Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Biological Assessment
Atlantic Sturgeon, Shortnose Sturgeon and Sea Turtles

Maryland Transportation Authority
MDTA

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ABBREVIATIONS AND ACRONYMS

ARDS	Alternatives Retained for Detailed Study
BA	Biological Assessment
CBBMP	Chesapeake Bay Benthic Monitoring Program
COMAR	Code of Maryland Regulations
CBP	Chesapeake Bay Program
DEIS	Draft Environmental Impact Statement
DPS	Distinct Population Segments
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
IBI	Index of Biotic Integrity
LOD	Limit of Disturbance
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDTA	Maryland Transportation Authority

MLLW	Mean Lower Low Water
NEPA	National Environmental Policy Act
NETR	Natural Environment Technical Report
NOAA Fisheries	NOAA National Marine Fisheries Service
NOB	Natural Oyster Bars
NWQMC	National Water Quality Monitoring Council
ROD	Record of Decision
SAV	Submerged Aquatic Vegetation
SUP	Shared Use Path
SWM	Stormwater Management
TOYR	Time of Year Restriction
VIMS	Virginia Institute of Marine Science
ZSFP	Zone of Safe Fish Passage

1 INTRODUCTION

The Chesapeake Bay Crossing Study (Bay Crossing Study) is a two-tiered engineering and environmental study being advanced by the Maryland Transportation Authority (MDTA) and Federal Highway Administration (FHWA). The Bay Crossing Study is addressing existing and future transportation issues at the William Preston Lane, Jr. Memorial Bridge (Bay Bridge) and its approaches along U.S. 50/301. Each tier of the Bay Crossing Study involves development of an Environmental Impact Statement (EIS), in compliance with the National Environmental Policy Act (NEPA), to describe potential significant environmental effects and inform the evaluation of alternatives. Tier 1 of the Bay Crossing Study (Tier 1 Study) was completed in April 2022. At that time, FHWA issued a Final Environmental Impact Statement /Record of Decision (FEIS/ROD) identifying Corridor 7, the corridor that includes the Bay Bridge and its approaches, as the Selected Corridor Alternative for further evaluation. Tier 2 of the Bay Crossing Study (Tier 2 Study) was launched in June 2022 to focus on a project-level (site-specific) analysis within the Tier 1 Selected Corridor Alternative (Corridor 7). In December 2024 the MDTA identified the Alternatives Retained for Detailed Study (ARDS), which are the NEPA range of reasonable alternatives for evaluation in the Tier 2 Study EIS. Since then, the MDTA Recommended Preferred Alternative was identified as Alternative C, a Build Alternative that includes construction of two new spans as well as demolition of the existing bridge spans. A Natural Environment Technical Report (NETR) and Draft EIS (DEIS) were prepared by the MDTA and FHWA and made available for the public in January 2026. The MDTA requested cooperating agency concurrence on Alternative C as the Preferred Alternative, and concurrence from all cooperating agencies was received as of May 2026.

This Biological Assessment (BA) evaluates the potential effects of the Preferred Alternative on aquatic species under NOAA National Marine Fisheries Service (NOAA Fisheries) jurisdiction that are federally listed under the Endangered Species Act (ESA). A review of the NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper on December 5, 2023, indicated that the federally listed Atlantic sturgeon (*Acipenser oxyrhynchus*) and shortnose sturgeon (*Acipenser brevirostrum*) may be present within the Tier 2 Study area. In addition, four species of federally listed sea turtles occur seasonally in the waters of Chesapeake Bay from late April – mid November of each year: loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*). Designated critical habitat for listed species is not present within the Tier 2 Study area. The information gathered from the December 5, 2023, review of the Section 7 Mapper was again confirmed on March 9, 2026. No changes in the listed species or designated critical habitat had occurred.

The Preferred Alternative is in the early stages of preliminary engineering. As the design progresses through NEPA and into final design, the MDTA, in coordination with FHWA, will continue to consult with NOAA Fisheries to develop a bridge design and construction means and methods that avoid and minimize impacts and ensure the protection of listed species.

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 United States Code [USC] 1531 *et seq.*), the MDTA, on behalf of FHWA, has prepared this Biological Assessment (BA) to analyze the potential effects on sturgeon and turtle species listed or eligible for listing under the ESA and designated critical habitat for such species.

2 CONSULTATION HISTORY

Early coordination with NOAA Fisheries has been conducted throughout the Tier 2 Study. Additional Tier 2 Study coordination and regular interagency coordination meetings have been occurring with NOAA Fisheries and other resource agencies before and during development of the DEIS, since July 2022. Coordination history for the Tier 2 Study is summarized in **Table 2-1**, and copies of correspondence are provided in **Appendix A**.

Table 2-1: NOAA Fisheries Coordination History – Tier 2 Study

Date	Coordination
June 30, 2023	NOAA Fisheries accepted FHWA's invitation to be a Cooperating Agency on the Tier 2 Study.
December 5, 2023	A list of federally listed species under NOAA Fisheries jurisdiction with the potential to occur in the vicinity of the Tier 2 Study area was obtained from the NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper.
March 2024	NOAA Fisheries reviewed the Notice of Intent (NOI) for FHWA to prepare an EIS for the Tier 2 Study.
January 13, 2025	NOAA Fisheries provided comments on the NOI.
February 5, 2025	The NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper was reviewed again to confirm no changes occurred to the species list obtained on December 5, 2023.
April 30, 2025	A draft of the NETR was provided to the Cooperating and Participating Agencies, including NOAA Fisheries, for review. (NOAA Fisheries provided comments on the NETR that were addressed in subsequent drafts of the NETR and DEIS.)
August 11, 2025	A draft of the DEIS was provided to the Cooperating and Participating Agencies, including NOAA Fisheries, for review. (Comments have been considered and incorporated in the DEIS, as well as this BA and the NETR.)
November 28, 2025	A draft of this BA was provided to NOAA Fisheries for review.
January 15, 2026	NOAA Fisheries provided comments to FHWA on the draft BA. Comments have been considered and incorporated in this BA.
February 23, 2026	A revised draft of this BA was provided to NOAA Fisheries for review.
March 6, 2026	NOAA Fisheries provided comments to FHWA on the draft BA. Comments have been considered and incorporated in this BA.
March 9, 2026	The NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper was reviewed to confirm no changes to listed species or critical habitat in the Action Area. No changes have occurred.
March 18, 2026	FHWA initiated formal consultation with NOAA Fisheries for the Tier 2 Study.

Additional coordination with NOAA Fisheries will occur for species and habitat protected under the Marine Mammal Protection Act (MMPA) and the Magnuson-Stevens Fishery Conservation and Management Act (MSA). In accordance with the MMPA, the MDTA will coordinate with NOAA Permits and Conservation Division to secure an Incidental Harassment Authorization (IHA) for impacts on bottlenose dolphins. The IHA will include appropriate BMPs to minimize harassment to the extent practicable. The MSA is the primary Federal law that governs fisheries resources and management in the United States. NOAA Fisheries regulates essential fish habitat (EFH) and habitat areas of particular concern (HAPC). Pursuant to section 305(b)(2) of the MSA, FHWA and the MDTA, acting as FHWA's designated non-Federal representative, have prepared an EFH Assessment. MMPA and EFH coordination are discussed further in the DEIS and the NETR, and the impacts to EFH and HAPC are evaluated in the EFH Assessment.

3 PROPOSED PROJECT

The Bay Bridge is a two-span structure that crosses the Chesapeake Bay from Anne Arundel County on the Western Shore to Queen Anne's County on the Eastern shore. The original span opened in 1952, and the second span opened in 1973. Today, the two-lane original span typically carries eastbound traffic, and the three-lane second span typically carries westbound traffic. However, lanes on the bridge can be reversed to accommodate periods of heavy traffic. The approaches along U.S. 50/301 on each shore have six lanes (three lanes for each travel direction). The Bay Bridge has become one of Maryland's most iconic and recognizable landmarks, used by millions of Maryland residents and other travelers every year.

A wide range of engineering and environmental considerations were evaluated for the ARDS, which included one no-build alternative and six build alternatives as detailed in the DEIS. Alternative A (the no-build alternative) is not the Preferred Alternative because it would not increase roadway capacity or mobility, correct roadway deficiencies, or provide the navigational clearance established by the U.S. Coast Guard. Alternative A would also require substantial maintenance and related lane closures that would worsen congestion over time and compound existing traffic congestion, mobility, and roadway deficiency issues. Each of the six build alternatives meets the Tier 2 Study's purpose and need and would therefore be reasonable to implement. However, the build alternatives differ in the degree of transportation benefit they would provide as well as the likely environmental impacts and cost. The Preferred Alternative, Alternative C (6-8-6 South), would have the least impact to natural, cultural, and socioeconomic resources compared to the other build alternatives. Therefore, this BA considers impacts as a result of the construction and operation of Alternative C.

The Preferred Alternative (**Figure 3-1**) would replace the existing Bay Bridge spans with two new bridge spans and would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes on a new bridge (four per direction), and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). Construction activities would include, but are not limited to, pile driving; dredging; placement of fill/structure for piers, pier protection systems, and pier islands; increased vessel traffic; and demolition (including blasting) and removal of existing structure. Further detail on construction activities are discussed in **Section 3.1**. The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. The approach roadways would remain on the existing roadway alignment, except where necessary to connect to the new bridge spans. Thus, the five existing bridge lanes would be increased to eight bridge lanes; however, the number of lanes on the Western Shore and Eastern Shore would not change and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans. The Preferred Alternative could include a bicycle/pedestrian shared use path (SUP) along a new bridge. The MDTA has identified SUP connections to existing and proposed trails and recreational facilities on the Eastern Shore and Western Shore. Though the SUP is only an option at this time, the impacts discussed in this BA include those anticipated from both the construction of the new bridge and the optional SUP, in order to account for all possible impacts to listed species.

Figure 3-1: Vicinity Map



3.1 Construction Methods

The Preferred Alternative is currently in preliminary engineering and as such, design, construction, and demolition means and methods are based on preliminary assumptions. Construction of the new bridge spans would likely occur in multiple phases. Phasing of the Preferred Alternative may involve building one span at a time: the first new bridge span may be built, then one existing bridge span could be demolished (mechanically and with blasting), and the new bridge span would be in use while the second new bridge span is built. Once both new bridge spans are complete, the second span of the existing bridge could be demolished. The exact order and timing of construction have yet to be determined; however, a preliminary construction sequence is found in **Table 3-1**.

