur seals). NARW and fin whales, as baleen whales, are within the low-frequency hearing group of cetaceans. The NOAA Fisheries PTS onset thresholds for both impulsive and non-impulsive noise sources for low-frequency cetaceans are shown in Table 5. The NOAA Fisheries PTS onset thresholds for both impulsive and non-impulsive noise sources for sea turtles are shown in Table 6.

Table 5. Marine Mammal Acoustic Thresholds[1, 2]

Faunal Group	**Impulsive Sound Signals**		**Non-Impulsive Sound Signals**
	Injury (PTS) Exposure Criteria		
	Unweighted PK[1] (dB re 1 µPa)	Frequency Weighted SEL_{cum}[2] (dB re 1 µPa2·s)	Frequency Weighted SEL_{cum}[2] (dB re 1 µPa2·s)
Low-Frequency (LF) Cetaceans	219	183	199
All Marine Mammals	**Behavioral Exposure Criteria (RMS, dB re 1 µPa)**		
	160		120

Source: NOAA Fisheries 2018

Notes:

[1] Peak sound pressure level (peak) is expressed in dB re 1 µPa and unweighted (flat weighted).

[2] SELcum is expressed in dB re 1 µPa2s and weighted according to the relevant weighting function with an accumulation period of 24 hours for marine mammals.

Key: µPa = micropascal; dB = decibel; LF = low-frequency cetaceans, SELcum = cumulative sound exposure level

Table 6. Sea Turtle Hearing Thresholds

Faunal Group	Injury (PTS)			Behavior
	Impulsive		Non-Impulsive	Impulsive and Non-Impulsive
	PK[1] dB re 1µPa	SEL_{cum}[2] dB re 1µPa2·s	SEL_{cum}[2] dB re 1µPa2·s	RMS dB re 1µPa
Sea Turtles	232	204	220	175

Source: Finneran et al. 2017
Notes:
[1] Peak sound pressure level (peak) is expressed in dB re 1 µPa and unweighted (flat weighted).
[2] SELcum is expressed in dB re 1 µPa2s and weighted according to the relevant weighting function with an accumulation period of 24 hours for sea turtles.
Key: µPa = micropascal; dB = decibel; RMS = root -mean -square; SELcum = cumulative sound exposure level

The assessment of the potential impact of Program activities was calculated using the NOAA Fisheries User Spreadsheet for Level A and Level B isopleths, using the most appropriate proxy source information in the NOAA Fisheries User Spreadsheet and Manual for Optional User Spreadsheet Tool (Version 2.2) for the best available information through external sources (i.e., drilling activity) (NMFS 2022). The proxy source information and data source can be found along with the source levels in each species group's respective table (Attachment 2, Tables 2-1 through 2-3).

VIEWSHED ANALYSIS

A viewshed analysis is a standard technique used in GIS to determine whether an area is visible from a specific location. The analysis uses direct line-of-sight to determine the straight-line cut-off points from a point of origin. Because landforms impede underwater noise transmission, this analysis can be applied to sound propagation to replicate how sound waves would travel through the water but would be truncated when encountering a land mass. There are several bends within the Cape Cod Canal that underwater sound waves originating from the Sagamore and Bourne Bridges would encounter, and would be blocked from propagating any further along the Canal (Attachment 1, Figure 1-1).

When calculating the Program's Zones of Influence (ZOI) (i.e., the area ensonified by noise levels at or greater than the threshold), the viewshed analysis is applied to each sound isopleth to estimate the full extent of the harassment areas during each Program activity (Attachment 3).

As indicated in Section 5.8, construction activities in both quadrants of each bridge will occur concurrently. Assuming two concurrent vibratory piling activities, or two concurrent impact piling activities, the maximum ZOI for each sound isopleth for the Program was estimated for both impact

and vibratory pile driving. While the sound from multiple sources at the same location results in louder levels than a single source alone, the sound level is measured on a logarithmic scale, so sound levels cannot be added by standard addition. To calculate the maximum sound level output for two concurrent pile driving activities, the 36-inch (0.9 meter) steel pipe piles proxy for impact pile driving and the 18-inch (0.5 meter) steel sheeting for vibratory pile driving were used, as they are the greatest pile size with the loudest sound levels for their respective pile types, and the single source sound levels for each pile driving activity type were raised by 3 decibels (dB), following the guidance from US Department of Transportation (USDOT 1995).

LEVEL A HARASSMENT

Sound propagation and the distances to the sound isopleths defined and relied upon by NOAA Fisheries for Level A harassment (injury due to PTS onset) of marine mammals and sea turtles (Table 5 and Table 6) were estimated using the User Spreadsheet and Manual for Optional User Spreadsheet Tool (Version 2.2) (NOAA Fisheries 2020a). This method uses estimates of SPL and duration of the activity to calculate the threshold distances at which a marine mammal and sea turtles exposed to those values would experience a PTS. Differences in hearing abilities among marine mammals and sea turtles are accounted for by the use of weighting factor adjustments for the five functional hearing groups for marine mammals and a separate set of adjustments for sea turtles (NOAA Fisheries 2018).

For impact pile driving the cumulative Single Strike Equivalent (cumulative sound exposure level (SEL_{cum})) method was used for calculating isopleths. Using this method resulted in larger isopleths for impulsive sound sources than those produced using the peak source level method. Based on estimated productivity rates, Level A harassment isopleths were calculated for the number of piles that are likely to be installed each day.

LEVEL B HARASSMENT

Program Level B harassment zones, areas where behavioral disturbance of marine mammals or sea turtles may occur without causing physical injury, have been determined using the practical spreading loss model described above and are presented in (Attachment 2, Table 2-1). Source levels for pile installation activities were estimated using the most appropriate proxy source information in the NOAA Fisheries User Spreadsheet Tool or the best available information through external sources (i.e., drilling activity) (NMFS 2022). The proxy source information and data source can be found along with the source levels in each species group's respective table. Due to the curvature of the Cape Cod Canal, the Level B ZOIs for all activities (i.e., as provided in Attachment 2, Table 2-1) are truncated in many directions (Attachment 3) for all marine mammals following the viewshed analysis exercise.

6.1.1.2 Distances to auditory impact from Program construction activity for impulsive and non-impulsive sound signals

Impact, vibratory, and rotary drilling pile installation will generate underwater noise that may lead to harassment (i.e., noise levels of ≥160 dB for impulsive sources [impact pile driving] and ≥120 dB for non-impulsive sources [vibratory pile driving and drilling]) of marine mammals within the Program Area. This section provides the distances, based on pile installation activity type, to Level A and Level B harassment. Distances (isopleths) are based on the attenuation of underwater noise (transmission loss [TL]) as calculated with the practical spreading loss model:

> TL = X log10(R/D), where R is the distance from the source, D is the distance of the known or measured noise level, and X is the TL coefficient.

For this assessment, MassDOT used the NOAA Fisheries'-recommended practical spreading TL coefficient of 15 dB.

Using the practical spreading loss assumption and NMFS-recommended TL coefficient, the model can be rearranged to estimate the propagation of underwater noise as follows:

$$R = D*10^{(\Delta/TL)}$$

where Δ is the difference between the SSL and the noise level at which behavioral harassment may occur.

MARINE MAMMAL EXCLUSION ZONES

The radial distance to the Level B threshold sound isopleths for each activity, based on the viewshed analysis, will be used as exclusion zones for observed marine mammals. The exclusion zone must be kept clear of marine mammals during underwater noise-generating construction activities, including impact, vibratory, and drilling-rotary drills. By keeping the exclusion zones clear of marine mammals, the sound source will be received at a level that will not be injurious or cause a behavioral disturbance to them. Attachment 2, Table 2-1 shows the derived distances from the viewshed analysis along with the untruncated distances calculated using the proxy sources. Impact pile driving of two concurrent 36-inch (0.9 meter) steel pipe piles and vibratory pile driving of two concurrent 18-inch (0.5 meter) steel sheeting piles will have the most far-reaching potential effects of the respective pile driving types and are therefore used to show the maximum exclusion zone distances for the Program (Attachment 3, Figures 3-1 and 3-2). Below are the Level B (behavioral threshold) distances based on proxies from the NOAA Fisheries User Spreadsheet Tool compared to the furthest extent distances derived from the viewshed analysis for the Proposed Action. In many instances listed below, the Tool produced the same Level B distance as the viewshed analysis for impulsive sources, but two of the non-impulsive sources resulted in truncated radii. The rules of significant figures are applied here to the calculated

results derived from proxy values used in the equation with one decimal place to retain precision and accuracy.

Impulsive Sources - Distance to Behavioral Threshold (160 dB rms)

- Radius of 1,584.9 meters (5,199.8 feet) from the 36-inch (0.9 meter) Steel Pipe Piles for the Work Trestle, Dolphin Piles-Large Variant, as well as Pier Cofferdam based on the NOAA Fisheries User Spreadsheet Tool, also derived from the viewshed analysis (furthest extent from both the Bourne and Sagamore Bridge)
- Radius of 1,000.0 meters (3,280.8 feet) from the 18-inch (0.5 meter) Steel Sheeting Piles for the Cofferdam Sheeting, Shoreline Sheeting, Bulkhead Sheeting, as well as Barge Sheeting based on the NOAA Fisheries User Spreadsheet Tool, also derived from the viewshed analysis (furthest extent from both the Bourne and Sagamore Bridge)
- Radius of 631.0 meters (2,070.2 feet) from the 14-inch (0.4 meter) Steel H-Piles for the Dolphin Piles-Small Variant based on the NOAA Fisheries User Spreadsheet Tool, also derived from the viewshed analysis (furthest extent from both the Bourne and Sagamore Bridge)
- Radius of 2,511.9 meters (8,241.1 feet) from two concurrent 36-inch (0.9 meter) Steel Pipe Piles based on the NOAA Fisheries User Spreadsheet Tool, also derived from the viewshed analysis (furthest extent from both the Bourne and Sagamore Bridge)

Non-Impulsive Sources - Distance to Behavioral Threshold (120 dB rms)

- Radius of 3,025.7 meters (9,926.7 feet) from the Bourne Bridge and 3,377.0 meters (11,079.4 feet) from the Sagamore Bridge derived from the viewshed analysis (furthest extent) from the 18-inch (0.5 meter) Steel Sheeting Piles for the Cofferdam Sheeting, Shoreline Sheeting, Bulkhead Sheeting, as well as Barge Sheeting
- Radius of 2,286.6 meters (7,502.0 feet) from the 14-inch (0.4 meter) Steel Pipe Piles for the Dolphin Piles-Small Variant based on the NOAA Fisheries User Spreadsheet Tool, also derived from the viewshed analysis (furthest extent from both the Bourne and Sagamore Bridge)
- Radius of 1,000.0 meters (3,280.8 feet) from the 12-inch (0.3 meter) Steel H-Piles for the Templates based on the NOAA Fisheries User Spreadsheet Tool, also derived from the viewshed analysis (furthest extent from both the Bourne and Sagamore Bridge)
- Radius of 3,025.7 meters (9,926.7 feet) from the Bourne Bridge and 3,377.0 meters (11,079.4 feet) from the Sagamore Bridge derived from the viewshed analysis (furthest extent) for two concurrent 18-inch (0.9 meter) Steel Sheeting Piles

SEA TURTLE EXCLUSION ZONES

The radial distance to the Level B threshold sound isopleths for each activity, based on the viewshed analysis, will be used as exclusion zones for observed sea turtles. The exclusion zone must be kept clear of sea turtles during underwater noise-generating construction activities, including impact and vibratory pile driving and rotary drilling. Attachment 2, Table 2-2 shows the derived distances from the viewshed analysis along with the untruncated distances calculated using the proxy sources. Impact pile driving of two concurrent 36-inch (0.9 meter) steel pipe piles and vibratory pile driving of two concurrent 18-inch (0.5 meter) steel sheeting piles will have the most far-reaching potential effects of the respective pile driving types and are therefore used to show the maximum exclusion zone distances for the Program (Attachment 3, Figures 3-3 and 3-4). Below are the Level B (behavioral threshold) distances based on proxies from the NOAA Fisheries User Spreadsheet Tool. The furthest extent distances derived from the viewshed analysis for the Proposed Action are the exact same as from the NOAA Fisheries User Spreadsheet Tool proxies.

Impulsive Sources - Distance to Behavioral Threshold (175 dB rms)

- Radius of 158.5 meters (520.0 feet) from the 36-inch (0.9 meter) Steel Pipe Piles for the Work Trestle, Dolphin Piles-Large Variant, as well as Pier Cofferdam
- Radius of 100.0 meters (32.8 feet) from the 18-inch (0.5 meter) Steel Sheeting Piles for the Cofferdam Sheeting, Shoreline Sheeting, Bulkhead Sheeting, as well as Barge Sheeting
- Radius of 63.1 meters (20.7 feet) from the 14-inch (0.4 meter) Steel H-Piles for the Dolphin Piles-Small Variant
- Radius of 251.2 meters (824.1 feet) from two concurrent 36-inch (0.9 meter) Steel Pipe Piles

Non-Impulsive Sources - Distance to Behavioral Threshold (175 dB rms)

- Radius of 1.0 meter (3.3 feet) from the 18-inch (0.5 meter) Steel Sheeting Piles for the Cofferdam Sheeting, Shoreline Sheeting, Bulkhead Sheeting, as well as Barge Sheeting
- Radius of 0.5 meter (1.6 feet) from the 14-inch (0.4 meter) Steel Pipe Piles for the Dolphin Piles-Small Variant
- Radius of 0.2 meter (0.7 feet) from the 12-inch (0.3 meter) Steel H-Piles for the Templates
- Radius of 1.6 meters (5.2 feet) from two concurrent 18-inch (0.9 meter) Steel Sheeting Piles

MARINE MAMMAL AND SEA TURTLE MONITORING AND MITIGATION

MassDOT's planned marine mammal and sea turtle monitoring and mitigation program incorporates both design features and operational procedures for minimizing potential impacts on marine mammals. The Program design features being utilized to minimize the potential impacts include:

- Using the following time of year (TOY) restrictions to avoid interactions with ESA-listed whale species during their periods of highest abundance: all pile driving will be conducted during the September 1 through February 28 work window.
- Confining in-water construction activities to Cape Cod Canal, which will allow for early detection of ESA-listed whale and sea turtle species through regular communication with canal operators and users during in-water construction activities.
- Conducting a pre-season acoustic assessment to establish precautionary safety and behavioral radii.

However, the sound introduced from Program construction into the Canal and Cape Cod Bay's underwater environment changes how these animals perceive their environment. Sound sources from vessel fleet transits, as well as construction activities that create impulsive or continuous sounds above their auditory thresholds, like pile driving, can mask other sounds that cue their survival responses (Section 6.1.1). These types of sound sources can be injurious to marine mammals and sea turtles if not avoided, minimized, or mitigated.

The potential disturbance of marine mammals and sea turtles during Program operations will be minimized further through the implementation of land/vessel-based mitigation measures, including Program soft start and shut down procedures and establishment of exclusion zones as described in Conservation and Mitigation Measures (Section 5.9), measures including 3, 4, 6, 10a, 10c, and 10d. These measures will be implemented during the Program's in-water construction activities to avoid, minimize, and/or mitigate potential effects from the Program, including injury to marine mammals and sea turtles.

The MassDOT Marine Mammal and Sea Turtle Monitoring and Mitigation Plan will specify that the Program's marine operations construction vessel captain, crew, and PSO(s) will be tasked with executing and maintaining the exclusion zones. If a marine mammal or sea turtle is observed entering their respective exclusion zone, listed in Attachment 2, Table 2-3, then the PSO has the stop work authority to halt marine operations until the animal has been observed leaving the exclusion zone or 30 minutes have passed since the animal(s) was last sighted within the exclusion zone. Implementation of these conditions is needed to avoid auditory and behavioral effects on all marine mammals and sea turtles.

6.1.1.3 Effects of Noise on Marine Mammals and Sea Turtles

Exposure to underwater sound or noise from specific construction activities could result in injurious or behavioral effects on marine mammals and sea turtles. To mitigate these potential effects, using NOAA guidance, the Program plans to implement exclusion zones monitored by PSOs at the behavioral threshold distance from each noise-generating activity (e.g., impact and vibratory pile driving and

drilling). The exclusion zones are the areas in which the respective construction activity (i.e., impulsive-impact pile driving and non-impulsive vibratory pile driving and drilling) will cease if a marine mammal or sea turtle is observed entering. Thus, as a conservative approach, observed marine mammals and sea turtles will be intentionally excluded from the areas where instantaneous injurious/PTS onset (Level A) or behavioral (Level B) disturbance levels are predicted to occur (Section 6.1.1.2).

This assessment of acoustic impacts to ESA-listed marine mammals and sea turtles that could potentially be present in the Action Area considers the low-frequency (LF) hearing group of cetaceans for potential effects to the NARW and fin whale, and the sea turtle hearing group for potential effects to the green, Kemp's ridley, leatherback, and loggerhead turtles. Construction activities for the Program could produce sound pressure levels that reach or exceed the LF cetaceans Level A (injury/PTS onset) threshold of SPL_{peak} 219 dB or $SEL_{cum(24h)}$ of 183 dB for impulsive sound sources, or $SEL_{cum(24h)}$ of 199 dB for non-impulsive sound sources (Table 5). Similarly, for sea turtles, construction activities for the Program could produce sound pressure levels that reach or exceed the Level A (injury/PTS onset) threshold of SPL_{peak} 232 dB or $SEL_{cum(24h)}$ of 204 dB for impulsive sound sources, or $SEL_{cum(24h)}$ of 220 dB for non-impulsive sound sources (Table 6).

For this Program, the maximum radial extent distance to the LF cetacean Level A (injurious/PTS onset) thresholds for instantaneous and cumulative exposure injury (SPL_{peak} 219 dB and $SEL_{cum(24h)}$ 183 dB) would occur during concurrent impact pile driving of 36-inch (0.9 meter) steel pipe piles. The distances to these thresholds would be 4 meters (13.1 feet) and 9,368.0 meters (5.8 miles), respectively. Similarly, for sea turtles, the maximum radial extent distances to the thresholds for instantaneous and cumulative injury/PTS onset (SPL_{peak} 232 dB and $SEL_{cum(24h)}$ 204 dB) would be 0.5 meter (1.6 feet) and 373.7 meters (1,226 feet), respectively, for the concurrent impact piling of 36-inch (0.9 meter) steel pipe piles (Attachment 2, Table 2-3).

For this Program, the maximum radial extent distance to the LF cetacean and sea turtle Level A (injurious/PTS onset) threshold ($SEL_{cum(24h)}$ 199 dB and $SEL_{cum(24h)}$ 220 dB, respectively) for non-impulsive sound sources would occur during the concurrent vibratory pile-driving of the 18-inch (0.5 meter) steel sheet piles (vibratory pile-driving is not planned for the larger 36-inch [0.9 meter] steel pipe piles). The maximum radial extent distance to the Level A (injurious/PTS onset) $SEL_{cum(24h)}$ thresholds for LF cetaceans and sea turtles would be 37.1 meters (122 feet) and 1.5 meters (5 feet), respectively, for the concurrent vibratory piling of 18-inch (0.5 meter) steel sheet piles (Attachment 2, Table 2-3).

However, these distances were calculated using the NOAA Fisheries Multi-species Pile Driving Calculator (2022) and do not take into account underwater sound being interrupted by land. When ground-truthed to the respective bridge locations using viewshed analysis (described in Section 6.1.1.1), the sound is truncated by land (as landforms impede underwater noise transmission), as a

result of the shape and sinuous nature of the Canal (illustrated in Attachment 3, Figures 3-1 through 3-4). Thus, sound levels from pile driving will not reach the extent of the modeled threshold distance depending upon the Canal topography. The maximum radial distance sound can travel before being interrupted by land is 3,025.7 meters (9,926.7 feet) from the Bourne Bridge and 3,377.0 meters (11,079.4 feet) from the Sagamore Bridge.

In addition, for a LF cetacean or sea turtle to be potentially exposed to injurious (onset of PTS) sound levels (SEL_{cum}) during impact pile driving at distances beyond the behavioral threshold distances (this does not occur for non-impulsive sound sources), the animal(s) would have to be exposed to that received sound level for over 24 hours to incur PTS. Given that both LF cetaceans and sea turtles are not stationary and rely on accessing the water surface to breathe air, it would be highly unlikely for this type of exposure to occur in the area immediately outside the exclusion zone area (behavioral threshold distance). However, for the construction activities where the SEL_{cum} threshold distances for marine mammals (inclusive of LF cetaceans) and sea turtles (Attachment 2, Tables 2-1 through 2-3 and Attachment 3, Figures 3-1 through 3-4) exceed the behavioral threshold distances (i.e., impact piling of 18-inch sheet piles, 36-inch steel pipe piles, 14-inch steel H-piles, and concurrent impact piling), the PSOs will monitor the larger distance (i.e., maximum radial distance), until where sound would be interrupted by land, to make sure marine mammals (inclusive of LF cetaceans) and sea turtles are not routinely present over a 24-hour period.

Behavioral effects (Level B thresholds), including avoidance or disruption of foraging, may occur in LF cetaceans exposed to RMS ≥160 dB re 1 µPa for impulsive sounds and RMS ≥120 dB re 1 µPa for non-impulsive sounds and in sea turtles exposed to RMS ≥175 dB (for impulsive and non-impulsive sounds). For this Program, exclusion zones have been established using these Level B behavioral thresholds, and if an animal were to be observed within its respective exclusion area, the PSO would "halt marine operations until the animal has been observed leaving the exclusion zone or 30 minutes have passed since the animal(s) was/were last sighted within the exclusion zone" (Section 5.9, Conservation Measure 10c).

Given the described precautionary monitoring methodology, conservation and mitigation measures (i.e., exclusion zones) that will be implemented to minimize exposure of marine mammals and sea turtles to noise impacts, underwater noise-associated effects of the Program on NARW, fin whales, and green, Kemp's ridley, leatherback, and loggerhead sea turtles will be too small to be meaningfully measured or detected and, therefore, extremely unlikely to occur.

6.1.2 Atlantic Sturgeon and Shortnose Sturgeon

As introduced in Section 6.1.1, underwater sound has the potential to cause behavioral changes, hearing impairment, physiological injury, or even mortality to fish (Popper and Hastings 2009, Popper

et al. 2014). Atlantic sturgeon and shortnose sturgeon have physostomous (i.e., open) swim bladders and although these organs are not associated with hearing, they are susceptible to barotrauma from underwater noise (Lovell et al. 2005, Meyer et al. 2010, Popper et al. 2014). Thresholds adopted by NOAA Fisheries for the onset of behavioral and physiological (injurious) effects on ESA listed fish species (including sturgeon) from anthropogenic underwater sound are provided in Table 7.

Table 7. Fish Hearing Thresholds (FHWG 2008)

Faunal Group	**Injury**		**Behavior[1]**
	Impulsive		Impulsive & Non-Impulsive
	PK^2 dB re 1µPa	$SEL_{cum}{}^3$ dB re 1µPa2·s	RMS dB re 1µPa
Fish equal to or greater than 2 grams	≥206 dB	≥187 dB	≥150 dB
Fish less than 2 grams		≥183 dB	

Note:
[1] Only the behavioral threshold is applicable to fish from non-impulsive sound sources.
[2] Peak sound pressure level (PK) is expressed in dB re 1 µPa
[3] Cumulative sound exposure level (SELcum) is expressed in dB re 1 µPa2s with an accumulation period of 12 hours for fish.
Key:
µPa = micropascal
dB = decibel
RMS = root mean square
SELcum = cumulative sound exposure level

Exposure to underwater sound levels of 206 dB peak and 183 dB or 187 dB SEL_{cum} (depending on fish size in grams) can result in injury to fish, including Atlantic sturgeon and shortnose sturgeon. In addition to the Peak exposure criteria that describes the maximum energy received from a single pile strike, the potential for injury also exists from multiple exposures to noise over an extended period, which is accounted for by the cumulative sound exposure level, or SEL_{cum} calculation. SEL_{cum} is not a measure of instantaneous maximum noise levels but is a measure of the accumulated energy level over a specific period (e.g., the duration it takes to install a pile). For SEL_{cum}, the farther a fish is away from the pile driving activity, the more strikes it must be exposed to before reaching injurious exposure levels. At some distance from the pile, the organism is far enough away that, regardless of the number of strikes it is exposed to, the energy accumulated is low enough so that there is no potential for injury. Behavioral effects, such as avoidance, may occur in fish exposed to underwater sound at levels greater

than or equal to 150 dB, as measured using the sound root-mean-square (RMS) metric. The area for these potential impacts is captured in the RMS "Behavioral" threshold isopleth.

Program-related underwater sound could potentially affect migrating or foraging adult and subadult Atlantic sturgeon and adult shortnose sturgeon. The types of Program-related underwater sound with the highest likelihood of impacting migrating or foraging sturgeon would primarily be noise associated with in-water pile driving to construct cofferdams, bulkheads, barge docks, work trestles, and mooring dolphins. Other Program activities that could cause elevated underwater sound include deconstruction of the existing bridge piers, dredging of the construction areas to the depths necessary for construction vessels, and the engines of the construction vessels.

Given the frequency of current vessel traffic transiting through the Cape Cod Canal, impacts on adult and subadult Atlantic sturgeon and adult shortnose sturgeon attributable to the temporary increase in noise created by construction vessels relative to existing conditions will be too small to be meaningfully measured or detected. Likewise, underwater noise associated with dredging and demolition of the existing bridge piers will be substantially less than that associated with pile driving and below thresholds for behavioral or injurious effects. Thus, impacts on adult and subadult Atlantic sturgeon and adult shortnose sturgeon from non-pile driving underwater sound sources will be too small to be meaningfully measured or detected.

6.1.2.1 Distances to Auditory Impact from Program Construction Activity for Impulsive and Non-Impulsive Sound Signals

Impact, vibratory, and rotary drilling pile installation will generate underwater noise that may lead to injurious or behavioral effects on adult and subadult Atlantic sturgeon and adult shortnose sturgeon. This section provides the distances from the pile installation activity types within which injurious and behavioral impacts may occur as derived based on proxies from the NOAA Fisheries User Spreadsheet Tool (NMFS 2022; Attachment 2, Tables 2-4, 2-5).

Concurrent impact pile driving of two 36-inch (0.9 meter) steel pipe piles and concurrent vibratory pile driving of two 18-inch (0.5 meter) steel sheeting piles will have the most far-reaching potential effects of the respective pile driving types and therefore represent the maximum distances for injurious and behavioral impacts, respectively, due to Program construction activities (Attachment 2, Table 2-5).

As noted in Section 6.1.1.1, bends within the Cape Cod Canal will truncate the distances underwater sound waves will travel from construction activities at the Sagamore and Bourne bridge sites; thus, a viewshed analysis was conducted to accurately assess the extents of the Cape Cod Canal within which elevated sound will occur.

Bends in the Cape Cod Canal will not truncate the maximum distances within which injurious peak SPLs will occur as a result of concurrent impact pile driving of 36-inch (0.9 meter) steel pipe piles (29.3

meters), nor the extent of underwater noise above behavioral thresholds as a result of concurrent vibratory pile driving of 18-inch (0.5 meter) steel sheet piles (73.6 meters), as the bends in the Canal are farther from the bridge sites than these respective distances. However, the maximum distances within which behavioral effects will occur due to concurrent impact pile driving of 36-inch (0.9 meter) steel pipe piles (11,659.1 meters [38,251.8 feet]) will be truncated by approximately 70 percent due to Canal geography. Attachment 3, Figures 3-5 and 3-6 illustrate the extents of the respective injurious and behavioral isopleths based on applicable analysis for each isopleth distance.

6.1.2.2 Effects of Noise on Atlantic Sturgeon and Shortnose Sturgeon

As noted, concurrent impact pile driving of the 36-inch (0.9 meter) steel pipe piles will have the most far-reaching potential effects of the different types of pile driving and is therefore discussed as the proxy for all impacts related to pile driving on adult and subadult Atlantic sturgeon and adult shortnose sturgeon. As detailed in Attachment 2, Table 2-5, to be exposed to potentially injurious SPLs during unattenuated concurrent impact hammering of 36-inch-diameter (0.9 meter) steel pipe piles, a fish would need to be within the 29.3 meters (96.1 feet) Peak isopleths emanating from each pile being driven for an instant, or within the 2,511.9 meters (8,241.1 feet) SEL_{cum} isopleth for an extended period. However, this is not expected to occur. It is expected that a fish that is present within the area exposed to underwater noise exceeding the behavioral threshold for fish (≥150 dB)—that is, within 3,025.7 meters (9,926.7 feet) of the Bourne Bridge site or within 3,376.9 meters (11,079.4 feet) of the Sagamore Bridge site, as illustrated in Attachment 3, Figures 3-5 and 3-6—would modify its behavior and move away from the ensonified area before being exposed to potentially harmful noise levels. Construction at the Bourne and Sagamore bridge sites will not occur simultaneously; therefore, the zones of injurious and behavioral impacts sound levels (as truncated by Canal topography) will only extend from a single bridge site at any given time, leaving the remainder of the Cape Cod Canal unaffected by underwater sound caused by pile driving. Underwater sound exceeding the threshold for behavioral impacts will encompass approximately one-third to one-half of the Cape Cod Canal, depending on the bridge site at which construction is occurring. Underwater sound exceeding the threshold for injurious impacts on sturgeon will emanate only 29.3 meters (96.1 feet) from the respective northern and southern quadrants of the bridges in which construction is occurring. This will leave the approximate middle 55 percent (115.1 meters; 377.6 feet) of the canal width unaffected by injurious underwater noise.

Migrating or foraging adult and subadult Atlantic sturgeon and adult shortnose sturgeon could be present in the Cape Cod Canal during the September 1 through February 28 work window when pile driving activities will occur. However, given that Atlantic sturgeon are found to move to deeper waters further offshore than the Cape Cod Canal during winter months (e.g., Beardsall et al 2016, Taylor et al 2016) and shortnose sturgeon generally overwinter in freshwater portions of rivers (SSSRT 2010), the

presence of Atlantic sturgeon and shortnose sturgeon within the Cape Cod Canal during construction activities is expected to be unlikely. If an individual Atlantic sturgeon or shortnose sturgeon is present at the onset of pile driving, the use of soft starts will allow the individual to move away from the immediate vicinity of the activity and beyond the range of injurious noise levels prior to the beginning of impact pile driving at full energy. Additionally, it is reasonable to assume that a sturgeon exposed to underwater noise levels above its behavioral threshold of 150 dB RMS would redirect its course of movement to avoid the ensonified area where the activity (i.e., pile driving) is occurring. Such effects on any sturgeon that may be exposed to noise above the behavioral threshold are expected to be limited to momentary startles and brief movement effects and would be unlikely to alter essential behaviors such as foraging and migration once outside of the ensonified area. Therefore, the effects of underwater noise on Atlantic sturgeon and shortnose sturgeon would be too small to be meaningfully measured or detected and would be insignificant.

6.2 Vessel Strikes

Program-related vessel traffic to and within the Cape Cod Canal will cause some increase in the risk of vessel strikes to ESA-listed marine mammal, sea turtle, or sturgeon. However, the baseline risk of these protected species being struck by a vessel within the Cape Cod Canal is unknown due to the absence of data regarding their presence in the Cape Cod Canal. Vessel strike related mortalities are primarily caused by large transoceanic vessels, due to their deep draft [up to 40 to 45 feet (12.2 to 13.7 meters)] relative to smaller vessels [typically less than 15 feet (4.5 meters)]. Smaller vessels and those with relatively shallow drafts provide more clearance and reduce the probability of vessel strikes. The Cape Cod Canal navigation channel is maintained at a depth of 32 feet. Program construction vessels associated with the daily marine-based construction activities will consist of work barges, delivery barges, tugs, and construction launches (as described in Section 5.7). The drafts of the specific vessels used during construction are currently unknown. However, the drafts of these types of vessels are typically less than 10 to 15 feet.

6.2.1 Marine Mammals and Sea Turtles

Vessel strikes to whales and sea turtles are a potential impact of the Proposed Action. The SAR records vessel strike data for each stock when these interactions are reported. However, whale mortalities from vessel strikes on the West Coast from naval encounters are estimated to be much higher than the minimum estimates from the region's stranding records (Rockwood et al. 2017). For example, captains of large ships and container vessels may not recognize a whale strike when it occurs. However, the Program vessels may not be in this vessel size category as vessel drafts within the Canal are limited to approximately 32 feet (9.8 m).

Information on how often whales and sea turtles have been struck by vessels in the Action Area is not available at this time. In lieu of a specific tool or application, Program information is presented to assist NOAA Fisheries in its analysis and estimation of this risk. One suggested method that is used by NOAA Fisheries West Coast Region, is to illustrate the Action Area with existing vessel traffic, adding automatic identification system (AIS)[7] data along with proposed Program vessel use to approximate the level of risk to ESA marine mammal and sea turtle species.

As indicated in Section 5.7, vessels to be used in the Program's day-to-day marine operations include work and delivery barges, safety barges, tugs, and support launches (Table 3). Independent from the day-to-day marine construction activities, vessels will be tasked with the float-out of existing bridge main spans over three to five days, and the float-in of replacement bridge main spans over three to five days (over two different dates for the two discrete bridges); it is estimated that four large vessels and four support (safety) vessels will be employed for each float-in and float-out operation. Program Additionally, vessels traveling to and from Cape Cod Canal are included in the Action Area as they would not be transiting to the site but for this specific Proposed Action. As described in Section 2.0, vessels may originate from the following ports and would incur longer coastal transits: New Bedford Harbor, New Bedford, MA; Taunton River, Fall River/Somerset, MA; Fore River, Weymouth, MA; Portsmouth, NH; or Portland, ME.

Vessel transits to and from the Program may extend up to 169 miles (272 kilometers) from origins as far north as Portland, ME to Cape Cod Canal and will occur within NARW critical habitat. Recent passive acoustic monitoring and historic visual observation data suggest a 'relative likelihood' for NARW occurrence in the Action Area (Davis et al. 2017; Kenney, Mayo, and Winn 2001; NOAA Northeast Fisheries Science Center 2021). Therefore, NARW have the potential to overlap with Program vessel activity.

There is potential for vessel strikes during vessel fleet transit; however, the fleet is composed of slow-moving construction vessels (traveling at approximately 3 to 5 knots [5.6 to 9.3 km per hour], as indicated in Section 5.7, which are of lesser concern than faster travelling vessels. Fast-moving, large commercial shipping vessels (and to a lesser extent fast-moving pleasure craft in coastal areas) are the main causes of such deleterious interactions (Clapham et al. 1999). Proposed Program mitigation measures include low speeds for large Program vessels that is required to be less than 10 knots at all times.

Although scientific data records at the time of this analysis do not show sea turtle presence in the Canal (Attachment 1, Figure 1-5), sea turtles may be in the Action Area from May to November. If sea

[7] Automatic identification systems (AIS) are a vessel tracking method that uses mobile maritime bands to relay information transmitted from vessels greater than 65 feet (19.8 meter).

turtles were to be present from October through January, they would likely be cold stunned and slow moving, leaving them more vulnerable to vessel strikes. Risk of vessel strikes to sea turtles would be minimized through reduced vessel speeds of 10 knots, the inclusion of a PSO during vessel transit, and alteration of work schedule and vessel routes if cold stunned turtles are observed, as addressed in Conservation Measures 9, 10, and 14 (Section 5.9).

Program vessels will also produce underwater sound effects from engine noise and cavitation at propeller blade tips (Popper and Hawkins 2019). Vessel transits are likely to be within NARW Critical Habitat as they approach the bridge locations within the Canal. However, the Program vessels are not likely to emit vessel sounds any greater than other vessels of similar size and class transiting the Eastern seaboard. The most direct transit routes between major ports are well used by similar vessels of the 65-foot or larger size class. This is reflected in AIS data from 2022 that illustrate high vessel density in approach to and entering Cape Cod Canal via Cape Cod Bay and Buzzards Bay (NROC 2023). For each bridge site, sound levels incurred from the Program's vessel fleet transits are likely to be spread across the construction duration and would be insignificant (so small that they cannot be meaningfully measured, evaluated or detected) amongst the eastern seaboard vessel density. As a result, this effect from Program vessels is insignificant.

The analysis of potential effects from vessel traffic associated with the proposed action includes transits to and from the furthest possible homeport to Cape Code Canal. The additional Program vessels in the Action Area will increase vessel traffic for the duration of the proposed action and could increase the risk of vessel strike to whales, which is a major contributor to the mortality of NARW (Kraus 1990, Knowlton and Kraus 2001, van der Hoop et al. 2013). However, vessels that observe the recommended voluntary speed reduction, in parallel with NARW's mitigation measures that are already in place, can contribute to the reduction of this risk, as the speed restriction is in place to avoid and minimize the potential for vessel strikes to NARW. Rockwood et al. (2020) applied a hypothetical ship strike model to west coast humpback and blue whale density data and AIS vessel data and estimated expected mortality of whales when speeds were below 10 knots in shipping lanes. Their results illustrated a 11 to 13 percent reduction in blue whale mortality and a 9 to 10 percent reduction in humpback whale mortality.

In addition to speed restrictions, Conservation Measures 9, 10a, 11, 12, 13, and 14 in Section 5.9 will further minimize and mitigate potential vessel related impacts on marine mammals and sea turtles.

In conclusion, effects to the fin whale and NARW resulting from the Program's vessel traffic, which will be concentrated within and through the Canal, would be too small to meaningfully measure, detect, or evaluate and therefore insignificant. Similarly, effects on sea turtle species, including green, Kemp's ridley, leatherback, and loggerhead, resulting from the Program's vessel traffic within and through the Canal, would be too small to meaningfully measure, detect, or evaluate and therefore insignificant.

6.2.2 Atlantic and Shortnose Sturgeon

Construction vessel traffic associated with the Proposed Action could affect adult or subadult Atlantic sturgeon and adult shortnose sturgeon by increasing the potential for vessel strikes. Factors that determine the potential effects of vessel traffic on Atlantic sturgeon and shortnose sturgeon include the number of vessels to be used as compared to baseline vessel activity in the Action Area, size and speed of the vessels, navigational clearance in the area where the vessel is operating, and likely presence of fish in the Action Area during the proposed construction activity.

The baseline risk of a sturgeon being struck by a vessel within the Cape Cod Canal is unknown due to the absence of data regarding sturgeon presence in the Cape Cod Canal. However, Atlantic sturgeon vessel related mortalities are primarily caused by large transoceanic vessels, due to their deep draft [up to 40 to 45 feet (12.2 to 13.7 meters)] relative to smaller vessels [typically less than 15 feet (4.5 meters)]. The deeper drafts of very large vessels increase the probability of collisions with demersal fishes like sturgeon, even in deep water (Brown and Murphy 2010). Smaller vessels and those with relatively shallow drafts provide more clearance and reduce the probability of vessel strikes. The Cape Cod Canal navigation channel is maintained at a depth of 32 feet. Program construction vessels associated with the daily marine-based construction activities will consist of work barges, delivery barges, tugs, and construction launches (as described in Section 5.7). The drafts of the specific vessels used during construction are currently unknown. However, the drafts of these types of vessels are typically less than 10 to 15 feet. The float-in and float-out vessels will have deeper drafts but will be moving slowly enough so that adult or subadult Atlantic sturgeon and adult shortnose sturgeon will be able to readily avoid the vessels as they transit through the Cape Cod Canal.

Additionally, the magnitude of daily Program vessel traffic movement would be relatively low compared to the baseline of daily vessel traffic through the Cape Cod Canal and across commercial shipping lanes between the Program site and the home ports of the construction vessels (discussed in Sections 1.3 and 5.6). Vessels operating in the Cape Cod Canal will be required to maintain a maximum speed of 10 knots in conditions of good visibility. Furthermore, a fisheries biologist or PSO will be present on construction vessels during their transits to and from the construction sites.

Vessel traffic associated with the Program is not expected to have direct impacts on adult and subadult Atlantic sturgeon or adult shortnose sturgeon. Atlantic sturgeon and shortnose sturgeon primarily occupy the bottom meter of the water column in the deepest portions of waterbodies; therefore, they would be below the draft of Program construction vessels moving slowly through the relatively deep waters of the Cape Cod Canal navigation channel or commercial shipping lanes of the open ocean. Construction activities in the shallower areas near the shorelines of the Canal would deter Atlantic sturgeon or shortnose sturgeon individuals from foraging in these areas and risking interactions with construction vessels. As such, any increased risk of a vessel strike caused by the Program will be too

small to be meaningfully measured or detected. As a result, the effects of the Program on Atlantic sturgeon and shortnose sturgeon due to the increased risk of a vessel strike in the Action Area are insignificant.

6.3 Water Quality / Turbidity

Program activities in the Cape Cod Canal that could affect water quality by increasing turbidity in the water column, as measured by total suspended solids (TSS), includes dredging and excavation, using cutterhead suction dredges or clamshell excavation dredges, to create appropriate drafts for construction vessels along the canal shorelines, excavating riprap along the canal shoreline, and pile driving and removal of different types of piles comprising the cofferdams, sheeting, bulkheads and dolphins used during construction. The duration of a resultant turbidity plume would be dependent on current speeds, sediments type and size, and duration of the plume in suspension. The Program site location in the Cape Cod Canal has a current speed of up to 6 knots that makes it unlikely for a plume to be persistent after initial disturbance. Sediments that will be excavated from the Cape Cod Canal are predominately sands and gravels, with very little fines (from 1.9 percent to 0.0 percent fines) due to the high currents in the canal (USACE 2023).

Mechanical dredging with a bucket in open water has been shown to cause TSS concentrations between 15 milligrams per liter (mg/L) and 91 mg/L up to 2,000 feet (610 meters) from dredge sites (Burton 1993 as cited in NOAA Fisheries 2020b). The US Army Corps of Engineers conducted extensive monitoring of mechanical dredge plumes and found that plumes dissipated to background levels within 600 feet (183 meters) of the source in the upper water column and 2,400 feet (732 meters) in the lower water column, regardless of bucket type or size (USACE 2015a as cited in NOAA Fisheries 2020b). NOAA Fisheries studies determined that elevated suspended sediment concentrations at several hundreds of mg/L above background may be present in the immediate vicinity of the bucket during mechanical dredging but would settle rapidly within 2,400 feet (732 meters) of the dredge location.

Pile driving activities are expected to create even smaller impacts on TSS concentration in the water column. Data collected from a project in the Hudson River (NOAA Fisheries 2020b) indicates that pile driving activities produce TSS concentrations of approximately 5.0 to 10.0 mg/L above background levels within approximately 300 feet (91.4 meters) from pile driving activities (FHWA 2013 as cited in NOAA Fisheries 2020b).

Dredging within a cofferdam, construction of the new pier foundations within containment cells, and demolition of the existing bridge pier foundations and footings within containment cells and would minimize turbidity.

6.3.1 Marine Mammals and Sea Turtles

Considering that current speeds in the Canal will cause rapid dissipation of turbidity plumes, this potential effect on water quality on marine mammals and sea turtles does not rise to the level of concern if minimized within Program design and construction methods to the amount practicable. Neither of these species groups would incur direct effects from elevated TSS, as marine mammals and sea turtles breathe air. The indirect effects of any movements to evade these plumes as necessary would be limited to the respective energetics expended, which would not raise an effect from this stressor to a level of concern and would be too small to be meaningfully measured or detected.

In conclusion, water quality effects resulting from the Program on marine mammal species including fin whale and NARW would be too small to meaningfully measure, detect, or evaluate and therefore insignificant. Similarly, water quality effects resulting from the Program on sea turtle species, including green, Kemp's ridley, leatherback, and loggerhead, would be too small to meaningfully measure, detect, or evaluate, and therefore insignificant.

6.3.2 Atlantic Sturgeon and Shortnose Sturgeon

The effects on water quality of construction vessels transiting to and from their ports of origin will be too small to be meaningfully measured or detected and therefore insignificant.

The effects of high concentration of TSS in the water column varies widely across fish species depending on the species and life stages being considered. Common impacts on fishes can include abrasion of gill membranes resulting in a reduction in the ability to absorb oxygen and decrease in dissolved oxygen concentrations in the surrounding waters and effects on growth rate. Behavioral responses by fishes to increased suspended sediment concentrations can include impairment of feeding, impaired ability to locate predators and reduced breeding activity. Increased TSS can inhibit migratory movements as well. TSS concentrations as low as 350 milligrams per liter (mg/L) have been shown to interfere with upstream migrations of various species. At high suspended sediment concentrations, mortality has also been documented (NOAA 2001).

Although there are no known studies on the effects of resuspended sediments on Atlantic sturgeon or shortnose sturgeon, they commonly occupy turbid waters and are therefore expected to be able to tolerate TSS concentration in the water column at the levels commonly generated by marine construction activities (Dadswell et al. 1984, NMFS 2011). Atlantic sturgeon and shortnose sturgeon feed on invertebrates that occur both on and within soft bottom substrates. Feeding activity by Atlantic sturgeon has been shown to cause voluminous quantities of clay and silt to be redistributed around their feeding areas (Pearson et al. 2007). NOAA Fisheries guidance states that Atlantic sturgeon and shortnose sturgeon should not be exposed to TSS levels of 1,000 mg/L above ambient for longer than 14 days at a time to avoid behavioral and physiological effects (NOAA Fisheries 2020b).

NOAA Fisheries determined that turbidity plumes resulting from dredging are not expected to persist and would likely result in only minor alterations to normal movements of Atlantic or shortnose sturgeon. Other studies have shown that anticipated TSS levels for mechanical dredging (up to 445.0 mg/L) are below those expected to have adverse effect on fish (typically up to 1,000.0 mg/L; see summary of scientific literature in Burton 1993 and Wilber and Clarke 2001 as cited in NOAA Fisheries 2020b).

As previously cited in Section 6.3, studies suggest that the TSS levels expected during pile driving or removal are below those shown to have adverse effects on fish and benthic communities (see summary of scientific literature in Burton 1993, Wilber and Clarke 2001, and EPA 1986 as cited in NOAA Fisheries 2020b).

Based on the above information, it is anticipated that Program construction activities may create turbidity plumes in the immediate vicinity of the construction activities. However, the plumes would be short-lived and minor, relative to the expected tolerances of adult and subadult Atlantic sturgeon and adult shortnose sturgeon, capable of being readily passed through by adult and subadult Atlantic sturgeon and adult shortnose sturgeon. Additionally, the high currents common in the Cape Cod Canal would rapidly disperse turbidity plumes created by the construction activities. Some of the in-water construction activities would be contained within a cofferdam (pier shaft/foundation construction) or containment cell (existing pier demolition), further limiting potential incursions of turbidity into the waters of the Canal. Therefore, although migrating or foraging adult and subadult Atlantic sturgeon and adult shortnose sturgeon could potentially occur in the Action Area during in-water construction, the effects of the stressor of increased turbidity on Atlantic sturgeon and shortnose sturgeon would be too small to be meaningfully measured or detected and, therefore, are insignificant.

6.4 Entrainment/Entrapment

The Proposed Action includes multiple dredging events, although small in footprint and areal extent. Dredging methods may employ either an excavator with a clamshell bucket or a cutter suction dredge from the shore or from an in-water barge. This is necessary for the demolition of both existing bridge piers, between barge slips and toe sheeting, and within cofferdams. When dredging operations occur, there is a low level of risk that an animal may be entrained in the clamshell bucket or a cutterhead suction dredge.

6.4.1 Marine Mammals and Sea Turtles

Marine species that may be at risk for entrainment include the green, loggerhead, and Kemp's ridley' sea turtles, especially when they are relatively small in overall size if they do not vacate the area upon arrival of equipment and remain unidentified by a PSO. Whale species are not likely to become

entrained in dredging equipment due to their large size in comparison to equipment used and their capacity to hear sound from the equipment during its operation.

Based on the Program's implementation of the proposed conservation and mitigation measures identified in Section 5.9, including Conservation Measures 5, 6, 10, and 14, entrainment of fin whale, NARW, and green, Kemp's ridley, leatherback, and loggerhead sea turtles is extremely unlikely to occur.

6.4.2 Atlantic Sturgeon and Shortnose Sturgeon

Construction activities such as dredging, riprap excavation, and cofferdam construction have the potential to lead to entrainment or entrapment of adult or subadult Atlantic sturgeon and adult shortnose sturgeon, which could lead to direct injury or mortality of an individual. Capture of an Atlantic sturgeon or shortnose sturgeon could also cause stress, which can lead to indirect injury or mortality. However, neither entrapment nor entrainment to sturgeon are expected to occur at any time during Program activities.

Although Atlantic sturgeon and shortnose sturgeon interactions with dredging operations have been documented, and such encounters often result in injury or mortality, these instances are considered rare and infrequent. In the period between 1990 and 2012, there were four documented interactions between dredges and live sturgeon reported along the East Coast of the United States (NOAA Fisheries 2020b). This record included annual dredging activities in the Kennebec River in Maine at a facility that employs 100 percent observer coverage during dredging operations (NOAA Fisheries 2020b). Additionally, NOAA Fisheries did not document any incidents with Atlantic sturgeon or shortnose sturgeon while observing large-scale dredging activities in 2013 and 2015 associated with the Tappan Zee Bridge Replacement project on the Hudson River, an area considered by NOAA to be a high use area for Atlantic sturgeon and shortnose sturgeon (NOAA Fisheries 2020b).

Dredging equipment speeds will be slow and cautious, following guidance in *Engineering and Design, Dredging and Dredged Material Management* (USACE 2015b), and all dredging and excavation activities associated with the Program will be conducted during the September 1 through February 28 work window, when the presence of adult or subadult Atlantic sturgeon and adult shortnose sturgeon is expected to be rare. Atlantic sturgeon are thought to move to deeper waters further offshore than the Cape Cod Canal during winter months (e.g., Beardsall et al 2016, Taylor et al 2016) and shortnose sturgeon generally overwinter in freshwater portions of rivers (SSSRT 2010). Additionally, a fisheries biologist or PSO will be onsite to monitor for the presence of sturgeon (as well as marine mammals and sea turtles) during dredging and excavation activities. If sturgeon are observed, in-water activities will be temporarily stopped until sturgeon are no longer visually observed in the vicinity of the vessel or work area and NOAA Fisheries will be notified within 48 hours. Therefore, Atlantic sturgeon and

shortnose sturgeon injury or mortality due to dredging and excavation activities associated with the Program are extremely unlikely to occur.

Cofferdam construction could result in entrapment of adult or subadult Atlantic sturgeon and adult shortnose sturgeon if an individual is present within the cofferdam when the last sheet pile is installed, and the cofferdam is fully enclosed. However, this risk of this occurring is deemed to be very low. As noted in Section 6.1.2, vibratory installation of the sheet piles comprising the cofferdams is expected to induce movement of sturgeon individuals away from the construction area should a rare individual be present. Nonetheless, to minimize the risk of an individual Atlantic sturgeon or shortnose sturgeon being present within a partially constructed cofferdam and unable to exit the structure, a fisheries biologist or PSO will be on-site during cofferdam construction. Before the partially erected cofferdam is completed, a snorkel/diver visual assessment will be completed to observe for sturgeon and confirm none are inside and at risk of becoming entrapped. If Atlantic sturgeon or shortnose sturgeon were to be observed in the work area, in-water work will be delayed until they have departed the work area and NOAA Fisheries will be notified. Given the unlikelihood of Atlantic sturgeon or shortnose sturgeon being present within the cofferdams during construction and the approach that will be taken to minimize this risk, any capture or entrapment effects on listed sturgeon species from the proposed cofferdam installation are extremely unlikely to occur.

6.5 Habitat Alteration

The Action Area contains designated critical habitat for the NARW and suitable, foraging and migration habitat for adult and subadult shortnose sturgeon and Atlantic sturgeon. Construction activities will change the canal substrate during demolition of the existing bridges and build out of the replacement bridges. The footprints of both bridge piers will be removed, dredged, and filled; the replacement bridge piers will be landward of the existing piers.

Table 8 presents a summary of Program-wide impacts on benthic habitat, divided by habitat type, with respect to direct physical disturbance. As described in Sections 5.1 through 5.5 and presented in Table 2, the impacts of Program construction components are high-level estimates of general impacts per component; the impacts are overlapping in area and are not mutually exclusive. Table 8 further dissects these quantities into impacts per substrate and benthic zones, based on the percent composition of habitats and substrate types that each mapped design element overlaps, to determine more specific construction impacts than those presented in Table 2.[8]

[8] Total direct benthic habitat impacts in Table 8 were determined using a combination of qualitative habitat survey results from the January 2024 Essential Fish Habitat (EFH) Habitat survey (Stantec), mapped eelgrass bed shapefiles (May 2024

All temporary structures will be removed after in-water work is complete, restoring most of the Program Footprint to pre-existing conditions. Removal of support structures as part of the Program activities will allow restoration of temporary habitat impacts through methods such as restoring the project contours, replacing riprap, and removing fill. It does not include natural restoration (e.g., introduction of native species or sediments, replanting submerged aquatic vegetation) or compensatory mitigation.

As noted in Table 8, the Program's only permanent changes to habitat below the HTL will be the placement of the new bridge piers and the removal of existing piers. Removal of the existing bridge piers will restore approximately 8,000 square feet (0.2 acre), reducing the net loss of land below the HTL, resulting in 4,837 square feet (0.11 acres) of permanent Program-wide benthic impact. In the subtidal zone, the footprints of the existing piers are larger than the footprints of the new piers, and therefore, there will be a net negative (square feet) permanent impact. As a result, the subtidal habitat will be able to fully recover.

Eelgrass Survey Report, Stantec) and specific CAD-derived shapefiles of in-water activity components within each quadrant's Program footprint. Based on field observations, habitat types were characterized as percentages of each quadrant's Program footprint and separated into intertidal zone (HTL-MLW) and subtidal zone (MLW to the canal-ward edge of the Project footprint).

Table 8. Program-wide Summary of Impacts on Benthic Habitat[1]

Location	Habitat Type	Impacts (Square Feet) to Sagamore North	Impacts (Square Feet) to Sagamore South	Impacts (Square Feet) to Bourne North	Impacts (Square Feet) to Bourne South	Total impacts (Square Feet) Program wide	Total Temporary impacts (Square Feet)	Net Permanent impacts (Square Feet)	Restored to pre-existing conditions?
Intertidal	Silt/mud	0	3,898	0	0	3,898	3,500	398	Partially
	Sand/shell	9,317	9,295	2,011	10,596	31,218	27,267	3,951	Partially
	Cobble/gravel	5,961	5,847	17,951	7,164	36,923*	34,178	2,745	Partially
	Shellfish reef	5,026	3,283	530	522	9,362	9,242	120	Partially
	SAV	0	0	0	0	0	0	0	N/A
Subtidal	Silt/mud	0	5,895	5,595	0	11,490	11,499	-9	Yes
	Sand/shell	42,245	41,267	32,534	55,662	171,707	173,762	-2,055	Yes
	Cobble/gravel	18,105	11,791	14,714	6,196	50,806*	51,119	-313	Yes
	Shellfish reef	0	0	0	0	0	0	0	N/A
	SAV	0	0	3,414†	104†	3,517†	3,517	0	Yes
TOTAL		**80,653**	**81,276**	**76,749**	**80,243**	**318,921**	**314,084**	**4,837**	**Partially**

[1] Totals do not account for barge spud impacts, as the potential placement of barge spuds is likely to overlap areas where other components will eventually be installed and/or the potential impact will be too small to be meaningfully measured.

†Eelgrass impacts sum to a figure greater than the square footage of the existing mapped eelgrass bed (2,345 square feet) when dredge impacts are added. Dredge square footage estimates provided for the different dredging components may overlap, and therefore the impacts presented are overestimates. All temporary work will be removed from the area after completion of in-water work, and excavated areas will be restored to pre-existing condition allowing for the existing eelgrass beds to re-populate.

6.5.1 Marine Mammals and Sea Turtles

Program activities will incur substrate and sediment changes that are not expected to directly affect whales and sea turtles. Primarily, ESA-listed marine mammals do not utilize the Canal, and when they do, they do not rely on the benthic habitat for any biological function; as a result, any loss of this habitat type would be extremely unlikely to affect these species. Similarly, ESA-listed sea turtles are extremely unlikely to rely on the areas of the Program's proposed construction and demolition of forage habitat, considering the scarcity of SAV in the Canal compared to its ready availability and abundance in the adjacent bays, combined with their very low likelihood of entering the Canal.

In conclusion, effects on habitat alteration resulting from the Program on marine mammal species including fin whale and NARW would be extremely unlikely. Similarly, effects of habitat alteration resulting from the Program on sea turtle species including green, Kemp's ridley, leatherback, and loggerhead would be extremely unlikely.

6.5.2 Atlantic Sturgeon and Shortnose Sturgeon

Temporary and permanent loss of benthic sediments resulting from dredging and fill within the Program construction area may affect the availability or composition of Atlantic sturgeon and shortnose sturgeon forage species. However, the loss of potential foraging habitat represents a fraction of similar available habitat throughout the Action Area. Restoration of the footprint of the existing bridges will create additional new potential foraging habitat primarily within the subtidal zone of the Cape Cod Canal, whereas the permanent loss of benthic habitat resulting from the construction of the new bridge piers will occur in the intertidal zone.

The areas temporarily affected by construction are expected to recover within one to three years. Generally, literature indicates sites with benthic substrates similar to the Cape Cod Canal characteristically recover within two to three years, though sites that experience high currents or dynamic sediment patterns associated with tidal exchange may be recolonized by benthic infauna sooner (e.g., Newell *et al* 1998, MMS 2004, Wilbur and Clark 2007). The intertidal portion of Cape Cod Canal that will be permanently displaced due to construction of the new bridges represents less than 0.1 percent of the approximately 660 acres that comprise the Cape Cod Canal.

Adult and subadult Atlantic sturgeon and adult shortnose sturgeon typically forage over fine-grained substrates in the deepest portions of waterbodies where dissolved oxygen levels are suitable (NOAA Fisheries 2013). As such, a minor localized reduction in benthic foraging habitat is not anticipated to substantially reduce foraging opportunities for Atlantic sturgeon and shortnose sturgeon transiting through the Cape Cod Canal. The potential impacts on adult and subadult Atlantic sturgeon and adult

shortnose sturgeon resulting from the loss of this small percentage of migration and foraging habitat within the Cape Cod Canal are too small to be meaningfully measured or detected and, therefore, insignificant.

6.6 North Atlantic Right Whale Critical Habitat

The Action Area overlaps the designated critical habitat for the NARW by means of Program vessel transits and their related sound sources in Northeast US Foraging Area Unit 1 (NOAA 2015a). The following describes the three PBFs (1, 3, and 4) essential to NARW foraging with the potential to be affected by the Program.

PBF 1: the physical oceanographic conditions and structures of the GOM and Georges Bank region that combine to distribute and aggregate *Calanus finmarchicus* [a copepod, and NARW preferred prey species] for NARW foraging, namely prevailing currents and 16 circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes.

The physical oceanographic features of the western GOM, where Program vessels are anticipated to transit, are not highly conducive for aggregations of *C. finmarchicus.* The western margin of the GOM is an extension of the Atlantic continental shelf and likely too shallow for large *C. finmarchicus* aggregations. Distribution maps show higher concentrations of *C. finmarchicus* further from the coast and in water deeper than 328 feet (100 meters) during late summer through early winter (Figure 10 and 11 of NOAA 2015a, Figure 3 Pershing et al. 2009). Although the bathymetry has the potential to attract small aggregations of *C. finmarchicus*, it does not have the same collecting capability as larger features such as Jeffery's Ledge, approximately 96 miles (156 kilometers) north-northeast of the eastern entrance to the Cape Cod Canal, or Wilkinson's Basin, approximately 100 miles (161 kilometers) northeast of the eastern entrance to the Cape Cod Canal (Melle et al. 2014, Ji et al. 2022).

Additionally, major currents that influence circulation in the GOM include the Labrador current (cold from north) and Gulf stream (warm from south) as well as the climate-driven North Atlantic Oscillation (NAO), all of which are concurrent with changes in nutrients and *C. finmarchicus* aggregations (Greene et al. 2003.). With respect to the Action Area, the cold Labrador and Scotian Shelf waters flow into the GOM through the Northeast Channel and follow a gyre circulation pattern, where water is first pushed northward towards the Bay of Fundy, cycles down the coast forming the Eastern and Western Maine Coastal Currents, passing as a shallow layer (0-75 meters). Since the currents in the GOM tend to be concentrated in two of the major basins (Jordan and Georges) as cyclonic or anticyclonic bodies of water, this allows the Maine Coastal Current of the western GOM to continue running south along the coast, preventing the waters south of Monhegan Island (and the Action Area) from acting as an oceanographic transitions zone relative to other regions (Townsend et al. 2015). Transition zones are often areas of high dissolved inorganic nutrients where ocean fronts and, therefore gradients occur,

collecting zooplankton such as *C. finmarchicus* (Baumgartner et al. 2007, NOAA 2015a). The *C. finmarchicus* is more abundant during high NAO years; high sea surface temperatures and lots of mixing in the upper water column (Conversi et al. 2001). Although temperature, density, and salinity gradients typical for accumulation of plankton will vary annually, there is no data that suggests the Program Area exists along an ocean front boundary or transition zone. Effects to PBF 1, and its conservation function, are extremely unlikely to occur, as the oceanographic features where Program vessel would transit are not expected to have dense aggregations of *C. finmarchicus* of any stage.

PBF 3: Late-stage *C. finmarchicus* in dense aggregations in the GOM and Georges Bank region

As described for PBF 1, it is not expected that *C. finmarchicus* of any stage will aggregate in dense populations in the Action Area. Therefore, effects to PBF 3, and its conservation function, are extremely unlikely to occur.

PBF 4: Diapausing *C. finmarchicus* in aggregations in the GOM and Georges Bank region (NOAA 2015a).

Modeling of *C. finmarchicus* aggregation in the GOM suggests that diapausing *C. finmarchicus* within the Program Action Area would not be measurably affected by sound introduced by vessel fleet transits over the Program duration (Figures 10 and 11 of NOAA 2015a, Pershing et al. 2009). This is due to the needs of *C. finmarchicus* to have two conditions present for diapausing to occur: peak densities (from March through June, as *C. finmarchicus* prefer warm temperatures to facilitate faster development) and depths great than 100 meters. Neither condition exists in the Program Action Area. Additionally, the short time that a vessel would take to transit through the Action Area would be temporary and intermittent over the duration of the Program. As a result, the potential for effects to these copepods is too small to be meaningfully measured or detected and therefore direct impacts on diapausing *C. finmarchicus* would be insignificant. Likewise, the effects on PBF 4 and its conservation function would be insignificant.

While underwater sound from Program construction activities is expected to be above ambient levels in Cape Cod Canal during specific construction activities, such as during pile driving, modeling indicates that sound effects from construction activities will remain within Cape Cod Canal and are not expected to reach Cape Cod Bay. Further, the Canal has rarely documented NARW presence and is outside of NARW critical habitat.

In conclusion, habitat alteration effects on NARW critical habitat and the four PBFs resulting from the Program activities would be extremely unlikely to occur for PBF 1 and PBF 3 and too small to meaningfully measure, detect, or evaluate and therefore insignificant for PBF 4.

7 Effects Determinations

Based on the analyses provided in sections 6.1 through 6.5, all effects of the Program, when added to baseline conditions and accounting for the proposed conservation and mitigation measures discussed in Section 5.9, are determined to be too small to be meaningfully measured or detected and, therefore, insignificant or are extremely unlikely to occur. Therefore, we have determined that the Cape Cod Bridges Program ***may affect, but is not likely to adversely affect***, NARW and fin whales; green, Kemp's ridley, leatherback and loggerhead sea turtles; and Atlantic sturgeon and shortnose sturgeon. The Program also ***may affect, but is not likely to adversely affect***, critical habitat for NARW as designated under the jurisdiction of NOAA Fisheries. To the extent possible, the best scientific and commercial data available has been used to complete this analysis. NOAA Fisheries' concurrence with this determination is hereby requested.

8 References

Altenritter, M.N, G.B. Zydlewski, M.T. Kinnison, G.S. Wippelhauser. 2017. Atlantic sturgeon use of the Penobscot River and marine movements within and beyond the Gulf of Maine. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science*. 9:216-230.

ASSRT (Atlantic Sturgeon Status Review Team). 2007. Status Review of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*). Report to National Marine Fisheries Service, Northeast Regional Office. February 23, 2007. 174 pp.

Bort, J., S. Van Parijs, P. Stevick, E. Summers and S. Todd. 2015. North Atlantic right whale *Eubalaena glacialis* vocalization patterns in the central Gulf of Maine from October 2009 through October 2010. Endanger. Spec. Res. 26:271–280.

Bain, M.B. 1997. Atlantic and shortnose sturgeons of the Hudson River: Common and divergent life history attributes. *Environmental Biology of Fishes* 48:347–358.

Baumgartner, M.F., C.A. Mayo, and R.D. Kenney. 2007. Enormous carnivores, microscopic food, and a restaurant that's hard to find. In "The Urban Whale: North Atlantic Right Whales at the Crossroads" (S. D. Kraus and R. M. Rolland, eds.), pp. 138–171. Harvard University Press, Cambridge, MA.

Beardsall, J. W., M. J. W. Stokesbury, L. M. Logan-Chesney, and M. J. Dadswell. 2016. Atlantic Sturgeon *Acipenser oxyrinchus* Mitchill, 1815 seasonal marine depth and Fernandes, S.J., Zydlewski, G.B., Zydlewski, J.D., Wippelhauser, G.S., and Kinnison, M.T. 2010. Seasonal distribution and movements of shortnose sturgeon and Atlantic sturgeon in the Penobscot River estuary, Maine. Trans. Am. Fish. Soc. 139: 1436–1449. doi:10.1577/T09-122.1.

Bradley, Rosemarie A. 2019. Phone Meeting Record for Cape Cod Canal (CCC) Bridges MRER, EA and NOAA ESA and EFH Coordination [Hosted by US Army Corps of Engineers (USACE)].

Brown, M.W., O.C. Nichols, M.K. Marx, and J.N. Ciano. 2002. "Surveillance of North Atlantic right whales in Cape Cod Bay and adjacent waters—2002." *Final Report to the Division of Marine Fisheries, Commonwealth of Massachusetts.* 29 pp. Available at: https://www.mass.gov/files/documents/2016/08/wh/rwhale02.pdf. Accessed September 23, 2024.

Brown, J.J. and G.W. Murphy. 2010. Atlantic sturgeon vessel strike mortalities in the Delaware River. Fisheries 3 5(2):7 2-83.

Cape Cod Times.2023. Why do whales swim through the Cape Cod Canal? What we know. (capecodtimes.com) March 6. https://www.capecodtimes.com/story/news/2023/03/06/cape-cod-canal-reopens-after-critically-endangered-right-whales-leave/69976029007/ Accessed September 23, 2024.

CBS Boston. 2023. Two Right Whales spotted in Cape Cod canal (youtube.com). https://www.youtube.com/watch?v=PJ6CBBkHgEM Accessed September 23, 2024.

California Department of Transportation. (Caltrans) 2015. Technical Guidance for the Assessment of the Hydroacoustic Effects of Pile Driving on Fish. California Department of Transportation Division of Environmental Analysis Sacramento, CA. November 2015.

California Department of Transportation. (Caltrans) 2020. Technical Guidance for the Assessment of the Hydroacoustic Effects of Pile Driving on Fish. California Department of Transportation Division of Environmental Analysis Sacramento, CA. October 2020.

Conant, Therese A., Peter H. Dutton, Tomoharu Eguchi, Sheryan P. Epperly, Christina C. Fahy, Matthew H. Godfrey, Sandra L. MacPherson et al. 2009. "Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the US Endangered Species Act." *Report of the loggerhead biological review Team to the National Marine Fisheries Service* 222 (2009): 5-2.

Conversi, A., S. Piontkovski, and S. Hameed. 2001. Seasonal and interannual dynamics of Calanus finmarchicus in the Gulf of Maine (Northeastern US shelf) with reference to the North Atlantic Oscillation. *Deep Sea Research Part II: Topical Studies in Oceanography*, 48(1-3), 519-530.

Clapham, Phillip J., Sharon B. Young, and Robert L. Brownell Jr. 1999. "Baleen whales: conservation issues and the status of the most endangered populations." *Mammal review* 29, no. 1 (1999): 37-62.

Damon-Randall, K., Colligan, M., and J. Crocker. 2012. Composition of Atlantic sturgeon in rivers, estuaries, and in marine waters (white paper). NOAA/NMFS, Gloucester, MA: Protected Resources Division.

Dadswell, M. J., B. D. Taubert, T. S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of Biological Data on Shortnose Sturgeon, Acipenser brevirostrum, LeSuer 1818.

Davis, G.E., M.F. Baumgartner, and J.M. Bonnell, *et al.* 2017. Long-term passive acoustic recordings track the changing distribution of North Atlantic right whales (*Eubalaena glacialis*) from 2004 to 2014. *Sci Rep* 7, 13460. https://doi.org/10.1038/s41598-017-13359-3. Accessed September 2024.

Dazey, E., McIntosh, B., Brown, S., and Dudzinski, K. (2012). Assessment of Underwater Anthropogenic Noise Associated with Construction Activities in Bechers Bay, Santa Rosa Island, California. Journal of Environmental Protection, 03 (10) 1286-1294.

Department of the Navy (DoN). 2017. Technical Report: Criteria and Thresholds for US Navy Acoustic and Explosive Effects Analysis (Phase III). San Diego, California: SSC Pacific.

Fernandes, S.J., Zydlewski, G.B., Zydlewski, J.D., Wippelhauser, G.S., and Kinnison, M.T. 2010. Seasonal distribution and movements of shortnose sturgeon and Atlantic sturgeon in the Penobscot River estuary, Maine. Trans. Am. Fish. Soc. 139: 1436–1449. doi:10.1577/T09-122.1.

Finneran, J.J., E.E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. Criteria and Thresholds for US Navy Acoustic and Explosive Effects Analysis (Phase III). Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 p. https://nwtteis.com/portals/nwtteis/files/technical_reports/Criteria_and_Thresholds_for_U.S._Navy_Acoustic_and_Explosive_Effects_Analysis_June2017.pdf.

Fisheries Hydroacoustic Working Group (FHWG). 2008. Agreement in principle for interim criteria for injury to fish from pile driving activities. Available at: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/ser/bio-fhwg-criteria-agree-a11y.pdf. Accessed September 22, 2024.

Greene, C.H., A.J. Pershing, A. Conversi, B. Planque, C. Hannah, D. Sameoto, and E. Durbin. 2003. Trans-Atlantic responses of Calanus finmarchicus populations to basin-scale forcing associated with the North Atlantic Oscillation. *Progress in Oceanography* 58(2-4):301–312.

Halpin, P.N., A.J. Read, E. Fujioka, B.D. Best, B. Donnelly, L.J. Hazen, C. Kot, K. Urian, E. LaBrecque, A. Dimatteo, J. Cleary, C. Good, L.B. Crowder, and K.D. Hyrenbach. 2009. OBIS-SEAMAP: The world data center for marine mammal, sea bird, and sea turtle distributions. *Oceanography* 22(2):104-115 https://seamap.env.duke.edu/species/948946. Accessed April 13, 2024.

IUCN [International Union for Conservation of Nature]. 2020. Almost a third of lemurs and North Atlantic right whale now critically endangered – IUCN Red List. International Union for Conservation of Nature, Gland, Switzerland. https://www.iucn.org/news/species/202007/almost-a-third-lemurs-and-north-atlantic-right whale-now-critically-endangered-iucn-red-list.

Ji, Rubao, Jeffrey A. Runge, Cabell S. Davis, and Peter H. Wiebe. 2022. "Drivers of variability of Calanus finmarchicus in the Gulf of Maine: roles of internal production and external exchange." *ICES Journal of Marine Science* 79(3):775–784.

Johnston, C. 2016. Shortnose sturgeon (Acipenser brevirostrum) spawning potential in the Penobscot River, Maine: Considering dam removals and emerging threats. Master's thesis, University of Maine, Orono.

Kenney, R., C. Mayo and H. Winn. 2001. Migration and foraging strategies at varying spatial scales in western North Atlantic right whales: a review of hypothesis. *Journal of Cetacean Research and Management* 2:251–260.

Kieffer, M.C., and B. Kynard. 1993. Annual Movements of Shortnose and Atlantic Sturgeons in the Merrimack River, Massachusetts. Transactions of the American Fisheries Society 122: 1088-1103, 1993.

Knowlton, A.R. and S.D. Kraus. 2001. Mortality and serious injury of North Atlantic right whales (*Eubalaena glacialis*) in the North Atlantic Ocean. *J. Cetacean Res. Manage.* (Special Issue) 2:193–208.

Kraus, S.D. 1990. Rates and potential causes of mortality in North Atlantic right whales (Eubalaena glacialis). *Mar. Mamm. Sci.* 6:278–291.

Lovell, J.M., M.M. Findlay, R.M. Moate, J.R. Nedwell, and M.A. Pegg. 2005. The inner ear morphology of and hearing abilities of the paddlefish (*Polyodon spathula*) and the lake sturgeon (*Acipenser fulvescens)*. Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology 142: 286-296.

Massachusetts Division of Fisheries and Wildlife. 2015a. Natural Heritage & Endangered Species Program. Atlantic Sturgeon *Acipenser oxyrinchus* Fact Sheet. Updated 2015. Available at https://www.mass.gov/doc/atlantic-sturgeon/download. Accessed September 22, 2024.

Massachusetts Division of Fisheries and Wildlife. 2015b. Natural Heritage & Endangered Species Program. Shortnose Sturgeon *Acipenser brevirostrum* Fact Sheet. Updated 2015. Available at https://www.mass.gov/doc/shortnose-sturgeon/download. Accessed September 22, 2024.

Massachusetts Division of Fisheries and Wildlife. 2019. Green Sea Turtle (*Chelonia mydas*) Fact Sheet. Natural Heritage and Endangered Species Program. Available at: https://www.mass.gov/doc/green-sea-turtle/download. Accessed 9 September 2024.

McCauley, R.D., Jane Fewtrell, A.J. Duncan, Curt Jenner, Micheline-Nicole Jenner, J.D. Penrose, R.I. T. Prince, Anita Adhitya, Julie Murdoch, and K. McCabe. 2000. "Marine seismic surveys—a study of environmental implications." *The APPEA Journal* 40(1): 692.

Melle, Webjørn, Jeffrey Runge, Erica Head, Stéphane Plourde, Claudia Castellani, Priscilla Licandro, James Pierson et al. 2014. "The North Atlantic Ocean as habitat for Calanus finmarchicus: Environmental factors and life history traits." *Progress in Oceanography* 129, Part B:244–284.

Meyer, M., A.N. Popper, and R.R. Fay. 2010. Frequency tuning and intensity coding of the auditory periphery of the lake sturgeon (*Acipenser fulvescens*). Journal of Experimental Biology 213: 1567-1578.

Minerals Management Service (MMS). 2004. Review of Existing and Emerging Environmentally Friendly Offshore Dredging Technologies. Prepared for the Leasing Division, Sand and Gravel Unit, Minerals Management Service, US Department of Interior, Herndon, Virginia. Prepared by W.F. Baird & Associates, Ltd. and Research Planning, Inc.

Morano, J.L., A.N. Rice, J.T. Tielens, B.J. Estabrook, A. Murray, B.L. Roberts and C.W. Clark. 2012. Acoustically detected year-round presence of right whales in an urbanized migration corridor. *Conserv. Biol.* 26:698–707.

National Marine Fisheries Service (NMFS). 1995. Small takes of marine mammals incidental to specified activities; offshore seismic activities in southern California: Notice of issuance of an incidental harassment authorization. *Federal Register* 60(200): 53753-53760. https://www.federalregister.gov/d/95-25722.

National Marine Fisheries Service (NMFS). 2011. Letter from Patricia A Kurkul, Regional Administrator, NMFS, to Mr. Michael P. Anderson, PE, New York State Department of Transportation, RE: Comments on Scoping – Tappan Zee Bridge Project. November 15, 2011.

National Marine Fisheries Service (NMFS). 2017. North Atlantic right whale (*Eubalaena glacialis*) 5-year review: Summary and evaluation. NMFS Greater Atlantic Regional Fisheries Office, Gloucester, Massachusetts. 34pp. https://www.greateratlantic.fisheries.noaa.gov/protected/final_narw_5-year_review_2017.pdf

National Marine Fisheries Service (NMFS). 2019. Letter to Ms. Wendy Gendron Chief, Civil Works/IIS Branch Department of the Army, Corps of Engineers. Re: Draft Major Rehabilitation Evaluation Report and Environmental Assessment for the Bourne and Sagamore Bridges. December 20, 2019.

National Marine Fisheries Service (NMFS). 2022. Fisheries Multi-species Pile Driving Calculator. Available at: https://www.fisheries.noaa.gov/resource/data/multi-species-pile-driving-calculator-tool.

National Oceanic and Atmospheric Administration (NOAA). 1998. Incidental taking of marine mammals; Acoustic harassment. *Federal Register* 63(143): 40103. https://www.federalregister.gov/d/98-19992.

National Oceanic and Atmospheric Administration (NOAA). 2001. Letter regarding NMFS's biological opinion regarding FERC's issuance of a permit for Millennium pipeline. United States Department of Commerce. National Marine Fisheries Service, Northeast Region. September 4, 2001.Newberger, T.A. and E.D. Houde. 1995. Population biology of bay anchovy *Anchoa mitchilli* in the mid Chesapeake Bay. Mar. Ecol. Prog. Ser. 116: 25-37.

National Oceanic and Atmospheric Administration (NOAA). 2012. Biological opinion to Federal Highway Administration for the replacement of the Richmond-Dresden Bridge on Route 197, Maine. Northeast Region, Gloucester, Massachusetts, USA. 26 November.

National Oceanic and Atmospheric Administration (NOAA). 2015a. North Atlantic Right Whale (*Eubalaena glacialis*). 2015.Source Document for the Critical Habitat Designation: A review of information pertaining to the definition of "critical habitat". December 21, 2015. https://repository.library.noaa.gov/view/noaa/18664. Accessed February 25, 2024.

National Oceanic and Atmospheric Administration (NOAA). 2015b. Kemp's Ridley Sea Turtle (*Lepidochelys Kempii*) 5-Year Review: Summary and Evaluation. https://www.fisheries.noaa.gov/resource/document/kemps-ridley-sea-turtle-lepidochelys-kempii-5-year-review-summary-and-evaluation

National Oceanic and Atmospheric Administration (NOAA). 2022. Stock Assessment Report. May 2022. Fin Whale (*Balaenoptera physalus*): Western North Atlantic Stock. https://media.fisheries.noaa.gov/2022-08/Fin%20Whale-West%20N%20Atl%20Stock_SAR%202021.pdf. Accessed March 25, 2023.

National Oceanic and Atmospheric Administration (NOAA). 2023a. Stock Assessment Report. May 2023. North Atlantic Right Whale, Western Atlantic. Final-Atlantic-and-Gulf-of-Mexico-SAR.pdf (noaa.gov). Accessed February 20, 2024.

National Oceanic and Atmospheric Administration (NOAA). 2023b. Section 7 Species Presence Table: Atlantic Large Whales in the Greater Atlantic Region June 23, 2023. https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-presence-table-atlantic-large-whales. Accessed September 10, 2024.

National Oceanic and Atmospheric Administration (NOAA). 2024. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2023. NOAA Technical Memorandum NMFS-NE-321. December.

NOAA Fisheries. 1998. Recovery plan for the shortnose sturgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries, Silver Spring, Maryland.

NOAA Fisheries. 2005. Recovery Plan for the North Atlantic Right Whale (*Eubalaena glacialis*). National Marine Fisheries Service, Silver Spring, MD.

NOAA Fisheries. 2010. Recovery plan for the fin whale (*Balaenoptera physalus*). National Marine Fisheries Service, Silver Spring, MD. 121 pp.

NOAA Fisheries. 2013. Endangered Species Act Section 7 Consultation Biological Opinion. Tappan Zee Bridge Replacement. NER-2013-9592. NOAA's National Marine Fisheries Service Northeast Regional Office. 10 April 2013.

NOAA Fisheries. 2018. 2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. US Dept. of Commer., NOAA. NOAA Technical Memorandum NMFS-OPR 59, 167 pp.

NOAA Fisheries. 2020a. Manual for Optional User Spreadsheet Tool (Version 2.1; December) for: 2018 Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts. Silver Spring, Maryland: Office of Protected Resources, National Marine Fisheries Service.

NOAA Fisheries. 2020b. Section 7 Effects Analysis: Turbidity in the Greater Atlantic Region. Available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region. Accessed May 20, 2024.

NOAA Fisheries. 2022a. ESA Section 7 Mapper. Version 2.1. https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=a85c0313b68b44e0927b51928271422a . Accessed March 27, 2023

NOAA Fisheries. 2022b. Atlantic Sturgeon and Critical Habitat Map and GIS Data. Available at: https://www.fisheries.noaa.gov/resource/map/atlantic-sturgeon-critical-habitat-map-and-gis-data. Accessed May 20, 2024.

NOAA Fisheries. 2023a. Section 7 Species Presence Table: Sea Turtles in the Greater Atlantic Region. https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-presence-table-sea-turtles-greater Accessed September 25, 2024.

NOAA Fisheries. 2023b. Section 7 Species Presence Table: Atlantic Sturgeon in the Greater Atlantic Region. Updated August 8, 2023. Available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-presence-table-atlantic-sturgeon-greater. Accessed October 8, 2023.

NOAA Fisheries. 2023c. Shortnose Sturgeon Fact Sheet. Available: https://www.fisheries.noaa.gov/species/shortnose-sturgeon. Accessed April 30, 2024.

NOAA Fisheries. 2023d. Section 7 Species Presence Table: Shortnose Sturgeon in the Greater Atlantic Region. Updated June 6, 2023. Available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-presence-table-shortnose-sturgeon-greater. Accessed October 8, 2023.

NOAA Fisheries. 2024a. Species Directory, Loggerhead Turtle. Available https://www.fisheries.noaa.gov/species/loggerhead-turtle . Accessed September 24, 2024.

NOAA Fisheries. 2024b. Atlantic Sturgeon Fact Sheet. Available: https://www.fisheries.noaa.gov/species/atlantic-sturgeon. Accessed April 30, 2024.

NOAA Northeast Fisheries Science Center. 2021. North Atlantic Right Whale Passive Acoustic Detections Report: July-December 2020. Woods Hole (MA).

NOAA Fisheries and U.S. Fish and Wildlife Service (USFWS). 1991. Recovery Plan for the U.S. Population of the Atlantic Green Turtle (*Chelonia mydas*). Washington, D.C.: U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service, and U.S. Department of the Interior, U.S. Fish and Wildlife Service. 59 pp.

NOAA Fisheries and U.S. Fish and Wildlife Service (USFWS). 1992. Recovery Plan for Leatherback Turtles (*Dermochelys coriacea*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), Second Revision. National Marine Fisheries Service, Silver Spring, MD.

NOAA Fisheries, U.S. Fish and Wildlife Service (USFWS), and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland 156 pp. + appendices.

Newell, R.C., L.J. Seiderer, D.R. Hitchcock. 1998. The impact of dredging works in coastal waters: a review of the sensitivity to disturbance and subsequent recovery of biological resources on the sea bed. In: *Oceanography and Marine Biology: an Annual Review*. Volume 36,127-78.

NROC. 2023. Northeast Ocean Data. Commercial Fishing Activity. Available at: https://www.northeastoceandata.org/data-explorer/?commercial-fishing|vessel-activity. Accessed August 2024.

Olcott, P.G. 1995. Surficial Aquifer System, Cape Code Glacial Aquifer. *Ground Water Atlas of the United States*. US Geological Survey. HA 730-M.

Pearson, N.J., M.K. Gingras, I.A. Armitage, and S.G. Pemberton. 2007. Significance of Atlantic sturgeon feeding excavations, Mary's Point, Bay of Fundy, New Brunswick, Canada. Palaios 22: 457-464.

Pershing, A.J., N.R. Record, B.C. Monger, D.E. Pendleton and L.A. Woodard. 2009. "Model-based estimates of Calanus finmarchicus abundance in the Gulf of Maine." *Marine Ecology Progress Series* 378:227–243.

Popper, A.N., M.C. Hastings. 2009. Effects of anthropogenic sources of sound on fishes. Journal of Fish Biology 75:455-498.

Popper, A.N., A.D. Hawkins. 2019. An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes. Journal of Fish Biology. 94:692-713. DOI: 10.1111/jhb.13948.

Popper, A.N, A.D. Hawkins, R.R. Fay, D.A. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, M.B. Halvorsen, S. Løkkeborg, P.H. Rogers, B.L. Southall, D.G. Zeddies, W.N. Tavolga. 2014. Sound exposure guidelines for fishes and sea turtles: A technical report prepared by ANSI-Accredited Standards Committee S3/S1 and registered with ANSI. ASA Press and Springer Press, New York. 87 pp.

Richardson, W.J.; C.R. Greene Jr., C.I. Malme, D.H. Thomson. 1995. *Marine Mammals and Noise*. Academic Press.

Rockwood, R. Cotton, Jeff Adams, Greg Silber, and Jaime Jahncke. 2020. Estimating effectiveness of speed reduction measures for decreasing whale-strike mortality in a high-risk region. *Endangered Species Research* 43:145–166.

Rockwood, R. Cotton, John Calambokidis, and Jaime Jahncke. 2017. High mortality of blue, humpback and fin whales from modeling of vessel collisions on the US West Coast suggests population impacts and insufficient protection. *PLoS One* 12, no. 8: e0183052.

Seminoff, Jeffrey Aleksandr, Camryn D. Allen, George H. Balazs, Peter Howard Dutton, Tomoharu Eguchi, Heather Haas, Stacy A. Hargrove et al. 2015. Status review of the green turtle (*Chelonia mydas*) under the Endangered Species Act. Available at: https://repository.library.noaa.gov/view/noaa/4922/noaa_4922_DS1.pdf. Accessed August 2024.

Shortnose Sturgeon Status Review Team (SSSRT). 2010. A Biological Assessment of shortnose sturgeon (*Acipenser brevirostrum*). Report to National Marine Fisheries Service, Northeast Regional Office. November 1, 2010. 417 pp.

Simard, Y., N. Roy, S. Giard, and F. Aulanier. 2019. North Atlantic right whale shift to the Gulf of St. Lawrence in 2015, revealed by long-term passive acoustics, Endangered Species Research, Vol 40:271-284. https://doi.org/10.3354/esr01005. Accessed January 2025.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: Initial scientific recommendations. *Aquatic Mammals* 33:411–521.

Stantec. 2024. Essential Fish Habitat Assessment. Cape Cod Bridges Program. [draft in progress]. Prepared for: Massachusetts Department of Transportation – Highway Division. MassDOT Project No. 608020.

Stein, A.B, K.D. Friedland, M. Sutherland. 2004. Atlantic sturgeon marine distribution and habitat use along the northeastern coast of the United States. *Transactions of the American Fisheries Society* 133:527-537.

Taylor, A. D., K. Ohashi, J. Sheng, and M. K. Litvak. 2016. Oceanic distribution, behaviour, and a winter aggregation area of adult Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*, in the Bay of Fundy, Canada. PLOS (Public Library of Science) ONE [online serial] 11(4):e0152470.

Townsend, D.W., N.R. Pettigrew, M.A. Thomas, M.G. Neary, D.J. McGillicuddy, Jr. and J. O'Donnell. 2015. "Water Masses and Nutrient Sources to the Gulf of Maine." *J Mar Res* 73(3-4): 93-122.

US Army Corps of Engineers (USACE). 2015a. Final Environmental Assessment Finding of No Significant Impacts and Section 404(b)(1) Evaluation. Cape Cod Canal and Town Neck Beach. Maintenance Dredging and Beneficial Use of Dredged Material for Beach Nourishment. Sandwich, Massachusetts. Environmental Resources Section Engineering/Planning Division US Army Corps of Engineers New England District Concord, Massachusetts. May.

USACE. 2015b. *Engineering and Design, Dredging and Dredge Materials Management.* Engineer Manual. Available at: USACE Publications - Engineer Manuals (army.mil). Accessed October 8, 2024.

US Army Corps of Engineers (USACE). 2023. Letter to Jennifer Anderson, Assistant Regional Administrator for Protected Resources, NOAA National Marine Fisheries Service Protected Resources Division. Endangered Species Act Section 7 Concurrence Request to the National Marine Fisheries Service regarding the USACE Proposal to Perform Maintenance Dredging of the Cape Cod Canal Federal Navigation Project (FNP) in Bourne and Sandwich, Massachusetts. May 3.

US Department of Transportation (USDOT). 1995. Highway Traffic Noise Analyses and Abatement: Policy and Guidance. U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch, Washington, D.C.

van der Hoop, J.M., M.J. Moore, S.G. Barco, T.V. Cole, P.Y. Daoust, A.G. Henry, D.F. McAlpine, W.A. McLellan, T. Wimmer and A.R. Solow. 2013. Assessment of management to mitigate anthropogenic effects on large whales. *Conserv. Biol.* 27:121–133.

Wilbur, D.H., and D.G. Clarke. 2007. Defining and assessing benthic recovery following dredging and dredged material disposal. *Proceedings XXVII World Dredging Congress* 2007:603–618.

Wippelhauser, G., and T.S. Squiers. 2015. Shortnose Sturgeon and Atlantic Sturgeon in the Kennebec River System, Maine: a 1977-2001 Retrospective of Abundance and Important Habitat. *Transactions of the American Fisheries Society* 144(3):591–601.

Zydlewski, G.B., Kinnison, M.T., Dionne, P.E., Zydlewski, J., and Wippelhauser, G.S. 2011. Shortnose sturgeon use small coastal rivers: the importance of habitat connectivity. J. Appl. Ichthyol. 27(s2): 41–44. doi:10.1111/j.1439-0426.2011.01826.x.