Table 3-1: Preliminary Construction Sequence

Construction Activity	Construction Years
Construction of Bridge 1 (eastbound) – Occurring during years 1 through 5	
Start Construction, Bridge 1	1
Construct landings (work completed on land)	1-4
Constructing approaches and main span	1-5
Trestles and water access construction	1
Dredging for eastbound bridge	1-2
Transport and disposal of dredge	1-2
Substructure/pier protection construction	1-3
Superstructure construction	2-5
Complete construction, Bridge 1	5
Demolition of existing eastbound bridge – Occurring during years 6 through 7	
Start demolition, existing eastbound bridge	6
Blasting (total of 18 blast events)	6-7
Superstructure Truss Units	
Cantilever Deck Truss Spans (12 spans, 4 events)	
Through Truss Spans (4 simple spans, 1 event)	
250’ Simple Deck Truss Spans (4 simple spans, 1 event)	
300’ Simple Deck Truss Spans (6 simple spans, 2 events)	
Suspension Spans (3 suspension spans, 1 event)	
Substructure Piers in Deep Water	
4 Column Piers (4 piers, 4 events)	
2 Column Piers (7 piers, 3 events)	
Solid Shaft Piers Under Suspension Span (4 piers, 2 events)	
Dismantling	6-7
Complete demolition, existing eastbound bridge	7
Construction of Bridge 2 (westbound) – Occurring during years 7 through 13	
Start construction, Bridge 2	7
Construct landings (work completed on land)	7-13
Constructing approaches and main span	7-13
Trestles and water access construction	7

Construction Activity	Construction Years
Dredging for westbound bridge	7-8
Transport and disposal of dredge	7-8
Substructure/pier protection construction	7-12
Superstructure construction	8-13
Complete construction, Bridge 2	13
Demolition of existing westbound bridge – Occurring during years 14 through 15	
Start demolition, existing westbound bridge	14
Blasting (16 total events)	14-15
Superstructure Truss Units	
Cantilever Deck Truss Spans (12 spans, 4 events)	
Through Truss Spans (3 spans, 1 event)	
Suspension Spans (3 suspension spans, 1 event)	
Substructure Piers in Deep Water	
4 Column Piers (8 piers, 8 events)	
2 Column Piers (6 piers, 3 events)	
Dismantling	14-15
Complete demolition, existing westbound bridge	15

The following sections include initial assumptions based on the current design and best available information from similar bridge projects including the Francis Scott Key Bridge, Tappan Zee Bridge, and Nice-Middleton Bridge. Information regarding anticipated construction methods and current assumptions of each phase follows.

Based on existing conditions within the Chesapeake Bay, dredging would likely be necessary to create access channels to support demolition and construction activities. Considering input from previous similar dredging efforts, a target depth of nine feet below the mean low water (MLW) level was assumed. The dredging areas were established using the "Maryland bathymetry Chesapeake Bay contours" data at both shores of the Bay (Western and Eastern shores). The northern limit of dredging was assumed to have an approximate offset of 50-feet north of the existing piers of the existing westbound span (to be demolished), and the southern limit was assumed to have an approximate offset of 60-feet from the southern edge of the proposed eastbound span.

The total area to be dredged at both shores of the Bay is approximately 50.2 acres (2.2 million square feet), totaling 16.4 acres on the Western Shore and 33.8 acres on the Eastern shore. These areas exclude the footprints of the proposed and existing bridge pier footings. The total dredged volume within the dredging area is approximately 308,800 cubic yards. Applying a bulking factor of 1.3 to the dredged volume, the volume of spoil to be hauled is approximately 401,500 cubic yards and is proposed to be hauled via barge. For the eastbound bridge, bucket dredging would likely take 14 days of activity within construction years 1 and 2 and for the westbound bridge bucket dredging would likely take 7 days of activity within construction years 7 and 8.

For access in shallow areas, dredging would need to be wide enough to facilitate equipment mobility, loading and unloading material barges, and erecting structures. Depending on the consistency of bottom materials, additional dredging area may be needed because the sides of dredged areas must be sloped back to prevent the material from sloughing back into the excavation areas. The bottom materials may need to be sloped as much as 3:1 horizontal to vertical. Additionally, based on the greater expanse of shallow water from the eastern shoreline, it is anticipated that more dredging would be required along the eastern shoreline than the western shoreline.

Dredging will occur prior to the construction of trestles that facilitate the loading and unloading of barges and support vessels. Multiple access points (dredged channels or trestles) may be needed depending on the work configuration and the specific construction equipment needed. Access and dredging details will be evaluated and further refined in future design phases.

Potential dredge disposal sites include Masonville Cove and Cox Creek dredged material containment facilities (DMCF). Utilizing Masonville Cove DMCF and Cox Creek DMCF will facilitate safe and efficient loading, transport, and placement of dredge material. Both sites are owned and operated by the Maryland Port Administration (MPA), are adjacent to the Patapsco River, and are accessible by barge for placement operations. Masonville Cove DMCF has a permitted capacity of 10.4 million cubic yards (mcy) on 101 acres. Cox Creek DMCF has a permitted capacity of 14.7 mcy on 241 acres. Both facilities have plans in place to incorporate the creation of wildlife habitat and community access for recreation including birdwatching. The Bay Crossing Study has coordinated with MPA and determined that either DMCF will have the capacity to accommodate the dredging volumes generated by the build alternative. MPA will require that the material suitability and operational plans be approved prior to placement in accordance with their *Right of Entry Application*.

Preliminary engineering assumptions include using a trestle for temporary construction access in waters less than 10 feet deep below MLW. Based on the Francis Scott Key Bridge Rebuild Project design, the MDTA assumes trestle piers will be constructed every 38 feet supported on 36-inch steel pipe piles. Preliminary engineering assumes that bridge piers would be constructed with 36-inch square pre-stressed concrete piles as well as 36-inch, 48-inch, and 96-inch driven steel pipe piles. Pier protection fenders would likely be supported on 48-inch driven steel pipe piles. Pier protection dolphins are assumed to include 19.6-inch-wide sheet pile, backed by 14-inch steel H-piles. Pier protection would be built with the corresponding bridge span. It is assumed that up to four pile driving rigs may operate concurrently. **Table 3-2** and **Table 3-3**Table 3-3 provide the estimated number and type of proposed piles and piers for the eastbound and westbound bridges, respectively.

Table 3-2: Eastbound Bridge – Assumed Pile Summary

Pile Type and Size	Total Piles	Total Piers
Bridge Piers	**1,741**	**77**
36” Pre-stressed Square Piles	132	18
36” Steel Pipe Piles	240	10
48” Steel Pipe Piles	1,231	43
96” Steel Pipe Piles	138	6
Trestle Piers		
36” Steel Pipe Piles	**628**	**157***
Pier Protection	**5,144**	**24**
48” Steel Pipe Piles for fenders	40	2
19.6” Sheet Piles (For Dolphins)	2,552**	22
14” Steel H-Piles (For Dolphins)	2,552**	
Grand Total	**7,513**	**258**

**A trestle pier is anticipated every 38 feet, beginning on land and extending one bridge pier beyond the limits of dredging (extending to 10-feet below MLW). Four 36-inch steel pipe piles are assumed to be required for each trestle pier.*
*** Pier protection dolphins have a diameter of 60’ and a circumference of 188.5’. Sheet piles and Steel H-piles would be constructed around the circumference of each dolphin and therefore, 116 sheet piles and 116 Steel H-piles are required per dolphin.*

Table 3-3: Westbound Bridge – Assumed Pile Summary

Pile Type and Size	Total Piles	Total Piers
Bridge Piers	**2,014**	**60**
36” Pre-stressed Square Piles	203	22
36” Steel Pipe Piles	243	9
48” Steel Pipe Piles	1,412	43
96" Steel Pipe Piles	156	6
Trestle Piers		
36” Steel Pipe Piles	**628**	**157***
Pier Protection	**5,144**	**24**
48” Steel Pipe Piles for fenders	40	2
19.6” Sheet Piles (For Dolphins)	2,552**	22
14” Steel H-Piles (For Dolphins)	2,552**	
Grand Total	**7,786**	**261**

** A trestle pier is anticipated every 38 feet, beginning on land and extending one bridge pier beyond the limits of dredging (extending to 10-feet below MLW). Four 36-inch steel pipe piles are assumed to be required for each trestle pier.*
*** Pier protection dolphins have a diameter of 60’ and a circumference of 188.5’. Sheet piles and Steel H-piles would be constructed around the circumference of each dolphin and therefore 116 sheet piles and 116 Steel H-piles are required per dolphin.*

The following are construction assumptions based on preliminary engineering:

- Multiple foundation types could be used by the contractor; however, to provide the most impactful estimate of noise, currently, the MDTA assumes the main span is by multiple driven steel-pipe piles, which require impact and vibratory hammering, and the approach span piles are assumed to be pre-stressed square concrete piles installed by impact hammer.
    - Noise attenuation in the form of bubble curtains would be used.
- Currently, a cable-stayed or suspension bridge is being considered.
- Piers would have some form of pier protection. Preliminary design assumes 2 fenders and 22 dolphins will be installed on both the eastbound and westbound bridges, respectively, to provide collision protection.
- Trestles would likely be used for construction access to facilitate pier placement for the new bridge within the dredged area. Trestles would be included for both construction and demolition activities. The preliminary design assumes a trestle pier would be constructed every 38 feet, beginning on land and extending one bridge pier beyond the limits of dredging (extending to 10-feet below MLW). Four 36-inch steel pipe piles are assumed to be required for each trestle pier. Trestles would remain in-place until construction is complete, approximately 15 years.
- Other temporary construction methods including cofferdams and other dewatering devices for pile driving may be used.
- Dredging in the shallows up to approximately 9-foot depth is assumed necessary to access areas for pier construction.
- It is assumed, based on the Francis Scott Key Bridge Test Pile Exposure Analysis assumptions, that impact driving would take a maximum of 2 hours per pile.
    - Due to equipment availability, it is assumed that up to 8 96” steel pipe piles may be driven in one day and up to 16 piles of other pile sizes could be driven in one day.
    - For the eastbound bridge, a total of 120 days of pile driving is anticipated throughout years 1-5 of construction.
    - For the westbound bridge, a total of 138 days of pile driving is anticipated throughout years 7-13 of construction.
- Throughout the construction duration an effective 12-hour quiet period of no pile driving will be implemented each day.
- For temporary staging areas, the MDTA anticipates using the existing MDTA piers that are currently used for bridge maintenance. Additional staging areas may be needed, which will be determined during final design. Any additional staging areas may include existing public or private industrial locations in the Baltimore Harbor area or along the major rivers that would facilitate material transportation by barge and which would not result in additional environmental impacts. Staging areas may also include mooring locations within the Chesapeake Bay. Temporary mooring locations in the Chesapeake Bay may have additional bay bottom impacts, however the MDTA will avoid placing moorings in areas of oyster beds or SAV. The specific locations and number of moorings will be determined in final design and coordinated with NOAA Fisheries.

Temporary lights may be used during construction, including in cases of extended construction day or overnight work, which may impact federally-managed fish and sea turtle species utilization of habitat; however, the use of aesthetic and continuous roadway lighting will be determined in final design. Lighting will include required navigation, aviation, and traffic control lighting.

Demolition of the existing bridge spans would occur following construction of each new span. During the demolition phase, noise and vibration impacts from blasting would likely have the most pronounced impacts to federally-managed fish and sea turtle species. The following are the demolition assumptions based on preliminary design:

- Mechanical removal would be employed wherever possible, however blasting may be necessary when water depths or pier element size makes mechanical removal infeasible.
- Trestles would be used where water depths are less than 10 feet to perform demolition activities, as needed.
- Marine cranes affixed to barges would be used where water depths are deeper than 10 feet below MLW to perform demolition activities, as needed.
- Steel bracing elements are anticipated to be torch cut and heavy lift marine cranes will be used to maneuver cut pieces.
- Shielding barges are anticipated for the removal and transportation of bridge elements from the water. These barges would be positioned underneath the existing bridge decks to capture any debris that may be released during demolition.
    - The MDTA will determine the exact number and location(s) of shielding barges during permitting. All proposed barges would be located in areas already assumed for impact.
- Terrestrial demolition of bridge decks, girders, substructures, and abutments is anticipated to use saw cutting, excavators, and slab grab buckets. All demolition debris will be disposed of in accordance with regulatory permits and applicable laws and regulations.

3.2 Impacts from the Preferred Alternative

The Preferred Alternative extends along U.S. 50/301 for approximately 8.3 miles from west of Oceanic Drive to east of Cox Creek. The limit of disturbance (LOD) is the boundary that would include all proposed construction, erosion and sediment control (ESC), stormwater management (SWM), and right-of-way offsets. The impacts to natural resources are summarized in **Table 3-4**. A more detailed discussion of potential impacts from the Preferred Alternative to listed species under NOAA Fisheries' jurisdiction and proposed mitigation measures under consideration is included in **Section 5, Effects Determination**.