Attachment 1 – Study Area Figures

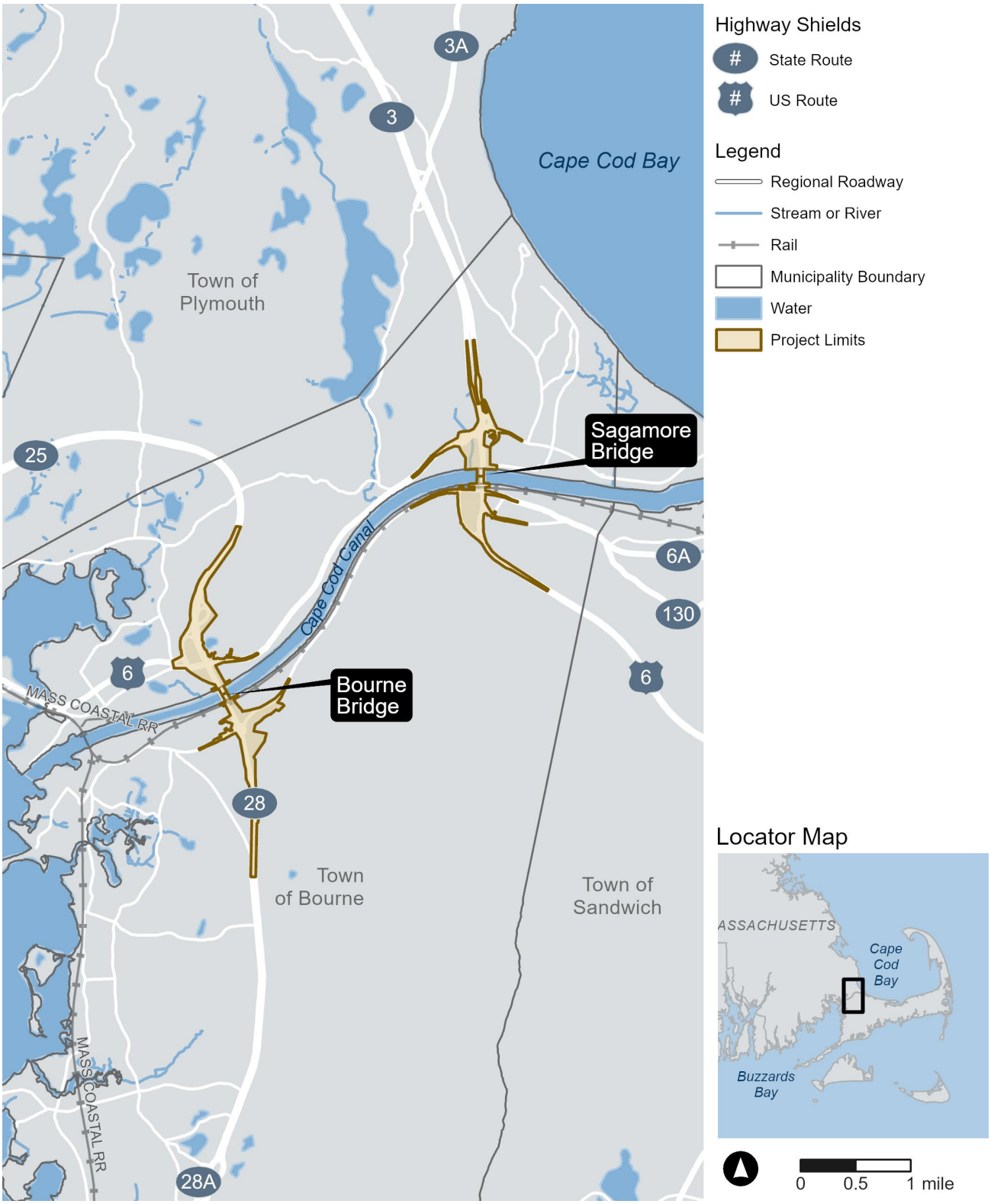


Figure 1-1. Cape Cod Bridges Program Proposed Project Limits

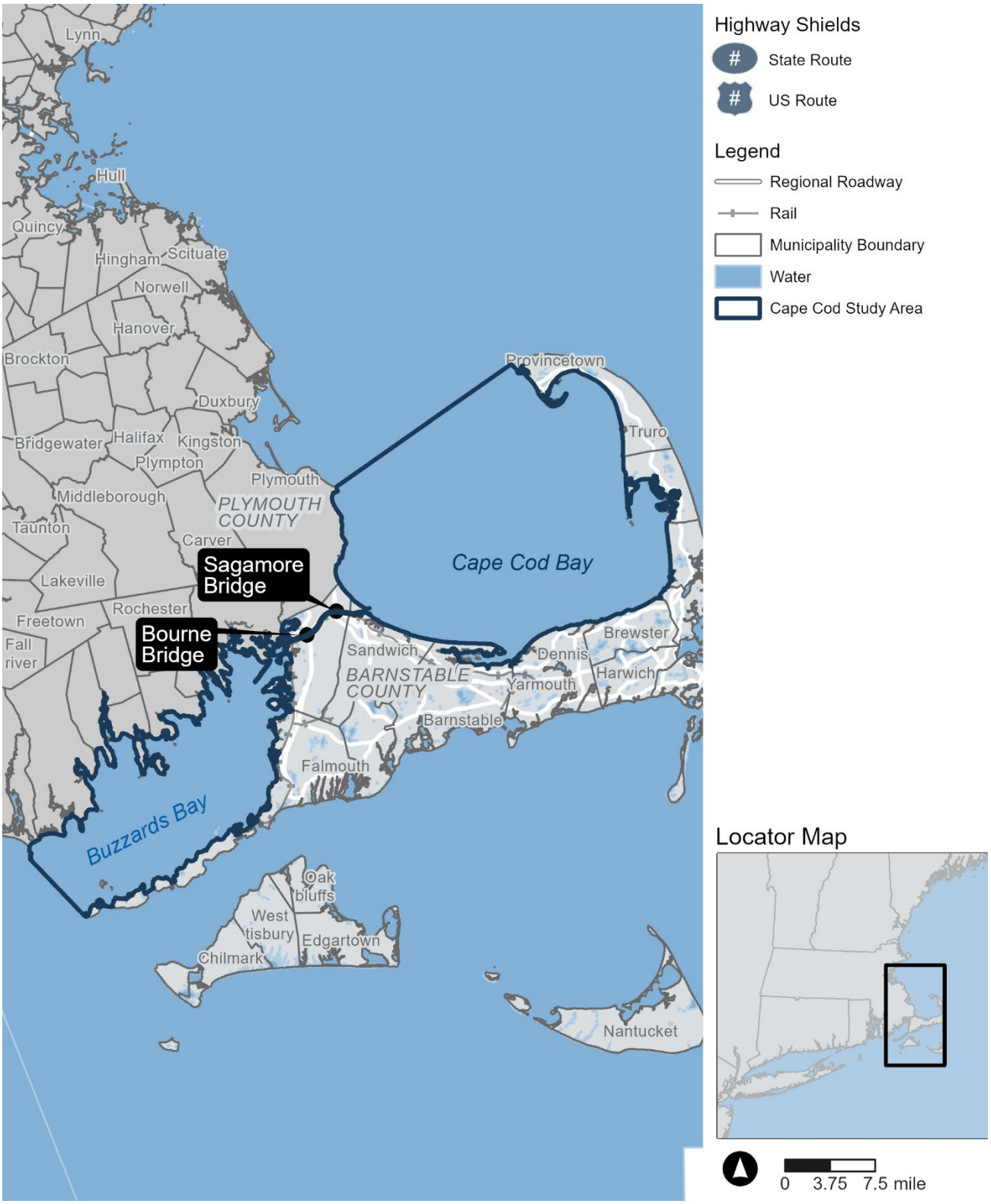


Figure 1-2. Cape Cod Study Area in Relation to Project Limits

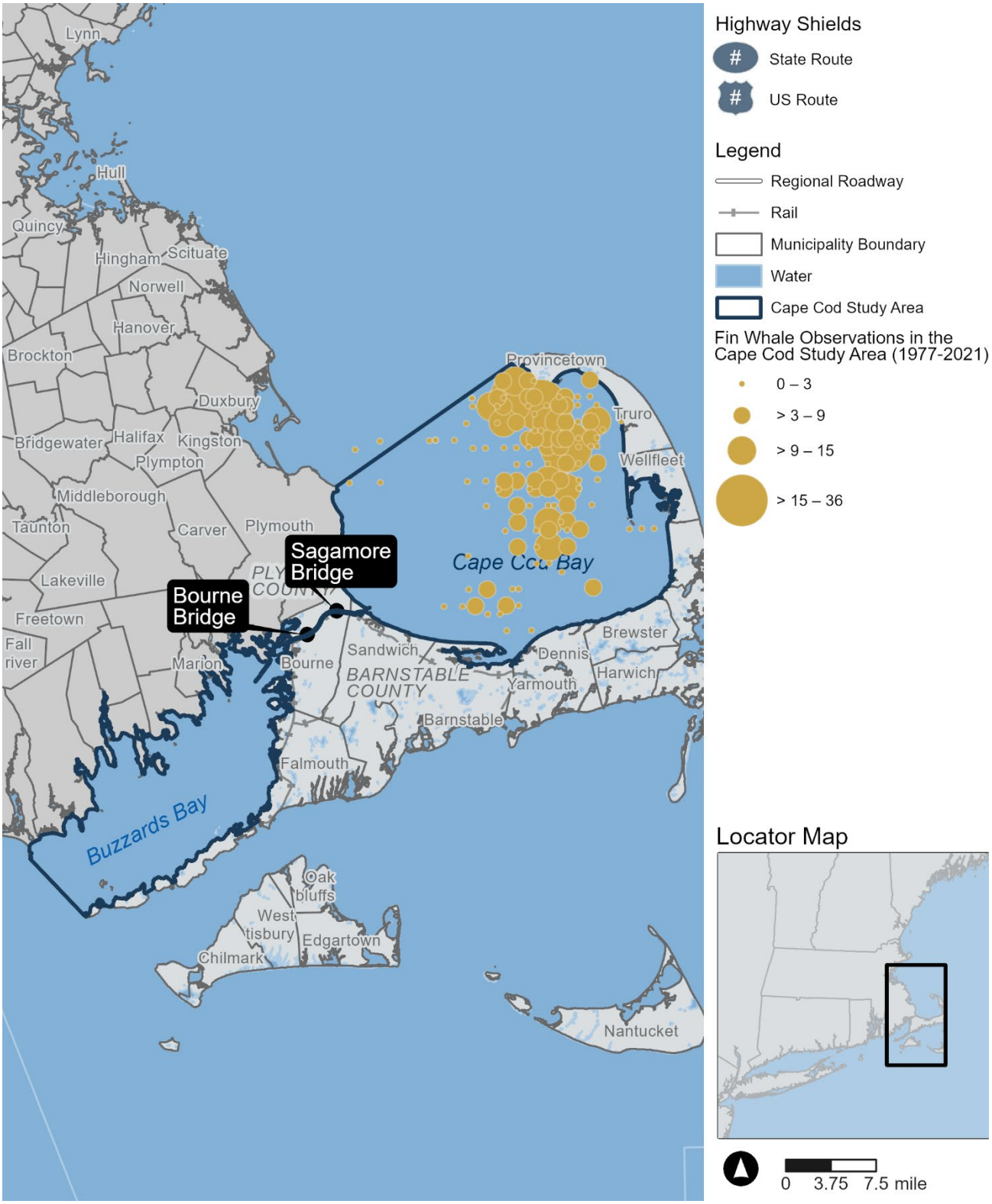


Figure 1-3. Fin Whale Observations in the Cape Cod Study Area 1977-2021

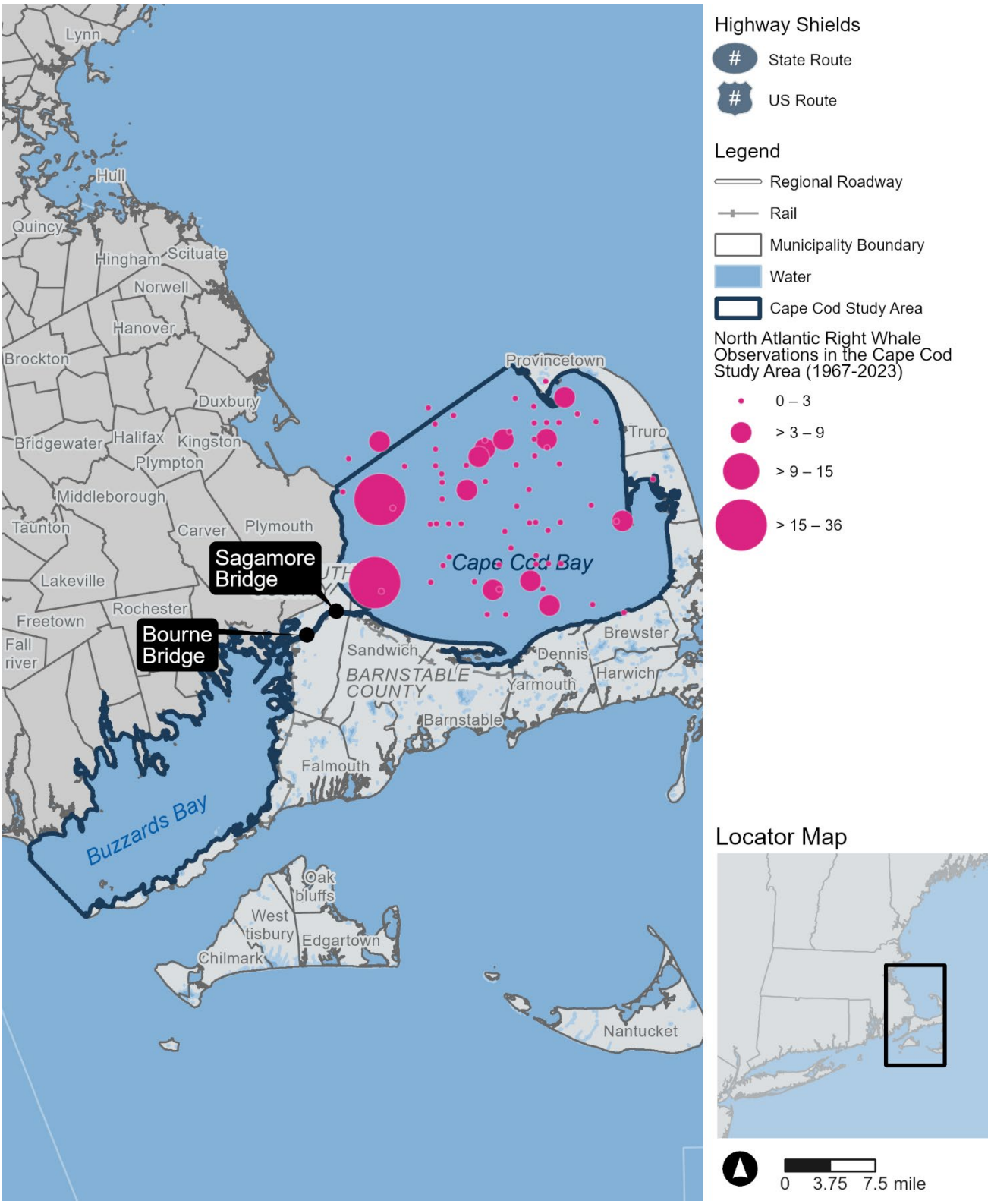


Figure 1-4. North Atlantic Right Whale Observations in Cape Cod Study Area 1967-2023

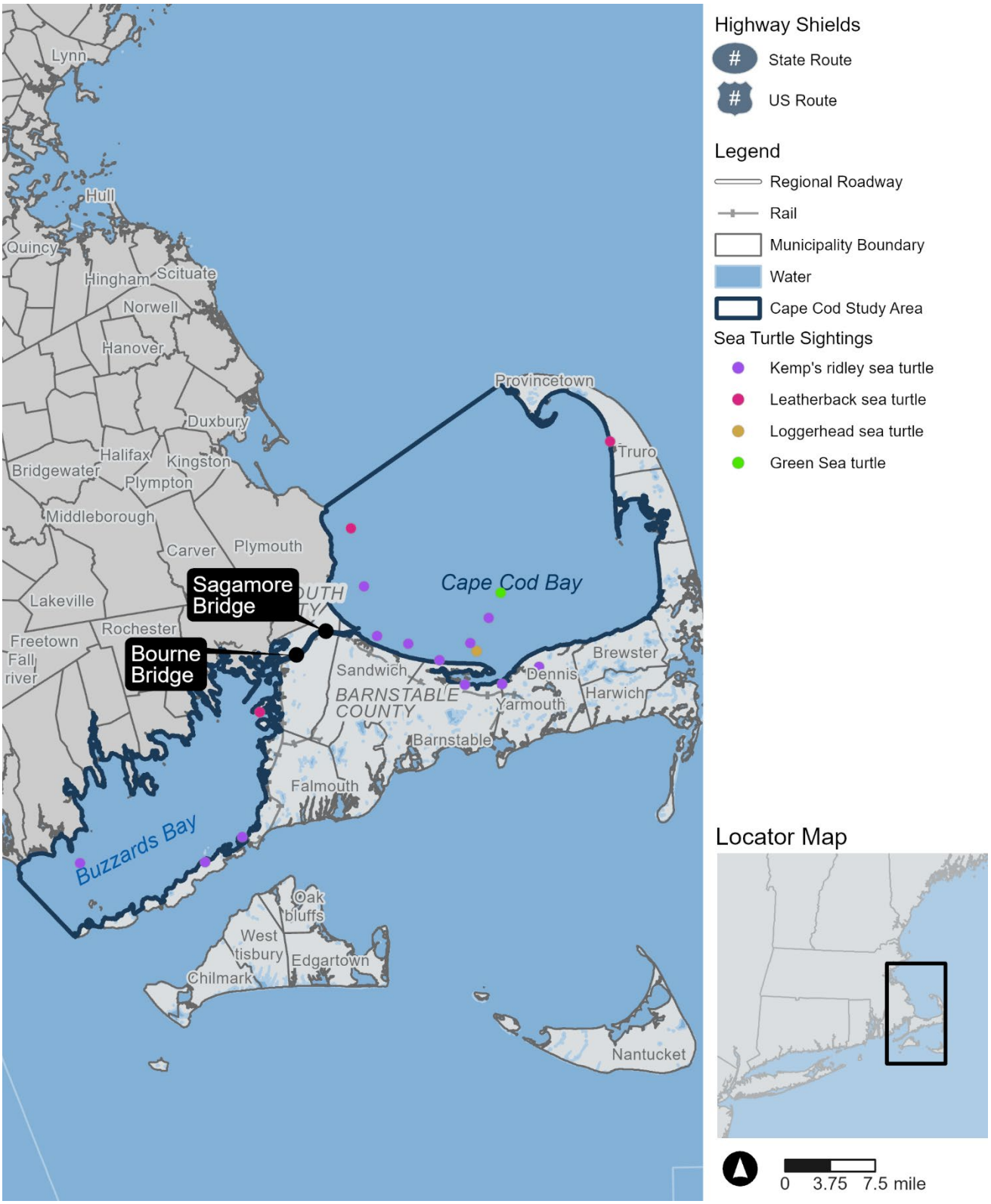


Figure 1-5. Sea Turtle Sightings in the Cape Cod Study Area 1966 to 2021

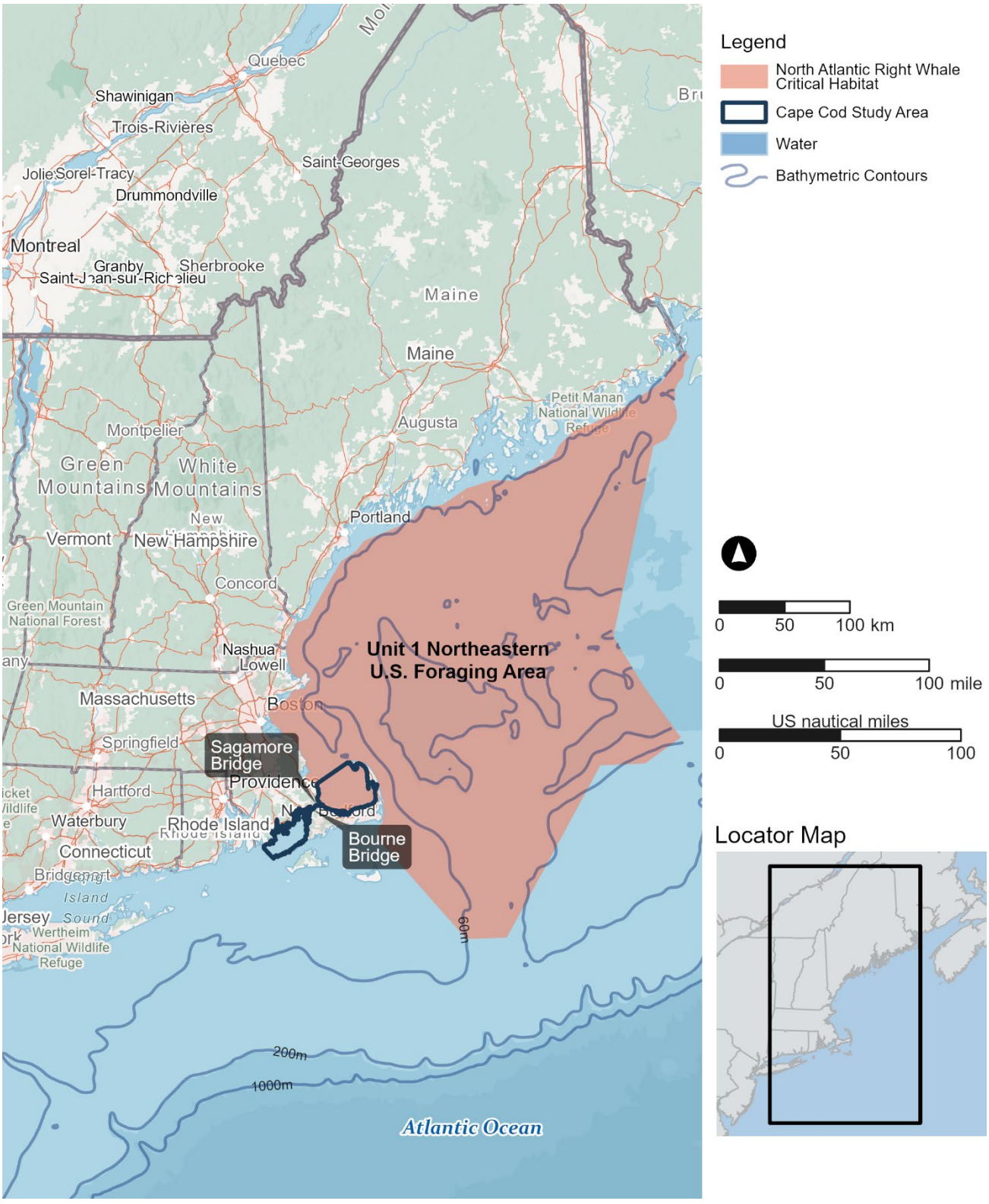


Figure 1-6. North Atlantic Right Whale Critical Habitat (Unit 1)

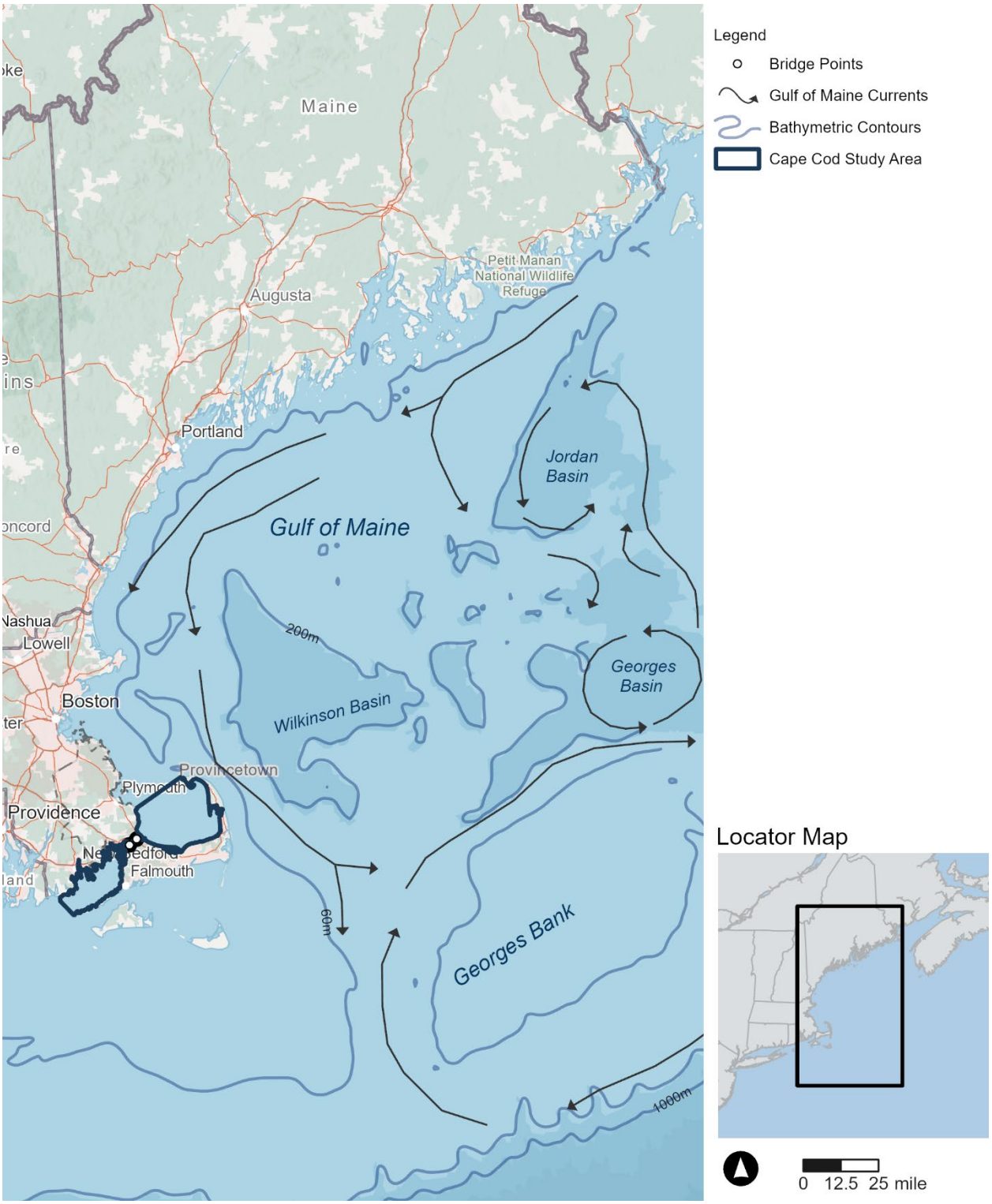


Figure 1-7. Location of the Program Study Area Relative to Major Oceanographic Features and Circulation Patterns that Contribute to the Formation of North Atlantic Right Whale Critical Habitat Physical and Biological Features (NOAA 2015a).

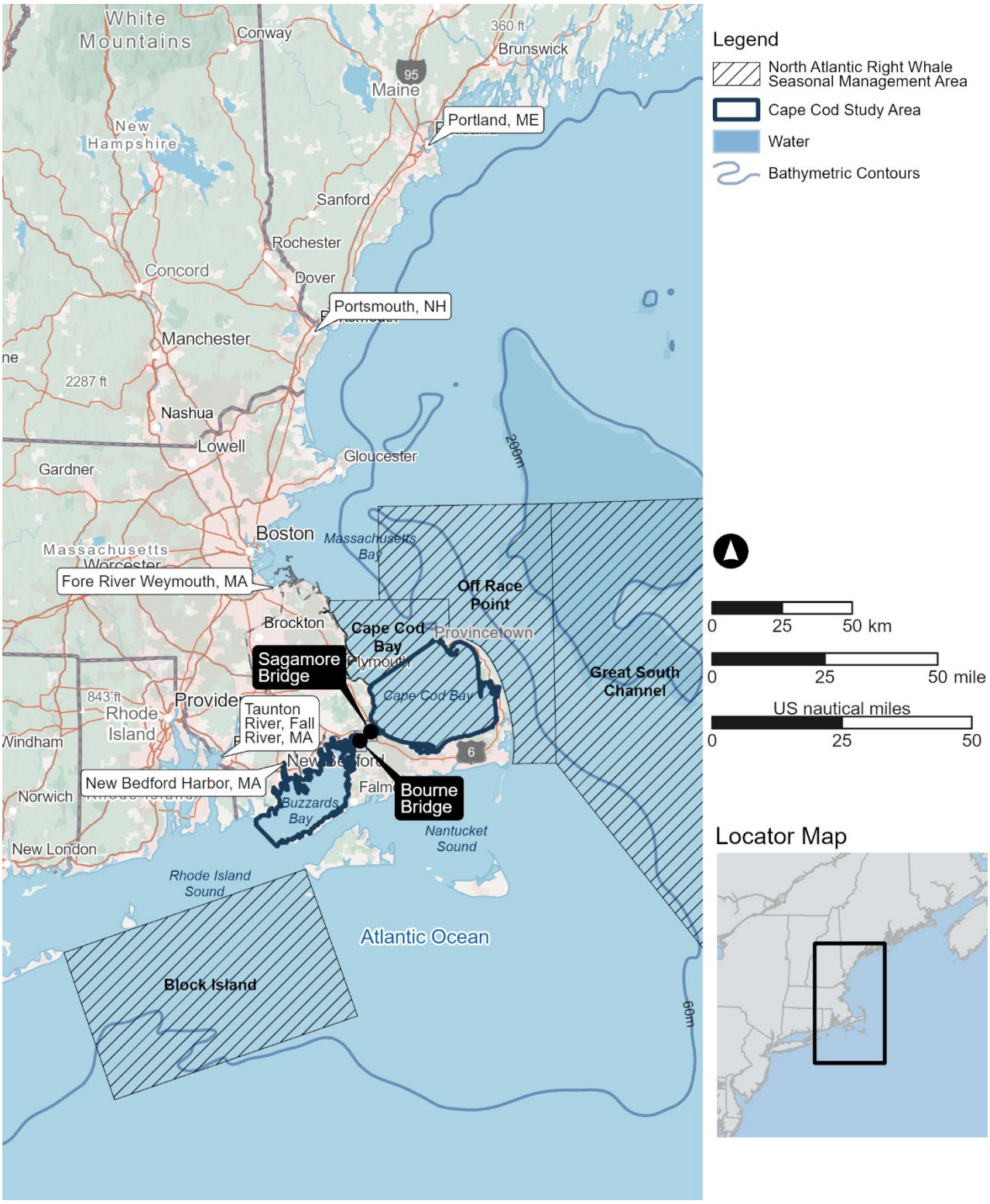


Figure 1-8 North Atlantic Right Whale Management Areas with Respect to Locations of Cape Cod Bridges and Potential Program Ports

Attachment 2 – Acoustic Impact Tables

Table 2-1. Distances (meters) to Marine Mammal Auditory Impact Thresholds from Program Construction Activity

Program Comp.	Pile Type	Install Method	NOTES[1]	Injury (PTS) – Impulsive Sound Signals				Injury (PTS) – Impulsive & Non-Impulsive Sound Signals				Behavior – Impulsive	Behavior – Non-Impulsive
				LF Cet. PK[2]	MF Cet. PK[2]	HF Cet. PK[2]	PW Pin. PK[2]	LF Cet. SEL_{cum}[3]	MF Cet. SEL_{cum}[3]	HF Cet. SEL_{cum}[3]	PW Pin. SEL_{cum}[3]	All Marine Mammals RMS	
				≥219 dB	≥230 dB	≥202 dB	≥218 dB	≥183 dB (Imp.) ≥199 dB (Non.)	≥185 dB (Imp.) ≥198 dB (Non.)	≥155 dB (Imp.) ≥173 dB (Non.)	≥185 dB (Imp.) ≥201 dB (Non.)	≥160 dB	≥120 dB
Cofferdam Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel Sheet Piles (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	2.2 m	0.4 m	29.3 m	2.5 m	2,653.14 m	94.4 m	3,160.2 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,419.8 m	1,000.0 m	N/A
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	N/A	23.4 m	2.1 m	34.6 m	14.2 m	N/A	4,641.6 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)
Shoreline Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	2.2 m	0.4 m	29.3 m	2.5 m	2,653.1 m	94.4 m	3,160.2 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,419.8 m	1,000.0 m	N/A
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	N/A	23.4 m	2.1 m	34.6 m	14.2 m	N/A	4,641.6 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)

Program Comp.	Pile Type	Install Method	NOTES[1]	Injury (PTS) – Impulsive Sound Signals				Injury (PTS) – Impulsive & Non-Impulsive Sound Signals				Behavior – Impulsive	Behavior – Non-Impulsive
				LF Cet. PK[2]	MF Cet. PK[2]	HF Cet. PK[2]	PW Pin. PK[2]	LF Cet. SEL_{cum}[3]	MF Cet. SEL_{cum}[3]	HF Cet. SEL_{cum}[3]	PW Pin. SEL_{cum}[3]	All Marine Mammals RMS	
				≥219 dB	≥230 dB	≥202 dB	≥218 dB	≥183 dB (Imp.) ≥199 dB (Non.)	≥185 dB (Imp.) ≥198 dB (Non.)	≥155 dB (Imp.) ≥173 dB (Non.)	≥185 dB (Imp.) ≥201 dB (Non.)	≥160 dB	≥120 dB
Bulkheads Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	2.2 m	0.4 m	29.3 m	2.5 m	2,653.1 m	94.4 m	3,160.2 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,419.8 m	1,000.0 m	N/A
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	N/A	23.4 m	2.1 m	34.6 m	14.2 m	N/A	4,641.6 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)
Barge Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	2.2 m	0.4 m	29.3 m	2.5 m	2,653.1 m	94.4 m	3,160.2 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,419.8 m	1,000.0 m	N/A
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	N/A	23.4 m	2.1 m	34.6 m	14.2 m	N/A	4,641.6 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)

Program Comp.	Pile Type	Install Method	NOTES[1]	Injury (PTS) – Impulsive Sound Signals				Injury (PTS) – Impulsive & Non-Impulsive Sound Signals				Behavior – Impulsive	Behavior – Non-Impulsive
				LF Cet. PK[2]	MF Cet. PK[2]	HF Cet. PK[2]	PW Pin. PK[2]	LF Cet. SEL_{cum}[3]	MF Cet. SEL_{cum}[3]	HF Cet. SEL_{cum}[3]	PW Pin. SEL_{cum}[3]	All Marine Mammals RMS	
				≥219 dB	≥230 dB	≥202 dB	≥218 dB	≥183 dB (Imp.) ≥199 dB (Non.)	≥185 dB (Imp.) ≥198 dB (Non.)	≥155 dB (Imp.) ≥173 dB (Non.)	≥185 dB (Imp.) ≥201 dB (Non.)	≥160 dB	≥120 dB
Work Trestle	36" Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	2.5 m	0.5 M	34.1 m	2.9 m	5,910.8 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	210.2 m	7,040.7 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	3,163.2 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,584.9 m	N/A
Dolphin Piles-Large Variant	36" Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	2.5 m	0.5 m	34.1 m	2.9 m	5,910.8 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	210.2 m	7,040.7 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	3,163.2 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,584.9 m	N/A
Pier Cofferdam	36" Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	2.5 m	0.5 m	34.1 m	2.9 m	5,910.8 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	210.2 m	7,040.7 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	3,163.2 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,584.9 m	N/A
Dolphin Piles-Small Variant	14" Steel H-Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 177 dB re 1µPa2·s PK = 208 dB re 1µPa RMS = 187 dB re 1uPa	1.8 m	0.3 m	25.1 m	2.2 m	3,735.4 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	132.9 M	4,449.4 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1,999.0 m	631.0 m	N/A
Dolphin Piles-Small Variant	14" Steel Pipe Piles	Drilling-Rotary Drill	(Dazey et al. 2012) RMS = 154.2 dB re 1uPa @ 12 m	N/A	N/A	N/A	N/A	11.5 m	1.0 m	17.1 m	7.0 m	N/A	2,286.6 m

Program Comp.	Pile Type	Install Method	NOTES[1]	Injury (PTS) – Impulsive Sound Signals				Injury (PTS) – Impulsive & Non-Impulsive Sound Signals				Behavior – Impulsive	Behavior – Non-Impulsive
				LF Cet. PK[2]	MF Cet. PK[2]	HF Cet. PK[2]	PW Pin. PK[2]	LF Cet. SEL_{cum}[3]	MF Cet. SEL_{cum}[3]	HF Cet. SEL_{cum}[3]	PW Pin. SEL_{cum}[3]	All Marine Mammals RMS	
				≥219 dB	≥230 dB	≥202 dB	≥218 dB	≥183 dB (Imp.) ≥199 dB (Non.)	≥185 dB (Imp.) ≥198 dB (Non.)	≥155 dB (Imp.) ≥173 dB (Non.)	≥185 dB (Imp.) ≥201 dB (Non.)	≥160 dB	≥120 dB
Templates	12” Steel H-Piles	Vibratory	(Caltrans 2015, NMFS 2022) RMS = 150 dB re 1uPa	N/A	N/A	N/A	N/A	5.0 m	0.4 m	7.5 m	3.1 m	N/A	1,000.0 m

Notes:
[1] Alternative proxy sound source measurements are described if the measurements of the same pile type are not available.
[2] Peak sound pressure level (PK) is expressed in dB re 1 µPa and unweighted (flat weighted).
[3] SELcum is expressed in dB re 1 μPa^2s and weighted according to the relevant weighting function with an accumulation period of 24 hours for marine mammals.
Key:
µPa = micropascal
dB = decibel
HF = high-frequency cetaceans
LF = low-frequency cetaceans
MF = mid-frequency cetaceans
PTS = permanent threshold shift
PW = phocid pinnipeds underwater
RMS = root mean square
SELcum = cumulative weighted sound exposure level
ssSEL = Single-strike sound exposure level

Table 2-2. Distances (meters) to Sea Turtle Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals)

Program Component	Pile Type	Installation Method	NOTES[1]	Injury (PTS)			Behavior
				PK[2] – Impulsive ≥232 dB	SEL_{cum}[3] – Impulsive ≥204 dB	SEL_{cum}[3] – Non-Impulsive ≥220 dB	RMS – Impulsive & Non-Impulsive ≥175 dB
Cofferdam Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel Sheet Piles (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	0.3 m	105.8 m	zN/A	100 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	0.9 m	1.0 m
Shoreline Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	0.3 m	105.8 m	N/A	100 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	0.9 m	1.0 m
Bulkheads Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	0.3 m	105.8 m	N/A	100 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	0.9 m	1.0 m
Barge Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	0.3 m	105.8 m	N/A	100 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	0.9 m	1.0 m
Work Trestle	36” Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	0.3 m	235.8 m	N/A	158.5 m

Program Component	Pile Type	Installation Method	NOTES[1]	Injury (PTS)			Behavior
				PK[2] – Impulsive ≥232 dB	SEL_{cum}[3] – Impulsive ≥204 dB	SEL_{cum}[3] – Non-Impulsive ≥220 dB	RMS – Impulsive & Non-Impulsive ≥175 dB
Dolphin Piles-Large Variant	36” Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	0.3 m	235.8 m	N/A	158.5 m
Pier Cofferdam	36” Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	0.3 m	235.8 m	N/A	158.5 m
Dolphin Piles-Small Variant	14” Steel H-Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 177 dB re 1µPa2·s PK = 208 dB re 1µPa RMS = 187 dB re 1uPa	0.3 m	149.0 m	N/A	63.1 m
Dolphin Piles-Small Variant	14” Steel Pipe Piles	Drilling-Rotary Drill	(Dazey et al. 2012) RMS = 154.2 dB re 1uPa @ 12 m	N/A	N/A	0.5 m	0.5 m
Templates	12” Steel H-Piles	Vibratory	(Caltrans 2015, NMFS 2022) RMS = 150 dB re 1uPa	N/A	N/A	0.2 m	0.2 m

Note:
[1] Alternative proxy sound source measurements are described if the measurements of the same pile type are not available.
[2] Peak sound pressure level (peak) is expressed in dB re 1 µPa and unweighted (flat weighted).
[3] SELcum is expressed in dB re 1 µPa2s and weighted according to the relevant weighting function with an accumulation period of 24 hours.
Key:
µPa = micropascals; dB = decibel; PTS = permanent threshold shift; RMS = root mean square; SELcum = cumulative weighted sound exposure level; ssSEL = Single-strike sound exposure level

Table 2-3. Distances (meters) to Marine Mammal and Sea Turtle Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sound Signals) for Concurrent Pile Driving

Program Component	Pile Type	Install Method	Level A PTS Onset PK/SEL_{cum}					Behav. RMS Threshold	Behav. RMS Threshold
			LF Cetaceans	MF Cetaceans	HF Cetaceans	PW Pinnipeds	Sea Turtles	All Marine Mammals	Sea Turtles
Cofferdam, Shoreline, Bulkhead, Barge Sheeting	18” Steel Sheet Piles	Vibratory	37.1 m	3.3 m	54.9 m	22.6 m	1.5 m	7,356.4 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	1.6 m
Work Trestle, Dolphin Piles-Large Variant, Pier Cofferdam	36” Steel Pipe Piles	Impact	4.0 m/ 9,368.0 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	0.7 m/333.2 m	54.1 m/ 11,158.7 m 3,025.7 m (Bourne-Furthest Extent) 3,377.0 m (Sagamore-Furthest Extent)	4.6 m/ 5.013.3 m 3,025.7m (Bourne-Furthest Extent) 3,377.0m (Sagamore-Furthest Extent)	0.5 m/ 373.7 m	2,511.9 m	251.2 m

Key:
µPa = micropascals
dB = decibel
HF = high-frequency cetaceans
LF = low-frequency cetaceans
MF = mid-frequency cetaceans
PTS = permanent threshold shift
PW = phocid pinnipeds underwater
RMS = root mean square
SELcum = cumulative weighted sound exposure level
ssSEL = Single-strike sound exposure level

Table 2-4. Distances (meters) to Fish Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals)

Program Component	Pile Type	Installation Method	NOTES[1]	Injury – Impulsive[2,3]			Behavior Impulsive & Non-Impulsive
				PK[2] – All Fish ≥206 dB	SEL_{cum}[3] – Fish ≥ 2 g ≥187 dB	SEL_{cum}[3] – Fish < 2 g ≥183 dB	RMS –All Fish ≥150 dB
Cofferdam Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel Sheet Piles (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Shoreline Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Bulkheads Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Barge Sheeting	18” Steel Sheet Piles	Impact	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m
		Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Work Trestle	36” Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	18.5 m	1,584.9 m	1,584.9 m	7,356.4 m

Program Component	Pile Type	Installation Method	NOTES[1]	Injury – Impulsive[2,3]			Behavior Impulsive & Non-Impulsive
				PK[2] – All Fish ≥206 dB	SEL_{cum}[3] – Fish ≥ 2 g ≥187 dB	SEL_{cum}[3] – Fish < 2 g ≥183 dB	RMS –All Fish ≥150 dB
Dolphin Piles-Large Variant	36” Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	18.5 m	1,584.9 m	1,584.9 m	7,356.4 m
Pier Cofferdam	36” Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	18.5 m	1,584.9 m	1,584.9 m	7,356.4 m
Dolphin Piles-Small Variant	14” Steel H-Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 177 dB re 1µPa2·s PK = 208 dB re 1µPa RMS = 187 dB re 1uPa	13.6 m	631.0 m	631.0 m	2,928.6 m
Dolphin Piles-Small Variant	14” Steel Pipe Piles	Drilling-Rotary Drill	(Dazey et al. 2012) RMS = 154.2 dB re 1uPa @ 12 m	N/A	N/A	N/A	22.9 m
Templates	12” Steel H-Piles	Vibratory	(Caltrans 2015, NMFS 2022) RMS = 150 dB re 1uPa	N/A	N/A	N/A	10.0 m

Notes:
[1] Alternative proxy sound source measurements are described if the measurements of the same pile type are not available.
[2] Peak sound pressure level (peak) is expressed in dB re 1 µPa.
[3] SELcum is expressed in dB re 1 μPa^2s with an accumulation period of 12 hours for fish.
Key: µPa = micropascals; dB = decibel; RMS = root mean square; SELcum = cumulative sound exposure level; ssSEL = Single-strike sound exposure level

Table 2-5. Distances (meters) to Fish Auditory Impact Thresholds from Maximum Concurrent Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals).

Program Component	Pile Type	Installation Method	NOTES[1]	Injury – Impulsive[2,3]			Behavior Impulsive & Non-Impulsive
				PK[2] – All Fish ≥206 dB	SEL_{cum}[3] – Fish ≥ 2 g ≥187 dB	SEL_{cum}[3] – Fish < 2 g ≥183 dB	RMS –All Fish ≥150 dB
Cofferdam Sheeting Shoreline Sheeting Bulkheads Sheeting Barge Sheeting	18” Steel Sheet Piles	Vibratory	Proxy Typical 24” AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa +3dB for concurrent piling of the same sound pressure levels (USDOT 1995)	N/A	N/A	N/A	73.6 m
Work Trestle Dolphin Piles-Large Variant Pier Cofferdam	36” Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa +3dB for concurrent piling of the same sound pressure levels (USDOT 1995)	29.3 m	2,511.9 m	2,511.9 m	11,659.1 m

Notes:
[1] Alternative proxy sound source measurements are described if the measurements of the same pile type are not available.
[2] Peak sound pressure level (peak) is expressed in dB re 1 µPa.
[3] SELcum is expressed in dB re 1 μPa^2s with an accumulation period of 12 hours for fish.
Key:
µPa = micropascals
dB = decibel
RMS = root mean square
SELcum = cumulative sound exposure level
ssSEL = Single-strike sound exposure level

Attachment 3 – Acoustic Impact Area Figures

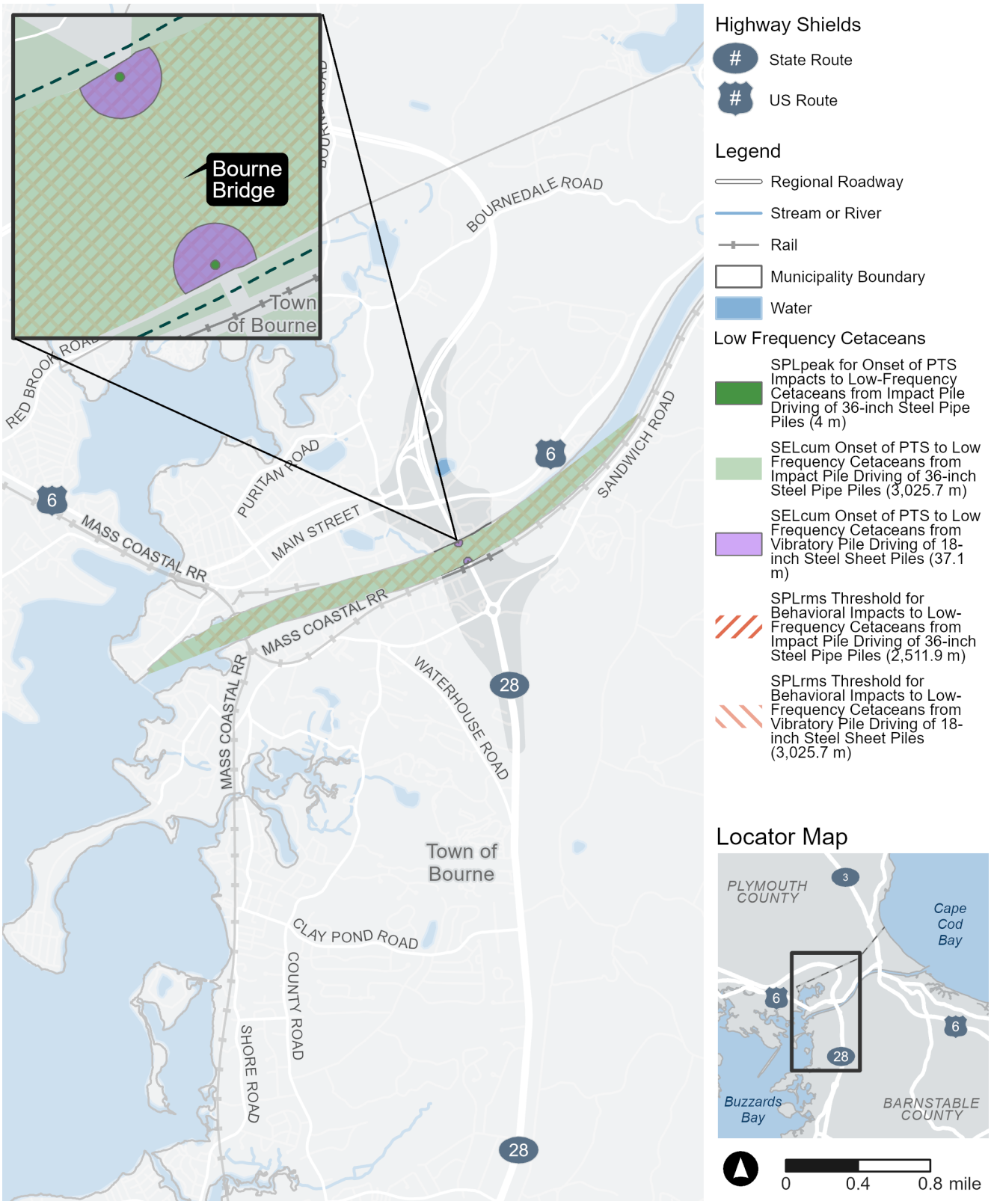


Figure 3-1. Acoustic Impact Areas to Low Frequency Cetaceans for the Bourne Bridge Site

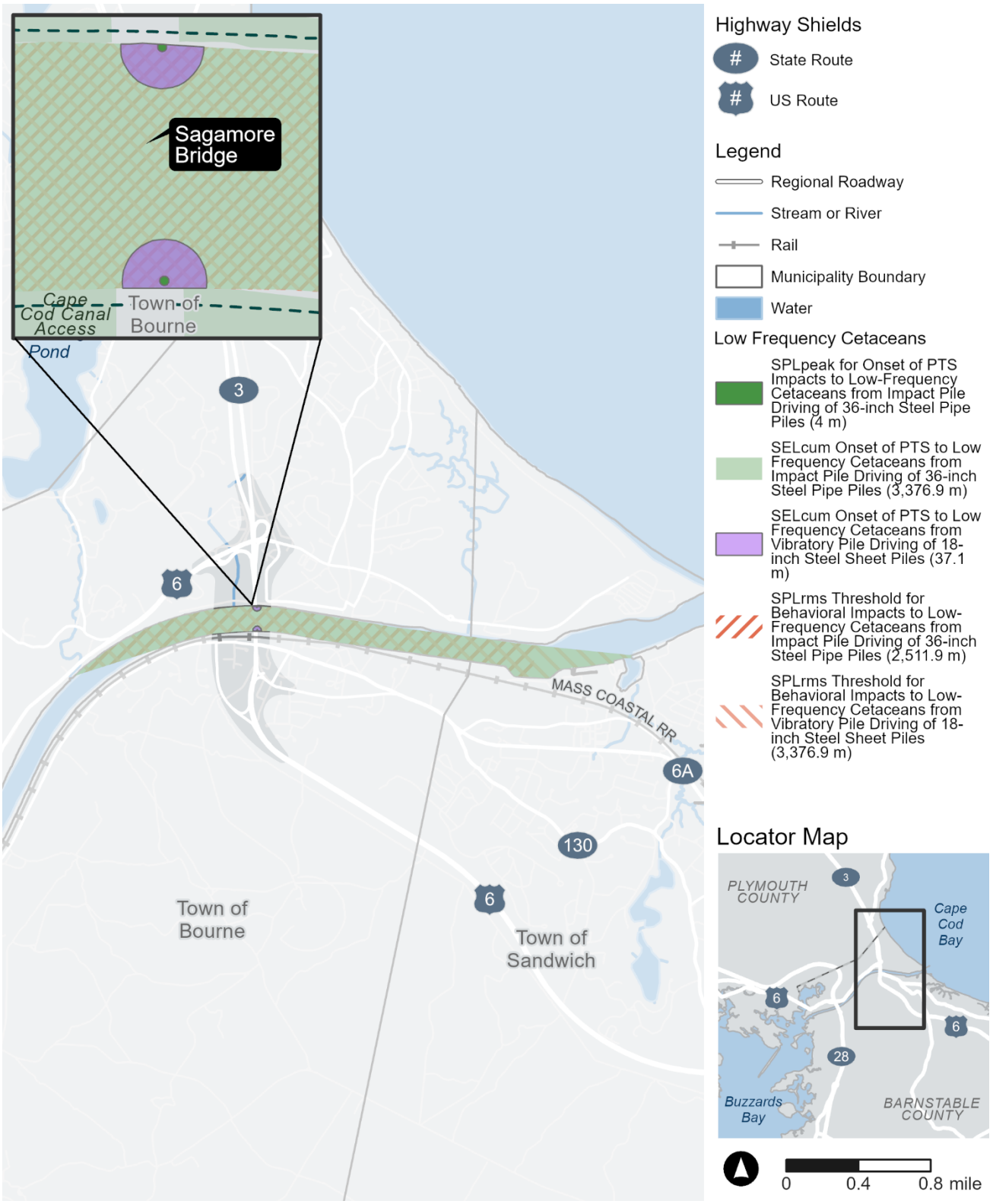


Figure 3-2. Acoustic Impact Areas to Low Frequency Cetaceans for the Sagamore Bridge Site

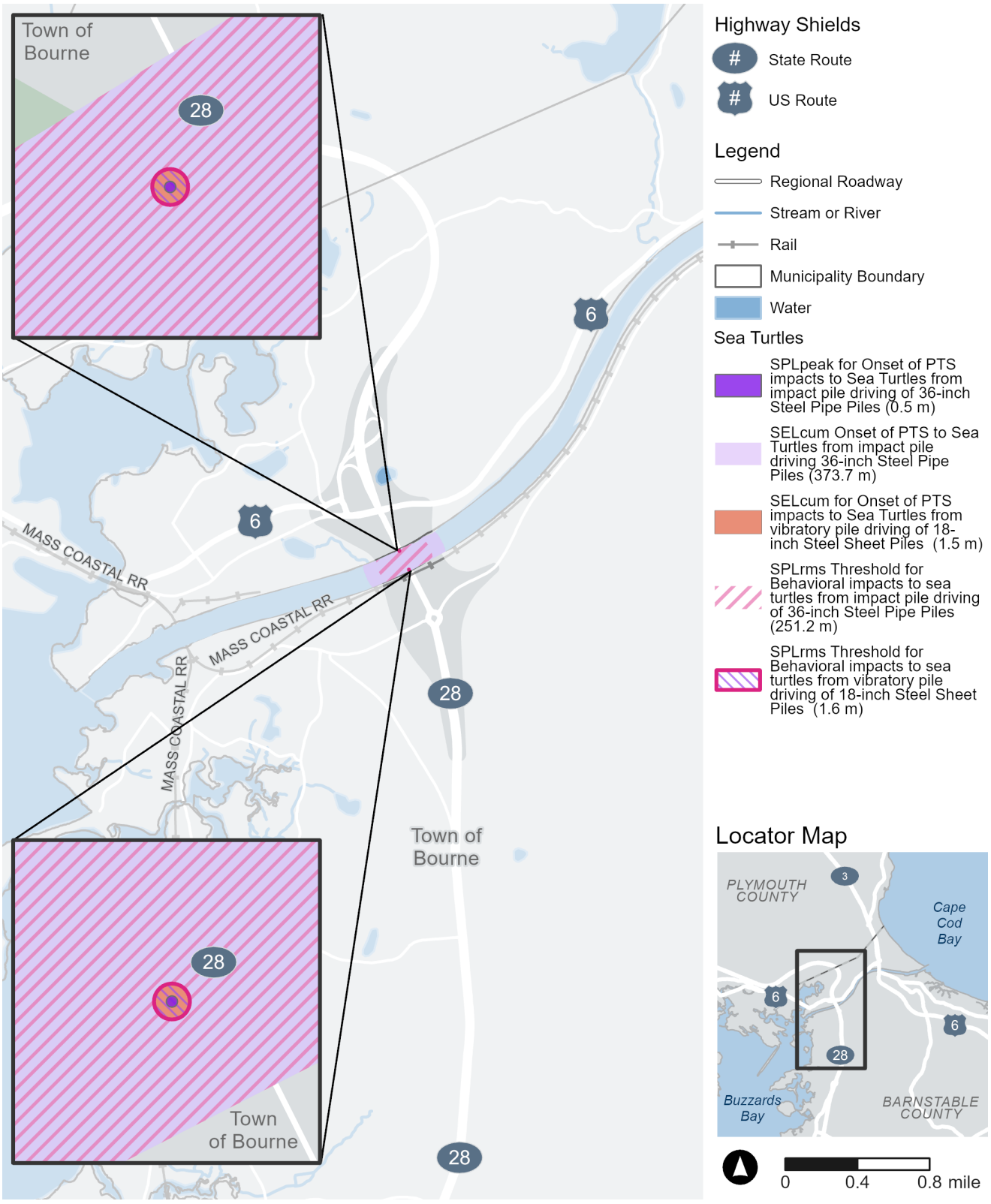


Figure 3-3. Acoustic Impact Areas to Sea Turtles for the Bourne Bridge Site

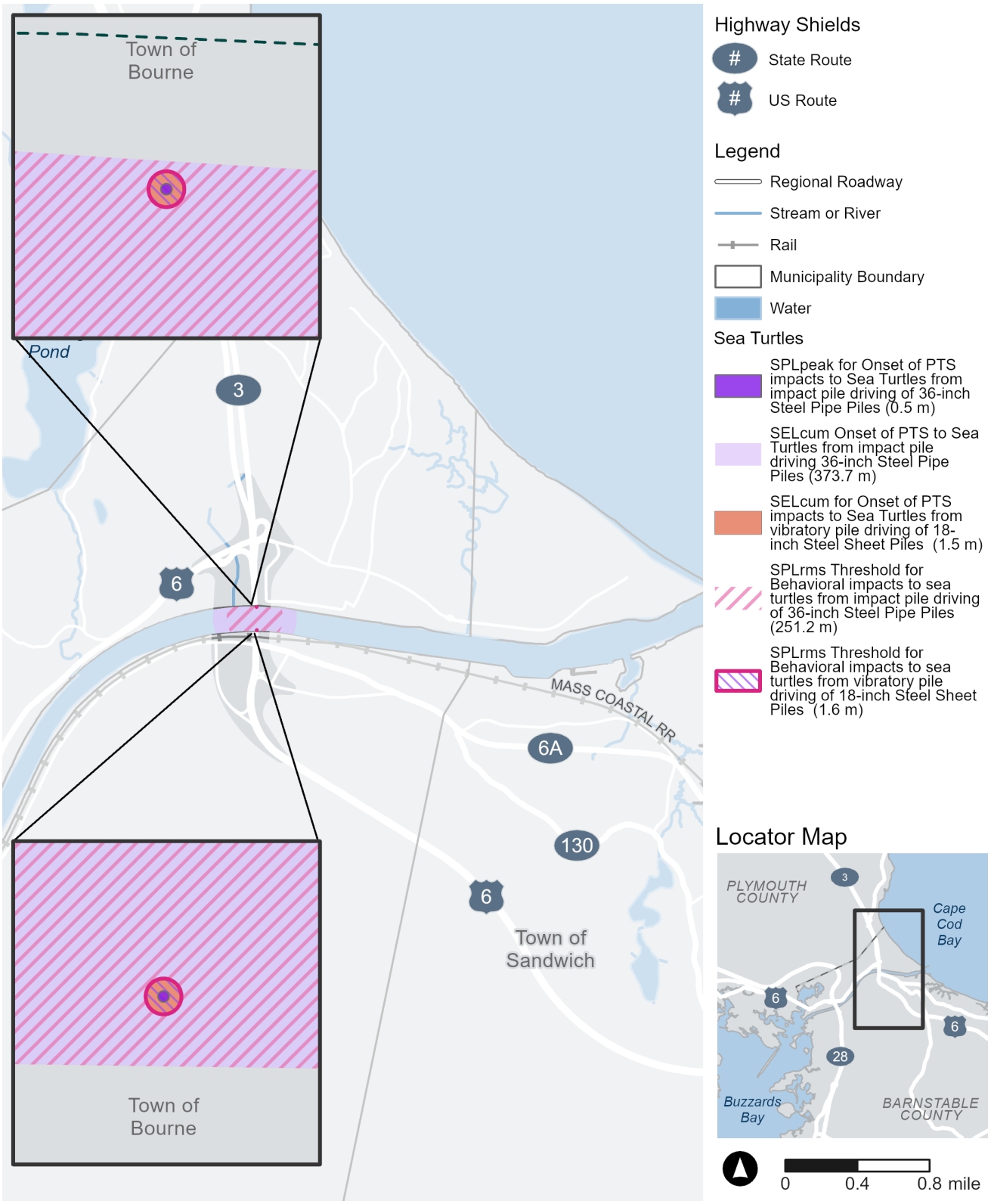


Figure 3-4. Acoustic Impact Areas to Sea Turtles for the Sagamore Bridge Site

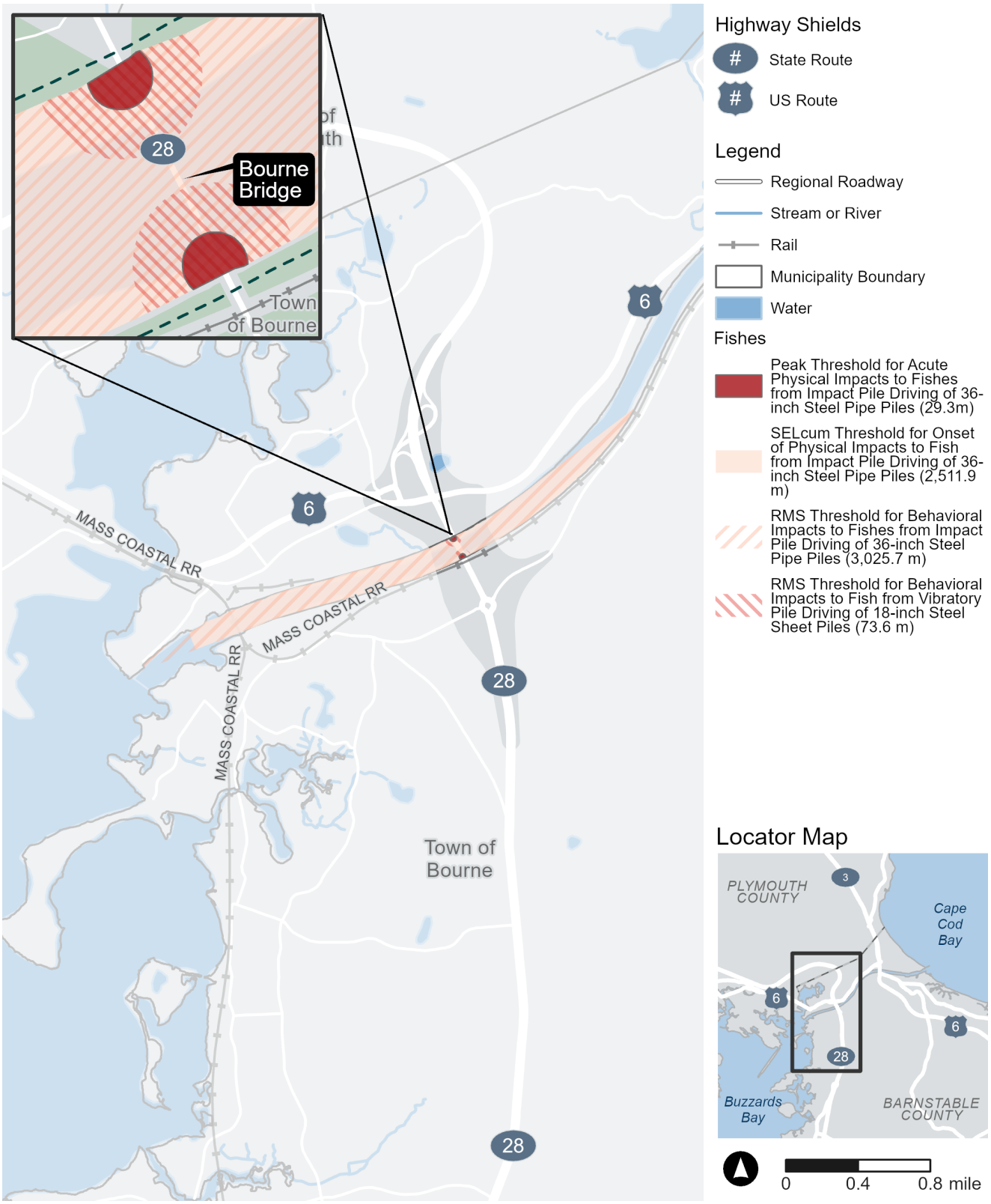


Figure 3-5. Acoustic Impact Areas to Fishes for the Bourne Bridge Site

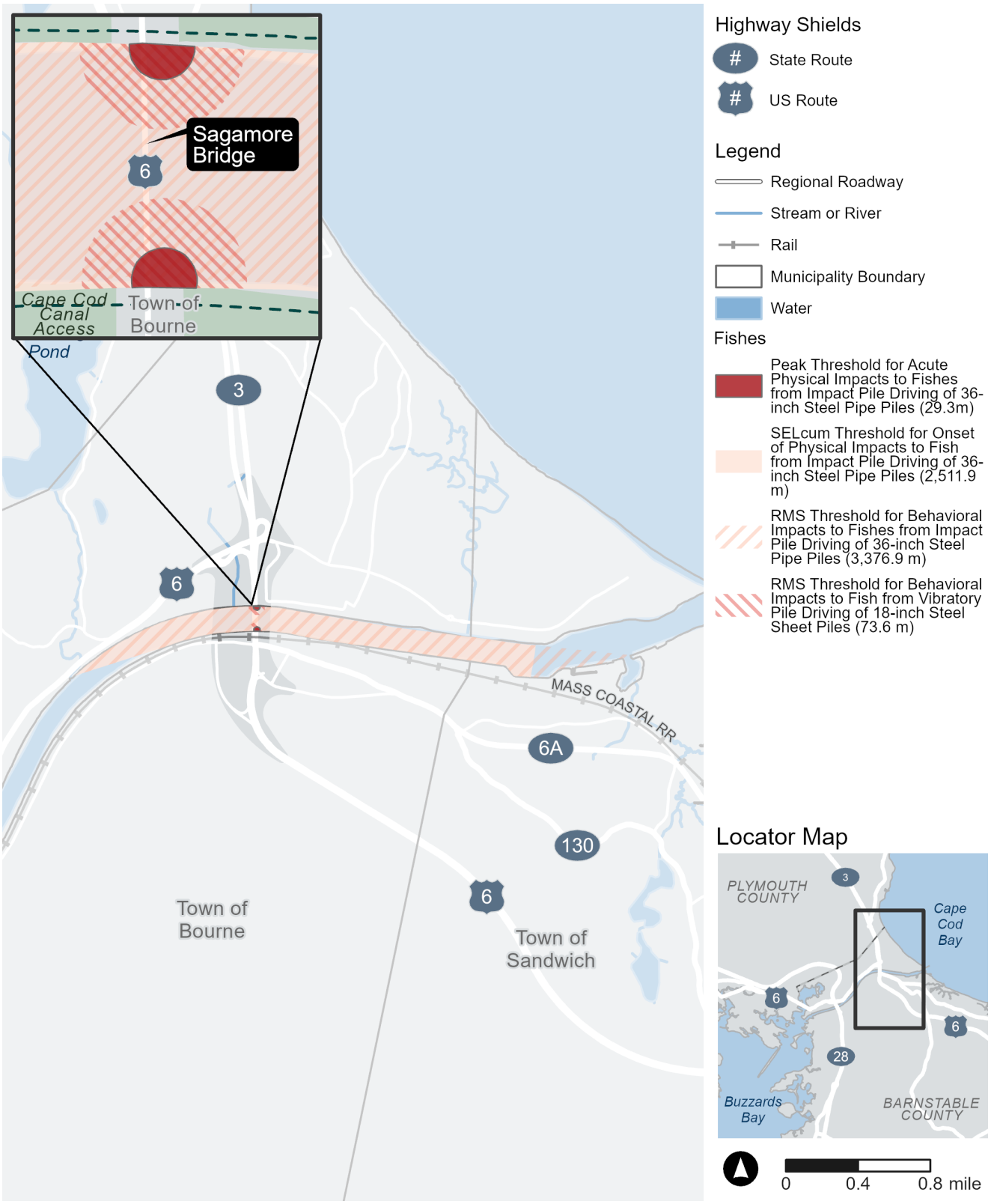


Figure 3-6. Acoustic Impact Areas to Fishes for the Sagamore Bridge Site

Agency Coordination

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
55 Great Republic Drive
Gloucester, MA 01930

April 7, 2025

Wildlife and Endangered Species Unit Supervisor
Environmental Services
MassDOT Highway Division
10 Park Plaza, Suite 730
Boston, MA 02116

Re: MA DOT Cape Cod Bridges Replacement Program Bourne, MA

Dear Mr. Paulson:

We have completed our consultation under section 7 of the Endangered Species Act (ESA) in response to your letter received January 13, 2025, and revised on February 27, 2025, regarding the above-referenced proposed project. We reviewed your consultation request document and related materials. Based on our knowledge, expertise, and your materials, we concur with your conclusion that the proposed action is not likely to adversely affect any NMFS ESA-listed species or designated critical habitat. Therefore, no further consultation pursuant to section 7 of the ESA is required.

We would like to offer the following clarifications to complement your incoming request for consultation. In your biological assessment, you refer to Level A and Level B harassment thresholds when analyzing acoustic impacts to ESA-listed marine mammals. We would like to clarify that those analyses and classifications are specific to marine mammals under the Marine Mammal Protection Act (MMPA), and are not relevant to ESA-listed marine mammals. It is our understanding that you are currently coordinating with the NMFS Office of Protected Resources to address any required authorizations under the jurisdiction of the MMPA. Furthermore, you applied Level A and Level B harassment to ESA-listed sea turtle species. That analysis is not applicable to these species.

As part of your analysis of effects from noise to listed whale and sea turtle species, although peak injury thresholds can be exceeded by some of the proposed pile driving components, exposure to harmful noise levels is not expected to occur. Any whale or sea turtle potentially present is expected to modify their behavior after being exposed to noise levels above behavioral thresholds, and move away from the ensonified area before any exposure to harmful sound pressure waves occurs. Therefore, effects from noise above injury thresholds to listed whales and sea turtles are extremely unlikely. Furthermore, the movements of these individuals away from the ensonified area will not alter essential whale or sea turtle behaviors, or would do so to an extent that the effects are too small to be meaningfully measured or detected, and therefore, insignificant.

Regarding the analysis of effects from increased vessel traffic to listed whales and sea turtles, the vessels proposed as part of the Program, when added to the baseline conditions of heavily trafficked commercial routes, will have effects on the risk of a vessel strike that are too small to

be meaningfully measured or detected, and therefore are insignificant. Lastly, we clarify that no take is anticipated or expected. As you indicate in your biological assessment, if any take does occur, the permittee or onboard staff shall immediately contact the NOAA Stranding Hotline at (866) 755-NOAA (6622) and submit the report via email to nmfs.gar.incidentaltake@noaa.gov. The incidental take of a listed species would require that you contact us about reinitiation of the consultation.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 FR 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act (84 FR at 45015; 89 FR at 24268). We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this letter of concurrence would not have been any different under the 2019 regulations or pre-2019 regulations.

Reinitiation of consultation is required and shall be requested by the federal agency or by us, where discretionary federal involvement or control over the action has been retained or is authorized by law and: (a) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in the consultation; (b) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this consultation; or (c) if a new species is listed or critical habitat designated that may be affected by the identified action. No take is anticipated or exempted. If there is any incidental take of a listed species, reinitiation would be required. Should you have any questions about this correspondence please contact Roosevelt Mesa at (978) 281-9186 or by email at Roosevelt.Mesa@noaa.gov. For questions related to Essential Fish Habitat, please contact Alexa Cacacie with our Habitat and Ecosystem Services Division at (978) 281-9294 or by email at Alexa.Cacacie@noaa.gov.

Sincerely,

Jennifer Anderson

Jennifer Anderson
Assistant Regional Administrator
for Protected Resources

EC: Cacacie, NMFS/HESD; Paulson, MA DOT
ECO: GARFO-2025-00604
File Code: H:\Section 7 Team\Section 7\Non-Fisheries\FHWA_State DOTs\Informals\MA DOT\2025\Cape Cod Bridges Program

Attachment 3.

Essential Fish Habitat Assessment and Fish and Wildlife Coordination Act Consultation Worksheet and Agency Coordination





Cape Cod Bridges Program

Bourne, Massachusetts

ESSENTIAL FISH HABITAT ASSESSMENT

SUBMITTED TO:
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
Protected Resources Division
55 Great Republic Drive
Gloucester, MA 01930

PROPONENT:
The Massachusetts Department of Transportation
Highway Division
10 Park Plaza
Boston, MA 02116

February 26, 2025

massDOT
Massachusetts Department of Transportation

NOAA Fisheries Greater Atlantic Regional Fisheries Office Essential Fish Habitat (EFH) Assessment & Fish and Wildlife Coordination Act (FWCA) Consultation Worksheet
August 2021 rev.

Authorities

The Magnuson Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NOAA Fisheries on any action or proposed action authorized, funded, or undertaken by such agency that may adversely affect essential fish habitat (EFH) identified under the MSA. This process is guided by the requirements of our EFH regulation at 50 CFR 600.905, which mandates the preparation of EFH assessments and generally outlines each agency's obligations in the consultation process.

The Fish and Wildlife Coordination Act (FWCA) requires that all federal agencies consult with NOAA Fisheries when proposed actions might result in modifications to a natural stream or body of water.
The FWCA also requires that federal agencies consider the effects that these projects would have on fish and wildlife and must also provide for improvement of these resources. Under the FWCA, we work to protect, conserve and enhance species and habitats for a wide range of aquatic resources such as shellfish, diadromous species, and other commercially and recreationally important species that are not federally managed and do not have designated EFH.

It is important to note that these consultations take place between NOAA Fisheries and federal action agencies. **As a result, EFH assessments, including this worksheet, must be provided to us by the federal agency, not by permit applicants or consultants.**

Use of the Worksheet

This worksheet can serve as an EFH assessment for **Abbreviated EFH Consultations**, and as a means to provide information on potential effects to other NOAA trust resources considered under the FWCA. An abbreviated consultation allows us to determine quickly whether, and to what degree, a federal action may adversely affect EFH. Abbreviated consultation procedures can be used when federal actions do not have the potential to cause substantial adverse effects on EFH and when adverse effects could be alleviated through minor modifications.

The intent of the EFH worksheet is to provide a guide for determining the information needed to fully assess the effects of a proposed action on EFH. In addition, the worksheet may be used as a tool to assist you in developing a more comprehensive EFH assessment for larger projects that may have more substantial adverse effects to EFH. However, for large, complex projects that have the potential for significant adverse effects, an **Expanded EFH Consultation** may be warranted and the use of this worksheet alone is not appropriate as your EFH assessment.

An **adverse effect** is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Consultation under the MSA is not required if there is no adverse effect on EFH or if no EFH has been designated in the project area. However, because the definition of "adverse effect" is very broad, most in-water work will result in some level of adverse effect requiring consultation with us, even if the impact is temporary or the overall result of the project is habitat restoration or enhancement. It is important to remember that an adverse effect determination is a trigger to consult with us. It does not mean that a project cannot proceed as proposed, or that project modifications are necessary. An adverse effect determination under the EFH provisions of the MSA simply means that the effects of the proposed action on EFH must be evaluated to determine if there are ways to avoid, minimize, or offset adverse effects. Additional details on EFH consultations, tools, and resources, including frequently asked questions can be found on our website.

Instructions

This worksheet should be used as your EFH assessment for **Abbreviated EFH Consultations** or as a guide to develop your EFH assessment. It is not appropriate to use this worksheet as your EFH assessment for large, complex projects, or those requiring an Expanded EFH Consultation.

When completed fully and with sufficient information to clearly describe the activities proposed, habitats affected, and project impacts, as well as the measures taken to avoid, minimize or offset any unavoidable adverse effects, this worksheet provides us with required components of an EFH assessment including:

1. A description of the proposed action.
2. An analysis of the potential adverse effects on EFH and the federally managed species.
3. The federal agency's conclusions regarding the effects of the action on EFH.
4. Proposed mitigation, if applicable.

When completing this worksheet and submitting information to us, it is important to ensure that sufficient information is provided to clearly describe the proposed project and the activities proposed. At a minimum, this should include the public notice (if applicable) or project application and project plans showing:

- location map of the project site with area of impact.
- existing and proposed conditions.
- all in-water work and the location of all proposed structures and/or fill.
- all waters of the U.S. on the project site with mean low water (MLW), mean high water (MHW), high tide line (HTL), and water depths clearly marked.
- Habitat Areas of Particular Concern (HAPCs).
- sensitive habitats mapped, including special aquatic sites (submerged aquatic vegetation, saltmarsh, mudflats, riffles and pools, coral reefs, and sanctuaries and refuges), hard bottom or natural rocky habitat areas, and shellfish beds.
- site photographs, if available.

Your analysis of effects **should focus on impacts that reduce the quality and/or quantity of the habitat or result in conversion to a different habitat type** for all life stages of species with designated EFH within the action area. Simply stating that fish will move away or that the project will only affect a small percentage of the overall population is not a sufficient analysis of the effects of an action on EFH. Also, since the intent of the EFH consultation is to evaluate the direct, indirect, individual and cumulative effects of a particular federal action on EFH and to identify options to avoid, minimize or offset the adverse effects of that action, is it not appropriate to conclude that an impact is minimal just because the area affected is a small percentage of the total area of EFH designated. The focus of the consultation is to reduce impacts resulting from the activities evaluated in the assessment. Similarly, a large area of distribution or range of the fish species is also not appropriate rationale for concluding the impacts of a particular project are minimal.

Use the information on the our EFH consultation website and NOAA's EFH Mapper to complete this worksheet. The mapper is a useful tool for viewing the spatial distribution of designated EFH and HAPCs. Because summer flounder HAPC (defined as: "all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH") does not have region-wide mapping, local sources and on-site surveys may be needed to identify submerged aquatic vegetation beds within the project area. The full designations for each species may be viewed as PDF links provided for each species within the Mapper, or via our website links to the New England Fishery Management Councils Omnibus Habitat Amendment 2 (Omnibus EFH Amendment), the Mid-Atlantic Fishery Management Councils FMPs (MAMFC - Fish Habitat), or the Highly Migratory Species website. Additional information on species specific life histories can be found in the EFH source documents accessible through the Habitat and Ecosystem Services Division website. This information can be useful in evaluating the effects of a proposed action. Habitat and Ecosystem Services Division (HESD) staff have also developed a technical memorandum *Impacts to Marine Fisheries Habitat from Non-fishing Activities in the Northeastern United States*, NOAA Technical Memorandum NMFS-NE-209 to assist in evaluating the effects of non-fishing activities on EFH. If you have questions, please contact the HESD staff member in your area to assist you.

Federal agencies or their non-federal designated lead agency should email the completed worksheet and necessary attachments to the HESD New England (ME, NH, MA, CT, RI) or Mid- Atlantic (NY, NJ, PA, DE, MD, VA) Branch Chief and the regional biologist listed on the Contact Regional Office Staff section on our EFH consultation website and listed below.

We will provide our EFH conservation recommendations under the MSA, and recommendations under the FWCA, as appropriate, within 30 days of receipt of a **complete** EFH assessment for an abbreviated consultation. Please ensure that the EFH worksheet is completed in full and includes detail to minimize delays in completing the consultation. If we are unable to assess potential impacts based on the information provided, we may request additional information necessary to assess the effects of the proposed action on our trust resources before we can begin a consultation. If the worksheet is not completely filled out, it may be returned to you for completion. **The EFH consultation and our response clock does not begin until we have sufficient information upon which to consult**.

If this worksheet is not used, you should include all the information required to complete this worksheet in your EFH assessment. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. You may need to prepare a more detailed EFH assessment for more substantial or complex projects to fully characterize the effects of the project and the avoidance and minimization of impacts to EFH. The format of the EFH worksheet may not be sufficient to incorporate the extent of detail required for large-scale projects, and a separate EFH assessment may be required.

Regardless of the format, you should include an analysis as outlined in this worksheet for an expanded EFH assessment, along with any additional necessary information including:

- the results of on-site inspections to evaluate habitat and site-specific effects.
- the views of recognized experts on habitat or the species that may be affected.
- a review of pertinent literature and related information.
- an analysis of alternatives that could avoid or minimize adverse effects on EFH.

For these larger scale projects, interagency coordination meetings should be scheduled to discuss the contents of the EFH consultation and the site-specific information that may be needed in order to initiate the consultation.

Please contact our Greater Atlantic Regional Fisheries Office, Protected Resources Division regarding potential impacts to marine mammals or threatened and endangered species and the appropriate consultation procedures.

HESD Contacts*

New England - ME, NH, MA, RI, CT

Chris Boelke, Branch Chief	christopher.boelke@noaa.gov
Mike Johnson – ME, NH	mike.r.johnson@noaa.gov
Kaitlyn Shaw – ME, NH, MA	kaitlyn.shaw@noaa.gov
Sabrina Pereira – RI, CT	sabrina.pereira@noaa.gov

Mid-Atlantic - NY, NJ, PA, MD, VA

Karen Greene, Branch Chief	karen.greene@noaa.gov
Jessie Murray – NY, Northern NJ (Monmouth Co. and north)	jessie.murray@noaa.gov
Keith Hanson – NJ (Ocean Co. and south), DE and PA, Mid-Atlantic Wind	keith.hanson@noaa.gov
Maggie Sage – NJ (Ocean Co. and south), DE and PA	lauren.m.sager@noaa.gov
Jonathan Watson – MD, DC	jonathan.watson@noaa.gov
David O'Brien – VA	david.l.obrien@noaa.gov

Ecosystem Management (Wind/Aquaculture)

Peter Burns, Branch Chief	peter.burns@noaa.gov

Please check for the most current staffing list on our contact us page prior to submitting your assessment.

EFH Assessment Worksheet rev. August 2021
Please read and follow all of the directions provided when filling out this form.

1. General Project Information

Date Submitted: January 13, 2025

Project/Application Number: MassDOT Project # 608020 and # 613678

Project Name: Cape Cod Bridges Program – Replacement of the Sagamore Bridge (Phase I) and Bourne Bridge (Phase II)

Project Sponsor/Applicant: Massachusetts Department of Transportation – Highway Division

Federal Action Agency (or state agency if the federal agency has provided written notice delegating the authority[1]): Federal Highway Administration

Fast-41: Yes ☐ No ☒

Action Agency:
Contact Name: David Paulson
Contact Phone: 857-262-3378
Contact Email: David.J.Paulson@dot.state.ma.us
Address, City/Town, State: MassDOT Highway Division, 10 Park Plaza, Boston, MA 02116

2. Project Description

Latitude/Longitude: 41.763° N, -70.569° W

Body of Water (e.g., HUC 6 name): 010900020201 Barnstable Harbor-Cape Cod Bay and 010900020304, Red Brook-Onset Bay as part of the Cape Cod Canal

Project Purpose:
The Massachusetts Department of Transportation – Highway Division (MassDOT), in partnership with the Federal Highway Administration – Massachusetts Division (FHWA), and in coordination with the New England District of the U.S. Army Corps of Engineers (USACE), proposes the Cape Cod Bridges program (Program) to replace the Sagamore and Bourne bridges that cross Cape Cod Canal with two new bridges built to modern highway design standards in the town of Bourne, Barnstable County, Massachusetts. The Program also proposes reconfiguring the highway approach networks north and south of Cape Cod Canal to align with the replacement highway bridges and providing separated pedestrian and bicycle accommodations along the replacement bridges with connections to the local roadway network. The purpose of the Program is to improve cross-canal mobility and accessibility between Cape Cod and mainland Massachusetts for all road users and to address the increasing maintenance needs, safety concerns, and functional obsolescence of the aging Cape Cod Canal highway bridges. The Program is needed to address the following transportation deficiencies:

[1] A federal agency may designate a non-Federal representative to conduct an EFH consultation by giving written notice of such designation to NMFS. If a non-federal representative is used, the Federal action agency remains ultimately responsible for compliance with sections 305(b)(2) and 305(b)(4)(B) of the Magnuson-Stevens Act.

- Deteriorating structural condition and escalating maintenance demands of the Cape Cod Canal highway bridges;
- Substandard design elements of the Cape Cod Canal highway bridges, the immediate mainline approaches, and their adjacent interchanges and intersections;
- Poor vehicular traffic operations; and
- Lack of accessible bicycle and pedestrian accommodations and connections between existing facilities.

In accordance with 23 U.S.C. 139(f)(4)(E)(ii) and 40 CFR 1501.12, the Program builds upon and references prior, multi-year foundational studies, including:

1) the USACE Cape Cod Canal Highway Bridges Major Rehabilitation Evaluation (MRE), which was completed to evaluate the current condition of the bridges and determine whether standard operation and maintenance, major rehabilitation, or replacement of either or both bridges would provide the most reliable, fiscally responsible solution for providing long-term vehicular access across Cape Cod Canal; and

2) the MassDOT Office of Transportation Planning (OTP) Cape Cod Canal Transportation Study, which was completed to identify and evaluate existing and future multimodal transportation deficiencies and needs of the existing roadway network around the Cape Cod Canal area.

Project Description:

The Proposed Action will replace the Sagamore and Bourne highway bridges with parallel, twin tied-arch bridge structures supported on delta frames with an approximate 700-foot mainline span length. The replacement bridges will maintain the existing vertical clearance of 135 feet above mean high water (MHW) and provide a minimum of 500 feet of horizontal channel width consistent with existing conditions. The bridge piers will be located at the waterline adjacent to the Canal Service Roads, within the riprap slope. The pier footprints will be partially above and partially below the high tide line (HTL), and some portions will extend below the Mean Low Water line (MLW) into the subtidal zone. At both the Sagamore and Bourne crossings, the replacement bridge mainline alignment location will be offline (outside of the footprint of the existing bridge), and inboard of the existing highway bridges, on the side of the canal between the existing Bourne Bridge and Sagamore Bridge. The twin deck structures will be approximately ten feet apart and parallel to each other; each main span will include two through-traffic lanes, one auxiliary lane, and shoulders and barriers in compliance with current MassDOT and FHWA standards and guidelines for highway and bridge design. Each crossing location will include one bi-directional pedestrian and bicycle shared-use path, separated from vehicular traffic by the shoulder and barrier. Additionally, each crossing location will include reconfiguration of the highway interchange approach networks on both sides of Cape Cod Canal to align with the replacement highway bridges. Sagamore Crossing will consist of a direct connection to State Road in Sagamore North and Westbound On-Ramp under U.S. Route 6 with Cranberry Highway Extension and Sandwich Road Connector in Sagamore South. The Bourne Crossing will include a directional interchange in Bourne North and Diamond Interchange in Bourne South.

The proposed bridges will include a system of inlets and pipes that will convey stormwater runoff to a series of treatment areas prior to discharging into the Cape Cod Canal. The treatment areas will consist of stormwater infiltration basins located at ground level set back from the surface water, which will provide recharge to groundwater, peak flow attenuation, and removal of pollutants such as suspended solids and phosphorus. This is an improvement over the existing condition, where stormwater runoff is conveyed from the bridge decks via inlets and downspouts directly to the Cape Cod Canal without treatment. The proposed drainage design will not impact EFH in the Cape Cod Canal.

The in-water and over-water activities within the footprint of the existing and proposed Bourne and Sagamore Bridges will include the installation of temporary construction framework including cofferdams, bulkheads, barge slips, fill, bollards, pile supported platforms and dolphins for the permanent installation of proposed bridge sections and the removal of the existing bridge materials. The footprints of both existing bridge abutments will be removed, dredged, and filled; the replacement bridge abutments will be landward of the existing conditions above MHW.

The Program's Aquatic Action Area encompasses the Cape Cod Canal, adjacent habitat—Buzzards Bay to the southwest, and Cape Cod Bay to the northeast—and the transit routes of Program vessels between the project site and necessary port locations throughout New England to account for potential extent of underwater noise disturbance, turbidity, and vessel traffic outside of the Canal. With respect to this EFH analysis, neither direct nor indirect impacts to EFH are expected to extend outside of the Cape Cod Canal; therefore, the Cape Cod Canal is the effective study area for this EFH assessment as presented in Figure 1. Canal shoreline and aquatic areas underneath and around both the Bourne and Sagamore bridges have been surveyed by the Program to characterize the substrates and delineate special aquatic sites, as presented in Figures 2a-2b, EFH Survey Areas. Refer to Section 3, Habitat Types for more detail.

Program Details:

Construction Methods

The replacement bridges will be constructed offline (outside of the existing footprint) and inboard of the existing highway bridges. The Sagamore Bridge will be replaced first, followed by the Bourne Bridge. At each bridge site, the most inboard span will be constructed first. For the Sagamore Bridge, this will be the western-most bridge, which will ultimately carry southbound traffic onto Cape Cod. For the Bourne Bridge, this will be the eastern-most bridge, which will ultimately carry northbound traffic off Cape Cod. After construction of the first new span, the existing bridge will be demolished, followed by construction of the second new span.

The piers of the new bridges will be constructed within and above the intertidal zone with delta frames that cantilever above the canal. The 600-foot main span arch of each new bridge will be floated in on barges and raised into place in one piece. Likewise, the main span arches of the existing bridges are expected to be lowered in one piece onto construction barges and floated out of the canal. Therefore, long-term in-water construction at both bridge locations will only occur along the shorelines. Short-term, temporary in-water construction associated with the float-in and float-out activities will occur within the navigation channel of the Cape Cod Canal. Barges used for the float-in and float-out activities will not be permitted to ground out and will not affect habitat within the Cape Cod Canal.