Table 3-4: Impact Summary

Resource	Impacts
Nontidal and Tidal Wetlands* (Acres)	6.3
Nontidal and Tidal Waterways* (Acres)	1.1
5-Year SAV 2019-2023 (Acres)	0
Historical SAV 2000-2018 (Acres)	0
Natural Oyster Bar (NOB) (Acres)	10.8

Resource	Impacts
Historic Oyster Bottom (Acres)	24.7
Oyster Plantings (Acres)	0
Oyster Sanctuaries (Acres)	0.6
Public Shellfish Fishery Areas (Acres)	6.5
Essential Fish Habitat (EFH)** (Acres)	138.4
Horseshoe Crab Habitat (Linear Feet)	290
Substrate – Dredging Impacts (Acres)	50.2
Substrate – Dredging Impacts (Cubic Yards)	317,400
Chesapeake Bay Tidal Waters (Acres)	133.8

3.3 Avoidance and Minimization Measures

Avoidance and minimization measures will continue to be evaluated for the Preferred Alternative during final design. This will include implementation of specialized construction methods to ensure the protection of sensitive resources. The MDTA commits to minimizing all in-water fills, both temporary and permanent. Temporary impacts in place for greater than one year are considered permanent impacts to account for the temporal loss of function in these areas. The MDTA has prepared a hydrodynamic modeling report that evaluates the existing hydrodynamic conditions of the broader study area and the MDTA commits to evaluating they hydrologic implications of the proposed design to maintain hydrodynamic conditions to the greatest extent practicable. Specialized construction methods may include time of year restrictions (TOYR), detailed monitoring plans, and project implementation schedules. It is assumed that in-water nets would not be used during demolition or construction, therefore potential impingement/entrainment BMPs have not been considered. Potential construction methods to minimize impacts to federally-managed fish and sea turtle species (adapted from the *NOAA Fisheries/FHWA BMP Manual* (NOAA Fisheries 2017a) and the FHWA Programmatic Essential Fish Habitat Consultation and General Concurrence for Select Transportation Actions in the NMFS Greater Atlantic Region (NOAA Fisheries 2024b)) are summarized in the following sections. The MDTA will commit to the avoidance and minimization methods included in the first list below and will consider all other measures/methods included in the second list below that may or may not be adopted and will be negotiated with the resource agencies.

List of Avoidance and Minimization Commitments:

Underwater Noise/Hydroacoustic Energy

1. Use noise attenuation and minimization measures during pile driving, including:
    a. Use a bubble curtain system that achieves 10 dB or greater attenuation for bridge piles and 5 dB or greater attenuation for dolphin pier protection piles. The effectiveness of the bubble curtain attenuation shall be demonstrated with a test pile and underwater noise program prior to initiating production pile driving activities.

b. Using a "soft start" or "ramping up" pile driving (e.g., driving does not begin at 100% energy).
c. Initially driving steel piles with a vibratory hammer through softer, sandy soils prior to using an impact hammer through stiffer material, as practicable and as appropriate.
d. Using cushion blocks to drive concrete piles with an impact hammer as practicable and as appropriate.

2. Develop an underwater noise monitoring plan to describe the underwater noise generated by project activities and adaptive management measures planned to address the underwater noise.
3. Include methods to document fish stuns/kills in the Underwater Noise Monitoring Plan and coordinate these methods with NOAA Fisheries Habitat and Ecosystem Services Division and Protected Resources Division.
4. Implement an effective quiet time of no pile driving for 12 consecutive hours per day.
5. Employ scare charges and fish deterrent boats, I tand monitor for the presence of tagged sturgeon, ahead of blasting activities.
6. Develop a detailed Demolition Plan in coordination with NOAA Fisheries and submit to NOAA Fisheries for review and approval in advance of any detonation activity. The Demolition Plan will evaluate the following measures:
    a. Detonation bore hole stemming, capping, or filling;
    b. Firing all charges in a single firing circuit with a delayed detonation between each charge;
    c. Focusing blast energy towards a solid substrate rather than towards the water column;
    d. Employing noise attenuating devices such as bubble curtains;
    e. Conducting the blasting during periods of low water or low tide;
    f. Using rubber blasting mats to reduce debris and acoustic signature;
    g. Employing scare charges;
    h. Installing appropriate monitoring devices to confirm the impact distance to adaptively manage the Demolition Plan;
    i. Using explosive weights that result in injury/mortality thresholds remaining within 100 feet of the blasting source; and
    j. Using adaptive management actions between blast events to minimize fish mortality.
7. Continue to coordinate to minimize the use of blasting.

Turbidity and Sedimentation

1. Limit the amount and extent of turbidity and sedimentation by using appropriate sedimentation and turbidity controls such as silt curtains, settling basins, and cofferdams. The MDTA will specify the measures to be used in the construction plans:
    a. Install erosion control measures prior to ground disturbance;
    b. Inspect daily and maintain continuously in an effective operating condition all ESC measures until such time as they are removed with prior permission from the Maryland Department of the Environment (MDE) inspector;
    c. Upon project completion, remove and stabilize all temporary construction materials with sediment and erosion control measures to prevent reentry into waterways.
2. The MDTA commits to the use of mechanical dredging.
3. Minimize the suspension of sediments and disturbance of the substrate when removing piles by implementing the applicable techniques:
    a. Remove piles with a vibratory hammer, rather than by direct pull, jetting, or clamshell;
    b. Remove piles slowly to reduce sediment sloughing off in the water column;
    c. Strike or vibrate the pile to break the bond between the sediment and pile to minimize the pile breakage, and reduce the amount of sediment sloughing off the pile during removal;

   d. Place piles on a barge equipped with a basin to contain all attached sediment and runoff water after removal.
4. Prevent sediment and debris from entering the water using geo-textile fabric, hay bales, or other methods. Use nets, tarps, and pans when demolishing bridge superstructures. Remove demolition debris that falls into the water.

Reduced Water Quality
1. Only use clean fill.
2. Avoid, to the greatest extent practicable, the use of creosote piles or other in-water structures, and coordinate with NOAA Fisheries if there is an essential use identified by the Contractor.
3. Remove cofferdams or other diversion structures only after water quality is consistent with ambient levels outside the structure.
4. Remove contaminants and sediments from water discharge prior to entering aquatic habitats.
5. Evaluate dredge material to determine the appropriate disposal method and location.
6. Manage concrete wash water and cooling water effluent from concrete saw operations to ensure they do not enter the Bay untreated.

Habitat Alteration
1. Employ an Independent Environmental Monitor (IEM).
2. Remove temporary structures and fills including monitoring devices in their entirety. Return aquatic habitats impacted by temporary activities, fills, or structures to pre-construction or better condition, including contours, elevations, substrate, and vegetation.
3. Coordinate with GARFO on specific recommended time-of-year restriction dates, based on the proposed activities and location.
4. Staging of activities to reduce intensity of disturbance.
5. Avoiding areas where protected species congregate for spawning/foraging or overwintering.
6. Coordinate with NOAA Fisheries and MDNR during Final Design to determine if SAV surveys would be informative of permit conditions. If so, conduct SAV surveys during the growing season, prior to construction, within nearshore areas of the action area to determine the presence and extent of SAV beds.

Fish Passage and Migration Habitat
1. From January 15 through May 15 (the anadromous fish migratory period), ensure a minimum contiguous Zone of Safe Fish Passage (ZSFP) equivalent to approximately one-third the waterway width (approximately 7,000 linear feet). The ZSFP will allow federally-managed fish species, including migratory fish, to safely navigate to their spawning grounds around undesirable noise (i.e., above the 150 dB RMS behavioral threshold) and turbidity levels. The ZSFP will encompass the channel edges. To maintain the ZSFP, 96” steel pipe piles will not be driven from January 15 through May 15, unless underwater noise monitoring results demonstrate 96” piles can be driven while ensuring a minimum contiguous 7,000-foot-wide ZSFP. The contractor shall use pile driving underwater noise monitoring results to determine an acceptable pile driving sequence of construction that ensures the ZSFP is achieved from January 15 through May 15. The project team will work with NOAA Fisheries and MDNR to refine and approve ZSFP locations and the migratory focal period during Final Design and permitting.

Vessel Interaction
1. Do not moor vessels in submerged aquatic vegetation (SAV) or in such a way that could shade SAV.
2. Enforcement of reduced construction vessel speeds (e.g., below 10 knots).
3. Employing species spotters to reduce species/vessel collisions; and keeping appropriate distance from protected species if spotted.

Impingement and Entrainment

1. Use of construction equipment that reduces potential for impingement and entrainment such as utilizing intake screens and using environmental buckets on mechanical dredges.
2. Employing a NOAA Fisheries approved observer during mechanical dredging/removal of demolition debris in case of accidental capture.

List of Avoidance and Minimization Considerations:

Underwater Noise/Hydroacoustic Energy

1. Use of mechanical demolition methods, instead of blasting, when possible.
2. Conduct noise-generating work in a way that minimizes acoustic effects and avoids injury to federally-managed fish species. Explore potential attenuation measures based on the Section 7 Acoustic Tool.
3. Use of noise attenuation and minimization measures during pile driving, such as:
    a. Isolation casing or dewatered cofferdam. Contained bubble curtains would be utilized to the extent practicable. Where use of a contained bubble curtain is not feasible, use of an uncontained bubble curtain would be evaluated. There may be some circumstances in which neither a contained nor uncontained bubble curtain would be feasible, in these circumstances rationale would be provided to the resource agencies prior to driving piles.
    b. Using vibratory hammers and construction phasing to minimize acoustic impacts.
    c. Minimizing the number and size of temporary and permanent piles.
    d. Using concrete piles and pre-cast piles versus steel piles to reduce underwater noise.
    e. Using drilled shafts instead of hammered piles where appropriate.

Turbidity and Sedimentation

1. Position new structures to avoid altering natural sediment accretion rates and pattern.
2. Use operational modifications to minimize turbidity and sedimentation during dredging. This may include using an environmental bucket on mechanical dredges, reducing lift speeds, using small diameter cutterhead dredges, and/or limiting the use of large hopper dredges.
3. Design the dredge footprint to avoid sensitive habitats to the greatest extent practicable and provide appropriate buffers to protect these areas from accretion of sediment resuspended during dredging.
4. Prohibit side-casting or temporary storage of dredged material in the waterway.
5. Prohibit unfiltered or unprocessed overflows from barges into the water and ensure that any barge transfer is accomplished without generating sediment plumes.

Reduced Water Quality

1. Minimize the amount of new impervious surfaces and maintain a vegetated buffer between the water and upland activities.
2. Incorporate stormwater controls to minimize pollutants in aquatic habitats, including determining whether the proposed bridge could include measures to collect runoff and route it to upland features for treatment prior to discharge.
3. Consider alternatives to the use of pressure treated (Chromated Copper Arsenate or Alkaline Copper Quaternary, etc.) piles or other in-water structures, as practicable and as appropriate.