The Program is divided into four quadrants, each representing an area of active construction: Sagamore-North, Sagamore-South, Bourne-North, and Bourne-South (Figures 3a–3d). The construction elements depicted in these Figures are estimated locations and are subject to change as Program plans develop. In each quadrant, in-water construction will be conducted in multiple phases. Work will begin with the temporary installation of supportive or mitigative structures such as trestles, cofferdams, bulkheads, bollards, docks, and dolphins as well as shoreline riprap removal and dredging to prepare for barge use and construction of the first bridge. This will be followed by construction of the first bridge. After construction of the first bridge, the temporary works enabling demolition of the existing bridge will be installed; these are anticipated to include trestles, containment cells, dolphins, and other items similar to the temporary works for bridge construction. Demolition of the existing bridge and piers will occur once the enabling temporary works are in place. Following demolition, additional temporary works to support the construction of the second bridge will be installed; these will be similar in nature to those used for construction of the first bridge. Construction of the second bridge will occur once the temporary works

that enable it are in place. Lastly, removal of temporary structures, and restoration of intertidal and subtidal fill/riprap will conclude the in-water construction portion of the Cape Cod Bridges Program.

Table 1 presents the four Program quadrants with their respective Program footprint, defined as the limits of construction components' contact with benthic habitat. The Program footprint is identified in Figures 3a–3d as an approximate zone of marine disturbance, represented by a black polygon. Estimated square footages for the Program footprints' potential direct impacts to EFH were derived from CAD shapefiles provided by the Program engineering team.

Table 1. Potential direct impact zones of marine disturbance to EFH defined by in-water construction limits (Program Footprint) in each quadrant.†

Quadrant	Program Footprint (sq ft)
Sagamore-North	85,451
Sagamore-South	89,128
Bourne-North	80,094
Bourne-South	88,491
Total	343,164

The following sections provide a range of potential construction scenarios. MassDOT has evaluated these construction scenarios in consultation with a construction specialist. MassDOT expects to contract the Program as a Design Build, therefore, the Design-Build team could propose different construction means and methods. However, the EFH analysis has been developed using the most conservative estimates to apply to the impact assessment to the best of FHWA's knowledge. If alternative construction means and methods are proposed, they will be within the impact limits proposed herein.

Temporary Works

In preparation for bridge construction and demolition, MassDOT and FHWA propose to temporarily remove existing shoreline riprap to allow for installation of sheeting and piles that are needed for the temporary works. The temporary works within each quadrant may include cofferdams constructed of sheeting around the proposed new bridge pier locations; containment cells constructed of sheeting around the demolition zone of the existing bridge piers; sheeting along the approximate high tide line to create upland work areas; sheeting below the high tide line to create a bulkhead for contractor use; docks constructed of sheeting and fill for mooring construction barges; pipe pile-supported trestles to support construction and demolition of the new and existing bridge piers, respectively; and pile-supported dolphins to assist with construction vessel mooring. Pipe piles may be installed in key locations to support the cofferdams surrounding the existing and proposed bridge piers. The shoreline and bulkhead sheeting structures may be reinforced with tiebacks through the sheeting and into land. Riprap may be temporarily placed at the base of the construction trestles to protect them from scour during construction (Table 2).

In-water dredging may be required along the toes of the bulkheads and between the barge docks to provide sufficient draft for vessels to approach the bulkheads and moor at the docks. Dredging may be conducted using cutterhead suction dredges or clamshell excavation dredges. Temporary fill may be placed between the shoreline and bulkhead sheeting to create the bulkhead and within the dock sheeting to complete the docks (Table 2). The cofferdams for construction of the new bridge piers are expected to be to excavated in-the-wet prior to sealing. The cofferdams will subsequently be dewatered prior to pier construction. Water pumped from the cofferdams will be maintained in settling basins prior to being pumped back into the canal.

While it is anticipated that most temporary works will not be contained, depending upon the contractor's means and methods, some of the work could be contained within the same containment cell that is used for the existing bridge demolition, including the portion of the temporary trestle that overlaps with the

existing pier and some of the trestle supporting structure such as driven piles or columns resting on the remaining footings of the existing pier.

Table 2 provides conservative estimated impacts to benthic habitat based on volumes and sizes of the components described herein. The estimated square footage of benthic impacts presented in Table 2 are high-level rounded numbers which show general impact quantities per component and are provided for context on the relative potential temporary and permanent impacts of different Program components considered singly. They do not specifically correlate with the type of habitat they could impact. Additionally, the impacts presented in Table 2 are overlapping in space and are not mutually exclusive. Therefore, the impacts cannot be used to determine total benthic habitat impact; summation of the individual values would overestimate total benthic habitat impact. A more detailed approach to evaluating impacts to habitat types is presented in Table 5, which describes and quantifies the temporary and permanent square footages of benthic habitat impacts, and the net impacts after removal of the existing and temporary structures. Table 5 further dissects these quantities into impacts per substrate and benthic zones, based on the percent composition of habitats and substrate types that each mapped design element overlaps.

Table 2. Program Construction Components and Temporary and Permanent Impacts to Benthic Habitat[1, 2]

Construction Component	Element Type	Count or Volume per Quadrant	Count or Volume Program-Wide	Construction Method	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†
					Temporary		***Permanent***	
Piling								
Cofferdams 180’ x 100’ (for construction of new bridge piers) Cofferdams 120’ x 100’ (for demolition of existing bridge piers)	18” steel sheeting	750	3,000	Vibratory and impact pile driver	1,275	5,100	*0*	*0*
Existing pier footprint return to open water	Excavation	850 yd^3	3,400 yd^3	Removal of existing bridge piers			*-2,000*	*-8,000*
New bridge piers	8’ diameter drilled shafts	8 shafts per pier; 2 piers per quadrant	64 drilled shafts	Shaft drilling, obstruction excavation, rock socket drilling to 170’ depth (assumes 150’ in soil, 20’ in bedrock), concrete shaft cap in tidal zone	0	0	*3,844* (Sagamore North)* *4,032* (Sagamore South)* *2,294* (Bourne North)* *3,070* (Bourne South)*	*13,241**
Cofferdam Support Piles (bridge pier construction and demolition)	36” steel pipe piles	24	96	Impact pile driver	150	600	0	0
Shoreline stabilization (600’) sheeting	18” steel sheeting	400	1,600	Vibratory and impact pile driver	900	3,600	0	0
Bulkhead (600’) sheeting	18” steel sheeting	400	1,600	Vibratory and impact pile driver	900	3,600	0	0
Barge dock (80’ x 30’) sheeting	18” steel sheeting	250	1,000	Vibratory and impact pile driver	420	1,680	0	0

Construction Component	Element Type	Count or Volume per Quadrant	Count or Volume Program-Wide	Construction Method	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†	In-Water Impact per Quadrant (SF)†	In-Water Impact Program-Wide (SF)†
					Temporary		***Permanent***	
Construction trestles pipe pile	36” steel pipe piles	140	560	Impact pile driver	1,000	4,000	0	0
Mooring dolphins	36” steel pipe piles	54	216	Impact pile driver	400	1,600	0	0
Mooring dolphins pile templates	12” steel H-piles	300	1,200	Vibratory pile driver	150	600	0	0
Dredging and Fill								
Excavation within cofferdams	Dredge	14,000 yd^3	56,000 yd^3	Mechanical excavation	25,500	102,000	0	0
Excavation between Barge Docks	Dredge	1,000 yd^3	4,000 yd^3	Mechanical excavation	3,000	12,000	0	0
Excavation along bulkhead	Dredge	4,000 yd^3	16,000 yd^3	Mechanical or cutter suction dredge	20,000	80,000	0	0
Excavation surrounding sheeting and piles to allow torch-cutting removal	Dredge	4,500 yd^3	18,000 yd^3	Mechanical or cutter suction dredge	17,755	71,020	0	0
Existing shoreline riprap removal	Dredge	10,000 yd^3	40,000 yd^3	Mechanical excavation	24,000	96,000	0	0
Bulkhead fill	Fill	15,000 yd^3	60,000 yd^3	Mechanical placement	12,000	48,000	0	0
Barge dock fill	Fill	2,800 yd^3	11,200 yd^3	Mechanical placement	4,800	19,200	0	0
Construction trestle riprap placement	Fill	3,000 yd^3	12,000 yd^3	Mechanical placement	14,000	56,000	0	0
New bridge pier riprap	Fill	21,000 yd^3	84,000 yd^3	Mechanical placement	0	0	*24,000*	*96,000*

Notes:

[1]The impacts presented in this table are overlapping in space and are not mutually exclusive; therefore, summation of the individual values would overestimate total benthic habitat impact. They are provided for context on the relative potential temporary and permanent impacts of different Program components, considered singly. Refer to Table 5 for total temporary and net benthic habitat impacts.

[2] The construction components and methods incorporate a range of construction scenarios evaluated in consultation with a construction specialist. MassDOT expects to contract the Program as Design-Build; the Design-Build team could propose different construction means and methods.

† Impacts provided in this table are based on the anticipated construction work footprint estimated per conceptual/preliminary design.
* Per-quadrant square footages for the new bridge piers are provided for Sagamore-North, Sagamore-South, Bourne-North, and Bourne-South, respectively. Due to rounding error, the Program-Wide value does not match the sum of these individual quadrants.
Key:
SF = square feet
yd^3 = cubic yards

New Bridge Construction

Each quadrant will have two new permanent canal-side pier structures (eight piers total for the full Program) installed in the supratidal riprap (above the HTL), intertidal or subtidal zones of each bank. Each quadrant's new pier structures overlap habitat below the HTL by different amounts, introducing an estimated permanent impact total, below the HTL of 13,241 sq ft, Program-wide (Table 2). The foundations of each pier are envisioned to consist of eight drilled shafts with steel casings filled with reinforced concrete. Construction of the new bridge piers may be conducted from floating shoreline barges moored to the temporary dolphins, from land, or from a temporary trestle over the footing and cofferdam. All work on the pier foundations and footings will be contained within the temporary cofferdams. The steel delta frames atop the bridge piers will be erected on site using cranes on work trestles or cranes on land abutting the canal. Once the delta frames are ready to receive them, the main span bridge arches will be floated in and permanently installed over the canal using construction barges over the course of approximately three to five days per bridge. The float-in of the main span arches will require full closure of the Cape Cod Canal throughout the duration of the operation and cannot be halted or paused once commenced. After bridge construction is complete, riprap will be placed on the three waterward sides of the pier bases for protection.

Existing Bridge Demolition

The main spans of the existing bridges are envisioned to be cut and lowered onto barges, similar to the float-out process. The lowering and float-out process will occur over the course of approximately 3 to 5 days per bridge. The float out will require full closure of the Cape Cod Canal and cannot be halted or paused once commenced.

The existing two concrete pier columns in the intertidal and/or subtidal zones of each quadrant (eight columns program-wide) are envisioned to be enclosed by a containment cell and demolished into the containment cell. Demolition of the above-water portions of the existing bridge piers may entail cutting or hoe-ramming. Demolition of the bases of the existing concrete bridge piers may include saw-cutting, hoe-ramming, and excavation of the canal bottom to expose the pier base. Demolition will be controlled to minimize debris falling into the canal outside the containment cell. Some demolished materials may be lifted away by crane, and some may be reduced to rubble in the containment cell. Rubble is envisioned to be removed from the containment cell in the wet. The footprints of the existing piers will be allowed to recover to the surrounding canal bottom habitat. This will result in 8,000 sq ft of permanently reclaimed benthic habitat, Program wide (2,000 sq ft per quadrant).

Area Restoration

Upon completion of construction, all temporary support structures will be removed, and the areas will be restored to pre-construction conditions to the maximum extent practicable. The fill placed against the various temporary works will be excavated, and areas previously excavated will have fill returned to match the pre-construction contours. The temporary riprap at the base of the construction trestles will be removed. Pending review and confirmation from USACE, all temporary works will be removed or cut off 2-feet (0.6 m) below the mudline, including sheeting used to construct the cofferdams, barge docks, and bulkheads, and the pilings used to construct the mooring dolphins and support the cofferdams. Sheeting and pipe piles may be removed using a vibratory pile driver or by torch cutting below the mudline. Torch cutting the sheeting and pipe piling will require in-water excavation to reach below the mudline.

Once all temporary works are removed, the canal bottom will be dredged where necessary to prepare the areas for final riprap installation. Riprap will be replaced in areas where it was initially removed for the installation of the temporary works. In addition, the Program may include placement of riprap around the new piers for protection, and removal of riprap around the existing piers per restoration efforts. The contours of the proposed riprap are expected to generally match existing contours, except for local changes near the existing and proposed piers.

Construction Vessels and Barges

MassDOT estimates that the Program will require as many as four work barges and two delivery barges in each quadrant at any time during daily marine-based construction activities. Each work or delivery barge may require a dedicated tug. Up to four support launch vessels may also be required in each quadrant. Work barges are anticipated to be spud barges with six spuds per barge. Spudding will be used as an alternative method of stabilization if anchoring to installed dolphin or shoreline bollards is insufficient. The estimated number and sizes of the types of construction vessels required for day-to-day marine-based construction activities are provided in Table 3.

Table 3. Estimation of Vessels Employed in Day-to-Day Marine Operations for the Program[1]

Quantity Per Construction Quadrant	Description Program-wide at Any Time During Construction	Size (feet)
4	Work barges (6 spuds per barge)	40x80
2	Delivery barges	60x180
6	Tugs	65 to 105 length overall
4	Support launches	To be Determined
16	**Total vessels per Quadrant**	**40x80 and larger**

[1] This table does not include vessels required for main span arch float-in and float-out.

Additional vessels will be required for the float-in of replacement bridge main span arches over three to five days and the float-out for demolition of the existing bridge main span arches over three to five days (total of six float-in or float-out operations for the entire Program). These short-duration activities will require a different configuration of barges and support vessels from the day-to-day operations. While the specific size and number of vessels has not yet been determined, MassDOT estimates that each float-in or float-out operation will require two large barges in the canal, with an approximate size of 60 feet by 160 feet each. Up to six tugs of the sizes shown in Table 3 could be required to control the barges during float-in and float-out; up to eight support launches may also be used. Additional work barges of the type shown in Table 3 are expected to be required during float-in and float-out as well. The float-in and float-out operations are exclusive of day-to-day operations.

EFH Designated Species and Habitat:

According to the Omnibus Essential Fish Habitat Amendment 2 (NEFMC 2017), Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NOAA Fisheries 2017) and the online EFH Mapper (NOAA 2022), the New England Fisheries Management Council (NEFMC) and the Mid-Atlantic Fisheries Management Council (MAFMC) have designated EFH for 29 finfish and invertebrate species within the Cape Cod Canal. EFH Mapper data also designated two types of Habitat Area of Particular Concern (HAPC): Inshore Juvenile Cod HAPC and Summer Flounder HAPC.

In addition to EFH species, there are 16 NOAA Trust Resources recognized by the Fish and Wildlife Conservation Act (FWCA) with the potential to be present in the area and therefore exposed to Program impacts. This includes two areas with a total of approximately 2,445 sq ft of eelgrass (*Zostera marina*)—2,345 sq ft in the Bourne-North and 100 sq ft in the Bourne-South Program footprints, respectively. Each of the four quadrants also contains a portion of shellfish habitat between the existing pier and the riprap slope (mainly blue mussels and sporadic American oysters) attached to cobble and gravel substrate. Shellfish beds were qualitatively assessed as percentages of the intertidal in each quadrant, and therefore were not mapped. Attachment A provides the eelgrass habitat survey and figures. The presence of shellfish beds can be observed in the figures of Attachment A and Attachment B.

MassDOT and NOAA Consultation:
MassDOT consulted with NOAA Fisheries regarding the potential Program impacts associated with the designated EFH species, HAPC, and NOAA Trust species. Cooperating Agencies coordination for the Program began in June 2023, soon after FHWA agreed to be the lead Federal Agency for the Program in January 2023, as requested by MassDOT. Cooperating Agencies' meetings for the Program have been held on the following dates: June 14 and October 17, 2023; and March 29 and June 27, 2024. Species and habitat lists have been approved as having the potential to be in the Cape Cod Canal per email communication with Sabrina Pereira, Marine Habitat Resource Specialist with the Habitat and Ecosystem Services Division, on May 30, 2024. Per direction from Sabrina Pereira, the impacts to intertidal zones and submerged aquatic vegetation (SAV) exceed Programmatic Consultation requirements, therefore the Program will require an individual, abbreviated EFH Consultation (email communication, Sabrina Pereira to David Paulson, MassDOT, September 11, 2024).

On January 13, 2025, MassDOT submitted a draft EFH worksheet to NOAA Fisheries. Louis Chiarella, NOAA Fisheries' Assistant Regional Administrator for Habitat and Ecosystem Services, responded on February 12, 2025, recommending the Program adopt further conservation recommendations for the mitigation of impacts to EFH (specifically, adverse effects to eelgrass) in addition to the Program Best Management Practices (BMPs) which are outlined in Section 7.

Potential Impacts:
Due to the Program's in-water construction activities, potential impacts to EFH species, their habitat and prey species, include a combination of direct or indirect and temporary or permanent stressors to the surrounding environment. Stressors may include underwater noise, entrapment, changes in water quality/turbidity, benthic disturbance, reduction in fish passage, habitat conversion and vessel interaction. To mitigate and minimize impacts, MassDOT will implement measures such as time of year (TOY) restrictions, vessel traffic guidelines, and best management construction methods, such as the use of vibratory hammers in place of impact hammers where feasible, cofferdams, equipment soft starts, and cushion blocks. Due to the swift currents in the canal, turbidity curtains and bubble curtains were deemed infeasible. Analysis of these stressors and proposed mitigation measures can be found in Section 7 (Effects Evaluation) of this worksheet.

Anticipated Duration of In-Water Work including planned Start/End Dates and any seasonal restrictions proposed to be included in the schedule:
Construction activities for the Sagamore and Bourne replacement bridges are expected to occur over the course of eight to ten years, respectively, for each replacement bridge. Construction of the Sagamore Bridge will begin first, followed by the Bourne Bridge once funding is secured. It is currently planned that construction of the Bourne replacement bridge will commence one year following commencement of Sagamore replacement bridge construction. However, timing of construction sequencing is dependent upon funding. Construction in both the north and south quadrants at the respective bridge sites is anticipated to occur concurrently.

In-water construction activities with the potential to cause acoustic impacts for protected species entrapment/entrainment (i.e., vibratory or impact pile driving, or rotary drilling, and dredging) will only occur between September 1 and February 28 each year; this TOY restriction on in-water work has been identified in coordination with NOAA Fisheries to accommodate EFH spawning seasons and early life stages (in addition to ESA species presence in the Program's Aquatic Action Area). Construction support vessel operations and activities conducted in the dry (i.e., within dewatered cofferdams), or above HTL will occur any time of year. In-water temporary impacts, including noise and turbidity and increased vessel traffic associated with the Program, are described as follows.

The following estimated durations of Program elements are based on evaluations conducted in coordination with a construction specialist; durations may vary based on the Design-Build team's

construction means and methods or based on contract packaging. Construction of the in water temporary works, drilled shafts, and substructures at the canal delta piers will require approximately two years for each new span, totaling eight years for the whole Program, given that each new crossing will consist of two main spans. Construction of the delta frames using cranes on work trestles or cranes on land near the shoreline will require approximately one year for each of the four new main spans, totaling four years for the full Program. Four canal closures, each lasting approximately three to five days, will be required to allow float-in of the new bridge arches. Demolition of the existing bridge arch spans will require approximately nine months per bridge and demolition of the existing piers will require six months per bridge. Two canal closures, each lasting approximately three to five days, will be required to allow float-out of the existing deconstructed bridge arches.

Site Description

EFH includes the biological, chemical, and physical components of the habitat. This includes the substrate and associated biological resources (e.g., benthic organisms, submerged aquatic vegetation, shellfish beds, salt marsh wetlands), the water column, and prey species.

Is the project in designated EFH[2]? **Yes**

Is the project in designated HAPC? **Yes**

Does the project contain any Special Aquatic Sites[3]? **Yes**

Is this coordination under FWCA only? **No**

Total area of impact to EFH: 318,921 sq ft (Table 5)

Total area of impact to HAPC: 91,246 sq ft (Table 5)

Current range of water depths at MLW: The water depth at MLW ranges from 0 ft at the canal shoreline to a maximum depth of 32 ft in the maintained navigation channel. Notably, the HTL is different between the two bridge areas: Sagamore Bridge Program Area HTL is 5.4 ft-NAVD88 (mean sea level tidal range -4.11 ft Mean Low Water (MLW) to 3.79 ft MHW); Bourne Bridge Program Area HTL is 2.9 ft-NAVD88 (mean sea level tidal range -2.22 ft MLW to 2.07 ft MHW (NOAA 2003, NOAA 2004).

Salinity range (PPT): 30 ppt – 32.3 ppt (Jakuba 2020, Costa et al 2023)

Water temperature range (°F): Sagamore Bridge 37.0°F–69.6°F (US Harbors 2024, World Sea Temperature 2024a); Bourne Bridge 36.9°F–72.3°F (World Sea Temperature 2024b)

3. Habitat Types

In the table below, select the location and type(s) for each habitat your project overlaps. For each

[2] Use the tables in Sections 5 and 6 to list species within designated EFH or the type of designated HAPC present. See the worksheet instructions to find out where EFH and HAPC designations can be found.

[3] Special aquatic sites (SAS) are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. They include sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes (40 CFR Subpart E). If the project area contains SAS (i.e. sanctuaries and refuges, wetlands, mudflats, vegetated shallows/SAV, coral reefs, and/or riffle and pool complexes, describe the SAS, species or habitat present, and area of impact.

habitat type selected, indicate the total area of expected impacts, then what portion of the total is expected to be temporary (less than 12 months) and what portion is expected to be permanent (habitat conversion), and if the portion of temporary impacts will be actively restored to pre-construction conditions by the project proponent or not. A project may overlap with multiple habitat types.

As noted above, EFH Study Areas were surveyed in January and May 2024 to identify habitat types, substrate composition, and delineate SAV. Additionally, square footage of impacts has been calculated (see Figures 2a-2b). As presented in Table 5, total direct benthic habitat impacts were determined using a combination of qualitative habitat survey results from the January 2024 Stantec EFH Habitat survey, mapped eelgrass bed shapefiles (May 2024 Eelgrass Survey Report; Attachment A) and specific CAD-derived shapefiles of in-water activity components within each quadrant's Program footprint (Figure 3a-3d) to determine more specific construction impacts than those presented in Table 2. The construction elements depicted in Figures 3a-3d are estimated locations and are subject to change as Program plans develop, therefore impact quantities are also subject to change.

Based on field observations, habitat types were characterized as percentages of each quadrant's Program footprint and separated into intertidal zone (HTL-MLW) and subtidal zone (MLW to the canal-ward edge of the Program footprint). Table 4 presents the habitat types and percentages. Areas of overlap between Program components were removed from the analysis via GIS-based impact calculations to avoid double-counting impacts and to improve the accuracy of the evaluations for each habitat type in Table 5.

Table 4. Habitat types as percentages of available habitat in each quadrant's Program Footprint.

Bourne North	Habitat Type	Present at Site? (Y/N)	Approximate Percentage of Total Habitat
Intertidal	Silt/mud	No	0%
	Sand/shell	Yes	10%
	Cobble/gravel	Yes	85%
	Rock	No	0%
	Shellfish reef	Yes	5%
	SAV	No	0%
Subtidal	Silt/mud	Yes	10%
	Sand/shell	Yes	58%
	Cobble/gravel	Yes	26%
	Rock	No	0%
	Shellfish reef	No	0%
	SAV	Yes	6%

Bourne South	Habitat Type	Present at Site? (Y/N)	Approximate Percentage of Total Habitat
Intertidal	Silt/mud	No	0%
	Sand/shell	Yes	55%
	Cobble/gravel	Yes	40%
	Rock	No	0%
	Shellfish reef	Yes	5%
	SAV	No	0%
Subtidal	Silt/mud	No	0%
	Sand/shell	Yes	89.80%
	Cobble/gravel	No	10.00%
	Rock	No	0%
	Shellfish reef	No	0%
	SAV	Yes	0.20%

Sagamore North	Habitat Type	Present at Site? (Y/N)	Approximate Percentage of Total Habitat
Intertidal	Silt/mud	No	0%
	Sand/shell	Yes	50%
	Cobble/gravel	Yes	25%
	Rock	No	0%
	Shellfish reef	Yes	25%
	SAV	No	0%
Subtidal	Silt/mud	No	0%

Sagamore South	Habitat Type	Present at Site? (Y/N)	Approximate Percentage of Total Habitat
Intertidal	Silt/mud	Yes	20%
	Sand/shell	Yes	35%
	Cobble/gravel	Yes	30%
	Rock	No	0%
	Shellfish reef	Yes	15%
	SAV	No	0%
Subtidal	Silt/mud	Yes	10%

Habitat Type	Present at Site? (Y/N)	Approximate Percentage of Total Habitat
Sand/shell	Yes	70%
Cobble/gravel	Yes	30%
Rock	No	0%
Shellfish reef	No	0%
SAV	No	0%

Habitat Type	Present at Site? (Y/N)	Approximate Percentage of Total Habitat
Sand/shell	Yes	70%
Cobble/gravel	Yes	20%
Rock	No	0%
Shellfish reef	No	0%
SAV	No	0%

Excavation totals (provided in Table 2) were not mapped in CAD and therefore were added to benthic impact totals separately and divided among habitat type based on the percentages provided in Table 4. Only excavation impacts outside of other mapped elements were included (i.e., dredging between barge docks, bulkhead/sheeting toe removal, canal bottom profiling and trestle rip-rap placement and removal). However, these components may also overlap each other, leading to slightly higher values of habitat impact than what may actually occur; a conservative approach. For example, in this conservative approach, eelgrass impacts would be larger than the actual mapped available bed at Bourne-North (3,414 sq ft of impact; versus the actual mapped bed of 2,345 sq ft) and at Bourne-South (104 sq ft of impact; versus the actual mapped bed of 100 sq ft). This result suggests that most of the available eelgrass bed will be impacted within the Program footprint due to a combination of installation and removal of temporary support structures and surrounding excavation. However, there is potential for patches of indirectly impacted SAV to re-populate the directly impacted areas, restoring any adjacent scarring after support structures are removed.

All excavation impacts were proposed as temporary impacts and have been added to the totals presented in Table 5, accordingly. The total impacts presented in Table 5 do not account for barge spud impacts, as the potential placement of barge spuds is likely to overlap areas where other components will eventually be installed and/or the potential impact to be too small to be meaningfully measured.

Pending USACE review and confirmation, all temporary structures will be removed or cut off 2-feet (0.6 m) below the mudline after in-water work is complete, restoring most of the Program footprint to pre-existing conditions. Removal of support structures suggests that as part of the Program, the temporary impacts to habitat will also be actively restored to pre-existing conditions, such as restoring the canal contours, replacing riprap, and removing fill. It does not include natural restoration (e.g., introduction of native species or sediments, replanting SAV) or compensatory mitigation.

The Program's only permanent changes to habitat below the HTL will be the placement of the new bridge piers and the removal of existing piers. Removal of the existing bridge piers will restore approximately 8,000 square feet (0.2 acre) of habitat, reducing the net loss of land below the HTL, and resulting in 4,837 square feet (0.11 acres) of net permanent Program-wide benthic impact. In the subtidal zone, the footprints of the existing piers are larger than the footprints of the new piers, and therefore, there will be a net negative (sq ft) permanent impact to subtidal habitat. As a result, the subtidal habitat will be able to fully recover.

Table 5. Program-wide summary of impacts to each habitat type with respect to direct physical disturbance.[1]

Location	Habitat Location	Habitat Type	Impacts (ft^2) to Sagamore North	Impacts (ft^2) to Sagamore South	Impacts (ft^2) to Bourne North	Impacts (ft^2) to Bourne South	Total impacts (ft^2) Program wide	Total Temporary impacts (ft^2)	Net Permanent impacts (ft^2)	Restored to pre-existing conditions?
Intertidal	Salt	Silt/mud	0	3,898	0	0	3,898	3,500	398	Partially
	Salt	Sand/shell	9,317	9,295	2,011	10,596	31,218	27,267	3,951	Partially
	Salt	Cobble/gravel	5,961	5,847	17,951	7,164	36,923*	34,178	2,745	Partially
	Salt	Shellfish reef	5,026	3,283	530	522	9,362	9,242	120	Partially
	Salt	SAV	0	0	0	0	0	0	0	N/A
Subtidal	Salt	Silt/mud	0	5,895	5,595	0	11,490	11,499	-9	Yes
	Salt	Sand/shell	42,245	41,267	32,534	55,662	171,707	173,762	-2,055	Yes
	Salt	Cobble/gravel	18,105	11,791	14,714	6,196	50,806*	51,119	-313	Yes
	Salt	Shellfish reef	0	0	0	0	0	0	0	N/A
	Salt	SAV	0	0	3,414†	104†	3,517*†	3,517	0	Yes
TOTAL			80,653	81,276	76,749	80,243	318,921	314,084	4,837	Partially

[1] Totals do not account for barge spud impacts, as the potential placement of barge spuds is likely to overlap areas where other components will eventually be installed and/or the potential impact to be too small to be meaningfully measured.

†Eelgrass impacts sum to a figure greater than the square footage of the existing mapped eelgrass bed (2,45 sq ft) when dredge impacts are added. Dredge square footage estimates provided for the different dredging components may overlap, and therefore the impacts presented are overestimates. All temporary work will be removed from the area after completion of in-water work, and excavated areas will be restored to pre-existing condition allowing for the existing eelgrass beds to re-populate.

*Total HAPC impacts have been summarized to include all complex rocky habitat (Cobble/gravel) for juvenile Atlantic cod and SAV for juvenile Atlantic cod and summer flounder based on CAD-shapefile calcs. Total is n= 91,246 sq ft of direct benthic impact.

Submerged Aquatic Vegetation (SAV) Present? Yes

If the project area contains SAV, or has historically contained SAV, list SAV species and provide survey results including plans showing its location, years present and densities if available. Refer to Section 12 below to determine if local SAV mapping resources are available for your project area.

Neither Program area had been historically mapped or known to contain SAV, including by the Massachusetts Department of Environmental Protection Eelgrass Mapping Project (via the MassDEP Eelgrass Viewer, Massachusetts Department of Environmental Protection 2022). However, SAV was identified at the Bourne Bridge and delineated during surveys in preparation for this assessment. Refer to Figures 2a and 2b for the EFH Survey Area; and see also the attached Stantec Consulting Services Inc. (Stantec) 2024 Eelgrass Survey Report for details on location and density of existing eelgrass in the EFH Survey Area (Attachment A). No eelgrass was observed from the shoreline at the Sagamore Bridge; as a result, no drop camera surveys were conducted in Sagamore South or Sagamore North.

Sediment Characteristics:

The level of detail required is dependent on your project – e.g., a grain size analysis may be necessary for dredging. In addition, if the project area contains rocky/hard bottom habitat [6](pebble, cobble, boulder, bedrock outcrop/ledge) identified as Rocky (coral/rock), Substrate (cobble/gravel), or Substrate (rock) above, describe the composition of the habitat using the following table.

Table 6 presents grain size analysis per quadrant based on visual qualitative observation of sediment characteristics conducted on January 9, 2024. Grain sizes are based on Wentworth grain size classification scale for granules, pebbles, cobbles, and boulders. Note that the riprap was considered cobble. Most are small (less than 10 inches across). Rock was considered bedrock, or boulder (rock greater than 10 inches across) based on the Wentworth scale for the purpose of this analysis. The sparse presence of larger boulder was determined to be negligible.

Table 6. Grain Size Analysis per Quadrant Based on Visual Qualitative Observation of Sediment Characteristics on January 9th, 2024.

Bourne North	Substrate Type* (grain size)	Present at Site? (Y/N)	Approximate Percentage (%)	Bourne South	Substrate Type* (grain size)	Present at Site? (Y/N)	Approximate Percentage (%)
Intertidal	Silt/mud	No	0	Intertidal	Silt/mud	No	0
	Sand/shell	Yes	10		Sand/shell	Yes	60
	Cobble/gravel	Yes	90		Cobble/gravel	Yes	40
	Rock	No	0		Rock	No	0
Subtidal	Silt/mud	Yes	10	Subtidal	Silt/mud	No	0
	Sand/shell	Yes	60		Sand/shell	Yes	60
	Cobble/gravel	Yes	30		Cobble/gravel	No	40
	Rock**	No	0		Rock**	No	0

Sagamore North	Substrate Type* (grain size)	Present at Site? (Y/N)	Approximate Percentage (%)	Sagamore South	Substrate Type* (grain size)	Present at Site? (Y/N)	Approximate Percentage (%)
Intertidal	Silt/mud	No	0	Intertidal	Silt/mud	Yes	20
	Sand/shell	Yes	60		Sand/shell	Yes	50
	Cobble/gravel	Yes	40		Cobble/gravel	Yes	30
	Rock	No	0		Rock	No	0
Subtidal	Silt/mud	No	0	Subtidal	Silt/mud	Yes	10
	Sand/shell	Yes	70		Sand/shell	Yes	70
	Cobble/gravel	Yes	30		Cobble/gravel	Yes	20
	Rock**	No	0		Rock**	No	0

*Grain sizes are based on Wentworth grain size classification scale for granules, pebbles, cobbles, and boulders.
** The riprap was considered cobble. Most are small (<10inches across). Rock was considered bedrock, or boulder (rock >10 inches across) based on the Wentworth scale for the purpose of this analysis. The sparse presence of larger boulder was negligible.

If no grain size analysis has been conducted, please provide a general description of the composition of the sediment. If available, please attach images of the substrate.

Surficial qualitative visual survey results collected by Stantec on January 9, 2024, are presented in Table 6 (above). Stantec's results align with previous pre-dredge studies of high accumulation of nearshore coarse sandy sediment (20–40 ft patch) interspersed with pebble, gravel, and cobble at the Sagamore-North quadrant between the riprap slope and the existing bridge piers. Subtidal sediments were similarly coarse sand interspersed with gravel and cobble. The Sagamore-South quadrant had the greatest percentages of fine sediment (fine-sand and silt) accumulation in the intertidal zone among all four sites, however, the majority of the subtidal sediment was coarse sand. The full extent of intertidal zone between the riprap slope and the existing piers was fine and coarse sand surrounding and/or covering riprap cobble, and pier bases. The subtidal zone also included some cobble.

Bourne North and Bourne South quadrant sediments have not previously been documented in detail, and significant shoaling has not been reported in these areas. The Stantec qualitative survey reported sediment accumulation between bridge piers on both banks beginning at the base of the riprap slopes. This is most likely due to the piers providing lee from flow, followed by deep scouring at the channel side of the piers. Similarly to the eastern end of the canal, few fine sediments were observed at either bank surrounding the Bourne Bridge except around eelgrass beds adjacent to the western bank of the Bourne-North piers. The Bourne-North intertidal zone was almost entirely cobble, with sand filling the spaces in between, while the subtidal zone was silty-sand, coarse sand, and cobble. The Bourne-South intertidal zone was composed of gravelly-sand, cobble extending to the pier, and marine shell hash. Deep scours in the subtidal zone were observed between piles of cobble and the piers, consisting of coarse-sand and shell hash. Additionally, there were patches of sand in the shallow subtidal zone, void of other grain sizes or organics, beneath outfalls roughly 30 ft west of both Bourne-North and Bourne-South existing piers. Attachment A includes representative photos of sediment distribution at each of the four quadrants.

4. EFH and HAPC Designations

Diadromous Fish (migratory or spawning habitat- identify species under Section 10 below): Yes (Table 7)

Within the Greater Atlantic Region, EFH has been designated by the New England, Mid-Atlantic,

and South Atlantic Fisheries Management Councils and NOAA Fisheries. Use the EFH mapper to determine if EFH may be present in the project area and enter all species and life stages that have designated EFH. Optionally, you may review the EFH text descriptions linked to each species in the EFH mapper and use them to determine if the described habitat is present at your project site. If the habitat characteristics described in the text descriptions do not exist at your site, you may be able to exclude some species or life stages from additional consideration. For example, the water depths at your site are shallower that those described in the text description for a particular species or life stage. We recommend this for larger projects to help you determine what your impacts are.

Table 7. Designated EFH for the Program.

Species Present	EFH is designated/mapped for: Mid-Atlantic – Bridge footprints of the Sagamore and Bourne Bridges in the Cape Cod Canal, Massachusetts			
	EFH: eggs	EFH: larvae	EFH: juvenile	EFH: adults/spawning adults
American Plaice	✓	✓	✓	✓
Albacore Tuna†			✓	
Atlantic Butterfish	✓	✓		✓
Atlantic Cod^	✓	✓	*✓	✓
Atlantic Herring		✓	✓	✓
Atlantic Mackerel†	✓	✓	✓	✓
Atlantic Surfclam			✓	✓
Atlantic Wolffish†	✓	✓	✓	✓
Atlantic Sea Scallop	✓	✓	✓	✓
Black Sea Bass	✓	✓	✓	✓
Bluefin Tuna†				✓
Bluefish			✓	✓
Little Skate			✓	✓
Longfin Inshore Squid	✓		✓	✓
Northern Shortfin Squid				✓
Ocean Pout	✓		✓	✓
Pollock		✓	✓	✓
Red Hake	✓	✓	✓	✓
Scup	✓	✓	✓	✓
Silver Hake	✓	✓		✓
Smoothhound Shark Complex (Atlantic Stock)	✓	✓	✓	✓
Spiny Dogfish				**✓
Summer Flounder		✓	✓	*✓
Thorny Skate			✓	
White Hake	✓	✓	✓	✓
Windowpane Flounder	✓	✓	✓	✓
Winter Flounder	✓	✓	✓	✓
Winter Skate			✓	✓
Yellowtail Flounder	✓	✓	✓	✓

† Species with habitat preferences outside of the Cape Cod Canal (offshore; NOAA Fisheries 1999b, NEFMC 2017, NOAA 2017)
^ Massachusetts Division of Marine Fisheries (MA DMF) states that Atlantic cod are not present in the Cape Cod Canal based on best professional judgement (Evans et al. 2015).
* Species life stage has a HAPC in the area
**Sagamore Bridge has designated adult female and male, sub-adult female, whereas Bourne Bridge only has adult female designated
✓ Sagamore Bridge Program area
✓ Bourne Bridge Program area
✓ Program area of both bridges

5. Habitat Areas of Particular Concern (HAPCs)

HAPCs are subsets of EFH that are important for long-term productivity of federally managed species. HAPCs merit special consideration based their ecological function (current or historic), sensitivity to human- induced degradation, stresses from development, and/or rarity of the habitat. While many HAPC designations have geographic boundaries, there are also habitat specific HAPC designations for certain species, see note below. Use the EFH mapper to identify HAPCs within your project area.

☑	Summer flounder: SAV[4]	☐	Alvin & Atlantis Canyons
☐	Sandbar shark	☐	Baltimore Canyon
☐	Sand Tiger Shark (Delaware Bay)	☐	Bear Seamount
☐	Sand Tiger Shark (Plymouth-Duxbury-Kingston Bay)	☐	Heezen Canyon
☑	Inshore 20m Juvenile Cod[5]	☐	Hudson Canyon
☐	Great South Channel Juvenile Cod	☐	Hydrographer Canyon
☐	Northern Edge Juvenile Cod	☐	Jeffreys & Stellwagen
☐	Lydonia Canyon	☐	Lydonia, Gilbert & Oceanographer Canyons
☐	Norfolk Canyon (Mid-Atlantic)	☐	Norfolk Canyon (New England)
☐	Oceanographer Canyon	☐	Retriever Seamount
☐	Veatch Canyon (Mid-Atlantic)	☐	Toms, Middle Toms & Hendrickson Canyons
☐	Veatch Canyon (New England)	☐	Washington Canyon
☐	Cashes Ledge	☐	Wilmington Canyon
☐	Atlantic Salmon		

[4] Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native species have been eliminated from an area, then exotic species are included. Use local information to determine the locations of HAPC.

[5] The purpose of this HAPC is to recognize the importance of inshore areas to juvenile Atlantic cod. The coastal areas of the Gulf of Maine and Southern New England contain structurally complex rocky-bottom habitat that supports a wide variety of emergent epifauna and benthic invertebrates. Although this habitat type is not rare in the coastal Gulf of Maine, it provides two key ecological functions for juvenile cod: protection from predation, and readily available prey. See EFH mapper for links to text descriptions for HAPCs.

6. Activity Details

Select all that apply	Project Type/Category
	Agriculture
	Aquaculture - List species here:
☑	Bank/shoreline stabilization (e.g., living shoreline, groin, breakwater, bulkhead)
	Beach renourishment
☑	Dredging/excavation
	Energy development/use e.g., hydropower, oil and gas, pipeline, transmission line, tidal or wave power, wind
☑	Fill
	Forestry
☑	Infrastructure/transportation (e.g., culvert construction, bridge repair, highway, port, railroad)
	Intake/outfall
	Military (e.g., acoustic testing, training exercises)
	Mining (e.g., sand, gravel)
	Overboard dredged material placement
☑	Piers, ramps, floats, and other structures
	Restoration or fish/wildlife enhancement (e.g., fish passage, wetlands, mitigation bank/ILF creation)
	Survey (e.g., geotechnical, geophysical, habitat, fisheries)
	Water quality (e.g., storm water drainage, NPDES, TMDL, wastewater, sediment remediation)

7. Effects Evaluation

Select all that apply	Potential Stressors Caused by the Activity
✓	Underwater noise
✓	Water quality/turbidity/ contaminant release
✓	Vessel traffic/barge grounding
✓	Impingement/entrainment**
✓	Prevent fish passage/spawning
✓	Benthic community disturbance
✓	Impacts to prey species

Select all that apply and if temporary* or permanent		Habitat alterations caused by the activity
Temp	Perm	
		Water depth change
		Tidal flow change
✓		Fill
✓	✓	Habitat type conversion
		Other:
		Other:

* Temporary in this instance means during construction.

**Entrainment is the voluntary or involuntary movement of aquatic organisms from a water body into a surface diversion or through, under, or around screens and results in the loss of the organisms from the population. Impingement is the involuntary contact and entrapment of aquatic organisms on the surface of intake screens caused when the approach velocity exceeds the swimming capability of the organism.

Details - project impacts and mitigation

Briefly describe how the project would impact each of the habitat types selected above and the amount (i.e., acreage or sf) of each habitat impacted. Include temporary and permanent impact descriptions and direct and indirect impacts. For example, dredging has a direct impact on bottom sediments and associated benthic communities. The turbidity generated can result in a temporary impact to water quality which may have an indirect effect on some species and habitats such as winter flounder eggs, SAV or rocky habitats. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. Attach supplemental information if necessary.

The Cape Cod Canal is a 17.4-mile sea level canal in southeastern Massachusetts constructed in the early 1900s which is now managed by the USACE. It connects Cape Cod Bay to the northeast and Buzzard's Bay to the southwest and is part of the Atlantic Intracoastal Waterway. The canal is a highly dynamic area with strong tidal currents and shifting shoals that form in various locations throughout the canal (USACE 2015a). It is frequently trafficked by commercial and recreational vessels (approximately 15,000 vessels per year; USACE 2022). There are industrial and marine-related uses, commercial entities, and campgrounds along and adjacent to the Cape Cod Canal. There are high amounts of pedestrian and bicycle traffic on the Canal Service Roads, lending to additional anthropogenic sources of pollution. The canal receives routine maintenance dredging due to frequent sand depositional features (most recently in 2016 and 2023; USACE 2015a, USACE 2023). The canal banks slope dramatically towards the canal channel, which is maintained by the USACE at a minimum depth of 32 feet below MLW. General Cape Cod Canal habitat conditions include a tidal saline environment, mean low water reaching 32 feet, maximum flow velocity of 5.2 miles per hour and a canal width of approximately 480 feet (USACE 2016, USACE 2023, Anraku 1964). The Program footprints cover the shoreline, intertidal and shallow subtidal (5-20 ft depth) zones of the four quadrants; except for the limited duration float-in and float-out activities, no in-water work has been proposed to overlap the canal's navigation channel.