Habitat Alteration

1. Place a geotextile barrier under any temporary platforms and/or access fills to ensure that any fill would be removed completely at the end of construction.
2. Develop a project schedule and plan prior to construction, which avoids or minimizes sediment disturbance, noise, and physical obstruction during sensitive life stages (migration and

spawning) of federally-managed fish species. This may include isolating in-water work or implementing time-of-year restrictions.
3. Complete pre- and post-construction monitoring to determine the project was completed as intended to determine fishery resources present, habitat impacts, and mitigation needs.
4. Use multiple-season biological sampling data (pre- and post-construction) to assess the potential and resultant impacts on habitat and aquatic organisms.
5. Fill all holes left by the piles with clean substrate appropriate for the site.
6. Orient artificial lighting on crossings to avoid illumination of the surrounding waters at night.
7. Design bridge abutments to minimize disturbances to banks and locate them outside of the floodplain.
8. Incorporate measures that increase the ambient light transmission under the bridge including:
    a. maximizing the height of the structure;
    b. minimizing the width of the structure; and
    c. minimizing the number of instream pilings/piers.
9. Consider beneficial use of suitable sediments and give priority to beneficial uses of material that contributes to habitat restoration and enhancement.
10. Ensure that any proposed dredging is necessary to maintain target depths. Evaluate recent bathymetric surveys to determine the existing depths of the proposed dredge area.
11. Use waterline pile cap/pier footings to avoid dredging to construct footings below the mudline.
12. Avoid and minimize all activities (including work footprint, structures, shading, temporary and permanent fill, excavation, etc.) in shallow water habitats and sensitive habitats such as critical habitat, SAV, mudflats, salt marsh, areas containing shellfish, and intertidal areas.
13. Provide compensatory mitigation for all unavoidable impacts to Essential Fish Habitat (EFH) and sensitive habitats.

Fish Passage and Migration Habitat
1. Ensure temporary structures or barriers do not block federally-managed fish species' access to an area, preventing movement in or out of a river or channel.
2. Design projects to maintain adequate flow conditions for fish passage, maintain water quality, and to maintain properly functioning channel, floodplain, riparian, and estuarine conditions.

Vessel Interaction
1. Reduce vessel speeds in inshore areas, or otherwise minimize wake damage to shorelines, and consider no-wake zones in highly sensitive areas, such as spawning habitat and SAV beds. Identify appropriate vessel routes in the design process to minimize impacts to shorelines and shallow water habitats.
2. Consider the effects of increased vessel traffic when conducting in-water actions.
3. Ensure that vessels are operated in adequate water depths to avoid propeller scour and grounding at all tides. Use shallow draft vessels that maximize the navigational clearance between the vessel and the bottom in shallow areas.

Impingement/Entrainment and Entanglement
1. Ensure any in-water lines, ropes, or chains are made of materials and installed in a manner (properly spaced) to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. Lines can be enclosed in a rigid sleeve.
2. Attach any cables or utility lines to structures above the water, instead of locating them in water or within the substrate. Bury and prevent cables or utility lines from coming through the substrate if they are necessary to be in the water.
3. Allow all fish to exit an enclosed area prior to any dewatering. Trapped fish greater than 5 inches long, observed during dewatering shall be captured and released from the dewatering

area except for invasive species (snakehead, blue catfish, flathead catfish) that will be disposed of.

4. Any water intakes (e.g., pumps) drawing from surface tidal waters should employ screening (1 mm wedgewire or better technology with maximum intake velocity of 0.5 fps) to minimize impingement/entrainment of fish and nekton.
5. Properly secure turbidity control measures and design them in a manner that does not block entry to or exit from critical habitat.
6. Monitor turbidity control measures to ensure aquatic species are not entangled or trapped within them.

4 ACTION AREA

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). *NOAA Fisheries Section 7 Program Technical Guidance* (NOAA Fisheries, 2024a) provides technical assistance for determining the action area. The action area of the Tier 2 Study includes the Tier 2 Study area and any area where stressors may affect listed species. Potential effects would occur during construction of the new bridge spans and pier protection, and removal of the existing bridge spans. The boundaries of the action area for the project have been determined by the likely extent of sedimentation, turbidity, noise, and construction-related vessel traffic, based on current high-level assumptions. A map of the action area is presented in **Appendix B**.

The action area includes areas within the waterway(s) that would experience temporary increases in sediment from dredging, pile driving, and bridge widening; temporary increases in noise from pile-driving activities and demolition of the existing bridge spans; and be affected by construction-related vessels. The action area extends up to 32,808.4 feet from the in-water portion of the Preferred Alternative LOD due to the anticipated noise generated by pile-driving. Sediment and turbidity impacts are expected to occur up to 300-feet from the pile driving locations, and up to 2,000 feet from the dredging locations (NOAA Fisheries, 2025). It is anticipated that the vessel home port location would be in the Baltimore area, in which case construction-related vessel traffic would travel between the Bay Bridge and the Baltimore area when involved in transport of material (a one-way distance of approximately 19 miles). Any vessel traffic to/from home ports is anticipated to be limited to the Federal navigation channel, but may occur anywhere within the extent of the Federal navigation channel.

4.1 NOAA Fisheries Listed Species in the Action Area

A review of the NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper and correspondence from NOAA Fisheries shows that the Preferred Alternative overlaps Section 7 Consultation Areas for six federally listed species that include two fish and four sea turtle species, as shown in **Table 4-1**Table 4-1.

Table 4-1: Federally Listed Species Under NOAA Fisheries Jurisdiction

Common Name	Scientific Name	Federal Status	Federal Register Citation	Species Recovery Plan	Distinct Population Segment (DPS) Potentially Occurring in the Action Area	Behavior in Action Area	Life Stage Potentially Occurring in the Action Area
Atlantic sturgeon	*Acipenser oxyrinchus*	Threatened/ Endangered[1]	77 FR 5880 and 77 FR 5914; February 6, 2012	Recovery Outline for the Atlantic Sturgeon Distinct Population Segments (NOAA Fisheries, 2018)	Gulf of Maine; New York Bight; Chesapeake Bay; Carolina; South Atlantic	Migrating & Foraging	Subadult, Juvenile, Adult
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	32 FR 4001; March 11, 1967	Final Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*) (SSRT, 1998)	Range-wide[2]	Overwintering; Migrating & Foraging	Adult
Loggerhead sea turtle	*Caretta caretta*	Threatened	76 FR 58868, September 22, 2011	Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*) (NOAA Fisheries & USFWS, 2008)	Northwest Atlantic	Migrating & Foraging	Juvenile, Adult
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	35 FR 18319 18322, December 2, 1970	Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (2nd Revision) (USFWS et al., 2011)	Range-wide[2]	Migrating & Foraging	Juvenile, Adult
Green sea turtle	*Chelonia mydas*	Threatened	81 FR 20058, April 6, 2016	Recovery Plan for U.S. Population of Atlantic Green Turtle (*Chelonia mydas*) (The Loggerhead/Green Turtle Recovery Team, 1991)	North Atlantic	Migrating & Foraging	Juvenile, Adult
Leatherback sea turtle	*Dermochelys coriacea*	Endangered	35 FR 8491, June 2, 1970	Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico (NOAA Fisheries & USFWS, 1992)	Range-wide[2]	Migrating & Foraging	Juvenile, Adult

[1] Gulf of Maine DPS is threatened. New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are endangered.
[2] DPS has not been designated for this species.

4.1.1 Atlantic and Shortnose Sturgeon

There are four distinct population segments (DPS) of Atlantic sturgeon listed as endangered (New York Bight, Chesapeake Bay, Carolina, and South Atlantic) and one DPS listed as threatened (Gulf of Maine) under the ESA. The five DPS were listed on February 6, 2012 (77 FR 5880, 77 FR 5914). The marine range for all five DPSs includes marine waters, coastal bays, and estuaries from the Labrador Inlet in Labrador, Canada to Cape Canaveral, Florida. The presence of Atlantic sturgeon has been documented in the action area. Available information on the distribution of Atlantic sturgeon indicates that a majority of the Atlantic sturgeon in the action area will be from the Chesapeake Bay DPS, though individuals from all five DPSs may be present within the action area.

Juvenile, subadult, and adult Atlantic sturgeon are found migrating and foraging throughout the Chesapeake Bay and its tributaries. Adult and subadult stages are present between mid March and late November, while juvenile stages are present year-round. Telemetry data collected from 2021 to 2024 and provided by NOAA Fisheries indicated the presence of Atlantic sturgeon in the Chesapeake Bay North array (located just south of the Bay Bridge), with detections of Atlantic sturgeon occurring mainly during the warmer months (May through July), with additional detections in October through December. The telemetry data provided by NOAA Fisheries are included in **Appendix C**. Atlantic sturgeon are bottom feeders, consuming invertebrates and bottom-dwelling fish. In the Chesapeake Bay system, Atlantic sturgeon spawn between late summer and fall. Threats to the species include fisheries interactions and bycatch, habitat degradation, habitat impediments, and vessel strikes (NOAA Fisheries, 2022a; NOAA Fisheries, 2023a).

Shortnose sturgeon are listed as endangered under the ESA throughout their range and occur in rivers and estuaries along the east coast of the U.S. and Canada (SSSRT 2010). Shortnose sturgeon were initially listed as endangered on March 11, 1967, under the Endangered Species Preservation Act and subsequently listed as endangered under the ESA when it passed in 1973. There are three metapopulations of the shortnose sturgeon (Carolinian Province, Virginian Province, and Acadian Province) within which there are 19 documented populations (NOAA Fisheries, 2023b). Available information on the distribution of shortnose sturgeon indicates that a majority of the shortnose sturgeon in the action area will be from the Virginian Province.

Adult stages of shortnose sturgeon are conservatively assumed to be present year-round throughout the Chesapeake Bay and its tributaries (NOAA Fisheries, 2022a). NOAA Fisheries conservatively assumes that shortnose sturgeon could be overwintering anywhere in the Bay or its tributaries from November 1st to February 28th. Shortnose sturgeon are bottom feeders that feed on mollusks as well as benthic crustaceans and insects (Dadswell, 1979). In the mid-Atlantic region, shortnose sturgeon migrate upriver to spawn from April to May and return downstream after spawning. Threats to the species include habitat impediments, habitat degradation, and fisheries interactions and bycatch (NOAA Fisheries, 2023b).

4.1.2 Sea Turtles

There are 11 DPSs of green sea turtle listed under the ESA. Three are listed as endangered and eight are listed as threatened. Green sea turtles potentially occurring in the action area are in the North Atlantic DPS, listed as threatened on April 6, 2016 (81 FR 20058). Nine DPSs of loggerhead turtles are listed under the ESA. Five are listed as endangered and four are listed as threatened. Loggerhead turtles potentially occurring in the action area are in the Northwest

Atlantic DPS, listed as threatened on September 22, 2011 (76 FR 58868). The leatherback sea turtle and Kemp's ridley sea turtle are listed as endangered throughout their ranges and were initially listed under the Endangered Species Conservation Act and subsequently listed as endangered when the ESA was passed in 1973.

Adult and juvenile stages of the loggerhead, Kemp's ridley, green, and leatherback sea turtles are found migrating and foraging in the Chesapeake Bay and its tributaries. These four species of sea turtles migrate north to the mid-Atlantic in the spring, arriving in May, and leave the area generally by the end of November (NOAA Fisheries, 2022b, 2023c, 2023d, and 2023e). Loggerhead sea turtles forage in coastal areas, feeding mostly on bottom dwelling invertebrates. Kemp's ridley sea turtles foraging in coastal areas consume mostly crabs and occasionally discarded bycatch. Green sea turtles are primarily herbivorous, feeding on algae and seagrasses, and occasionally consuming sponges, invertebrates, and discarded fish. Leatherback sea turtles consume soft-bodied prey such as jellyfish. Threats to the loggerhead, Kemp's ridley, green, and leatherback sea turtles include bycatch in fishing gear, loss and degradation of nesting habitat, vessel strikes, direct harvest of the sea turtles and their eggs, and ocean pollution/marine debris. Additionally, threats to the Kemp's ridley sea turtle include predation of eggs and hatchlings, and threats to the green sea turtle include Fibropapillomatosis, a tumor-causing disease (NOAA Fisheries, 2022b, 2023c, 2023d, and 2023e).

4.1.3 Critical Habitat

Designated critical habitat for listed species is not present in the action area. The furthest extent of the action area is expected to result from noise generated by pile-driving, with the largest potential noise isopleths extending over 6 miles from the pile being driven. The designated critical habitat nearest the project location is located in the Nanticoke and Potomac Rivers. The furthest extent of the estimated noise isopleths occurs north of the southernmost point of Kent Island, which is located north of the mouths of both rivers. Therefore, impacts to designated critical habitat are not anticipated and are not discussed further in this BA.

4.1.4 Additional NOAA Protected Species and Habitat

4.1.4.1 Mammals

The University of Maryland Center for Environmental Science (UMCES) Chesapeake DolphinWatch program compiles reported sightings of bottlenose dolphins from the public and verifies them. A review of the Chesapeake DolphinWatch website indicates that there were nearly 2,000 dolphin sightings in the Chesapeake Bay in 2022 and about 1,500 dolphin sightings in 2023 (UMCES, 2024). Dolphins are typically seen in the Chesapeake Bay from May through October, including around the Bay Bridge. As noted in Section 2, the MDTA will coordinate with NOAA Fisheries to secure an IHA for impacts on bottlenose dolphins and to determine appropriate BMPs. Bottlenose dolphins are protected under the MMPA and not listed under the ESA; therefore, bottlenose dolphins are not discussed further in this document. Additional information on bottlenose dolphins is included in the DEIS and NETR.

4.1.4.2 EFH and HAPC

EFH and HAPC are included in the action area. As noted in Section 2, impacts to EFH and HAPC were evaluated and are presented in the EFH Assessment document. The MDTA will continue to coordinate with NOAA Fisheries to determine and implement appropriate avoidance and minimization measures as design progresses. EFH and HAPC are protected under the MSA and

not the ESA; therefore, EFH and HAPC are not discussed further in this document. Additional information on EFH and HAPC is included in the EFH Assessment, the DEIS, and the NETR.

4.2 Habitat within the Action Area

4.2.1 Waterways

Waterways within the Preferred Alternative action area include Chesapeake Bay and Cox Creek. These tidal waterways are shaped by the region's geological history and the regular fluctuations of the tides.

The Chesapeake Bay is the largest estuary in the United States and contains a diversity of habitats including shallow waters, open waters, deepwater refuge areas, marshes and wetlands, sandy beaches, mud flats, oyster reefs, and other habitat niches that sustain a wide range of aquatic species. The portion of the Bay crossed by the Preferred Alternative is the narrowest point in the mainstem of the Bay, which widens to the north and south where the action area extends up and down the Bay along Federal navigational channels.

The Chesapeake Bay is designated by MDE as a Use II tidal waterway, or tidal waters designated for supporting estuarine and marine aquatic life and shellfish harvesting. North of the bridge, the Bay is identified as within the Upper Chesapeake Bay segment (CB3MH), and south of the bridge, the Bay is identified as within the Middle Central Chesapeake Bay segment (CB4MH). The Chesapeake Bay is a mesohaline system (represented as the MH within the segment identifier above), which means its waters have a low to medium saline content, or are brackish waters, and are typically defined as having salinity between 5 and 18 parts per thousand (Park, 2012).

Cox Creek is a tidal system both north and south of U.S. 50/301 that almost bisects Kent Island. This is a wide system that narrows where it is bridged by U.S. 50/301 and is approximately 575 feet wide north of the roadway and 1,650 feet wide south of the roadway. Although the FEMA 100-year floodplain is associated with this waterway both north and south of the road, there are no vegetated wetlands identified to the north. Large areas of estuarine common reed (*Phragmites australis*) wetland are located along the western bank, on the south side of the road.

4.2.1.1 Water Quality

Water quality data was gathered from MDE, Maryland Department of Natural Resources' (MDNR) Eyes on the Bay Program, and other monitoring programs accessed through the Chesapeake Bay Program (CBP) DataHub to assess water quality during the development of the Tier 2 Study NETR. In addition, water quality data were gathered from the National Water Quality Monitoring Council (NWQMC) database and in situ data were obtained from MDNR's Chesapeake Bay Benthic Monitoring Program (CBBMP). This section summarizes the water quality data for the watersheds within the action area.

Data available within the Chesapeake Bay closest to the Western Shore have sampling locations north of and beyond the action area, however, these locations are along the shoreline of the Chesapeake Bay and flow directly into the action area. Dissolved Oxygen (DO) data for this area reflects existing turbidity and shoreline erosion conditions, since DO and turbidity are inversely related, and provides baseline conditions for the area where the bridge would be constructed.

Recent chemical grab data from this part of the Chesapeake Bay is available for three monitoring locations from the NWQMC database, which indicated approximately 5 percent of pH records, 14

percent of all *Enterococcus* records, and 8 percent of fecal coliform records not meeting Code of Maryland Regulations (COMAR) criteria. Values for pH ranged from 6.1 to 9.0, which violated both the low and high COMAR criteria of 6.5 and 8.5, respectively. In general, DO values met COMAR criteria for the various designated habitats and seasons, with records infrequently falling below specific criteria. Salinity ranged from 1.9 to 16 ppt, depending on sampling event.

Sampling data is captured just north of the Bay Bridge landside connection with Anne Arundel County. In situ and grab sample water quality data for two locations in this area were gathered from the CBP DataHub, where approximately 10 percent of surface pH records exceeded the COMAR criterion of 8.5, with a maximum recorded value of 9.1. All surface DO readings met COMAR criteria for the various designated habitats and seasons, and between 7 percent and 29 percent of bottom DO readings fell below COMAR criteria, depending on the designated habitat and season. The full range of DO values observed across all seasons and habitat types can be found in **Table 4-2**. Chemical grab sample data was available for one monitoring location from the NWQMC database, indicating approximately 8 percent of all fecal coliform records exceeded the most stringent COMAR criterion for shellfish harvesting areas (i.e., ≤14 MPN/100 mL). Recent in-situ water quality data for one location, available from CBBMP, revealed that there were no exceedances of water quality criteria, however, this location is well south of the action area and flowing away from the Bay Bridge. Salinity ranged from 0.61 to 18.48 ppt, depending on the sampling event, location, and depth (**Table 4-3**).

Recent chemical grab sample data from one location in the Northern Eastern Bay MD 12-digit watershed, located downstream of the build alternatives, were available from the NWQMC database. Approximately 30 percent of all fecal coliform records exceed the most stringent COMAR criterion for shellfish harvesting areas (i.e., ≤14 MPN/100 mL).

Additional in situ and grab sample water quality data was retrieved from five sampling sites in the Kent Island True Bay MD 12-digit watershed, within the Chesapeake Bay, just north of the Bay Bridge. Data from two sites in the CBP DataHub and three sites in the NWQMC dataset indicated that approximately 9 percent of in situ surface records for pH and less than 1 percent of bottom records exceeded the upper COMAR criterion of 8.5. All surface DO readings met COMAR criteria for the various designated habitats and seasons. Bottom DO readings frequently fell below COMAR criteria, with 12 percent to 51 percent of readings not meeting COMAR criteria, depending on the designated habitat and season. Approximately 1 percent of all fecal coliform records exceeded the most stringent COMAR criterion for shellfish harvesting areas (i.e., ≤14 MPN/100 mL). Salinity ranged from 0.50 to 22.32 ppt, depending on the sampling event, location, and depth (**Table 4-3**).

Table 4-2 COMAR Water Quality Parameters within 12-digit Watersheds in the Vicinity of the Action Area

Watershed	Source	Number of Sites	Year	Depth (m)	Parameter				
					Temperature (°C)	pH	DO (mg/L)*	Enterococcus (MPN/100mL)	Fecal Coliform (MPN)
Annapolis Shore	CBBMP	1	2018	0.5 / 9	26.30 / 26.37	7.8 / 7.2	6.35 / **4.20** (ppm)	---	---
	CBP	2 / 1	2013 - 2023	0.5 / 4	3.7 - 30.9 / 1 - 28.3	7.1 - **9.1** / 7.1 - 8.4	**4.6** - 15.1 / **0.28** - 12.6	---	---
	NWQMC	1	2013 - 2019	---	---	---	---	---	1 - **23**
Northern Eastern Bay	NWQMC	1	2013 - 2019	---	---	---	---	10 - **2,010** (2013 - 2022)	1 - **1,100**
Kent Island True Bay	CBP	2	2013 - 2023	0.5 / 6	1.3 - 29.6 / 0 - 28	6.9 - **9.6** / 6.8 - **8.7**	5.1 - 17.8 / **0.09** - 12.7	---	---
	NWQMC	1 - 3	2013 - 2019	---	1.2 - 29	7.4 - **8.8**	**4.1** - 14.5	10 - **1,450** (2013 - 2022)	1 – **23**

*In dilute aqueous solutions, 1 mg/L is approximately equivalent to 1 ppm.

Notes:

1. Red values indicate that they exceed/are below COMAR criteria during the listed time period.

2. Data collected at two depths is shown in the same cell separated by a "/," corresponding to the two depths reported in the Depth column.

3. Not all parameters or sites were monitored in each year within the year range.

4. A range of number of sites is presented to note that not all parameters were assessed at all sites for certain watersheds and datasets.

Table 4-3 Salinity and Conductivity within 12-digit Watersheds in the Vicinity of the Action Area

Watershed	Source	Number of Sites	Year	Depth (m)	Parameter	
					Salinity (ppt)*	Conductivity (UMHO/cm)
Annapolis Shore	CBBMP	1	2018	0.5 / 9	3.26 / 5.83 (PSU)	5,972 / 10,340
	CBP	2 / 1	2013 - 2023	0.5 / 4	0.61 - 16.43 / 3.38 - 18.48	3,100 - 27,000 / 6,640 - 30,000
Kent Island True Bay	CBP	2	2013 - 2023	0.5 / 6	0.5 - 16.56 / 4.75 - 22.32	3,120 - 27,200 / 8,940 - 35,500
	NWQMC	1	2013 - 2019	---	2.8 - 15.2	---

*1 PSU is approximately equivalent to 1 ppt.

4.2.2 Bathymetry

The Chesapeake Bay in the Preferred Alternative action area is deepest in the center and east of the county boundary, located within the Chesapeake Bay Bridge Auxiliary Federal navigation channel. As expected, the depth becomes increasingly shallower towards the shorelines. The Chesapeake Bay has an average depth of approximately 40 feet within the action area, with the main channel depth approximately 56 feet, and the Chesapeake Bay Bridge Auxiliary channel depth approximately 92 feet. **Figure 4-1**Figure 4-1 illustrates the bathymetry of the Chesapeake Bay, with the close contours indicative of varying steep slopes within the deeper areas.