As described in Section 4, the intertidal zone is composed of a mix of complex hard substrate (riprap, coble/gravel, course sand/shell) gradually sloping into finer grain sediments in the subtidal zone; however, most sediments are coarse sand and gravel. The Cape Cod Canal is used as a permanent habitat for some prey species, sessile invertebrates, and for developing early life stages (see site photos in Attachment B). The vegetative eelgrass beds observed at Bourne-North and Bourne-South, and, to a lesser extent, the available algal communities on hard substrate observed adjacent to both the Bourne and Sagamore Bridge banks, have the potential to create nursery and foraging habitat for EFH fish and prey species, including juvenile inshore Atlantic cod and summer flounder, both of which have designated HAPC in the Cape Cod Canal (NEFMC 2017, NOAA 2022). Similarly, scattered hard complex habitat provides two key ecological functions for juvenile life stages: protection from predation, and collection of readily available prey. The 29 EFH species, and 16 NOAA Trust resources, including 2,445 sq ft of eelgrass beds, may experience varying degrees of potential behavioral and/or physiological stress resulting from Program activities (see Sections 4 and 10 for species lists and Attachment A for the 2024 Eelgrass Survey Report). Disruption of designated HAPC for inshore juvenile Atlantic cod and summer flounder, such as eelgrass beds and hard substrates, as well as other sensitive habitats (shellfish beds), may indirectly impact EFH species and their prey until these habitats have had time to recover, post-construction. Among the species designated, four species with preferences for offshore habitat (i.e., Albacore tuna, Atlantic mackerel, Atlantic wolfish, and bluefin tuna) have low likelihood to be in the Cape Cod Canal (NOAA Fisheries 1999b, NEFMC 2017, NOAA 1999c, NOAA 2017). Additionally, Atlantic cod are not likely to be present based on Massachusetts Division of Marine Fisheries *Technical Report 47* (Evans et al. 2015), despite the designated mapped EFH habitat in the Program area and potential presence in Cape Cod Bay and Buzzards Bay (NEFMC 2017). Therefore, these five species are not likely to be adversely affected by the Program.

In-water construction work is expected to occur intermittently over the course of six to eight years, including the construction of both the Sagamore and Bourne Bridges, during the months of September through February. Young life stages are also unlikely to temporally overlap active in-water work due to TOY restrictions (no pile driving or dredging from March 1 through August 30) except for Atlantic cod, pollock, and winter flounder, whose spawning seasons may overlap winter Program work (NOAA Fisheries 2024a, NOAA Fisheries 2024b, NOAA Fisheries 1999a). However, MA DMF states that Atlantic cod are not present in the Cape Cod Canal (Evans et al. 2015) and Atlantic cod typically spawn in offshore areas, as does pollock (NOAA Fisheries 2024a, NOAA Fisheries 2024b). Likewise, winter flounder spawn in inshore estuaries, which are markedly different habitat than that of the Cape Cod Canal. Therefore, it is highly unlikely that these species would spawn within the Cape Cod Canal during Program activities. Furthermore, the canal contains minimal suitable habitat for spawning or rearing juveniles due to the high velocity currents, reduced shelter, and sporadic patches of eel grass. Habitat outside the canal provides higher quality habitat and will not be affected by the Program activities. Although EFH and HAPC will experience minimal turbidity, and individuals may experience underwater acoustic effects, it is unlikely that spawning adults or early life stages will occupy the affected habitat for extended periods of time. Special measures for these species are not proposed, but proposed mitigation measures and the intermittent nature of the proposed in-water work will minimize effects to individuals migrating through the canal. The adverse effect on these winter-spawning EFH species is not expected to be substantial.

Underwater Noise

Vessel activity has the potential to create underwater noise. The Program has proposed use of 6 large barges and 10 smaller support vessels in a single quadrant at a given time. Vessel noise levels associated with each activity are expected to be relatively low as they will be stationary for most of the in-water construction and produce noise levels similar to current vessel traffic that the canal experiences regularly (over 15,000 vessels annually and 30-60 large transport vessels in a 24-hour period; USACE 2015a, USACE 2022, USACE 2023). Vessels will also be required to maintain speeds of 10 knots or less in the Canal during transit, further reducing the potential for injurious noise levels. Noise exposure from vessel transport is not expected to reach injurious levels for any life stage of fish. Even in the unlikely event that Program-related vessel traffic causes behavioral disturbance to species with designated EFH, the disturbance would be short-term and temporary due to the intermittent periods during the months of September through February of Program vessel activities and the transient nature of the fishes expected to occur in the Cape Cod Canal. Underwater noise from Program vessel activity is not expected to have an adverse effect on EFH.

Acoustic sources related to in-water construction may have an impact on species behavior. Stantec's acoustic analysis of underwater noise from the Program's proposed pile and sheeting installation and removal methods and materials is provided in Attachment C. Based on analysis, rotary drilling of 14-inch steel pipe piles (considered for dolphin piles and bollards) has the potential to create sound levels that may temporarily influence fish behavior within distances of 22.9 meters (m); likewise, vibratory installation or removal of 18-inch steel sheeting (for cofferdams, shoreline bulkheads, and barges) could exceed fish behavioral response thresholds within 46.4 m of the source location. Impact driving, as needed, for installation of the same 18-inch sheet piles could produce a zone of behavioral effects to fish extending up to 4,641.6 m. Concurrent vibratory or impact driving activities (during simultaneous activity in quadrants on opposing banks), noise impacts may also exceed behavioral thresholds levels within distances up to 73.6 m during the use of 18-inch steel sheet or up to 11,659.1 m during 36-inch steel pipe pile installation.

During impact driving, peak sound levels may also exceed those expected to cause physiological harm during both pile and sheeting installation at conservative distance estimates of less than 18.5 m and 15.8 m, respectively. Models of cumulative exposure to these impulsive noise sources have resulted in injurious levels of noise up to 1,000 m for driving one steel sheet at a time or 1,584.9 m during driving of one steel pipe pile. Concurrent driving activities may also lead to physiological injurious levels at 29.3 m from the

sound source at peak intervals and at 2,511.9 m cumulatively over the course of 12 hours during impulsive noise activity. However, these effects are only anticipated to be experienced if a fish remains within 1,000 m, 1,584.9 m or 2,511.9 m of sound exposure levels above their injury threshold for 12 or more hours. With the use of soft starts and ramp-ups prior to pile driving activity, this scenario is understood to be unrealistic given that the sound exposure would likely elicit a behavioral avoidance response before injury was sustained. Effects of physiological injury to surrounding EFH species or prey species, although unlikely, have the potential to temporarily occur at close distance.

However, the location of these activities lies within the intertidal and shallow subtidal zones in an already active anthropogenic area. Additionally, the curvature of the canal channel also has the potential to disrupt the sound propagation, reducing the impact of injurious noise. Bends within the Cape Cod Canal will truncate the distances underwater sound waves will travel from construction activities at the Sagamore and Bourne bridge sites. The larger thresholds, for example, during 36-inch steel pipe pile installation (11,659.1 m) could be truncated by approximately 70 percent due to Canal geography. Bends in the Cape Cod Canal will not truncate the maximum distances within which injurious peak SPLs will occur as a result of concurrent impact pile driving of 36-inch steel pipe piles (29.3 meters), nor the extent of underwater noise above behavioral thresholds as a result of concurrent vibratory pile driving of 18-inch steel sheet piles (73.6 meters), as the bends in the Canal are farther from the bridge sites than these respective distances. That said, the use of equipment soft starts may allow for sound impact avoidance at shorter impact thresholds.

In relation to avoidance, fish passage during fall migrations of some NOAA trust resources and EFH species may be temporarily impeded by underwater sound production, which could extend over 50 percent of the canal width (480 ft) during impact driving activities, particularly if quadrant activities are concurrent. To mitigate for the potential of behavioral (and physiological) adverse impacts, soft starts and ramp-up procedures will function as a warning for EFH species and NOAA trust species in the Cape Cod Canal and cushion blocks will be utilized for pile driving activities to minimize noise levels. Further, the use of the TOY (between September 1st and February 28th) work window avoids noise production during spawning adults, eggs, or larvae for most fish and invertebrate species. The proposed in-water activities will be temporary and intermittent during the in-water work period (from September 1 through February 28), allowing for ample time outside of structure installation or removal for fish to use the Cape Cod Canal without impedance of their migration or normal behavior. Underwater noise behavioral and physical impacts are not expected to substantially adversely affect EFH species. See Attachment C for more detailed information on underwater acoustic impacts.

Entrapment/Entrainment

Riprap removal, dredging, and cofferdam installation introduce the risk of entrapment or entrainment to less mobile prey species or EFH species by dredging equipment or within a cofferdam. Risk of entrapment/entrainment will be minimized by applying the TOY restriction that will limit all dredging and excavation activities associated with the Program to be conducted between September 1 and February 28. Entrapment could have a direct temporary impact on mobile species; however, this risk is highly unlikely since these species can avoid the area as dredge equipment will be slowly inserted into the water and as disturbance of the sheeting area is defined. Sessile organisms, in particular blue mussel, softshell clam, Northern quahog, razor clam, and the American oyster; or slow-moving species such as the horseshoe crab, American lobster, and bay scallop have a higher risk of entrapment, desiccation after dewatering or dredging, or smothering when fill is introduced. However, there is ample surrounding habitat for mobile or slow-moving species to migrate to, and dredge equipment speeds will be slow and cautious, per the USACE guidelines for *Engineering and Design, Dredging and Dredged Material Management* (USACE 2015b), resulting in an impact that is too small to be meaningfully measured. Prey and sessile resources are not expected to relocate during activity; however, re-colonization is predicted after disturbance due to ample adjacent shellfish communities throughout the Cape Cod Canal. Additionally, a fisheries biologist or PSO will be on-site during cofferdam construction and will complete

a snorkel/diver visual assessment to relocate any fish or less mobile species at risk of becoming entrapped before the cofferdam is closed. Therefore, entrapment is not expected to substantially adversely affect EFH.

Water Quality/Turbidity

Direct increases in turbidity and therefore indirect reduction in dissolved oxygen and light penetration in the Cape Cod Canal have the potential to occur during in-water work within the Program footprint. Dredging and excavation - using cutterhead suction dredges or clamshell excavation dredges to create appropriate drafts for construction vessels along the canal shorelines, excavating riprap along the canal shoreline, and pile driving and removal of different types of piles comprising the cofferdams, sheeting, bulkheads and dolphins used during construction - may influence fish behavior, produce sublethal physiological response in small juveniles, or smother sessile organism Program wide and eelgrass beds observed at Bourne North and South.

Dredging within a cofferdam, construction of the new pier foundations within containment cells, and demolition of the existing bridge pier foundations and footings within containment cells would minimize turbidity. Additionally, the total suspended solid (TSS) levels expected for mechanical clamshell dredging (up to 445.0 milligrams per liter [mg/L]) and pile driving/removal (5.0 to 10.0 mg/L; FHWA 2012) are below those shown to have adverse effect on fish (typically up to 1,000.0 mg/L; Burton 1993; Wilber and Clarke 2001). Any resultant turbidity or deterioration in oxygen levels due to TSS is also expected to be temporary and dissipate quickly due to the swift currents (up to 6 k nots) and heavy sediments (predominately sands and gravels, with 0.0 - 1.9 percent fines) in the Program footprint (USACE 2023). Even with the potential for two simultaneously active quadrants, based on USACE's previous dredging of Cape Cod Canal, suspended drifting sediments are only expected to remain in the canal for a short period of time and are not expected to reach further than 2,000 feet (610 meters) downriver or reach the adjacent bays (USACE 2015a, Burton 1993 as cited in NOAA Fisheries 2020).

Studies indicate that most fish species previously exposed to environments with a high degree of turbulence, for example, striped bass, have higher tolerance during events of higher TSS (ECORP 2009, Miller et al 2002). The Cape Cod Canal experiences both natural and anthropogenic sources of turbidity regularly, indicating a range (low to high) of turbidity within the canal (USACE 2015a). Natural sources of turbidity include runoff, storm events, tidal currents, erosion, and plankton blooms. Anthropogenic sources of turbidity include urban runoff, agricultural runoff, vessel traffic, wastewater discharges, and in-water construction (including dredging, pile installation/removal and vessel activity) (Clark and Wilber 2000 as cited in USACE 2015a).

Due to pre-existing turbidity stressors, the intermittent nature of proposed Program in-water work, the resulting TSS levels below harmful mg/L, use of USACE excavation best management practices (*Engineering and Design, Dredging and Dredged Material Management;* USACE 2015b), and proposed sediment containment measures (i.e., using cofferdams and settling basins during all proposed dewatering activities), Program activities causing turbidity are not expected to adversely affect EFH.

Benthic Disturbance/Habitat Conversion

Program wide direct temporary benthic disturbance and minimal permanent disturbance is anticipated within defined quadrant Program footprints (Table 1) due to the following Program components: temporary installation of trestles, shoreline cofferdams, bulkheads, bollards, barge docks, and dolphins which require pile or sheet installation; shoreline riprap removal and dredging to prepare for barge use and bridge installation/removal; placement of fill for support structures; potential barge spudding before anchoring; permanent installation of the two bridge piers at each crossing; removal of temporary support structures; and restoration of intertidal and subtidal zones through additional fill and/or riprap. Table 5 presents the square footage of direct (crushing, dislodging, removing) impacts of each habitat type found in the Program footprint due to the above components (with exception of barge spudding). Activity

impacts to the benthos will be restricted to specific pile, sheet, and dredge bucket size or fill placement.

In the intertidal zone of the Program footprint, an estimated 3,898 sq ft of silt/mud, 31,218 sq ft of sand/shell, 36,923 sq ft of cobble/gravel, and 9,362 sq ft of shellfish reef has the potential to be directly impacted Program wide; however, only 7,214 sq ft of intertidal habitat is expected to be permanently affected. In the Program footprints subtidal zone, an estimated 11,490 sq ft of silt/mud, 173,762 sq ft of sand/shell, 51,119 sq ft of cobble/gravel, and 3,517 sq ft of eelgrass bed has the potential to be directly impacted; however, the subtidal zone will have minor direct permanent impact as the removal of the existing piers offsets the introduction of new subtidal-pier placement, resulting in a net negative square footage impact total (n= -2,377 sq ft), exposing more benthic habitat than previously available for colonization. Permanent impacts are associated with the eight proposed bridge piers (four per bridge) which are partially below the high tide line, converting areas of existing soft substrate to hard concrete pile. Permanent impact also accounts for the restoration of canal bottom due to the removal of the existing bridge piers converting substrate from concrete pile to soft open habitat (net Program wide temporary impacts n=314,084 sq ft and permanent impacts where conversion of habitat may occur n=4,837 sq ft; Table 5).

The Program's resulting substrate disturbance is not expected to substantially adversely affect the surrounding EFH or prey species in the area, unless excavation overlaps the majority of existing eelgrass beds, due to the following reasons. Different invertebrate and fish species designated as EFH may experience different degrees of impacts depending on their general zonation preferences and their ability to relocate. Mobile fish are likely to temporarily vacate the area to adjacent habitat in the Cape Cod Canal, Buzzards Bay, or Cape Cod Bay. Sessile organisms are anticipated to recover and recolonize after direct impact areas have been restored or settle and develop on newly introduced hard structure. Additionally, the restored riprap slope and adjacent sediments are expected to fill in and settle into open space over time due to natural and anthropogenic processes as is present in today's canal landscape.

Since the Cape Cod Canal is a dynamic, high-energy environment exposed to regular dredging by the USACE for canal maintenance, wave action, storms and vessel activity, recovery of both soft and hard habitats is expected to be rapid. Recolonization of invertebrates, prey species and some SAV in or on soft substrates in similar environments has occurred as soon as one month after disturbance and full recovery is anticipated to be between one and three years (USACE 2013a, USACE 2013b, USACE 2017). Eelgrass, which grows in areas of reduced flow and soft sediments, has the potential to recover within one year of minor disturbance such as crushing, smothering, or shading (above-ground disturbance/shoot disturbance; Neckles et al 2005. Smith et al 2016). The installation of the existing pier's containment cell and the installation of trestle piles will temporarily lead to above-ground disturbance of 308 sq ft of the 2,345 sq ft eelgrass bed at Bourne-North. There is also potential for barge spudding to physically impact the eelgrass at Bourne-North or Bourne-South, however these locations are unknown to date. Recovery from these temporary activities will likely be short-term. In contrast, excavation within the mapped eelgrass beds would be considered disturbance of above- and below-ground biomass; literature indicates that recovery can take between 3 to 20 years depending on conditions and availability of surrounding undisturbed eelgrass biomass or seedbanks for sexual or asexual reproduction (Smith et al 2016, Neckles et al 2005, Canal-Verges et al 2014). Footprints of new pier installation and existing pier removal will not directly impact mapped eelgrass beds; however, dredging and riprap introduction/removal activities could result in a limited extent of long-term (decades) substantial effects to eelgrass. Of the total estimated temporary impacts shown in Table 5 (3,517 sq ft), the estimated sum of potential dredging, fill, and riprap areas that may overlay the existing mapped eelgrass beds is 3,209 sq ft. This total (3,209 sq ft) is an overestimation of long-term impacts to eelgrass, as these construction impacts overlap in space. The actual amount of impacted eelgrass would not exceed the area of mapped eelgrass present (2,445 sq ft per the May, 2024 Eelgrass Survey), which will be reconfirmed in a pre-construction eelgrass drop camera and/or underwater drone survey prior to commencement of Bourne Bridge construction.

Hard bottom habitats in the Cape Cod Canal, restricted to the intertidal and shallow subtidal zones, have an abundance of surrounding intertidal invertebrate communities, algal beds, mussel beds and complex hard substrate, lending to faster recovery rates of two to five years in shallow habitats relative to other environments (Lambert et al. 2014, Foster 1975; Konar and Foster 1992; Konar and Estes 2003, Konar 2007, Pacheco et al 2010). For example, moderate and sporadic intertidal shellfish beds (composed of blue mussels and American oyster) exist in each of the four quadrants along the lower intertidal zone. Bivalves, such as the blue mussel observed on the existing pile and riprap substrate, are expected to repopulate the new pier bases and replaced riprap. Footprints of new pier installation and existing pier removal will impact areas where blue mussel beds are the densest (in the lower intertidal zone between the existing pier and the riprap; 120 sq ft of permanent impact). Overlap of intertidal disturbance will have temporary direct physiological impact (crushing or removal) on at least 9,242 sq ft of shellfish bed (Table 5).

It is likely the entirety of the shellfish beds and mapped eelgrass beds within the Program footprints will also be exposed to indirect, temporary effects of disturbance from the installation and removal of in-water structures, including shading by trestle and barge platforms or sedimentation disturbance leading to smothering. Indirect impacts of smothering and shading on other sensitive habitats (algal colonies, shellfish beds and complex rocky habitat; Table 5) and sessile organisms may include burying, suffocation, or reducing the surrounding water temperature (lack of sun as a heat source). However, as previously cited, the affected algal and shellfish communities are documented to have rapid rates of recovery, especially in a dynamic canal environment with fast currents to remove sediment. An additional 2,004 sq ft of trestle platform will be suspended over the Bourn-North eelgrass beds for up to eight years, which could cause temporary shade impacts such as die-offs. That said, the nature of proposed in-water work is intermittent; shaded areas would likely receive some light penetration as the sun moves throughout each day; and the portion of disturbed beds or complex substrate would be minimal with respect to the overall habitat availability in the Cape Cod Canal.

In conclusion, direct temporary or permanent stressors to benthic habitat in the four quadrant Program footprints are not likely to substantially adversely affect EFH in the Cape Cod Canal unless a majority of the existing eelgrass beds are removed by excavation, potentially resulting in long-term adverse effect to HAPC, and there for EFH. Similarly, indirect impacts are not likely to have substantial temporary adverse effects to EFH.

What specific measures will be used to avoid and minimize impacts, including project design, turbidity controls, acoustic controls, and time of year restrictions? If impacts cannot be avoided or minimized, why not?

To address impacts to early life stages and eelgrass growing season, a TOY restriction has been proposed from March 1 through August 31 when no in-water construction activities causing potentially acoustic impacts or risk for marine species entrapment/entrainment (i.e., vibratory or impact pile driving, rotary drilling, and dredging) will occur; this TOY restriction will avoid most species' early life stage development and spawning seasons. The early life stages of three species whose spawning timeframes have the potential, yet low likelihood, to overlap winter work—Atlantic cod, pollock and winter flounder—may experience acoustic, entrapment/entrainment, turbidity, or benthic habitat impacts if larvae or eggs drift into or settle within the Program footprint from spawning grounds adjacent to the Cape Cod Canal. Mitigation for these species includes measures listed below to minimize effects to individuals, eggs, or larvae utilizing the canal corridor. Additionally, the Program's in-water activity is proposed to be intermittent across six to eight years, allowing for a greater possibility for spawning to occur outside of active construction time periods. As stated above, in-water construction activities causing potential acoustical disturbances or species entrapment/entrainment will only occur between September 1 and February 28 each year. Work can progress in the dry, within dewatered cofferdams, or above the HTL throughout the year with no restrictions.

To address stress due to noise, turbidity/water quality and benthic disturbance, the following measures will be employed: use of equipment ramp-ups or soft starts; use of cushion blocks; vibratory driving or rotary drilling when feasible to drive piles to refusal instead of impact driving; reduced size and number of piles and vessels to the maximum extent practicable; use of dolphins and bollards to anchor vessels rather than repetitive barge spudding; completion of shoreline work via shoreline cranes where possible; use of clamshell dredge buckets and USACE excavation BMPs per the *Engineering and Design, Dredging and Dredged Material Management* (USACE 2015b); maintenance of vessel speeds of 10 knots or less in the Canal during transit unless unsafe to do so; use of cofferdams around existing bridge pier removal and new bridge pier installation, shoreline sheeting and bulkhead; dewatering within cofferdams and the use of diver surveys to confirm cofferdams are clear before dewatering; maintenance of water pumped from the cofferdams in settling basins prior to being discharged into the canal; and capture and treatment of highway stormwater prior to discharge into the canal. Other sediment or noise containment methods are not technically feasible in the higher currents of the Cape Cod Canal.

The removal of the existing pier structures (8,000 sq ft) will facilitate the reclamation and restoration of the natural soft/granular habitat to the existing streambed conditions, per MassDOT streambed restoration specifications (Attachment D). All temporary support structures will be removed upon construction completion, leaving only the eight new bridge piers in place. Pending review and confirmation by the USACE, temporary support structures consisting of piles and sheeting will be cut off 2-feet (0.6 m) below the mudline.

Risk of entrapment/entrainment will be minimized by applying the TOY restriction that will limit all dredging and excavation activities associated with the Program to be conducted between September 1 and February 28, when fish occurrence of early life stages and migratory species activity are lowest. Furthermore, a fisheries biologist or PSO will be on-site during cofferdam construction and will complete a snorkel/diver visual assessment to observe for any fish at risk of becoming entrapped before the cofferdam is closed. Finally, slow bucket speeds have been proposed during dredging, riprap removal/replacement, and placement of fill.

Is compensatory mitigation proposed? Yes

If compensatory mitigation is not proposed, why not? If yes, describe plans for compensatory mitigation (e.g. permittee responsible, mitigation bank, in-lieu fee) and how this will offset impacts to EFH and other aquatic resources. Include a proposed compensatory mitigation and monitoring plan as applicable.

Per discussion with USACE on November 19th, 2024, regarding feasibility and approach to potential eelgrass mitigation efforts, MassDOT has committed to providing compensatory mitigation, if necessary, in addition to BMPs. Following the draft EFH review, NOAA Fisheries Assistant Regional Administrator for Habitat and Ecosystem Services, Louis Chiarella, provided conservation recommendations for eelgrass mitigation in the Bourne Bridge quadrants on February 12, 2025. Eelgrass mitigation planning does not apply to Sagamore Bridge permitting or development, as there has been no eelgrass observed from the shoreline in these quadrants.
MassDOT has committed to the following measures for avoiding, minimizing, and mitigating impacts to EFH, consistent with NOAA Fisheries' recommendations:

- The Program has proposed restoration of the Program footprint after in-water activity has concluded to the greatest extent practicable. However, a conservative approach is warranted, assuming the full extent of eelgrass mapped within the Bourne-North and Bourne-South Program footprints is expected to be impacted if still present upon construction commencement.

- Given the sensitive nature of eelgrass beds and the extended Bourne Bridge Program timeline, the presence or absence of eelgrass will be re-evaluated in the Bourne Bridge Program footprint closer to bridge construction commencement and/or when Program funding is secured for Bourne Bridge construction. Pre-construction photographic surveys will be completed, and surveys will be sent to alexa.cacacie@noaa.gov for review.

- An eelgrass mitigation and monitoring plan will be developed in coordination with USACE, to include post-construction eelgrass monitoring with photographic surveys and compensatory mitigation methods for an area equivalent to the total potential long-term impacts to eelgrass. Post-construction photographic survey results will be sent to alexa.cacacie@noaa.gov for review.

- The amount of eelgrass mitigation will not exceed the amount of mapped eelgrass, per the updated pre-construction survey.

- The preferred compensatory mitigation plan is for an In Lieu Fee payment directed to a Massachusetts eelgrass research project.

- A secondary mitigation option is transplanting the eelgrass present within the Bourne Bridge footprints (2,445 sq ft) to the next closest location with appropriate habitat or existing eelgrass (Buzzards Bay, Sagamore inlet or Town Neck Beach). If transplanting existing eelgrass is determined to be the best option, due to the USACE's requirements to maintain the canal and banks for navigation support, as well as the existing canal currents, eelgrass harvesting will be conducted via a shoreline excavator where possible. SCUBA divers will be utilized only where necessary with approval from USACE.

- Final mitigation will be determined in coordination with USACE and NOAA by the amount of eelgrass present, predicted success of regrowth or reestablishment, scale, timeline, and cost.

8. Effects of Climate Change

Effects of climate change should be included in the EFH assessment if the effects of climate change may amplify or exacerbate the adverse effects of the proposed action on EFH. Use the Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathways (RCP) 8.5/high greenhouse gas emission scenario (IPCC 2014), at a minimum, to evaluate the future effects of climate change on the proposed projections. For sea level rise effects, use the intermediate-high and extreme scenario projections as defined in Sweet et al. (2017). For more information on climate change effects to species and habitats relative to NMFS trust resources, see Guidance for Integrating Climate Change Information in Greater Atlantic Region Habitat Conservation Division Consultation Processes.

1. **Could species or habitats be adversely affected by the proposed action due to projected changes in the climate? If yes, please describe how:** No

2. **Is the expected lifespan of the action greater than 10 years? If yes, please describe project lifespan:** No, in-water activity is proposed to last a maximum of 8 years. New piers will be the only component of the Program that will be in the water longer than 10 years and are not expected to have substantial adverse effects on EFH.

3. **Is climate change currently affecting vulnerable species or habitats, and would the effects of a proposed action be amplified by climate change? If yes, please describe how:** No

4. **Do the results of the assessment indicate the effects of the action on habitats and species will**

be amplified by climate change? If yes, please describe how: No

5. **Can adaptive management strategies (AMS) be integrated into the action to avoid or minimize adverse effects of the proposed action as a result of climate?** No
If yes, please describe how:

9. Federal Agency Determination

Federal Action Agency's EFH determination (select one)	
	There is no adverse effect* on EFH or EFH is not designated at the project site. EFH Consultation is not required. This is a FWCA only request.
✓	The adverse effect* on EFH is not substantial. This means that the adverse effects are no more than minimal, temporary, or can be alleviated with minor project modifications or conservation recommendations. This is a request for an abbreviated EFH consultation.
	The adverse effect[7] on EFH is substantial. This is a request for an expanded EFH consultation. We will provide more detailed information, including an alternatives analysis and NEPA documents, if applicable.

*An adverse effect is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

10. Fish and Wildlife Coordination Act

Under the FWCA, federal agencies are required to consult with us if actions that the authorize, fund, or undertake will result in modifications to a natural stream or body of water. Federal agencies are required to consider the effects these modifications may have on fish and wildlife resources, as well as provide for the improvement of those resources. Under this authority, we consider the effects of actions on NOAA-trust resources, such as anadromous fish, shellfish, crustaceans, or their habitats, that are not managed under a federal fisheries management plan. Some examples of other NOAA-trust resources are listed below. Some of these species, including diadromous fishes, serve as prey for a number of federally-managed species and are therefore considered a component of EFH pursuant to the MSA. We will be considering the effects of your project on these species and their habitats as part of the EFH/FWCA consultation process and may make recommendations to avoid, minimize or offset and adverse effects concurrently with our EFH conservation recommendations. See Table 8.

Please contact our Greater Atlantic Regional Fisheries Office, Protected Resources Division regarding potential impacts to marine mammals or species listed under the Endangered Species Act and the appropriate consultation procedures.

Table 8. NOAA-trust resources designated as having overlapping habitat with the Program's Study Area.

Species known to occur at site	Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat).
American eel (*Anguilla rostrate*)	Species present in the Cape Cod Canal September to November and offshore in later winter (Jessop 2021, Chase 2018); no adverse impact anticipated due to localized area of Program activities.
American lobster (*Homarus americanus*)	Species present year-round (USACE 2015a); temporary impact to habitat in the Cape Cod Canal is likely due to proposed pile and cofferdam installation and dredging. Lobsters are expected to vacate the area when impacts begin and repopulate after activities have ceased and/or replaced natural dredge material. Program impacts to suitable lobster habitat are expected to be minimal compared to available habitat in the vicinity.
American oyster (*Crassostrea virginica*)	Species present year-round in intertidal and shallow subtidal portion of the Cape Cod Canal (Stantec January 2024 survey; Attachment B); oyster reefs were not observed and have not been previously documented in the Cape Cod Canal (Evans et al. 2015). Only temporary disturbance of existing sporadic individuals and rocky intertidal habitat is likely.
American shad (*Alosa sapidissima*)	Species determined to be not present in the Cape Cod Canal based upon best professional judgement of MA DMF (Evans et al. 2015).
Atlantic menhaden (*Brevoortia tyrannus*)	Species present the Cape Cod Canal in the summer (Collette and Klein-MacPhee 2002); no adverse impact anticipated due to TOY restrictions.
Bay scallop *(Argopecten irradians)*	Species could be present year-round in soft substrates or in eelgrass patches of the subtidal Cape Cod Canal, excluding the Sagamore end of the canal (Evans et al. 2015, NOAA Fisheries 2015). Limited temporary impact to habitat is anticipated in the Program footprint.
Blue mussels (*Mytilis edulis*)	Species present year-round in intertidal and shallow subtidal portion of the Cape Cod Canal (Evans et al. 2015); disturbance of existing mussel beds (shellfish reef) and temporary impact in areas where riprap and dredge material will be replaced is likely to occur. Permanent impact to habitat where existing piers are removed, and hard substrate is not replaced is also likely to occur.
Eelgrass (*Zostera marina*)	Species present in the Cape Cod Canal year-round, and more abundant in the growing season (spring and summer) (Northeast Regional Ocean Council 2024, USACE 2015a, USACE 2023). Confirmed presence under the Bourne Bridge (Stantec January 2024 survey). Temporary and long-term impact is anticipated in the Cape Cod Canal.
Hickory shad (*Alosa mediocris*)	Species present during summer and fall in the Cape Cod Canal and offshore (ASMFC 2018); however, no adverse impact is anticipated due to localized area of Program activities and TOY restrictions.
Horseshoe crab (*Limulus polyphemus*)	Species could be present May through August (Evans et al. 2015). Temporary impact to habitat in the Cape Cod Canal is likely due to proposed pile and cofferdam installation and dredging. In-water activities will not occur during Cape Cod spawning season (May-June). Habitat is expected to recover, and prey are expected to repopulate after activities have ceased and/or replaced natural dredge material. Program impacts to suitable horseshoe crab habitat are expected to be minimal compared to available habitat in the vicinity and TOY restrictions will prevent direct contact with horseshoe crabs.

Species known to occur at site	Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat).
Rainbow smelt (*Osmerus mordax*)	Species determined to be not present in the Cape Cod Canal based upon best professional judgement of MA DMF (Evans et al. 2015).
Razor clam (*Siliqua patula*)	Species has potential to be present year-round in the Program Study Area due to adjacent populations (MassGIS 2011), however limited razor clam habitat is present in the direct impact area since there is significant hard substrate in the intertidal zone. No impact anticipated due to lack of available habitat in the Program Study Area.
Alewife (*Alosa pseudoharengus*)	Species present in early spring through late fall in the Cape Cod Canal, passing through to reach a spawning run in Great Herring Pond. MA DMF does not recommend TOY restrictions for this species in the Cape Cod Canal (Evans et al. 2015). No adverse impact anticipated due to localized area of Program activities.
Blueback herring (*Alosa aestivalis*)	Species present in early spring through late fall in the Cape Cod Canal, passing through to reach a spawning run in Great Herring Pond. MA DMF does not recommend TOY restrictions for this species in the Cape Cod Canal (Evans et al. 2015). No adverse impact anticipated due to localized area of Program activities.
Softshell clam (*Mya arenaria*)	Species present in the intertidal and shallow subtidal portion of the Bourne Program Study Area. Limited soft-shell clam habitat present in vicinity since there is significant hard substrate in the intertidal zone and they prefer soft substrate. They are concentrated at the southern mouth of the Cape Cod Canal and are not present at the Sagamore end of the canal (Evans et al. 2015). Limited temporary impact to habitat is likely.
Northern quahog (*Mercenaria mercenaria*)	Species present in the intertidal and shallow subtidal portion of the Bourne Program Study Area year-round. Limited Northern quahog habitat present in vicinity since there is significant hard substrate in the intertidal zone and they prefer soft substrate. They are concentrated in a cove south of the Railroad Bridge and are not present at the Sagamore end of the canal (Evans et al. 2015). Limited temporary impact to habitat is likely.
Striped bass (*Morone saxatilis*)	Species could be present year-round, however are abundant in the spring in the Cape Cod Canal and offshore (Collette and Klein-MacPhee 2002); however, no adverse impact is anticipated due to localized area of Program activities.
White perch (*Morone americana)*	Species present late fall through early spring in the Cape Cod Canal and offshore (Evans et al. 2015); however, no adverse impact is anticipated due to localized area of Program activities.

11. Resources

Anraku, M. Influence of the Cape Cod Canal on the Hydrography and on the Copepods in Buzzards Bay and Cape Cod Bay, Massachusetts. I. Hydrography and Distribution of Copepods. Limnology and Oceanography, [s. l.], 9(1):46–60, 1964. Available at: https://research.ebsco.com/linkprocessor/plink?id=f7eebce7-c65a-39e3-b65d-2b2ee3547037. Accessed: June 6, 2024.

ASMFC. 2018. Hickory Shad Life History and Habitat Needs. . https://www.asmfc.org/uploads/file/568edf07HickoryShad.pdf. Accessed June 12, 2024.

Burton, W.H. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Versar, Inc., 9200 Rumsey Road, Columbia, Maryland 21045.

Canal-Verges P., M.R. Flindt, M.H. Holmer, J.K. Peterson. 2014. Reviewing the potential eelgrass impacts caused by mussel dredging. Danish Shellfish Centre, DTU Aqua. Syddansk University. pp. 1–18.

Chase, B. 2018. The Natural History of American Eel on Cape Cod. Slide deck developed by Massachusetts Division of Marine Fisheries, Waquoit Bay National Estuarine Research Reserve. Falmouth, MA. April 17, 2028. pp. 1–53.

Collette, B.B., and G. Klein-MacPhee (eds) 2002. Bigelow and Schroeder's fishes of the Gulf of Maine, 3rd edition. Smithsonian Institution Press. pp. 54 and 748.

Costa, A., C. Goodwin, C. Hudak, B. McKenna. 2023. Water Column Monitoring Results for Cape Cod.

ECORP. 2009. Literature Review (for studies conducted prior to 2008): Fish Behavior in Response to Dredging and Dredge Material Placement Activities. ECORP Consulting, Inc., Rocklin, CA. October 2009.

Evans, N.T., K.H. Ford, B.C. Chase, J.J. Sheppard. 2015. Recommended Time of Year Restrictions (TOYs) for Coastal Alteration Projects to Protect Marine Fisheries Resources in Massachusetts. Commonwealth of Massachusetts Executive Office of Energy and Environmental Affairs, Department of Fish and Game, Massachusetts Division of Marine Fisheries. April 2011. Revised January 2015. Available at: https://www.mass.gov/doc/time-of-year-recommendations-tr-47/download. Accessed December 30, 2024.

FHWA (Federal Highway Administration). 2012. Tappan Zee Hudson River Crossing Project. Final Environmental Impact Statement. August 2012.

Foster, MS. 1975. Algal succession in a *Macrocystis pyrifera* forest. Mar Biol 32:313–329.

Konar, B. and M.S. Foster. 1992. Distribution and recruitment of subtidal geniculate coralline algae. J Phycol 28:273–280.

Konar, B. and J.A. Estes. 2003. The stability of boundary regions between kelp beds and deforested areas. Ecology 84:174–185.

Konar, B. 2007. Recolonization of a high latitude hard-bottom nearshore community. Polar Biol (2007) 30:663–667. DOI 10.1007/s00300-007-0261-7 123.

Jakuba, R. 2020. Buzzards Bay Coalition Water Quality Monitoring in Upper Buzzards Bay: Summary of Four Years of Data Collection. September 2020. pp.1-16.

Jessop, B.M. 2021. Oceanic Water Temperatures Less Than 20º C May Partly Account for Bias in American Eel Elver Otolith Age Estimates. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science.

Lambert G.I., S. Jennings, M.J. Kaiser, T.W. Davies, J.G. Hiddink. 2014. Quantifying recovery rates and resilience of seabed habitats impacted by bottom fishing. pp. 1-35.

Massachusetts Department of Environmental Protection. 2022. MassDEP Eelgrass Viewer [Massachusetts Department of Environmental Protection Eelgrass Mapping Project Webviewer]. Available at: https://mass-eoeea.maps.arcgis.com/apps/webappviewer/index.html?id=07f8d48c714f4f81bec49864ecf252da. Accessed October 11, 2024.

MassGIS. 2011. Shellfish-suitability areas. MassGIS Data: Shellfish Suitability Areas Available at: https://www.mass.gov/info-details/massgis-data-shellfish-suitability-areas. Accessed June 12, 2024.

Miller, D., S. Poucher, L. Coiro. 2002. Determination of lethal dissolved oxygen levels for selected marine and estuarine fishes, crustaceans, and a bivalve. Marine Biology 140, 287–296.

Neckles, A.H., T. S. Frederick, B. Seth and S. K. Blaine. 2005. Disturbance of eelgrass *Zostera marina* by commercial mussel *Mytilus edulis* harvesting in Maine: dragging impacts and habitat recovery. Marine Ecology Progress Series, 285:57–73. Available at: https://www.int-res.com/abstracts/meps/v285/p57-73/. Accessed September 22, 2024.

New England Fishery Management Council (NEFMC). 2017. Omnibus essential fish habitat amendment 2. Volume 2: EFH and HAPC designation alternatives and environmental impacts. New England Fishery Management Council, Newburyport, and National Marine Fisheries Service, Gloucester, Massachusetts, USA. October 25.

NOAA. 2003. Tide and Currents. Datums for 8447173, Sagamore, Cape Cod Canal (Sta. 115) MA. Center for Operational Oceanographic Products and Services. Available at: https://tidesandcurrents.noaa.gov/datums.html?id=8447173. Accessed June 10, 2024.

NOAA. 2004. Tides and Current. Datums for 8447259, Bourne Bridge, Cape Cod Canal (Sta.320) MA. Center for Operational Oceanographic Products and Services. Available at: https://tidesandcurrents.noaa.gov/datums.html?id=8447259. Accessed June 10, 2024.

NOAA. 2022. Essential Fish Habitat Mapper: New England / Mid-Atlantic. https://www.habitat.noaa.gov/apps/efhmapper/ Accessed: June 11, 2024.

NOAA Fisheries 1999a. Essential Fish Habitat Source Document: Winter Flounder, *Pseudopleuronectes americanus*, Life History and Habitat Characteristics. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. September.

NOAA Fisheries. 1999b. Essential Fish Habitat Source Document: Atlantic Mackerel, *Scomber scombrus*, Life History and Habitat Characteristics . U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. September.

NOAA Fisheries. 2015. Bay Scallop Vulnerability Ranking. Available at: https://www.st.nmfs.noaa.gov/Assets/ecosystems/climate/images/species-results/pdfs/Bay_Scallop.pdf. Accessed August 6, 2024.

NOAA Fisheries. 2017. Final Amendment 10 to the 2006 consolidated Atlantic highly migratory species fishery management plan: Essential Fish Habitat and environmental assessment. Highly Migratory Species Management Division, Silver Spring, Maryland. 1 September.

NOAA Fisheries. 2020. Section 7 Effects Analysis: Turbidity in the Greater Atlantic Region. Available at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region. Accessed May 20, 2024.

NOAA Fisheries. 2023. Section 7 Effects Analysis: Turbidity in the Greater Atlantic Region. Guidance for action agencies on how to address turbidity in their Effects Analysis. GARFO (Greater Atlantic Regional Fisheries Office). Section 7 Effects Analysis: Turbidity in the Greater Atlantic Region | NOAA Fisheries Accessed June 14, 2024.

NOAA Fisheries. 2024a. *Atlantic cod*. Last updated 9/06/2024. Available at: https://www.fisheries.noaa.gov/species/atlantic-cod. Accessed October 5, 2024.

NOAA Fisheries. 2024b. *Atlantic pollock*. Last updated 9/06/2024. Available at: https://www.fisheries.noaa.gov/species/atlantic-pollock. Accessed October 5, 2024.

Northeast Regional Ocean Council . 2024. Eelgrass: Regional Map of Eelgrass. Eelgrass | Northeast Ocean Data Portal. Available at: https://www.northeastoceandata.org/. Accessed July 31, 2024.

Pacheco, A.S., J. Laudien, M. Thiel, M. Oliva, O. Heilmayer. 2010. Succession and seasonal onset of colonization in subtidal hard-bottom communities off northern Chile. Blackwell Verlag GmbH. Marine Ecology 32: 75–87.

Smith, T.M., P.H. York, P.I. Macreadie, M.J. Keough, D.J. Ross, C.D.H. Sherman. 2016. Recovery pathways from small-scale disturbance in a temperate Australian seagrass. Mar Ecol Prog Ser 542:97-108.

USACE. 2013a. Final Environmental Assessment and Finding of No Significant Impact. Portland Harbor Federal Navigation Project Maintenance Dredging in Fore River, Portland and South Portland, Maine. May 2103.

USACE. 2013b. New York and New Jersey Harbor Deepening Project, Benthic Recovery Monitoring Report. Contract areas: S-AN-2, S-AN-1b, S-E-1, and S-NB-1. Prepared for the United States Army Corps of Engineers – New York District. 41 pp.

USACE. 2015a. Final Environmental Assessment Finding of No Significant Impact and Section 404(B)(1) Evaluation: Cape Cod Canal and Town Neck Beach. Maintenance Dredging and Beneficial Use of Dredged Material for Beach Nourishment Sandwich, Massachusetts. p. 1-400.

USACE. 2015b. Engineering and Design, Dredging and Dredge Materials Management. Engineer Manual. Available at: https://www.publications.usace.army.mil/USACE-Publications/Engineer-Manuals/u43544q/6472656467/. Accessed October 8, 2024.

USACE. 2016. Cape Cod Canal Navigation and Recreation. New England District Website. Available at: https://www.nae.usace.army.mil/Media/Images/igphoto/2000724266/#:~:text=The%20Cape%20Cod%20Canal%20is,the%20ebb%20(westerly)%20tide.. Accessed June 7, 2024.

USACE. 2017. New York and New Jersey Harbor Deepening Project, Benthic Recovery Monitoring Report. Contract Areas: S-AK-2 and S-AK-3. Prepared for the United States Army Corps of Engineers – New York District. 37 pp.

USACE. 2022. Cape Cod Canal. Buzzards Bay and Sandwich, Massachusetts. Army Corp of Engineers. New England District Website. Available at: https://www.nae.usace.army.mil/missions/recreation/cape-cod-canal/. Accessed October 4, 2024.

USACE. 2023. Letter of Endangered Species Act (ESA) concurrence for the Cape Cod Canal Federal Navigation Project. p.1-28

US Harbors. 2024. Cape Cod Canal, East (Sandwich), MA Weather Forecast and Current Conditions. Available at: https://www.usharbors.com/harbor/massachusetts/cape-cod-canal-east-sandwich-ma/weather. Accessed June 6, 2024.

Wilber, D.H., and Clarke, D.G. 2001. Biological effects of suspended sediments: A review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. North American Journal of Fisheries Management 21(4):855-875.

World Sea Temperature Information. 2024a. Sandwich ocean water temperature today | MA, United States temp Available at: https://seatemperature.info/bourne-water-temperature.html. Accessed June 6, 2024.

World Sea Temperature Information. 2024b. Bourne ocean water temperature today | MA, United States temp Available at: https://seatemperature.info/bourne-water-temperature.html. Accessed June 6, 2024.