The shallows of the Chesapeake Bay (1 to 3 feet) extend channelward approximately 800 to 950 feet from the western shoreline in Anne Arundel County, and approximately 1,200 to 1,300 feet from the eastern shoreline in Queen Anne's County. Areas with depths from approximately 3 feet to 12 feet generally extend from about 2,100 to 2,200 feet from the western shoreline and 3,900 to 4,700 feet from the eastern shoreline. Based on bathymetric analysis, it is anticipated that

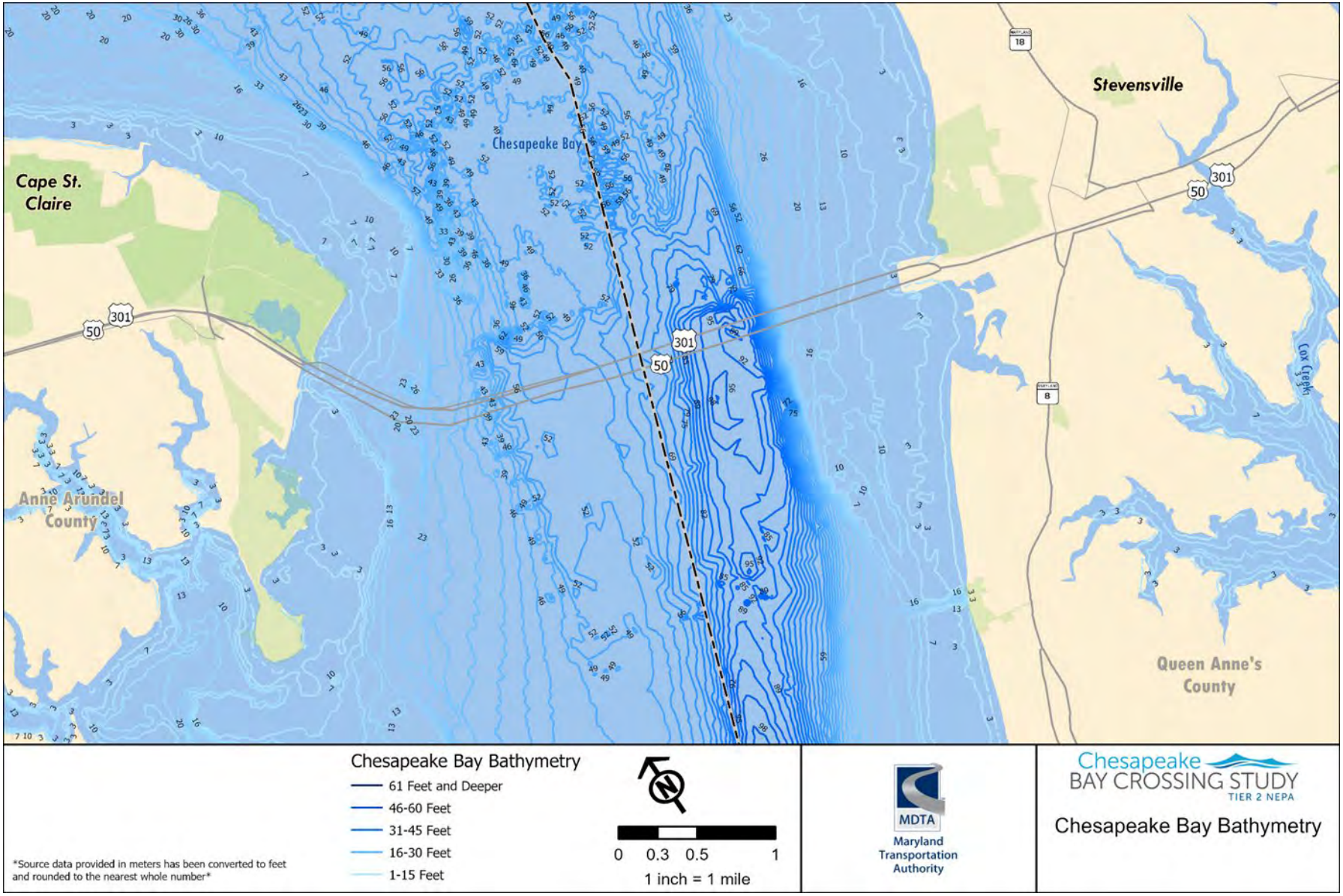
dredging would be required to a depth of 9 feet at mean lower low water (MLLW). Previous agency coordination for other bridge projects that required dredging required mitigation for areas with a water depth of 3 feet or less. Except in the shallow areas along the Anne Arundel and Queen Anne's shorelines, the Chesapeake Bay is deep enough for barge-mounted construction equipment and material barges to perform work adjacent to the existing Bay Bridge.

4.2.3 Bay Depths

The shallowest areas within the action area are along the Anne Arundel County and Queen Anne's County shorelines. From the Anne Arundel County shoreline north of the Bay Bridge, the water depth is approximately 9 feet deep between approximately 1,400 to 1,600 feet channelward. This area is adjacent to the access channel into Mezick Ponds and the Sandy Point State Park marina. The access channel is protected by a 525-foot-long rock groin. From the Anne Arundel County shoreline south of the Bay Bridge, the water depth is approximately 9 feet deep at approximately 2,000 feet channelward. This area is adjacent to the MDTA maintenance yard and dock areas that are used for service vessels.

From the Queen Anne's County shoreline north of the Bay Bridge, the water depth is approximately 9 feet deep at approximately 3,500 to 3,700 feet channelward. This area is adjacent to and north of the peninsula where the Bay Bridge lands and south of the Terrapin Nature Park. From the Queen Anne's County shoreline south of the Bay Bridge, the water depth is approximately 9 feet deep between approximately 3,700 to 4,000 feet channelward. This area is adjacent to the peninsula where the Bay Bridge lands and the Chesapeake Bay Bridge Marina. The channel to access the marina runs southwest away from the Bay Bridge.

Figure 4-1: Chesapeake Bay Bathymetry



4.2.4 Bay Bottom Material

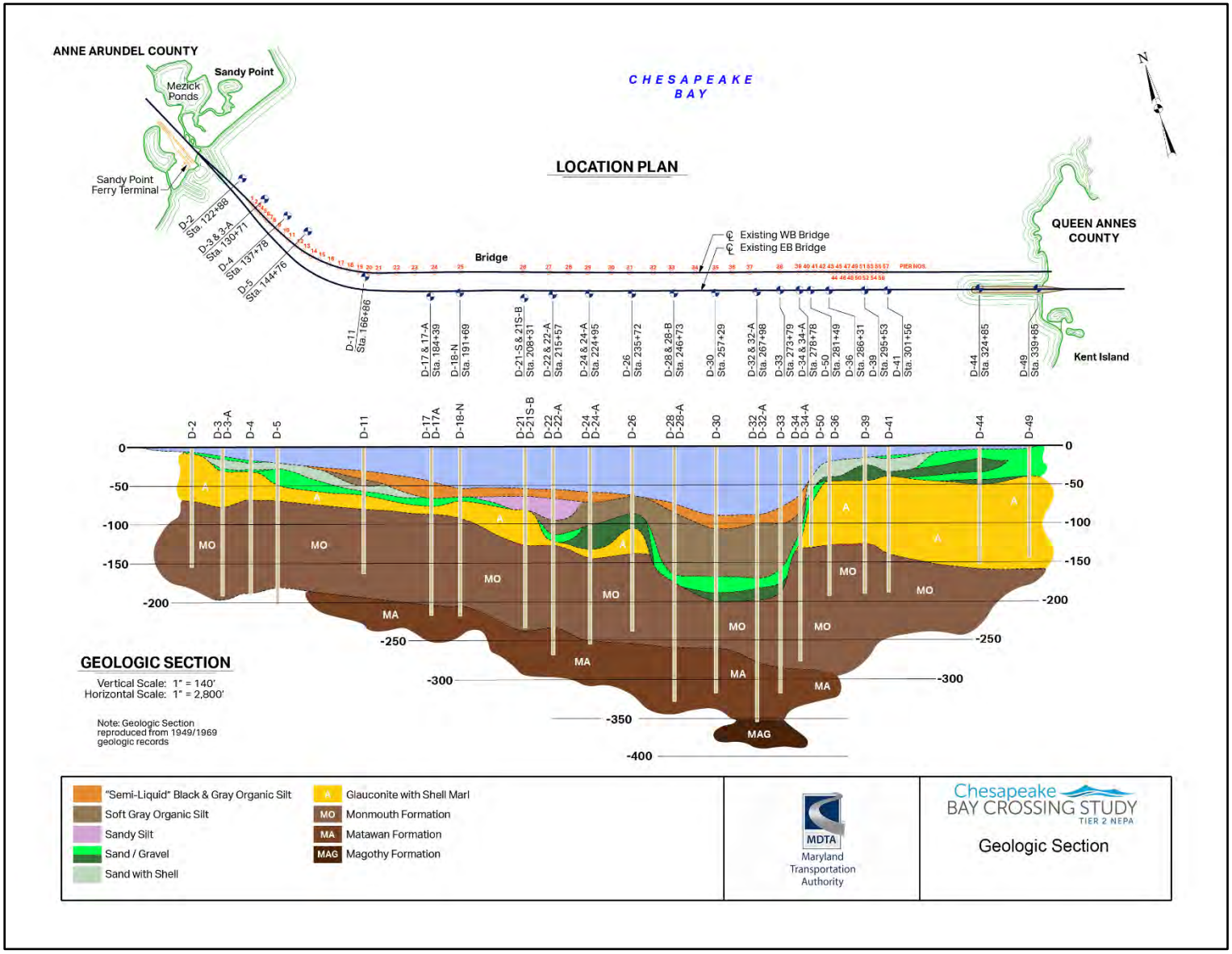
The Chesapeake Bay bottom is primarily formed by layers of Magothy, Matawan, and Monmouth formations, which is overlaid by sandy material in the shallow areas and loose silty clay material in the deeper channels. Surficial sand is generally found in the areas that are most affected by wave action and tidal fluctuations. The waves and tide move fine silt, clay, and organic material out of the sand and deposit them in lower energy areas along the bottom (**Figure 4-2**). Currently there is no indication of contaminated material, as the U.S. Army Corps of Engineers (USACE) 50ft Project has not found contaminated material in the Bay Bridge area (USACE 2017).

Sand: Surficial sand extends approximately 1,100 feet channelward from the Anne Arundel County shore, which corresponds to an approximate 6-foot water depth. Surficial sand extends approximately 4,200 feet channelward from the Queen Anne's County shore which corresponds to an approximate 12-foot water depth. Both shorelines correspond to bottom slopes that are flat (less than 0.5 percent) and near the surface. Geotechnical borings near the shorelines show the Chesapeake Bay bottom is underlain by sand to 50 feet deep where it begins to increase in clay content.

Cultch: Material (such as oyster shells) that has been laid down on oyster grounds and furnishes points of attachment for oyster spat is found in shallower areas (less than 26 feet deep). Cultch areas are generally inclusions in sandy bottom and may be incorporated into organic/silt mud areas.

Silty Clay: Surficial silty clay covers most of the Chesapeake Bay bottom along the action area. Silty clay is generally associated with relatively deep waters (deeper than 6 to 12 feet). Geotechnical borings in the mid-bay show organic silt and silty clay layers from 10 to 50 feet thick, before transitioning to clayey sand below.

Figure 4-2: Geologic Section and Chesapeake Bay Bottom Material



4.2.5 Submerged Aquatic Vegetation (SAV)

Information regarding SAV was obtained from the Virginia Institute of Marine Science (VIMS) SAV monitoring program, which uses multispectral aerial imagery to annually assess the distribution and abundance of SAV in areas including the Chesapeake Bay. Ground surveys are conducted to provide supplementary information, including species data, though not all areas are ground surveyed. This data is then used to develop trends, identify areas of decline and abundance, and to implement strategies of preservation.

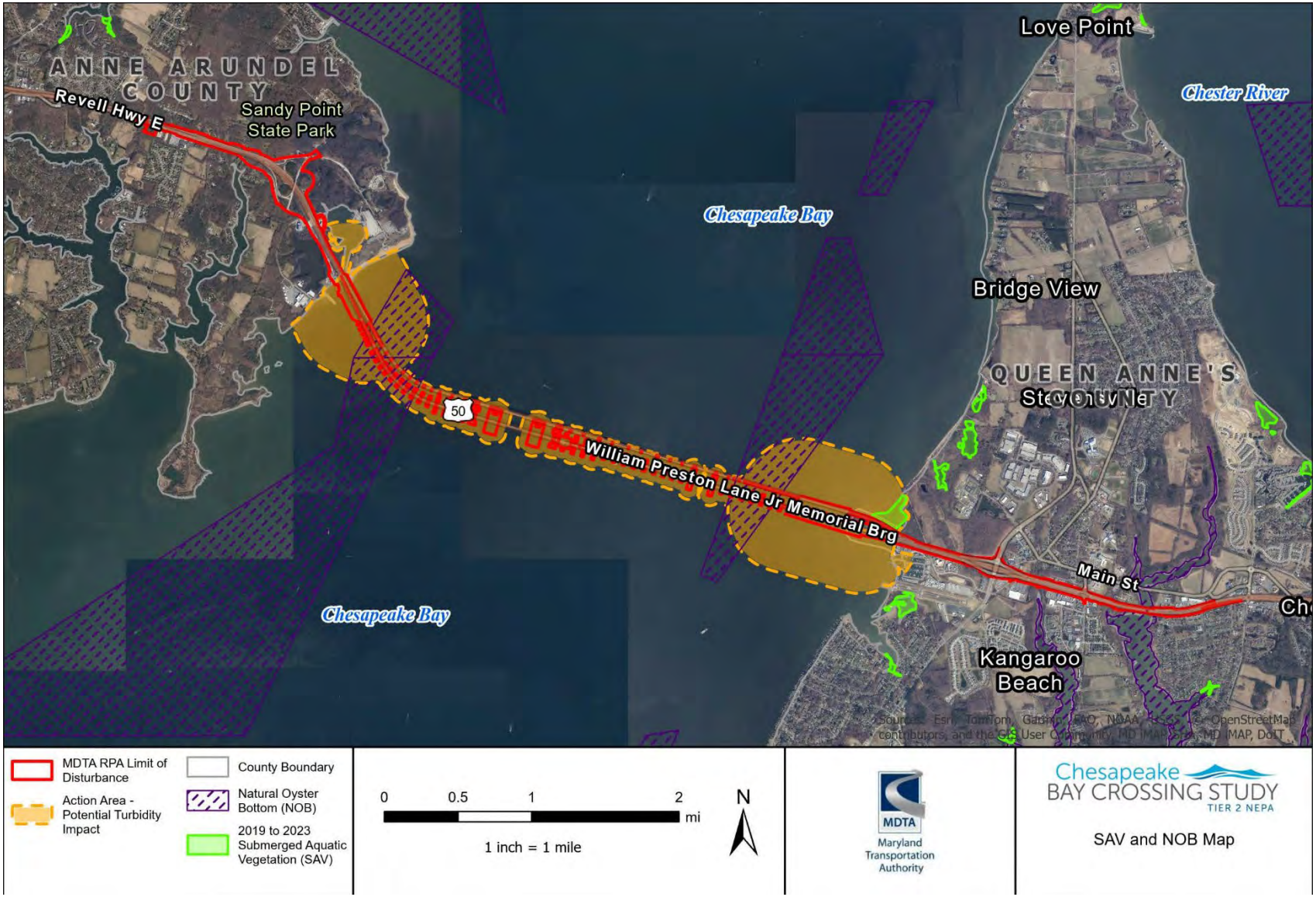
The extent of SAV present was determined through an analysis of existing and historical SAV beds documented by VIMS. The 5-year average extents of SAV were determined using a GIS overlay of the action area with the VIMS data from 2019 through 2023. The MDTA analyzed SAV density from year to year, utilizing the annual datasets from VIMS from 2000 to 2023. MDNR considers any area mapped in those 5 years to be habitat that supports SAV, even if SAV is not found there on a given date during the growing season. This analysis revealed historic patterns and trends that enhanced understanding of SAV in the action area. Historical data from 2000 to 2018 were also reviewed to identify areas that could potentially support SAV again in the future, given the right conditions.

SAV habitat exists north of the eastern terminus for the Bay Bridge, to approximately 1,200 feet north, along the Queen Anne's County shoreline. Records show that SAV has been present in this area in 4 of the last 5 years (2023, 2022, 2021, and 2019) of available data. There are no SAV records south of the eastern terminus of the bridge in Queen Anne's County or for either side of the western terminus of the bridge in Anne Arundel County. Most of the SAV beds within this area in 2023 were identified as dense SAV beds (>70 percent cover). There were no SAV beds in the Cox Creek mainstem or in the Chesapeake Bay mainstem within the action area (**Figure 4-3**).

4.2.6 Natural Oyster Bars (NOBs)

Information on the locations of NOBs was obtained through coordination with MDNR. NOBs exist from approximately 1,500 feet to 4,500 feet off the Anne Arundel County shoreline towards the main channel, extending north and south of the Chesapeake Bay Bridge. NOBs exist from approximately 4,100 feet to 6,200 feet off the Queen Anne's County shoreline towards the main channel, extending north and south of the Chesapeake Bay Bridge. Most tidal crossings along Kent Island cross NOBs, including Cox Creek. Historic oyster bottom habitat generally falls in the same areas as NOBs, with differences in specific boundaries. Cultch areas are found in concentrated areas along both the Anne Arundel and Queen Anne's County shorelines. One oyster planting area, Sandy Point South, is located within the action area, in the vicinity of the Chesapeake Bay Bridge and approximately 3,500 feet from the Anne Arundel County shoreline towards the main channel. Oyster sanctuaries are present where the review area crosses Cox Creek. Public Shellfish Fishery Areas overlap NOBs off the Anne Arundel County shoreline towards the main channel and within Kent Island Narrows and adjacent tidal connections. Approximately 124.8 acres of NOB are located within the Preferred Alternative LOD and potential turbidity impact portions of the action area (**Figure 4-3**).

Figure 4-3: Submerged Aquatic Vegetation (SAV) and Natural Oyster Bars (NOB) Map



4.2.7 Aquatic Habitat and Biota

Within the vicinity of the action area, MDNR CBBMP tidal benthic macroinvertebrate data was available for the Chesapeake Bay. MDNR assessed benthic macroinvertebrate communities at two random sites and one fixed monitoring location, all located upriver of U.S. 50/301. Benthic macroinvertebrate community health varied from "severely degraded" to "meets restoration goals" for these sites, based on benthic index of biotic integrity (IBI) scores. Benthic macroinvertebrate data was not available for Cox Creek.

5 EFFECTS ANALYSIS

The MDTA is currently in the early stages of preliminary engineering for the Preferred Alternative. Specific construction means and methods have not been determined. Therefore, this BA will assess all potential construction means and methods that are being considered and these methods will be further defined during the final design stage. Any major changes to design assumptions that result in the potential for changes in impacts to listed species will be coordinated with NOAA Fisheries and other resource agencies. The following sections include initial assumptions based on the current design and best available information from similar bridge projects including the Francis Scott Key Bridge, Tappan Zee Bridge, and Nice-Middleton Bridge.

Currently, two cable-stayed or suspension bridge spans are being considered for the Preferred Alternative. To construct the bridge spans, trestles could be used to facilitate pier placement for the new bridge and demolition of the piers from the existing bridge. Piers would have some form of pier protection whether it be an island or fender system. Pile driving, dredging, filling of tidal waters and associated aquatic resources, demolition of the existing structure (including blasting), and land-based activities have the potential to impact Atlantic sturgeon, shortnose sturgeon, and sea turtles. Specialized protection measures will be implemented during construction to avoid and minimize impacts to protected species, as discussed in Section 3.3. The MDTA is committed to building upon the work and lessons learned from other recent bridge projects, including the Nice-Middleton Bridge Project and the Francis Scott Key Bridge Project.

5.1 Pile Driving

Pile driving causes pressure waves and sound waves that impact fish. Pressure waves can kill or seriously injure fish by rupturing their swim bladders. The acoustic effects of pile driving can affect the hearing, swim bladders, and tissue of fish, and can cause behavioral impacts (e.g. changes in foraging or movements) (Popper et al. 2013; Caltrans 2020). Similar to sturgeon species, sea turtle species can be adversely affected by underwater noise; however, sea turtles have a higher threshold for behavior disturbance (NOAA Fisheries 2023b).

The distance of the sound effects would be dependent upon pile size, material, and methods of pile driving (Popper et al. 2013; Caltrans 2020). Though specific construction means and methods have not been developed, estimates of noise levels were calculated based on construction means and methods of similar projects, including Francis Scott Key Bridge, to provide the most impactful reasonable estimates of impacts. The Francis Scott Key Bridge is a project in the same geographic region, with similar maximum pile sizes and similar pile materials (the largest piles being 96” steel pipe piles). Actual noise levels resulting from pile driving operations for the pile types and sizes assumed during this initial design are not available at this time; therefore, pile installation noise level estimates were calculated using the NOAA Fisheries Multi-Species Pile Driving Calculator (NOAA Fisheries 2025). Calculations were completed for multiple pile driving scenarios for bridge piers based on the current Tier 2 Study high-level assumptions, including: impact hammer installation of 36” square concrete piles; impact hammer and vibratory hammer installation of 36” steel pipe piles; 48” steel shells (for fender installation); 48” steel pipe piles; 96” steel pipe piles; and 14” steel H-piles and 19.6” sheet piles for dolphin pier protection.

Conservative estimates were used for all instances. As unattenuated sound pressure levels associated with construction of the Preferred Alternative are unknown, proxy sound levels were used for the Peak, SEL_{ss}, and RMS Unattenuated Single Strike Level, as provided by the Multi-Species Pile Driving Calculator. When a proxy was not available for a specific pile type, a larger pipe proxy was included in the calculations to provide the most impactful estimate of noise impacts. The MDTA assumes construction of the Preferred Alternative would require installation of up to 16 piles per day, 2,500 strikes per pile (impact), and 30 minutes per pile (vibratory), based on the Underwater Noise Monitoring Plan for the Francis Scott Key Bridge Project. The Distance Associated with Single Strike Level/Measurement Distance (meters) and Transmission Loss Constant values were maintained at their default values, 10 and 15, respectively. Attenuation is assumed as bubble curtains would be in place. Calculations were completed with attenuation levels set at 10 dB for most pile types, a conservative estimate based on the 15-20 dB of attenuation attained with pile driving associated with the Nice-Middleton Bridge Project. Dolphin pier protection installation calculations were completed with attenuation levels set at 5 dB based on the assumption that the bubble curtain would be less protective in this scenario.

Pile driving will not be continuous for the duration of bridge construction. Pile driving for construction of the first span and its pier protection is expected to occur for approximately 120 days during year 1 through year 3 of construction. Pile driving for construction of the second span and its pier protection is expected to occur for approximately 138 days during year 7 through year 12 of construction. While pile driving will be protracted, it will not happen on a daily basis and when it occurs, it will not always occur for full days. Exact timing of pile driving has not been determined, but it could possibly take place throughout multiple seasons of the year, with breaks for TOYRs coordinated with NOAA Fisheries and MDNR to protect aquatic species, for adverse weather conditions, to set-up or break-down equipment, and to conduct other construction activities.