12. Useful Links

National Wetland Inventory Maps EPA's National Estuary Program (NEP)
Northeast Regional Ocean Council (NROC) Data Portal
Mid-Atlantic Regional Council on the Ocean (MARCO) Data Portal

Resources by State

Maine
Maine Office of GIS Data Catalog
Town shellfish information including shellfish conservation area maps State of Maine Shellfish Sanitation and Management
Eelgrass maps
Casco Bay Estuary Partnership Maine GIS Stream Habitat Viewer

New Hampshire
NH Statewide GIS Clearinghouse, NH GRANIT NH Coastal Viewer
State of NH Shellfish Program

Massachusetts
MA DMF Shellfish Sanitation and Management Program MassGIS Data (Including Eelgrass Maps)
MA DMF Recommended TOY Restrictions Document Massachusetts Bays National Estuary Program
Buzzards Bay National Estuary Program Massachusetts Division of Marine Fisheries Massachusetts Office of Coastal Zone Management

Rhode Island
RI Shellfish and Aquaculture RI Shellfish Management Plan RI Eelgrass Maps
Narragansett Bay Estuary Program
Rhode Island Division of Marine Fisheries
Rhode Island Coastal Resources Management Council

Connecticut
CT Bureau of Aquaculture Natural Shellfish Beds in CT Eelgrass Maps
Long Island Sound Study
CT GIS Resources
CT DEEP Office of Long Island Sound Programs and Fisheries CT River Watershed Council

New York
Eelgrass Report
Peconic Estuary Program NY/NJ Harbor Estuary Program New York GIS Clearinghouse

New Jersey
Submerged Aquatic Vegetation Mapping Barnegat Bay Partnership
NJ GeoWeb
NJ DEP Shellfish Maps

Pennsylvania
Delaware River Management Plan
PA DEP Coastal Resources Management Program PA DEP GIS Mapping Tools

Delaware
Partnership for the Delaware Estuary Center for Delaware Inland Bays Delaware FirstMap

Maryland
Submerged Aquatic Vegetation Mapping
MERLIN (Maryland's Environmental Resources and Land Information Network)
Maryland Coastal Atlas Maryland Coastal Bays Program

Virginia
VMRC Habitat Management Division
Submerged Aquatic Vegetation mapping

FIGURES

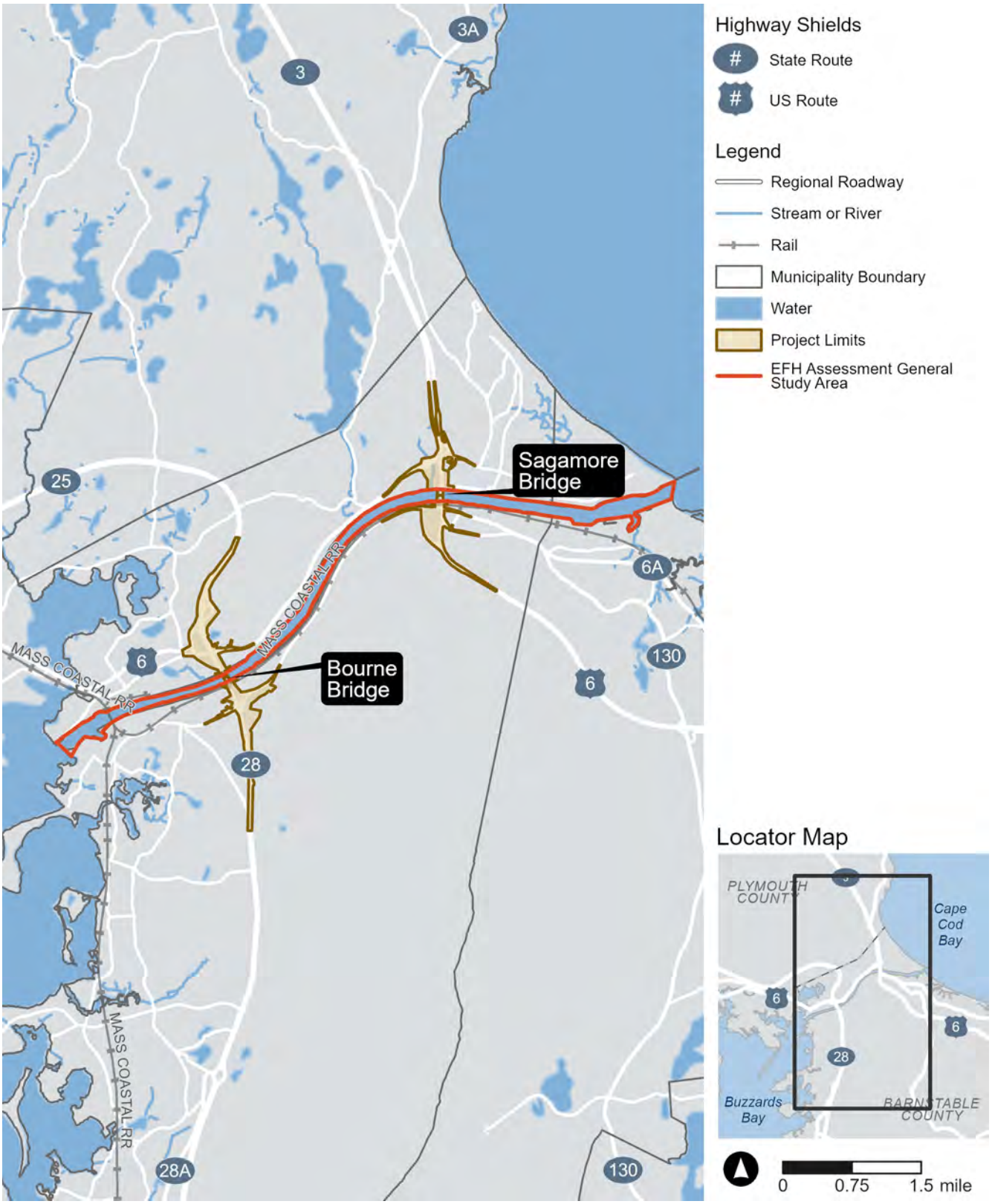


Figure 1. Essential Fish Habitat General Study Area

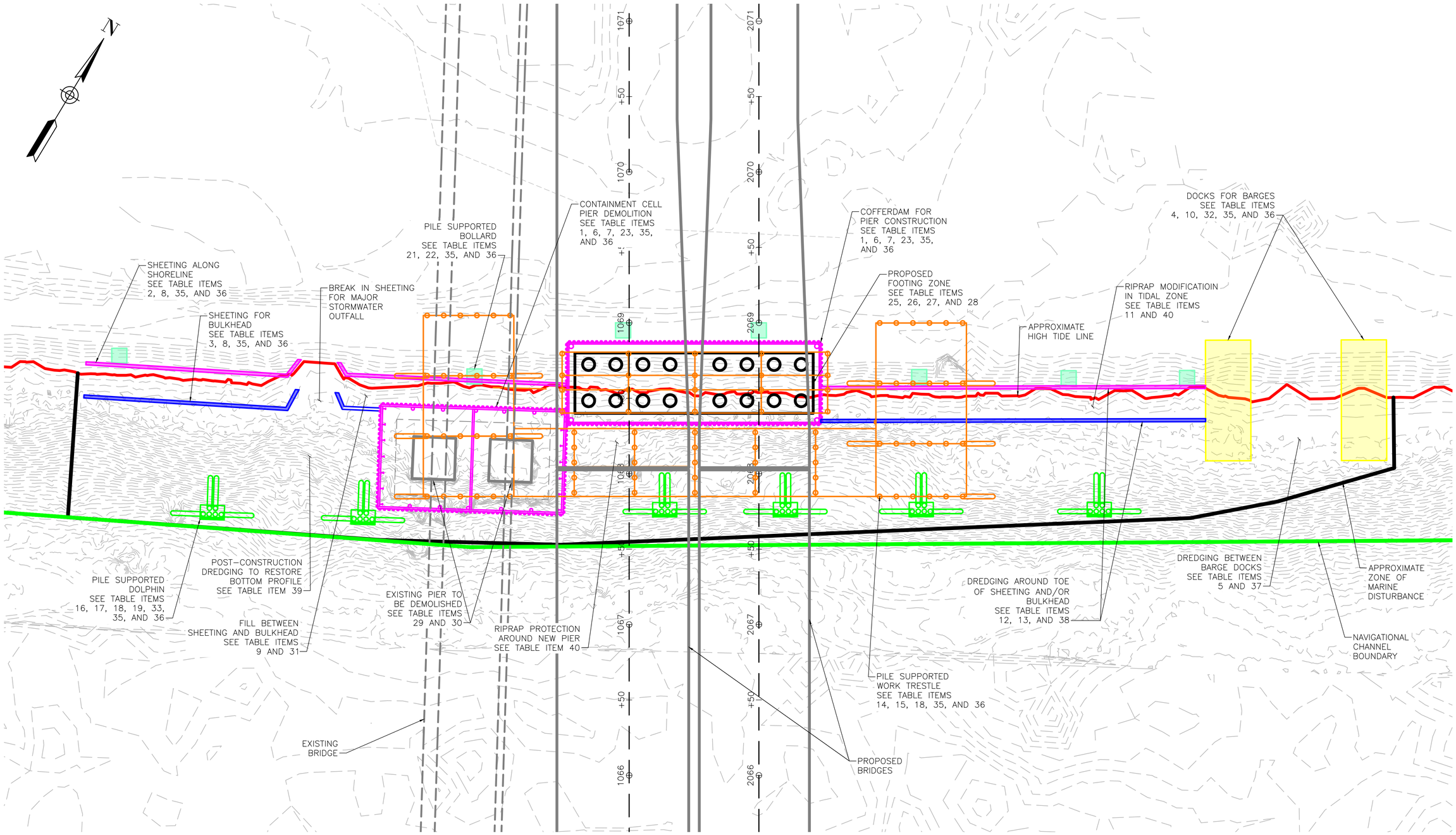


Figure 2a. Essential Fish Habitat Focus Survey Area for Bourne Bridge



Figure 2b. Essential Fish Habitat Focus Survey Area for Sagamore Bridge

PRE-DECISIONAL AND DELIBERATIVE



0 30 60 90 120

SCALE: 1" = 30'

CONCEPTUAL TEMPORARY WORKS PLAN
SCALE: 1" = 30' ELEVATION DATUM NAVD88, CONTOUR 1'

THE CAPE COD BRIDGES PROGRAM

BOURNE NORTH - CONCEPTUAL TEMPORARY WORKS PLAN

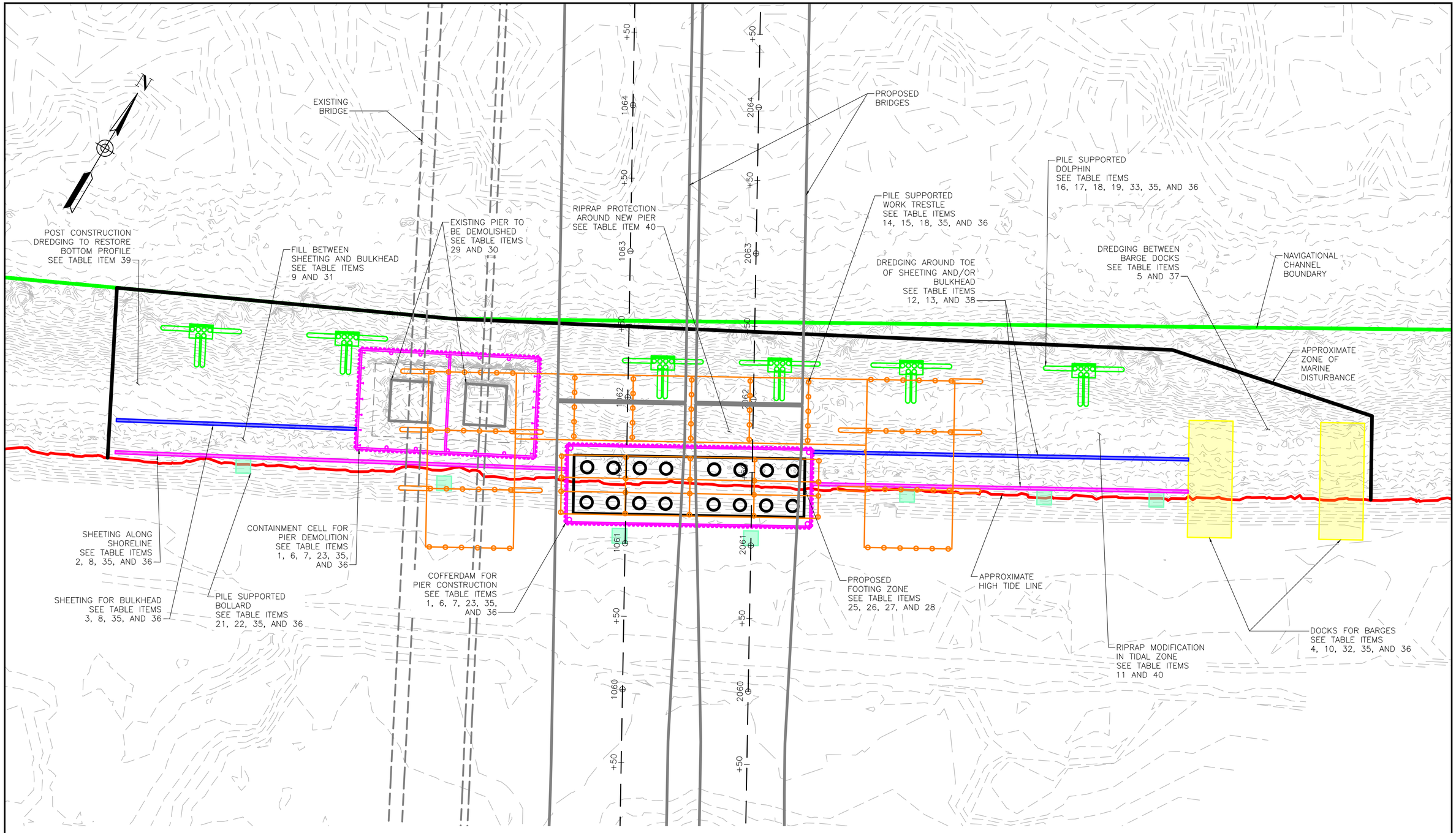
FOR ENVIRONMENTAL DISCUSSION

DRAFT
3a.

SCALE: 1" = 30'	HNTB	MassDOT Massachusetts Department of Transportation Highway Division	
DATE: 7/11/2024	DRAWN BY: PM	CHECKED BY: MTB	SHEET NO: MT-101

608020_BR(PERMIT_BORTEMPWORKS).DWG Plotted on 14-Aug-2024 8:37 AM

PRE-DECISIONAL AND DELIBERATIVE



0 30 60 90 120

SCALE: 1" = 30'

CONCEPTUAL TEMPORARY WORKS PLAN
SCALE: 1" = 30' ELEVATION DATUM NAVD88, CONTOUR 1'

608020_BR(PERMIT_BORTEMPWORKS).DWG Plotted on 14-Aug-2024 8:37 AM

THE CAPE COD BRIDGES PROGRAM

BOURNE SOUTH - CONCEPTUAL TEMPORARY WORKS PLAN

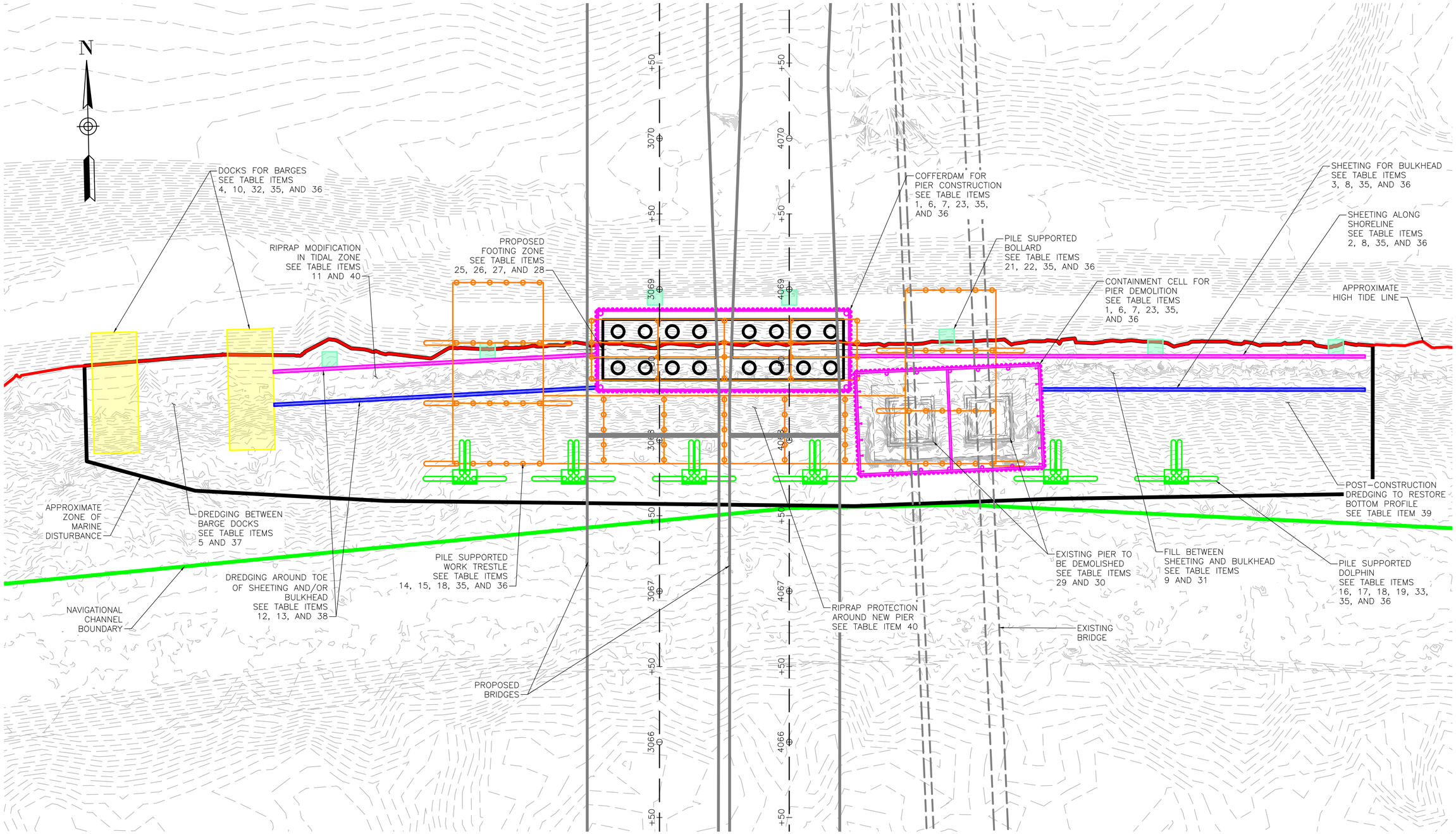
FOR ENVIRONMENTAL DISCUSSION

DRAFT

3b.

SCALE: 1" = 30'	HNTB		massDOT Highway Division
DATE: 7/11/2024	DRAWN BY: PM	CHECKED BY: MTB	SHEET NO: MT-301

608020_BR(PERMIT_SAGTEMPWORKS).DWG Plotted on 14-Aug-2024 8:37 AM



0 30 60 90 120

SCALE: 1" = 30'

CONCEPTUAL TEMPORARY WORKS PLAN
SCALE: 1" = 30' ELEVATION DATUM NAVD88, CONTOUR 1'

THE CAPE COD BRIDGES PROGRAM

SAGAMORE NORTH - CONCEPTUAL TEMPORARY WORKS PLAN

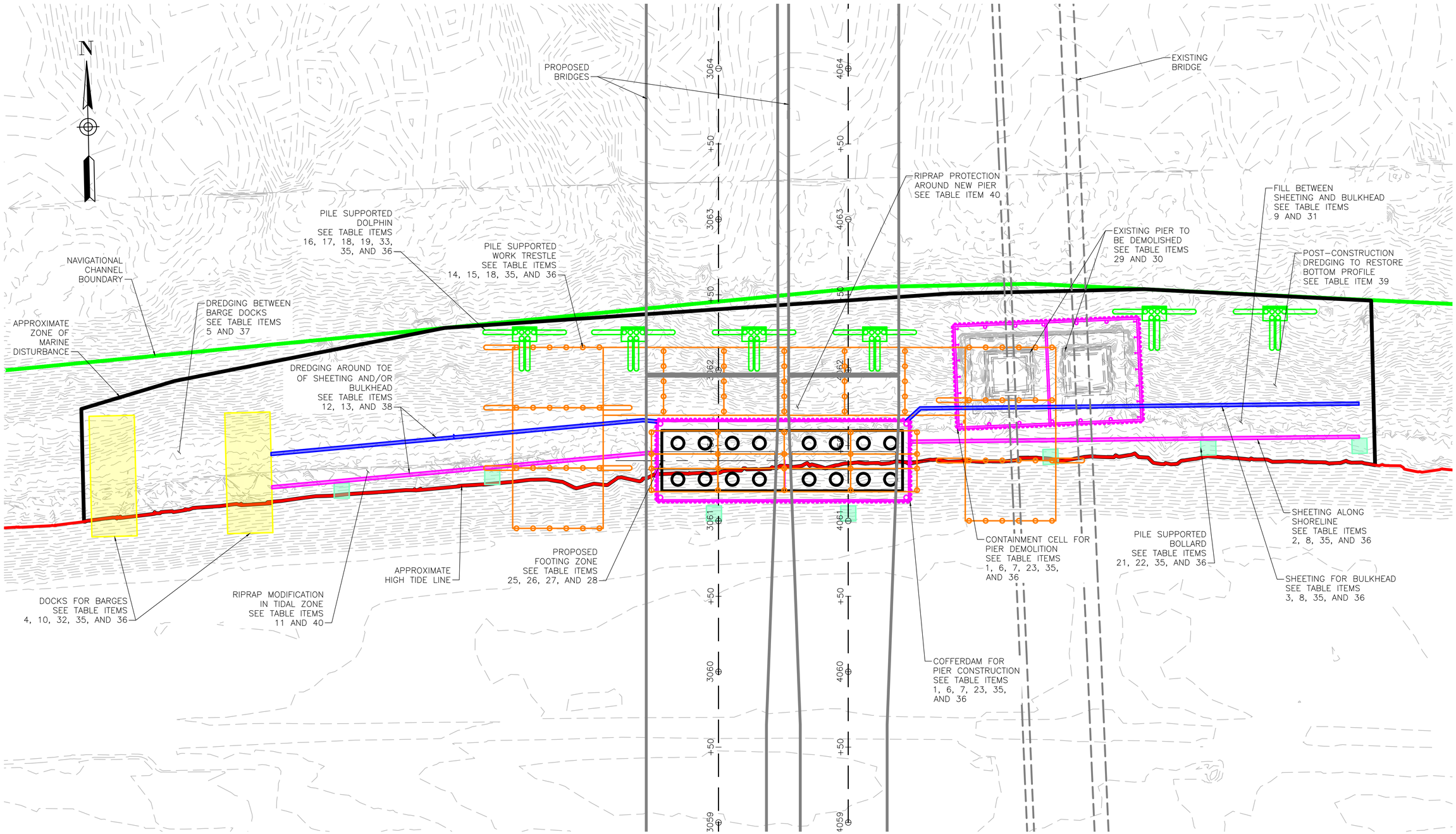
FOR ENVIRONMENTAL DISCUSSION

DRAFT

3c.

SCALE: 1" = 30'	HNTB		massDOT Massachusetts Department of Transportation Highway Division
DATE: 8/14/2024	DRAWN BY: PM	CHECKED BY: MTB	SHEET NO: MT-501

PRE-DECISIONAL AND DELIBERATIVE



0 30 60 90 120

SCALE: 1" = 30'

CONCEPTUAL TEMPORARY WORKS PLAN
SCALE: 1" = 30' ELEVATION DATUM NAVD88, CONTOUR 1'

608020_BR(PERMIT_SAGTEMPWORKS).DWG Plotted on 14-Aug-2024 8:37 AM

THE CAPE COD BRIDGES PROGRAM

SAGAMORE SOUTH - CONCEPTUAL TEMPORARY WORKS PLAN

FOR ENVIRONMENTAL DISCUSSION

DRAFT
3d.

SCALE: 1" = 30'	HNTB		massDOT Highway Division
DATE: 8/14/2024	DRAWN BY: PM	CHECKED BY: MTB	SHEET NO: MT-701

ATTACHMENT A: 2024 EELGRASS SURVEY REPORT





Cape Cod Bridges Program

Bourne, Massachusetts

Essential Fish Habitat Assessment
Eelgrass Survey Report

SUBMITTED TO:
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
Habitat and Ecosystem Services Division
55 Great Republic Drive
Gloucester, MA 01930

PROPONENT:
The Massachusetts Department of Transportation
Highway Division
10 Park Plaza
Boston, MA 02116

Submitted January 13, 2025

massDOT
Massachusetts Department of Transportation

Table of Contents

1 Purpose 1

2 Eelgrass Habitat 1

Figures

Figure 1. Eelgrass Survey Results Within the Bourne-North project Area – May 2024 3
Figure 2. Representative Moderately Dense Eelgrass Bed with Light Epiphyte Coverage at the Base of the Leaf Blades in Course Sandy Sediments 4
Figure 3. Portion of the Larger Eelgrass Bed 10 Feet from the Existing Bourne-North Pier 5
Figures 4. Drop Camera Screen-Shot Image Captured from the Top-Side Live Imaging Screen - Representative of a Dense Eelgrass Bed with Epiphyte Coverage Absent 5
Figure 5. Drop Camera Screen-Shot Images Captured from the Top-Side Live Imaging Screen – Representative of Moderately Dense Bed with Light Epiphyte Coverage 6
Figure 6. Eelgrass Survey Results Within the Bourne-South Project Area – May 2024 7

1 Purpose

Massachusetts Department of Transportation and the Federal Highway Administration is proposing the replacement and renovation of the Bourne and Sagamore approaches, bridges, and pedestrian river access way for the Cape Cod Bridges Program. The bridge replacement activity and new bridge piers are likely to have impact on the immediate benthic habitat and eelgrass beds. This memo presents the findings of the eelgrass habitat mapping survey conducted by Stantec on May 22, 2024, as part of the Essential Fish Habitat Assessment of the potential impacts associated with the Cape Cod Bridges Program's in-water actions. Presence or absence of submerged aquatic vegetation was initially investigated during a survey on January 9, 2024, from the shore or shallow subtidal which determined further investigation was necessary at the north and south piers of the Bourne Bridge (Bourne-North and Bourne-South, respectively).

2 Eelgrass Habitat

Observation of the presence of eelgrass at the Bourne-North during the January 9th shore-based survey prompted Stantec biologists to return to the Cape Cod Bridges Program Footprints on May 22, 2024, to further investigate the extent of the observed eelgrass beds at Bourne-North, and the potential habitat at Bourne-South. Given that the January 9th survey and previous investigations of Sagamore Bridge subtidal habitat did not report the potential presence of eelgrass, these areas were excluded from this secondary survey.

The survey area encompassed shoreline and subtidal areas within the photic zone (30 feet in depth) and within the Program limits of potential direct benthic disturbance as currently understood for the Bourne Bridge (approximately 350 feet on the outboard side of the existing bridge and 650 feet on the inboard side of the existing bridge, totaling 1,000 feet of shoreline and 100 feet perpendicular from the shore). Although eelgrass had a patchy distribution, where eelgrass was present within ≤2 meters of other nearby eelgrass was defined as a continuous eelgrass bed.

In addition to the boundary survey, Stantec recorded the following information:

1. General sediment type (e.g., silt, mud, sand, and shell);
2. Qualitative estimate of the percent cover of eelgrass within the project vicinity (e.g., barren, sparse [1–10% cover], low [11–25%], moderate [26–50%], and high [>50%]). This was done for each survey area as a whole and within individual eelgrass beds where percent cover is highly variable; and
3. Epiphyte coverage (i.e., absent, light, or heavy).

Eelgrass beds were mapped using an Aqua-Vu drop camera (model: VDT-M3-HD7D-V2) and GPS from a moving vessel. Results of both survey areas are described below.

Bourne-North survey area contained two separate eelgrass beds restricted to the subtidal area east of the existing pier, at depths of 3 feet to 20 feet, in mixed sediments of silty-sand and sporadic cobble (Figure 1). Both beds were of moderate to high density and exhibited absent-to-light epiphyte coverage of brown filamentous algae. Brown algae coverage was mostly restricted to the base of the leaf blade and eelgrass was majority healthy (Figure 2, 3, 4 and 5). The larger of the two eelgrass patches measured approximately 1,446 square feet and the smaller bed (farther east from the pier) measured approximately 899 square feet. The first eelgrass bed began roughly 10 feet from the eastern-most existing pier (outside of the sand scour) and extended to a maximum distance of approximately 100 ft from the pier (Figure 1). There were at least 150 feet between the two beds, the second of which terminated approximately 300 ft east of the existing pier (Figure 1).

Bourne-South survey area contained one small eelgrass patch (100 square feet) with low coverage, approximately 100 ft west of the existing pier (Figure 6). Epiphytic brown filamentous algal density was light and restricted to the base of the eelgrass stalks. There were also isolated eelgrass sprigs in low densities observed father out from the pier which were healthy and did not exhibit epiphyte coverage (Figure 6). Eelgrass in this subtidal area was growing among sandy-gravel and cobble, including shell hash and mixed leafy green and red algae.



Figure 1. Eelgrass Survey Results Within the Bourne-North Project Area – May 2024



Figure 2. Representative Moderately Dense Eelgrass Bed with Light Epiphyte Coverage at the Base of the Leaf Blades in Course Sandy Sediments



Note: Eelgrass is adjacent to algal beds and epiphyte coverage is absent.

Figure 3. Portion of the Larger Eelgrass Bed 10 Feet from the Existing Bourne-North Pier



Figure 4. Drop Camera Screen-Shot Image Captured from the Top-Side Live Imaging Screen - Representative of a Dense Eelgrass Bed with Epiphyte Coverage Absent



Figure 5. Drop Camera Screen-Shot Images Captured from the Top-Side Live Imaging Screen – Representative of Moderately Dense Bed with Light Epiphyte Coverage



Figure 6. Eelgrass Survey Results Within the Bourne-South Project Area – May 2024

Stantec anticipates 100 percent of the eelgrass habitat on the Bourne-North and Bourne-South project areas (approximately 2,345 square feet at Bourne-North and 100 SF at Bourne-South) to be temporarily, directly or indirectly impacted by the Cape Cod Bridges Program's in-water activities including the installation and removal of temporary support structures (shoreline, cofferdam and bulkhead sheeting, trestle piles, dolphins), dredging, shading, and barge interaction.

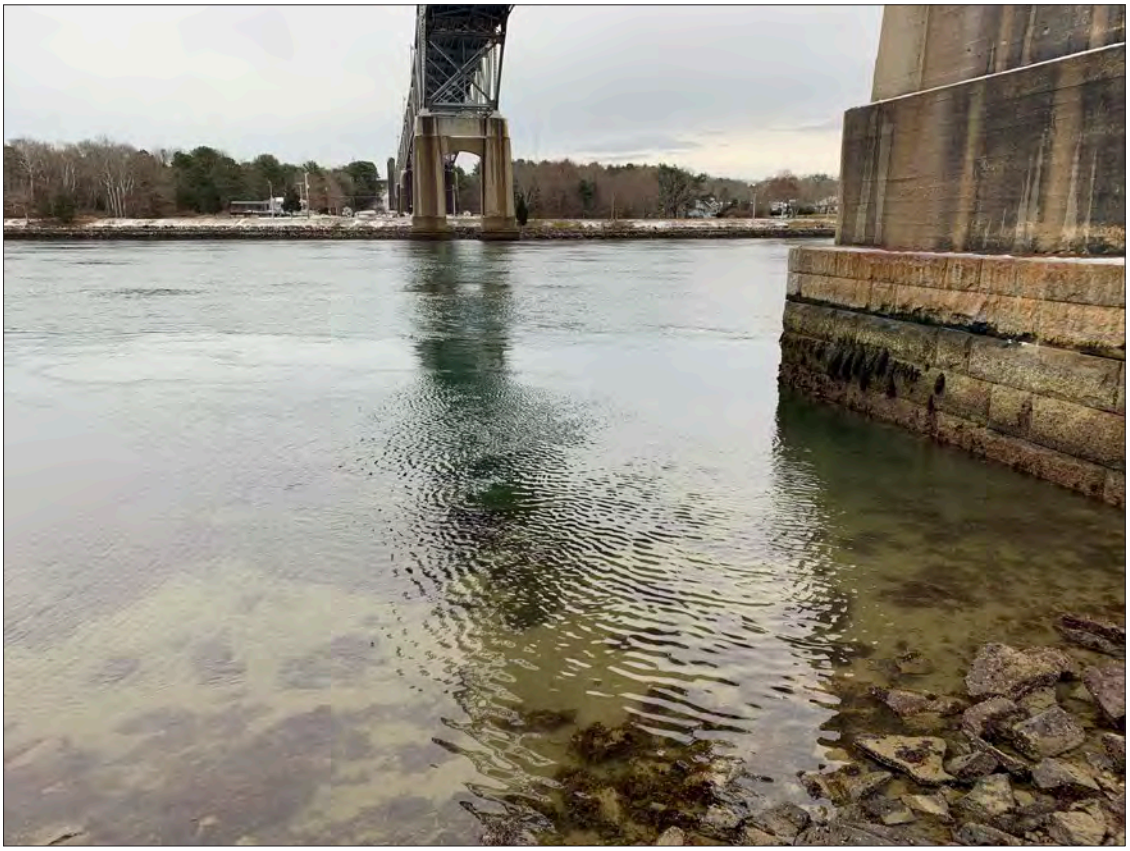
ATTACHMENT B: SITE PHOTOS



Bourne Bridge North. Taken January 9, 2024.



Bourne Bridge North. Taken January 9, 2024.



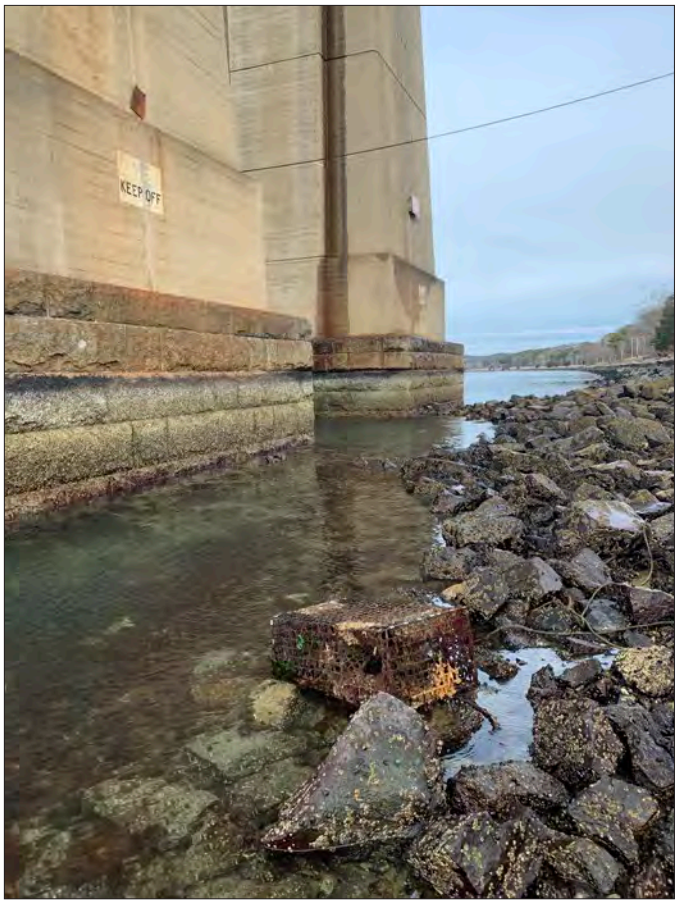
Bourne Bridge North. Taken January 9, 2024.



Bourne Bridge North. Taken January 9, 2024.



Bourne Bridge South. Taken January 9, 2024.



Bourne Bridge South. Taken January 9, 2024.



Bourne Bridge South. Taken January 9, 2024.



Bourne Bridge South. Taken January 9, 2024.



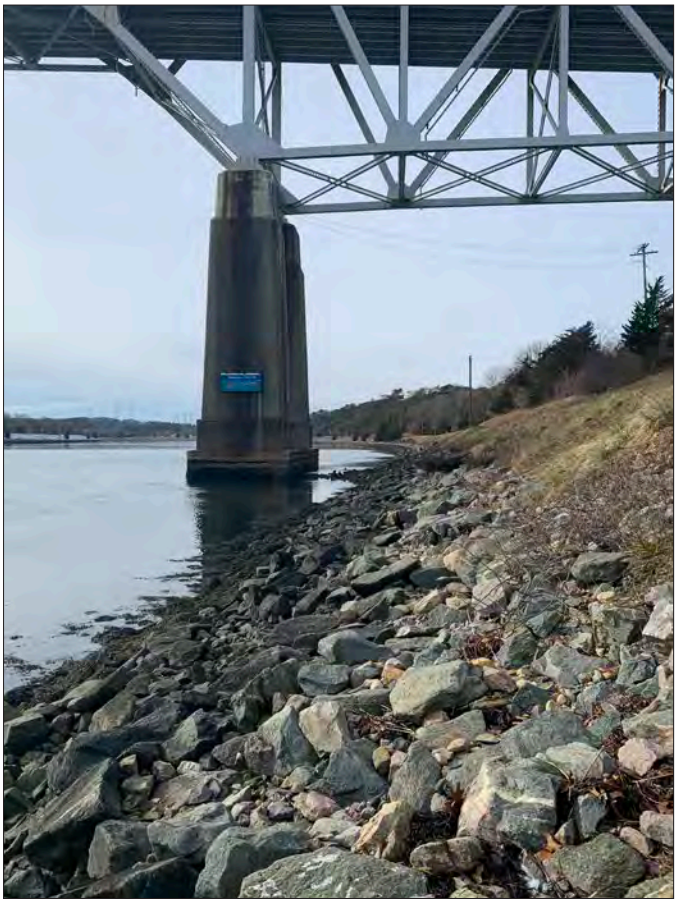
Bourne Bridge South. Taken January 9, 2024.



Bourne Bridge South. Taken January 9, 2024.



Bourne Bridge South. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



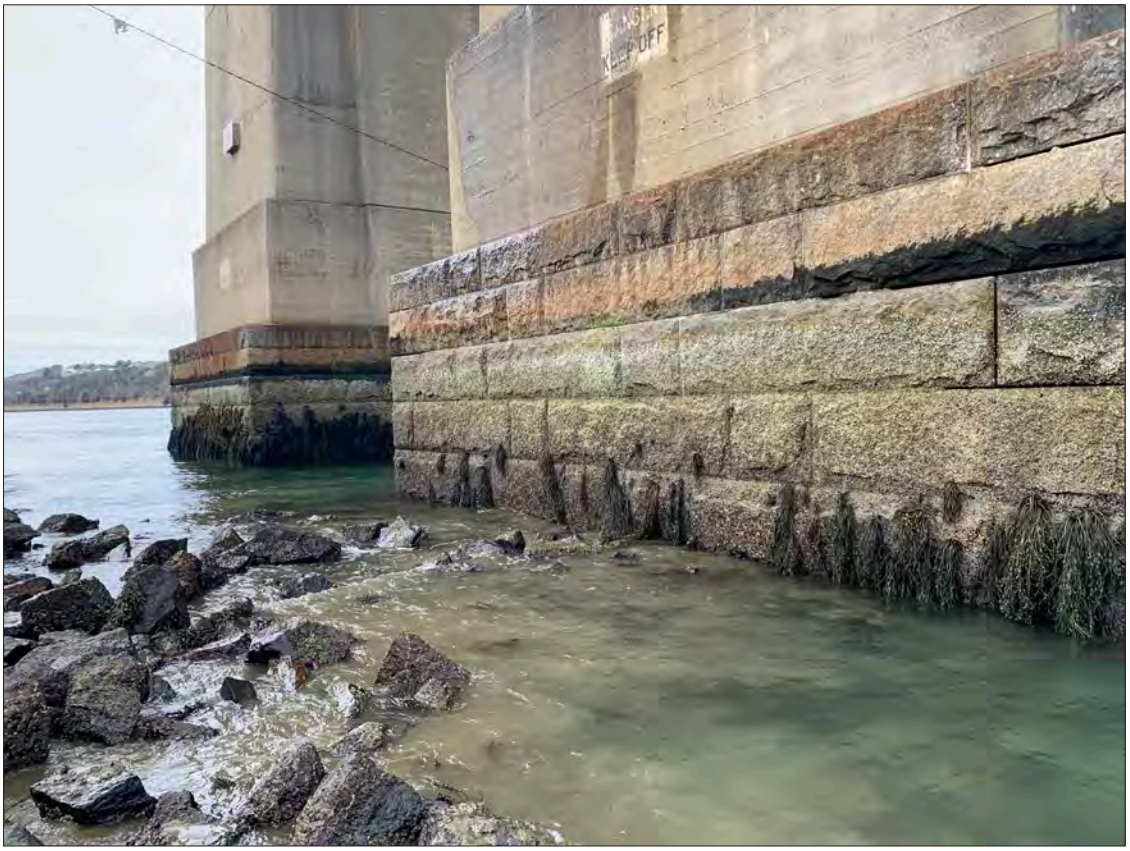
Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge North. Taken January 9, 2024.



Sagamore Bridge South. Taken January 9, 2024.



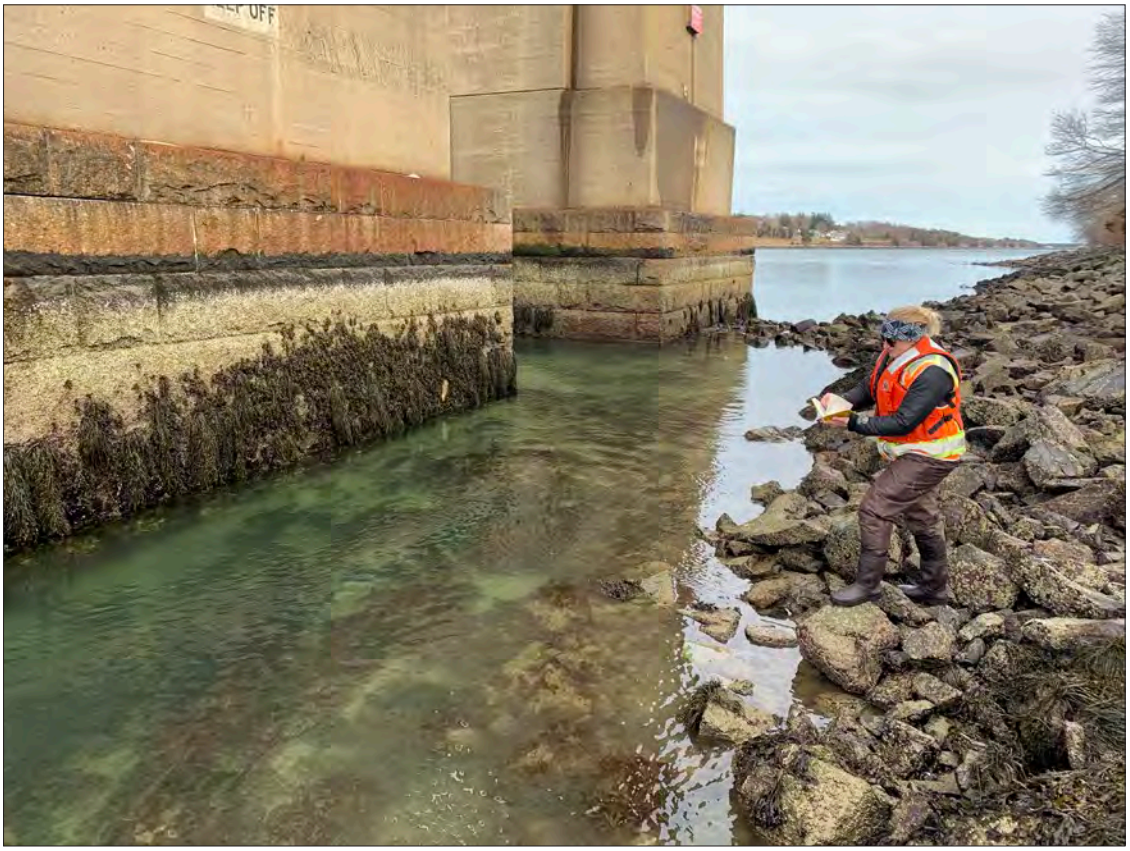
Sagamore Bridge South. Taken January 9, 2024.



Sagamore Bridge South. Taken January 9, 2024.



Sagamore Bridge South. Taken January 9, 2024.



Sagamore Bridge South. Taken January 9, 2024.



Sagamore Bridge South. Taken January 9, 2024.

ATTACHMENT C: UNDERWATER ACOUSTIC ANALYSIS





Cape Cod Bridges Program

Bourne, Massachusetts

Acoustic Analysis of Underwater Noise Due to Pile and Sheeting Installation/Removal for the Cape Cod Bridges Program

SUBMITTED TO:
NOAA Fisheries
Greater Atlantic Regional Fisheries Office
Habitat and Ecosystem Services Division
55 Great Republic Drive
Gloucester, MA 01930

PROPONENT:
The Massachusetts Department of Transportation
Highway Division
10 Park Plaza
Boston, MA 02116

Submitted January 13, 2025

massDOT
Massachusetts Department of Transportation

Table of Contents

1 Purpose 1

2 Underwater Noise Effects 1

3 Acoustic Thresholds for Fish 1

4 Underwater Acoustic Analysis of Program Pile Driving 4

4.1 Effects to Early Life Stages 11

5 References 14

Figures

Figure 1. Acoustic Impact Areas to Fishes for the Bourne Bridge Site 12

Figure 2. Acoustic Impact Areas to Fishes for the Sagamore Bridge Site 13

Tables

Table 1. Fish Hearing Thresholds (FHWG 2008) 3

Table 2. Distances (meters) to Fish Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals) 6

Table 3. Distances (meters) to Fish Auditory Impact Thresholds from Maximum Concurrent Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals). 9

Acronyms and Abbreviations

Acronym/Abbreviation	Definition
µPa	micro-Pascal
dB	decibel
EFH	Essential Fish Habitat
FHWG	U.S. Fisheries Hydroacoustic Working Group
NOAA	National Oceanic and Atmospheric Administration
PEAK SPL	peak sound pressure level
Program	Cape Cod Bridges Program
RMS	root mean square
SEL	sound exposure level

1 Purpose

Massachusetts Department of Transportation and the Federal Highway Administration is proposing the replacement and renovation of the Bourne and Sagamore approaches, bridges, and pedestrian river access way for the Cape Cod Bridges Program (Program). The bridge replacement activity and new bridge piers are likely to have underwater noise impact in the Aquatic Action Area. This memo presents the findings of the potential for underwater noise impacts conducted by Stantec in 2024, as part of the Essential Fish Habitat (EFH) Assessment of the potential impacts associated with the Program's in-water actions.

2 Underwater Noise Effects

Under certain conditions, underwater sound generated from construction activities may cause behavioral or physiological changes in aquatic organisms. Behavioral changes often include avoidance of the action area, disruption of foraging attempts, or interruption of reproduction. Physiological effects include stunning the exposed fish and making it more susceptible to predation. Fish can also suffer temporary or permanent hearing loss or barotrauma injuries such as bruising, ruptures to capillaries, hemorrhaging of organ systems like the lateral line, damage to the swim bladder and internal organs, or death (Halvorsen et al., 2011). Swim bladders function as hydrostatic or ballast organs and are sometimes used for hearing function. Swim bladders are absent in some bottom-dwelling species, all elasmobranchs (i.e., sharks, skates, and rays), and crustacea. However, crustacea, typical prey for many EFH species, are also known to exhibit behavioral changes such as avoidance due to increased sound pressure (Tidau and Briffa 2016).

The nature or symptoms of the effects on EFH species depend on several factors. These include noise source parameters (e.g., the duration and intensity of sound produced and the individual's proximity to the sound source) and species physiology and behavior (e.g., hearing sensitivity, how long the animal stays in the vicinity of the sound source, and the animal's motivation and mobility level; Caltrans 2020). Generally speaking, different species are thought to have different tolerances to noise and may exhibit different responses to the same noise source.

3 Acoustic Thresholds for Fish

This section summarizes the acoustic thresholds used by National Oceanic and Atmospheric Administration (NOAA) Fisheries for all fish species. The intensity of a sound wave in water is expressed in terms of decibels (dB) relative to 1 micro-Pascal (µPa) (dB re 1 µPa). Decibels are a logarithmic scale; each 10-dB increase is a 10-fold increase in sound pressure. Accordingly, a 20-dB increase is a 100x

increase in sound pressure. The following are commonly used measures of sound (and examples of common uses):

Peak sound pressure level (PEAK SPL): the maximum sound pressure level (highest level of sound) in a signal measured in dB re 1 µPa, such as for a single blast explosion. This measurement is better understood in terms of physiological impacts on fish during impulsive sound source operation.

Sound exposure level (SEL): the integral of the squared sound pressure over the duration of the pulse measured in dB re 1µPa2-s (e.g., a full pile driving strike). SEL is the integration over time of the square of the acoustic pressure in the signal and is thus an indication of the total acoustic energy received by an organism from a source (such as pile strikes) over a specific duration of exposure. SEL is a common metric since it allows sound exposures of different durations to be related to one another in terms of total acoustic energy and is used for non-impulsive sounds for all species types (i.e., fish, turtles, marine mammals). However, the duration of a sound event should be specified because the level of impact resulting from summation of energy is different between fish (12 hours) and marine mammals and sea turtles (24 hours).

- Single Strike SEL: the amount of energy in one strike of a pile (i.e., with a hammer).
- Cumulative SEL (cSEL): the energy accumulated over multiple strikes. cSEL indicates the full energy to which an animal is exposed during any kind of signal. The rapidity with which the cSEL accumulates depends on the level of the single-strike SEL. The actual level of accumulated energy (cSEL) is the logarithmic sum of the total number of single-strike SELs. Thus, cSEL (dB) = Single-strike SEL + 10log10(N), where N is the number of strikes.

Root Mean Square (RMS): the average level of a sound signal over a period of time, such as for continuous drilling, vibratory pile driving, vessel operation, and background noise.

To determine which threshold is most appropriate, NOAA Fisheries characterizes sound sources as impulsive/non-impulsive (permanent and temporary threshold shifts) and intermittent/continuous (behavioral disturbance):

Impulsive sound sources: produce sounds that are typically transient, brief (less than one second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay. Impulsive sounds can occur in repetition (e.g., seismic airguns, impact pile driving) or as a single event (e.g., explosives).

Non-impulsive sound sources can be continuous or intermittent and produce sounds that can be broadband, narrowband, or tonal and brief or prolonged. They do not have the high peak sound pressure with rapid rise time typical of impulsive sounds. Examples of non-impulsive sources include drilling, vibratory pile driving, and certain active sonars.

Continuous sound sources: emit sound with a sound pressure level that remains above ambient sound during the entire observation period. Examples of continuous sound sources include drilling and vibratory pile driving.

Intermittent sound sources have interrupted levels of low or no sound or bursts of sound separated by silent periods. Typically, intermittent sounds have a more regular (predictable) pattern of bursts of sound and silent periods (i.e., duty cycle). Examples of intermittent sound sources include scientific sonar, high-resolution geophysical survey equipment (e.g., sub-bottom profilers), and impact pile driving.

Other Program activities that could cause elevated underwater sound include deconstruction of the existing bridge piers, dredging of the construction areas to the depths necessary for construction vessels, and the engines of the construction vessels. Given the frequency of current vessel traffic transiting through the Cape Cod Canal, impacts on EFH species attributable to the temporary increase in noise created by construction vessels relative to existing conditions will be too small to be meaningfully measured or detected. Likewise, underwater noise associated with dredging and demolition of the existing bridge piers will be substantially less than that associated with pile driving and below thresholds for behavioral or injurious effects. Thus, impacts on EFH species from non-pile driving underwater sound sources will be too small to be meaningfully measured or detected.

Table 1 shows the U.S. Fisheries Hydroacoustic Working Group (FHWG) sound thresholds for fish based on size categories; these acoustic thresholds apply to all species of fish and do not distinguish between fish of different groups (e.g., elasmobranchs or teleosts).

Table 1. Fish Hearing Thresholds (FHWG 2008)

Faunal Group	Injury – Impulsive		Behavior[1]
	Physical Injury		Impulsive & Non-Impulsive
	PK[2] dB re 1µPa	SEL_{cum}[3] dB re 1µPa2·s	RMS dB re 1µPa
Fish equal to or greater than 2 grams	≥206 dB	≥187 dB	≥150 dB
Fish less than 2 grams		≥183 dB	

Notes:
[1] Only the behavioral threshold is applicable to fish from non-impulsive sound sources.
[2] Peak sound pressure level (PK) is expressed in dB re 1 µPa
[3] Cumulative sound exposure level (SELcum) is expressed in dB re 1 µPa²s with an accumulation period of 12 hours for fish.
Key:
µPa = micro-Pascal
dB = decibel
RMS = root mean square
SELcum = cumulative sound exposure level

4 Underwater Acoustic Analysis of Program Pile Driving

For this evaluation, underwater noise levels were calculated using the NOAA Multi-Species Pile Driving Calculator, Version 1.2 (NOAA 2022). The most conservative pile estimates have been applied with respect to the Program materials proposed and the most current available proxy source resources. These results can be used to understand how EFH species and their prey within the Program Area could react to Program-related noise levels.

Thresholds in Table 1 have been used to evaluate the isopleth distances for all proposed in-water construction activities, presented in Tables 2 and 3, to assess the potential impact (physical injury and behavioral disturbance) to fish. Thus, a thorough evaluation of the bridge construction materials, sizes, and methods of installation or demolition was conducted using the NOAA Fisheries acoustic thresholds for fishes, including the best available science in their development (NOAA 2022) and the NOAA Fisheries User Spreadsheet Tool (Version 2.2). The analysis applies proxy sound source levels for similar construction materials and equipment to the specifications in the Program design. The proxies chosen to calculate the expected distances focus on the largest impact producing construction activity for this Program which are the impact pile driving, vibratory pile driving, and impact drilling, as other construction activities such as vessel noise and dredging or excavation would produce a smaller sound signature in the water. The values presented in the table are the extent (in meters) of the sound isopleths taken at a 10 meters proxy distance, except for the rotary drill proxy for the dolphin piles (small variant), which was measured from 6 to 12 meters from the sound source. In this case, the most conservative distance of 12 meters was used (Dazey et al. 2012).

Due to the limited amount of data, the U.S. Fisheries Hydroacoustic Working Group (FHWG 2008) relied on data from a variety of surrogate impulsive sources (i.e., explosives: Govoni et al. 2003; Govoni et al. 2007; Hastings et al. 2007; Yelverton et al. 1975; seismic airguns: Popper et al. 2005; Song et al. 2008; See Stadler and Woodbury 2009 for more information as cited by FHWG 2008) to derive dual interim thresholds for impact pile driving that account for vulnerability depending on fish size. While the behavioral threshold for fish is not recognized as a “formal” threshold, it can provide a level at which one can begin to examine potential responses in fish. Vibratory pile driving does not produce a rapid rise in sound pressure like impact driving. Outside of California, Oregon, and Washington state, NOAA Fisheries does not use the $SEL_{CUMULATIVE}$ criteria because it is understood that fish are not stationary and because there has been no indication of a single injury related to barotrauma from underwater sound pressure as defined by the current $SEL_{CUMULATIVE}$ thresholds of 183 and 187 dB. These criteria were developed for impact pile driving only (Caltrans 2020). Therefore, no metric is applied to vibratory activities (denoted with N/A). NOAA Fisheries uses 150 dB RMS as the threshold for behavioral effects on listed fish species for the purposes of Endangered Species Act consultations (Buehler et al. 2015). Exposure to sound levels of 150 dB re 1 µPa RMS will not always result in behavioral modifications, and behavioral modifications will not always result in adverse effects (i.e.,

harm or harassment to fish), but there is the potential for behavioral response upon exposure to 150 dB re 1 µPa RMS (NOAA 2012).

The Program has also proposed the potential for in-water work to occur at opposing bank bridge quadrants, at the same time. This may create additive underwater noise sources, which has therefore been modeled at the most conservative levels (Table 3). Impact pile driving of two concurrent 36-inch (0.9-meter) steel pipe piles and vibratory pile driving of two concurrent 18-inch (0.5-meter) steel sheeting piles will have the most far-reaching potential effects of the respective pile driving types and therefore represent the maximum distances for injurious and behavioral impacts due to Program construction activities.

Table 2. Distances (meters) to Fish Auditory Impact Thresholds from Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals)

Program Component	Pile Type	Installation Method	NOTES[1]	Injury – Impulsive[2,3]			Behavior Impulsive & Non-Impulsive
				PK[2] – All Fish ≥206 dB	SEL_{cum}[3] – Fish ≥ 2 g ≥187 dB	SEL_{cum}[3] – Fish < 2 g ≥183 dB	RMS –All Fish ≥150 dB
Cofferdam Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel Sheet Piles (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Shoreline Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Bulkheads Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m

Program Component	Pile Type	Installation Method	NOTES[1]	Injury – Impulsive[2,3]			Behavior Impulsive & Non-Impulsive
				PK[2] – All Fish ≥206 dB	SEL_{cum}[3] – Fish ≥ 2 g ≥187 dB	SEL_{cum}[3] – Fish < 2 g ≥183 dB	RMS –All Fish ≥150 dB
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Barge Sheeting	18" Steel Sheet Piles	Impact	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) ssSEL = 180 dB re 1µPa2·s PK = 209 dB re 1µPa RMS = 190 dB re 1uPa	15.8 m	1,000.0 m	1,000.0 m	4,641.6 m
		Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, NMFS 2022) RMS = 160 dB re 1uPa	N/A	N/A	N/A	46.4 m
Work Trestle	36" Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	18.5 m	1,584.9 m	1,584.9 m	7,356.4 m
Dolphin Piles-Large Variant	36" Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	18.5 m	1,584.9 m	1,584.9 m	7,356.4 m

Program Component	Pile Type	Installation Method	NOTES[1]	Injury – Impulsive[2,3]			Behavior Impulsive & Non-Impulsive
				PK[2] – All Fish ≥206 dB	SEL_{cum}[3] – Fish ≥ 2 g ≥187 dB	SEL_{cum}[3] – Fish < 2 g ≥183 dB	RMS –All Fish ≥150 dB
Pier Cofferdam	36" Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa	18.5 m	1,584.9 m	1,584.9 m	7,356.4 m
Dolphin Piles-Small Variant	14" Steel H-Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 177 dB re 1µPa2·s PK = 208 dB re 1µPa RMS = 187 dB re 1uPa	13.6 m	631.0 m	631.0 m	2,928.6 m
Dolphin Piles-Small Variant	14" Steel Pipe Piles	Drilling-Rotary Drill	(Dazey et al. 2012) RMS = 154.2 dB re 1uPa	N/A	N/A	N/A	22.9 m
Templates	12" Steel H-Piles	Vibratory	(Caltrans 2015, NMFS 2022) RMS = 150 dB re 1uPa	N/A	N/A	N/A	10.0 m

Notes:
[1] Alternative proxy sound source measurements are described if the measurements of the same pile type are not available.
[2] Peak sound pressure level (peak) is expressed in dB re 1 µPa.
[3] SELcum is expressed in dB re 1 μPa^2s with an accumulation period of 12 hours for fish.
Key:
µPa = micro-Pascal
dB = decibel
RMS = root mean square
SELcum = cumulative sound exposure level
ssSEL = Single strike sound exposure level

Table 3. Distances (meters) to Fish Auditory Impact Thresholds from Maximum Concurrent Program Construction Activity (Non-Impulsive & Impulsive Sounds Signals).

Program Component	Pile Type	Installation Method	NOTES[1]	Injury – Impulsive[2,3]			Behavior Impulsive & Non-Impulsive
				PK[2] – All Fish ≥206 dB	SEL_{cum}[3] – Fish ≥ 2 g ≥187 dB	SEL_{cum}[3] – Fish < 2 g ≥183 dB	RMS –All Fish ≥150 dB
Cofferdam Sheeting Shoreline Sheeting Bulkheads Sheeting Barge Sheeting	18" Steel Sheet Piles	Vibratory	Proxy Typical 24" AZ Steel sheet pile (Caltrans 2015, 2020, NMFS 2022) RMS = 160 dB re 1uPa +3dB for concurrent piling of the same sound pressure levels (USDOT 1995)	N/A	N/A	N/A	73.6 m
Work Trestle Dolphin Piles-Large Variant Pier Cofferdam	36" Steel Pipe Piles	Impact	(Caltrans 2020, NMFS 2022) ssSEL = 183 dB re 1µPa2·s PK = 210 dB re 1µPa RMS = 193 dB re 1uPa +3dB for concurrent piling of the same sound pressure levels (USDOT 1995)	29.3 m	2,511.9 m	2,511.9 m	11,659.1 m

Notes:
[1] Alternative proxy sound source measurements are described if the measurements of the same pile type are not available.
[2] Peak sound pressure level (peak) is expressed in dB re 1 µPa.
[3] SELcum is expressed in dB re 1 µPa2s with an accumulation period of 12 hours for fish.
Key:
µPa = micro-Pascal
dB = decibel
RMS = root mean square
SELcum = cumulative sound exposure level
ssSEL = Single-strike sound exposure level

Conclusions

In summary, EFH species, NOAA-trust species, and prey species exposed to Program activities during pile or sheet driving have the potential to experience direct physiological and behavioral stress. When only one Program quadrant is active, physiological injury has the potential to occur in fish of any size exposed to impulsive Program sound sources up to 18.5 meters from pile driving and up to 15.8 meters from impact sheet installation. During impact driving of the various kinds of steel sheeting with a diameter of 24 inches, if fish are to stay within 1,000 meters (fish ≥ 2 g or < 2 g) of the source for 12 or more hours, they could experience a cumulative sound exposure level above their threshold for physical injury. However, results for sheet pile impact driving were derived from a proxy source of 24 inches steel sheeting piles due to there not being an available proxy for the proposed 18 inches sheet piles. Therefore, impact distances are likely closer than 18.5 meters and 1,000 meters, respectively. During impact driving of 36-inch-diameter steel piles, fish within 1,584.9 meters for at least 12 hours could experience physiological injury. Behavioral impact results show Program rotary drilling and vibratory pile driving activities for sheeting and pile installation are expected to exceed the 150 RMS threshold for all fish within 22.9 meters and 46.4 meters, respectively. Similarly, when two concurrent sounds sources are active, the maximum distances within which injurious PEAK SPLs during concurrent impact pile driving of 36-inch steel pipe piles (29.3 meters) and behavioral effects will occur because of concurrent vibratory pile driving of 18-inch steel sheet piles (73.6 meters) may occur.

However, it is important to note the following stipulations:

1. that these are criteria for the onset of physiological effects and not levels at which fish are necessarily fatally injured,
2. SELcum value assuming that a fish would stay in the ensonified area (without being trapped) for at least 12 hours. The cumulative amount of time a fish must be exposed to the impulsive sound pressure is longer than realistically expected when considering fish behavior and the amount of time a fish would remain in the same place or at the same harmful threshold,
3. that the nature of pile driving and sheeting activities is short-term and will be no longer than 10 continuous minutes of sheeting, 120 continuous minutes of drilling, 60 continuous minutes of driving per item installed, and,
4. if the fish are affected by the noise level, work is restricted to the intertidal and shallow subtidal area, allowing mobile fish to utilize the remaining width of the canal (680 feet) to avoid the area,
5. to be detected by fish, sounds must be louder than background-level noise and at a frequency that is detectable by a given species (Plachta and Popper, 2003).
6. The shape of the Cape Cod Canal channel will disrupt the noise propagation in certain areas, reducing the potential for adverse effects.

To elaborate, the bends within the Cape Cod Canal will truncate the distance underwater sound waves will travel from construction activities at the Sagamore and Bourne bridge sites. These results are the same for the viewshed analysis and the NOAA Fisheries User Spreadsheet Tool, in some instances, depending on the bridge site and side of the Cape Cod Canal that construction is occurring. For example, the distances within which behavioral and SELcum impacts will occur as a result of concurrent impact pile driving of 36-inch steel pipe piles may be less in the viewshed analysis than the NOAA Fisheries User Spreadsheet Tool. Figures 1 and 2 illustrate the extents of the respective injurious and behavioral isopleths based on applicable analysis for each isopleth distance. Based on these models, noise impacts are not expected to reach adjacent bodies of water (Buzzards Bay and Cape Cod Bay).

4.1 Effects to Early Life Stages

Impacts of underwater noise on early life stages (egg and larvae) are difficult to monitor and therefore not well understood. Moreover, the acoustic analysis presented does not account for early life stages. However, based on available resources, adverse effects to EFH early life stages are possible. Direct impact of noise on eggs and larvae can reduce settlement success in crab, lobster and fish larvae, malformations in scallops and behavioral feeding and breeding changes in fish species, such as flounder and other anadromous fish (Pine 2013, De Soto et al. 2013, Gendron 2020). In coordination with NOAA Fisheries, the Program has identified a time of year restriction that limits the in-water work window for activities producing underwater acoustic effects to September 1 – February 28), avoiding overlap with a majority of designated periods of fish or invertebrate spawning and therefore eggs or larvae presence, thereby avoiding such direct impacts. Indirect impacts such as changes in spawning adult behavior and success due to Program activity or benthic disturbance could indirectly lead to lower reproductive success (Butler and Maruska 2020, de Jong et al 2020). Indirectly, breeding adults who may be overwintering or foraging in the affected area may have reduced spawning capabilities the following season due to the energetic cost imposed by physical or behavioral Program related stress throughout the winter. However, this potential effect is too small to be meaningfully measured.

Due to the Program time of year restrictions, sensitive life stages and breeding behavior will not occur in the affected area during in-water work, and the indirect impacts of underwater noise on breeding fish would be too small to be meaningfully measured or detected. Additionally, due to the above list of stipulations, EFH, NOAA-Trust and prey species of any life stage with the potential to overlap pile and sheeting activity are not expected to be adversely affected by underwater noise generate by the Program.

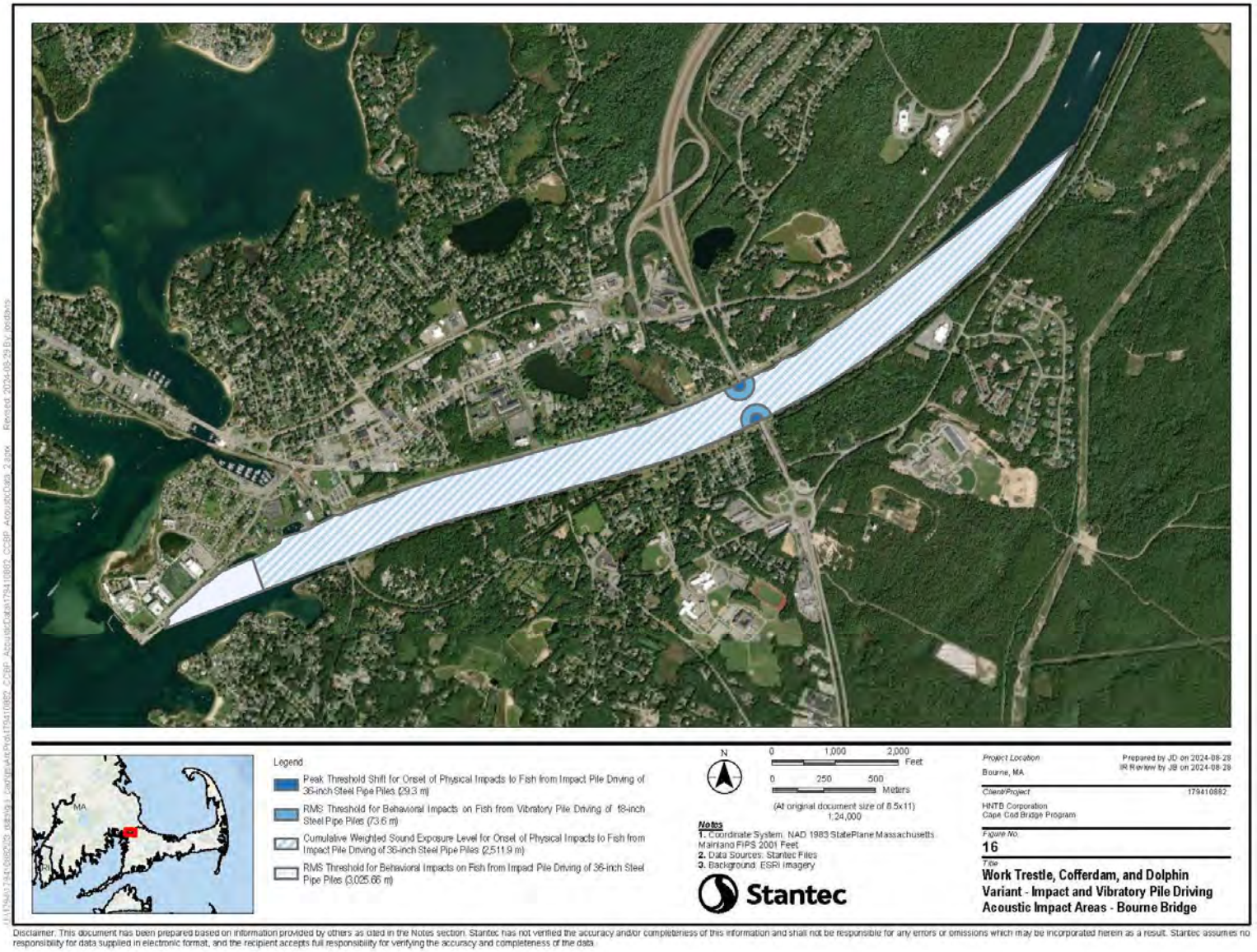


Figure 1. Acoustic Impact Areas to Fishes for the Bourne Bridge Site



Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Figure 2. Acoustic Impact Areas to Fishes for the Sagamore Bridge Site

5 References

Buehler, D., R. Oestman, J. Reyff, K. Pommerenck, and B. Mitchell. 2015. Technical guidance for assessment and mitigation of the hydroacoustic effects of pile driving on fish. CalTrans Technical Report No. CTHWANP-RT-15-306.01.01.

Butler, J.M., and K.P. Maruska. (2020). Underwater noise impairs social communication during aggressive and reproductive encounters. *Animal Behaviour*, *164*, 9-23.

California Department of Transportation (Caltrans). 2020. Technical Guidance for the Assessment of the Hydroacoustic Effects of Pile Driving on Fish. California Department of Transportation Division of Environmental Analysis Sacramento, CA. October.

Caltrans. 2015. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. California Department of Transportation Division of Environmental Analysis, Sacramento, California.

Dazey, E., B. McIntosh, S. Brown, and K. Dudzinski. (2012). Assessment of Underwater Anthropogenic Noise Associated with Construction Activities in Bechers Bay, Santa Rosa Island, California. Journal of Environmental Protection, 03 (10) 1286-1294.

de Jong, K., T.N. Forland, M.C.P. Amorim, G. Rieucau, H. Slabbekoorn, and L.D. Sivle. (2020). Predicting the effects of anthropogenic noise on fish reproduction. *Reviews in Fish Biology and Fisheries*, *30*, 245-268.

De Soto, N.A., N. Delorme, J. Atkins, S. Howard, J. Williams, and M. Johnson. (2013). Anthropogenic noise causes body malformations and delays development in marine larvae. *Scientific reports*, *3*(1), 2831.

FHWG (Fisheries Hydroacoustic Working Group). 2008. Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving Activities. 12 Jun 2008 edition. Available at: http://www.dot.ca.gov/hq/env/bio/files/fhwgcriteria_agree.pdf.

Gendron, G., R. Tremblay, A. Jolivet, F. Olivier, L. Chauvaud, G. Winkler, and C. Audet. (2020). Anthropogenic boat noise reduces feeding success in winter flounder larvae (Pseudopleuronectes americanus). *Environmental biology of fishes*, *103*, 1079-1090.

Halvorsen, M.B., B.M. Casper, C.M. Woodley, T.J. Carlson, and A.N. Popper. 2011. Mitigating hydroacoustic effects on fish from pile installations. NCHRP Research Results Digest 363. National Cooperative Highway Research Program, National Academy of Sciences, Washington, D.C.

NOAA. 2012. Biological opinion to Federal Highway Administration for the replacement of the Richmond-Dresden Bridge on Route 197, Maine. Northeast Region, Gloucester, Massachusetts, USA. 26 November.

NOAA Fisheries. 2022. Fisheries Multi-species Pile Driving Calculator. Available at: https://www.fisheries.noaa.gov/resource/data/multi-species-pile-driving-calculator-tool.

Pine, M. (2013). *Underwater Anthropogenic Sound: Understanding the potential impacts on the marine environment and the influence on crab larval behaviour* (Doctoral dissertation, ResearchSpace@ Auckland).

Plachta, D.T., and A.N. Popper. (2003). Evasive responses of American shad (Alosa sapidissima) to ultrasonic stimuli. *Acoustics Research Letters Online*, *4*(2), 25-30.

Tidau, S., M. Briffa. 2016. Review on behavioral impacts of aquatic noise on crustaceans. *Proc. Mtgs. Acoust.* 10 July 2016; 27 (1): 010028. https://doi.org/10.1121/2.0000302

ATTACHMENT D: MASSDOT STREAMBED RESTORATION SPECIFICATIONS

ITEM 755.55 **STREAMBED RESTORATION** **CUBIC YARD**

STREAMBED MATERIAL FOR EXCAVATION AREAS

The purpose of this item is to restore the disturbed areas of streambed, as directed by the plans, the engineer and/or wetland specialist. This work shall consist of construction of streambed restoration using a nature-like streambed.

This work shall consist of furnishing and placing nature-like stone fill material on the river bed, in the areas of excavation for existing pier removal, and upstream and/or downstream of the excavations to set a desired channel profile and maintain a natural bed appearance. The ultimate product will replicate the function and appearance of the existing stream to the most practicable extent.

The streambed restoration is an important element to comply with environmental permits issued for the project. In order to satisfy those requirements and ensure the restoration is constructed as designed, the Wetland Specialist shall provide on-site oversight and assistance during streambed and bank restoration.

MATERIAL

The natural streambed material is to be installed as depicted on the plans.

Any stone or material excavated from the existing streambed during bridge pier removal shall be stockpiled and reused for natural streambed material, provided the excavated stone and material is characteristic of the existing stream material upstream and downstream of the work area, or meets the below criteria. The elevations and conditions of the existing streambed shall be maintained to the maximum extent practicable.

The natural streambed material shall be locally sourced and match the composition of the native streambed. This streambed material shall be supplemented, as available, with the existing natural streambed material that is excavated within the project limits.

Natural Streambed Material Gradation

Stone Size	% Finer
3 inches	90-100
2.3 inches	79-89
0.8 inch	45-55
0.4 inches	25-35
0.04 inches	5-15

Natural streambed material shall be green/gray, brown/gray, dark gray, and/or dark brown shall be acceptable. White rock is not acceptable. All natural stream bed material shall be free from laminations, weak cleavages and will not disintegrate from the action of air, water and in handling and placing. Granular sedimentary stone will generally be unacceptable.

CONSTRUCTION

The work area shall be dewatered with water flow maintained around the site by a method to be submitted for approval by the Resident Engineer and Wetland Specialist and/or stream geomorphologist.

Streambed material shall be placed overtop the remaining exposed pier foundations so that it matches the streambed grade around the piers.

The streambed material mix shall be spread over the remaining exposed pier foundations as shown on the plans. Streambed mix shall be tamped down in order to fill / choke voids in the material. Fill voids by hand tamping with metal tamping rods, by shaking stone with the teeth of an excavator bucket, and/or by spraying water to settle fines between large stones. Plate compactors shall not be used. The purpose for filling the voids is to prevent subsurface flow where water disappears into the large voids in the stone fill below the channel bed surface.

After all material has been placed in the stream channel and approved by the Wetland Specialist, stream geomorphologist or Resident Engineer, the Contractor shall remove the dewatering materials in such a way to slowly wet the stream to minimize the initial sediment pulse. Every attempt shall be made to minimize the downstream movement of sediment.

The final streambed shall look like a natural river/stream, shall match nearby river/stream reaches, and there shall be minimal to no subsurface flow upon final inspection by the Engineer and Wetland Specialist.

METHOD OF MEASUREMENT AND BASIS OF PAYMENT

Item 755.55 Natural Streambed material will be measured for payment by cubic yard, complete in place and accepted by the Engineer. It shall include all labor, tools, materials, equipment and incidental costs required to complete work.

Agency Coordination

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
GREATER ATLANTIC REGIONAL FISHERIES OFFICE
55 Great Republic Drive
Gloucester, MA 01930

February 12, 2025

David Paulson
Wildlife and Endangered Species Unit Supervisor
Massachusetts Dept. of Transportation
USDOT, Massachusetts Division
101 Park Plaza, Suite 4160
Boston, MA 02116

Re: Cape Cod Bridges Program

Dear Mr. Paulson:

We have reviewed the Essential Fish Habitat (EFH) assessment for the Cape Cod Bridges Program located in the Cape Cod Canal in Bourne, Massachusetts. According to the EFH Assessment, prepared by Massachusetts Department of Transportation (MassDOT) on behalf of the Federal Highway Administration (FHWA), the proposed project would replace the Sagamore and Bourne bridges in Bourne, MA. The Program would also reconfigure the highway approach networks north and south of the Cape Cod Canal to align with the replacement highway bridges and provide separate pedestrian and bicycle accommodations along the replacement bridges with connections to the roadway network. Construction is expected over six to eight years for each bridge, and will be undertaken in multiple phases. The replacement bridges will be constructed offline and inboard of the existing highway bridges. The Sagamore will be replaced first, followed by the Bourne Bridge. At each site, the most inboard span will be constructed first, then the existing bridge will be demolished, followed by construction of the second new span.

We have been a cooperating agency on this project since April 2023, and have attended cooperating agency meetings on June 14 and October 17, 2023; and March 29, June 27, and December 4, 2024. Permitting timelines were discussed at these meetings, and we provided guidance on conservation measures for federally managed EFH and diadromous fish species. Your EFH assessment included detailed habitat delineations on project plans and site maps, and included a comprehensive discussion on project impacts to EFH and diadromous fish. Additionally, the best management practices (BMPs) that were incorporated into the project design and construction plans, as described in the EFH Assessment, included minimization and avoidance measures for protecting EFH and diadromous fish including, the use of sediment controls around the perimeter of the project, no in-water work from March 1 through August 30, and the use of soft-starts for any pile-driving activity. While the BMPs provided in the EFH assessment may sufficiently minimize impacts to finfish and shellfish species, we have outstanding concerns regarding potential impacts to eelgrass at the Bourne Bridge site.

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Fish and Wildlife Coordination Act (FWCA) require federal agencies to consult with one another on projects such as this. Insofar as a project involves EFH, as this project does, this process is guided by the requirements of our EFH regulation at 50 CFR 600.920, which mandates the

preparation of EFH assessments and generally outlines your agency's obligations in this consultation procedure. Based on our preliminary assessment, we have determined the proposed activities will result in adverse impacts to eelgrass beds at the Bourne bridge site, and we offer the following comments for your consideration.

Eelgrass Impacts

According to the EFH Assessment, eelgrass was identified at the Bourne Bridge site and delineated on surveys. Submerged aquatic vegetation, like eelgrass (*Zostera marina*), provides habitat for early life stages of many finfish and shellfish species, and is identified by the U.S. Environmental Protection Agency (USEPA) as a "special aquatic site" pursuant to 40 CFR Part 230 Section 404(b) (1) of the Federal Clean Water Act due to its important role in the marine ecosystem. Specifically, eelgrass is used by foraging species, including winter flounder, and for spawning, breeding, feeding, and growth to maturity for fish. Furthermore, the Mid-Atlantic Fishery Management Council has designated eelgrass as a Habitat Area of Particular Concern (HAPC) when overlapped with summer flounder EFH. As per the EFH Assessment, "Footprints of new pier installation and existing pier removal will not directly impact mapped eelgrass beds, however dredging and rip-rap introduction/removal activities could result in a limited extent of long-term (decades) substantial effects to approximately 3,209 sq ft (SF) of eelgrass Program wide." You indicated that you will provide mitigation for any impacts to SAV, and we support those efforts.

EFH Conservation Recommendations

Section 305(b)(2) of the MSA requires all federal agencies to consult with NMFS on any action authorized, funded, or undertaken by that agency that may adversely affect EFH. The CCC has been identified as EFH under the MSA for 52 federally-managed species. We recommend pursuant to Section 305(b)(4)(A) of the MSA that you adopt the following EFH conservation recommendations:

1. Eelgrass beds at the Bourne bridge site should be monitored with photographic surveys before and after construction. Please send surveys to alexa.cacacie@noaa.gov for our review. Should impacts be identified post-construction, compensatory mitigation should be provided for 3,209 SF of impacts to eelgrass beds.

Please note that Section 305(b)(4)(B) of the MSA requires you to provide us with a detailed written response to these EFH conservation recommendations, including a description of measures you adopt for avoiding, mitigating or offsetting the impact of the project on EFH. In the case of a response that is inconsistent with our recommendations, Section 305(b)(4)(B) of the MSA also indicates that you must explain your reasons for not following the recommendations. Included in such reasoning would be the scientific justification for any disagreements with us over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate or offset such effects pursuant to 50 CFR 600.920(k). Please also note that a distinct and further EFH consultation must be reinitiated pursuant to 50 CFR 600.920(l) if new information becomes available or the project is revised in such a manner that affects the basis for the above EFH conservation recommendations.

Endangered Species Act

Threatened and endangered species under our jurisdiction may be present in the action area, and consultation pursuant to section 7 of the Endangered Species Act of 1973 is ongoing. If you have any questions regarding the status of this consultation, please contact Roosevelt Mesa at 978-281-9186 or roosevelt.mesa@noaa.gov.

Conclusion

In summary, due to the potential for adverse effects to eelgrass, we recommend the above measures to avoid, minimize and mitigate permanent impacts to EFH. We also support inclusion of the best management practices provided in the EFH narrative to sufficiently avoid, minimize and mitigate permanent impacts to EFH and NOAA trust resources. We look forward to working with you on this matter and providing continued guidance on the avoidance, minimization and mitigation of adverse effects to federally-managed species and their habitats. If you have any questions regarding information in this letter, please contact Alexa Cacacie at alexa.cacacie@noaa.gov or 978-281-9294.

Sincerely,

Louis A. Chiarella
Assistant Regional Administrator
for Habitat and Ecosystem Services

cc: Roosevelt Mesa, GARFO PRD
John Simkins, FHWA
Dan Vasconcelos, USACE
Amanda Davis, MA DMF
John Logan, MA DMF
Steve McKenna, MA CZM

From: Mark Kolonoski
To: Sarah Walker
Subject: FW: EFH Assessment Worksheet for Cape Cod Bridges Program Bourne, Massachusetts
Date: Friday, March 14, 2025 3:11:00 PM

From: Paulson, David J. (DOT) <David.J.Paulson@dot.state.ma.us>
Sent: Thursday, March 13, 2025 9:31 PM
To: Sabrina Pereira - NOAA Federal <sabrina.pereira@noaa.gov>
Cc: Alexa Cacacie - NOAA Federal <alexa.cacacie@noaa.gov>; Dexter, Timothy D. (DOT) <Timothy.Dexter@dot.state.ma.us>; Burns, Trevor B. (DOT) <Trevor.B.Burns@dot.state.ma.us>; Mark Kolonoski <mkolonoski@HNTB.com>; Walsh, Kevin <Kevin.Walsh@stantec.com>; Paiewonsky, Luisa (DOT) <Luisa.Paiewonsky@dot.state.ma.us>; O'Dowd, Michael J. (DOT) <Michael.ODowd@dot.state.ma.us>; Dave Anderson <dranderson@HNTB.com>; Buchanan, Susan <Susan.Buchanan@stantec.com>; Brewer, John <john.brewer@stantec.com>; Canaday, Anne C. (DOT) <Anne.C.Canaday@dot.state.ma.us>; Christopher Boelke - NOAA Federal <christopher.boelke@noaa.gov>; Lou Chiarella - NOAA Federal <Lou.chiarella@noaa.gov>; Roosevelt Mesa - NOAA Affiliate <roosevelt.mesa@noaa.gov>; Simkins, John (FHWA) <John.Simkins@dot.gov>; Vasconcelos, Daniel B CIV USARMY CENAE (USA) <Daniel.B.Vasconcelos@usace.army.mil>; Davis, Amanda (FWE) <Amanda.Davis@mass.gov>; Logan, John (FWE) <john.logan@mass.gov>; McKenna, Steve (EEA) <stephen.mckenna@mass.gov>; Duffey, Sean (EEA) <Sean.Duffey@mass.gov>; Haney, Rebecca (EEA) <rebecca.haney@mass.gov>
Subject: RE: EFH Assessment Worksheet for Cape Cod Bridges Program Bourne, Massachusetts

External Email: Use caution when clicking on links, replying, or opening attachments.

Sabrina,

On behalf of MassDOT and the Cape Cod Bridge Project Team, we are acknowledging receipt of the February 12, 2025 Essential Fish Habitat letter. In addition, we have reviewed the proposed EFH Conservation Recommendation. Below is our response.

MassDOT has committed to the following measures for avoiding, minimizing, and mitigating impacts to EFH, consistent with NOAA Fisheries' recommendations:

- *The Program has proposed restoration of the Program footprint after in-water activity has concluded to the greatest extent practicable. However, a conservative approach is warranted, assuming the full extent of eelgrass mapped within the Bourne-North and Bourne-South* Program *footprints is expected to be impacted if still present upon construction commencement.*

- *Given the sensitive nature of eelgrass beds and the extended Bourne Bridge*

Program timeline, the presence or absence of eelgrass will be re-evaluated in the Bourne Bridge Program footprint closer to bridge construction commencement and/or when Program funding is secured for Bourne Bridge construction. Pre-construction photographic surveys will be completed, and surveys will be sent to alexa.cacacie@noaa.gov for review.

- *An eelgrass mitigation and monitoring plan will be developed in coordination with USACE, to include post-construction eelgrass monitoring with photographic surveys and compensatory mitigation methods for an area equivalent to the total potential long-term impacts to eelgrass. Post-construction photographic survey results will be sent to alexa.cacacie@noaa.gov for review.*

- *The amount of eelgrass mitigation will not exceed the amount of mapped eelgrass, per the updated pre-construction survey.*

- *Final mitigation will be determined in coordination with USACE and NOAA by the amount of eelgrass present, predicted success of regrowth or reestablishment, scale, timeline, and cost.*

Thank you for your time and consideration. Please do not hesitate to reach out with any questions.

Sincerely,

David Paulson
Wildlife and Endangered Species Unit Supervisor
Environmental Services
MassDOT Highway Division
(857) 262-3378

From: Sabrina Pereira - NOAA Federal <sabrina.pereira@noaa.gov>
Sent: Wednesday, February 12, 2025 10:25 AM
To: Paulson, David J. (DOT) <David.J.Paulson@dot.state.ma.us>
Cc: Alexa Cacacie - NOAA Federal <alexa.cacacie@noaa.gov>; Dexter, Timothy D. (DOT) <Timothy.Dexter@dot.state.ma.us>; Burns, Trevor B. (DOT) <Trevor.B.Burns@dot.state.ma.us>; Mark Kolonoski <mkolonoski@hntb.com>; Walsh, Kevin <kevin.walsh@stantec.com>; Paiewonsky, Luisa (DOT) <Luisa.Paiewonsky@dot.state.ma.us>; O'Dowd, Michael J. (DOT)

<Michael.ODowd@dot.state.ma.us>; Dave Anderson <dranderson@HNTB.com>; Buchanan, Susan <Susan.Buchanan@stantec.com>; Brewer, John <john.brewer@stantec.com>; Canaday, Anne C. (DOT) <Anne.C.Canaday@dot.state.ma.us>; Christopher Boelke - NOAA Federal <christopher.boelke@noaa.gov>; Lou Chiarella - NOAA Federal <Lou.chiarella@noaa.gov>; Roosevelt Mesa - NOAA Affiliate <roosevelt.mesa@noaa.gov>; Simkins, John (FHWA) <John.Simkins@dot.gov>; Vasconcelos, Daniel B CIV USARMY CENAE (USA) <Daniel.B.Vasconcelos@usace.army.mil>; Davis, Amanda (FWE) <Amanda.Davis@mass.gov>; Logan, John (FWE) <john.logan@mass.gov>; McKenna, Steve (EEA) <stephen.mckenna@mass.gov>; Duffey, Sean (EEA) <Sean.Duffey@mass.gov>; Haney, Rebecca (EEA) <rebecca.haney@mass.gov>
Subject: Re: EFH Assessment Worksheet for Cape Cod Bridges Program Bourne, Massachusetts

CAUTION: This email originated from a sender outside of the Commonwealth of Massachusetts mail system. Do not click on links or open attachments unless you recognize the sender and know the content is safe.

Good morning,

I hope you're all doing well. Please find attached our EFH conservation recommendations for the Cape Cod Bridges program in Bourne, MA. Please let us know if you have any questions, and we look forward to MassDOT's/FHWA's response within the next 30 days.

Thank you for coordinating with us.

Sabrina Pereira
Marine Habitat Resource Specialist
Greater Atlantic Regional Fisheries Office (GARFO)
NOAA Fisheries | U.S. Department of Commerce
Office: (978)-675-2178
www.fisheries.noaa.gov





On Mon, Jan 13, 2025 at 2:29 PM Paulson, David J. (DOT) <David.J.Paulson@dot.state.ma.us> wrote:

> Sabrina and Alexa,
>
> EFH Assessment Worksheet for Cape Cod Bridges Program Bourne, Massachusetts

MassDOT, on behalf of the U.S. Federal Highway Administration (FHWA), is submitting an EFH assessment worksheet (rev August 2021) for the Cape Cod Bridge Program in Bourne, Massachusetts. Please let us know if you have any questions.

Sincerely,

David Paulson
Wildlife and Endangered Species Unit Supervisor
Environmental Services
MassDOT Highway Division
(857) 262-3378