Assumptions for pile driving information based on similar projects in the region are presented in **Table 5-1**. Estimated sound levels and distances to sturgeon and sea turtle injury and behavioral effects are presented in **Table 5-2** and **Table 5-3**. Isopleths are shown in the mapping included in **Appendix D**; the NOAA Fisheries Multi-Species Pile Driving Calculator output is included in **Appendix E**. Note that one representative pile driving isopleth is shown for each pier and representative isopleths for every pier are shown. In practice, however, a maximum of sixteen piles would be driven at any given time resulting in sixteen concurrent isopleths or zones of fish injury/behavioral modification. Based on the behavior modification impact isopleths generated from pile driving, it is clear that pile driving activities could be phased to accommodate driving up to sixteen piles at a time while still allowing for fish migration.

Table 5-1: Proxy Levels for Underwater Noise

Type of Pile**	Hammer Type	Proxy Type Used	Estimated Peak Noise Level (dB_{Peak})	Estimated Single Strike Sound Exposure Level (dB_{SELss})	Estimated Pressure Level (dB_{RMS})
36" Square Concrete	Impact	30" Square (Type II)	200	166	176
36" Steel Pipe	Impact	36" Steel Pipe	210	183	193
	Vibratory	36" Steel Pipe	N/A	N/A	175
48" Steel Pipe	Impact	48" Steel Pipe	213	179	192
48" Steel Pipe (60" Steel Pipe Proxy)*	Impact	60" Steel Pipe	210	185	195
48" Steel Pipe (72" Steel Pipe Proxy)	Vibratory	72" Steel Pipe	N/A	N/A	180
96" Steel Pipe	Impact	96" Steel Pipe	220	195	205
	Vibratory	72" Steel Pipe	N/A	N/A	180
14" H-Pile	Impact	14" Steel H-Pile	208	177	187
	Vibratory	14" Steel H-Pile	N/A	N/A	150
AZ Sheet Pile	Impact	24" AZ Sheet Pile	205	180	190
	Vibratory	AZ Steel Sheet – Loudest	N/A	N/A	165

**In order to create an increasing trend in noise effect between all steel pipe pile sizes, two 48" steel pipe proxies were used in order to create a range of likely impacts. The noise proxy levels for a 48" steel pipe did not produce the expected impacts for the SELcum and RMS Threshold and therefore the noise proxy for a 60" steel pipe was used instead.*
***The NOAA Fisheries Multi-Species Pile Driving Calculator only includes vibratory proxies for 36" steel pipes and 72" steel pipes. Therefore, for every steel pipe greater than 36" in diameter, 72" steel pipe sound proxy levels were used.*

Table 5-2: Estimated Distances to Sturgeon Injury and Behavioral Thresholds

Type of Pile	Hammer Type	Distance (ft) to 206 dB_{Peak}	Distance (ft) to SEL_{cum} thresholds (187 dB; 183 dB)	Distance (ft) to Behavioral Disturbance Threshold (150 dB_{RMS})
36" Square Concrete	Impact	2.8	82.4; 82.4	382.5
36" Steel Pipe	Impact	13.1	1,120.3; 1,120.3	5,199.8
	Vibratory	N/A	N/A	328.1
48" Steel Pipe	Impact	20.7	606.3; 606.3	4,459.8
	Vibratory	N/A	N/A	706.8**
48" Steel Pipe (60" Steel Pipe Proxy)*	Impact	13.1	1,522.8; 1,522.8	7,068.4
	Vibratory	N/A	N/A	706.8**
96" Steel Pipe	Impact	60.6	7,068.4; 7,068.4	32,808.4
	Vibratory	N/A	N/A	706.8**
14" H-Pile	Impact	20.7	960.8; 960.8	4,459.8
	Vibratory	N/A	N/A	15.2
AZ Sheet Pile	Impact	13.1	1,522.8; 1,522.8	7,068.4
	Vibratory	N/A	N/A	152.3

**In order to create an increasing trend in noise effect between all steel pipe pile sizes, two 48" steel pipe proxies were used in order to create a range of likely impacts. The noise proxy levels for a 48" steel pipe did not produce the expected impacts for the SELcum and RMS Threshold and therefore the noise proxy for a 60" steel pipe was used instead.*
***The NOAA Fisheries Multi-Species Pile Driving Calculator only includes vibratory proxies for 36" steel pipes and 72" steel pipes. Therefore, for every steel pipe greater than 36" in diameter, 72" steel pipe sound proxy levels were used.*

Table 5-3: Estimated Distances to Sea Turtle Injury and Behavioral Thresholds

Type of Pile	Hammer Type	Distance (ft) to 232 dB_{Peak}	Distance (ft) to SEL_{cum} threshold (184 dB Impact / 198 dB Vibratory)	Distance (ft) to Behavioral Disturbance Threshold (175 dB_{RMS})
36" Square Concrete	Impact	0.1	519.5	8.2
36" Steel Pipe	Impact	0.3	7,061.8	112.0
	Vibratory	N/A	193.7	7.1
48" Steel Pipe	Impact	0.5	3,821.6	96.1
	Vibratory	N/A	417.3**	15.2**
48" Steel Pipe (60" Steel Pipe Proxy)*	Impact	0.3	9,599.5	152.3
	Vibratory	N/A	417.3**	15.2**
96" Steel Pipe	Impact	1.5	28,069.2	706.8
	Vibratory	N/A	417.3**	15.2**
14" H-Pile	Impact	0.5	6,056.9	96.1
	Vibratory	N/A	9.0	0.3
AZ Sheet Pile	Impact	0.3	9,599.5	152.3
	Vibratory	N/A	89.9	3.3

**In order to create an increasing trend in noise effect between all steel pipe pile sizes, two 48" steel pipe proxies were used in order to create a range of likely impacts. The noise proxy levels for a 48" steel pipe did not produce the expected impacts for the SELcum and RMS Threshold and therefore the noise proxy for a 60" steel pipe was used instead.*
***The NOAA Fisheries Multi-Species Pile Driving Calculator only includes vibratory proxies for 36" steel pipes and 72" steel pipes. Therefore, for every steel pipe greater than 36" in diameter, 72" steel pipe sound proxy levels were used.*

Exposure to underwater noise levels of 206 dB peak and 187 dB SEL_{cum} (cumulative sound exposure level) can result in injury to sturgeon, and levels of 232 dB peak, 184 dB SEL_{cum} (impact) and 198 dB SEL_{cum} (vibratory) (permanent threshold shift or PTS) can result in injury to sea turtles. These noise levels refer to the maximum instantaneous sound pressure in water and the cumulative sound exposure level, respectively, expressed in decibels.

The maximum distance to the 206 dB peak for sturgeon is estimated (based on the NOAA Fisheries Multi-Species Pile Driving Calculator outputs) to be 60.6 feet, and the maximum distance to the 187dB SEL_{cum} isopleth for sturgeon is estimated to be 7,068.4 feet, which would occur during impact pile driving of the 96-inch diameter steel pipe piles. To be exposed to potentially injurious levels of noise during impact pile driving of the steel piles, a sturgeon would need to be within 60.6 feet of the pile for a single strike or remain within 7,068.4 feet of the pile

being driven for a prolonged time period. The expectation is that adult and juvenile sturgeon would modify their behavior and move away from the area upon exposure to underwater noise levels of 150 dB_{RMS} (the sound pressure threshold for causing behavioral effects to sturgeon). Given that sturgeon would be exposed to levels of noise that cause behavioral modification (at 32,808.4 feet for impact pile driving with assumed attenuation of 10 dB from bubble curtains) before being exposed to injurious levels of noise (at 7,068.4 feet), sturgeon would be expected to move away from the sound source and never be exposed to potentially injurious levels of underwater noise. If any sturgeon are within 7,068.4 feet of pile driving operations, injury to sturgeon is still not expected to occur. This is because the SEL_{cum} injury threshold is cumulative (requiring prolonged exposure to the noise at that level). For fishes, the Multi-Species Acoustic Tool indicates that there is no consistent data to support tissue/hearing recovery between pile strikes such that repeated strikes have a cumulative effect that can contribute to injury. However, the Multi-Species Acoustic Tool does assume that a 12-hour period of "effective quiet" resets the accumulated sound exposure level (SEL) such that the accumulated energy from multiple strikes would not contribute to injury. The assumption of cumulative effects during pile driving has resulted in generally larger distances to behavioral and physiological thresholds for fishes compared to the NOAA Fisheries GARFO Acoustic Tool spreadsheet previously used for evaluations of acoustic impacts. Sturgeon would be expected to alter behavior and move away from the pile being driven in a matter of seconds once pile driving commences. NOAA Fisheries included estimates of swim speeds for sturgeon in the Tappan Zee Bridge Replacement Biological Opinion based on several studies (Kelly and Klimley 2011; LeBreton et al. 2006; Boysen and Hoover 2009; and Clarke 2011). NOAA Fisheries estimated that shortnose and Atlantic sturgeon have a prolonged swim speed of at least 1.1 feet per second (fps) (35 cm/s) and an escape or burst speed of at least 1.4 fps (45 cm/s). NOAA Fisheries also estimated that sturgeon could sustain their prolonged swim speed for up to 200 minutes without muscle fatigue (NOAA Fisheries, 2017b). Based on the estimated prolonged swim speed, a sturgeon could be expected to exit the maximum SEL_{cum} ensonified area (7,068.4 feet from the pile driving location) within approximately 6,426 seconds, or 107 minutes, and would not reach or exceed the duration at which muscle fatigue would be expected. The initiation of daily pile driving with a soft start technique would also give sturgeon in the area time to move out of the range of any injurious sound waves.

While it is anticipated that sturgeon will leave the area following the initiation of pile driving with a soft start, no active removal of sturgeon from the area will occur, and any sturgeon remaining within 7,068.4 feet for a prolonged period during the impact pile driving of the 96-inch diameter steel pipe piles will be at risk for injury. Additionally, it is possible that multiple pile sizes will be driven simultaneously resulting in multiple overlapping isopleths and therefore a larger overall ensonified area than would occur from a single pile being driven. As specific population data are not available at this time, estimates of the number of sturgeon expected to be exposed to injurious levels of noise cannot be determined; however, the MDTA will continue to coordinate with NOAA Fisheries and will calculate estimates if specific population data are made available.

For sea turtles, the maximum distance to the 232 dB peak is expected to be 1.5 feet, and the maximum distance to the 184 dB SEL_{cum} isopleth is expected to be 28,069.2 feet, which would occur during impact pile driving of the 96-inch diameter steel pipe piles. To be exposed to potentially injurious levels of noise, sea turtles would need to be within 1.5 feet of the pile for a single strike or remain within 28,069.2 feet of the pile being driven for a prolonged time period. Exposure to the 232 dB peak is unlikely to occur because sea turtles are extremely unlikely to be

within 1.5 feet of the pile when pile driving begins. Sea turtles are expected to avoid areas where noise is above 175 dB RMS behavioral threshold, which is an area estimated to extend 706.8 feet from the pile during impact pile driving of the 96-inch diameter steel pipe piles. Sea turtles would be at risk of exposure to injurious levels of noise if they are within 28,069.2 feet of pile driving for a prolonged period of time during impact pile driving of the 96-inch diameter steel pipe piles. While the calculated SELcum isopleth exceeds the behavioral isopleth, the cumulative model assumes a stationary receptor. Because sea turtles are transient and highly mobile, they are expected to move through or away from the area, preventing the accumulation of acoustic energy required to reach the injury threshold. Sea turtle swim speeds vary significantly depending on life stage, but average cruising speeds are estimated to hover around 0.5 m/s to 0.7 m/s (B. Hopper, personal communication, March 16, 2026). Therefore, a sea turtle would be expected to exit the ensonified area (up to 28,0692 feet, or 8,555.5 meters) within approximately 12,222 to 17,111 seconds, or 204 to 285 minutes. Additionally, it is possible that multiple pile sizes will be driven simultaneously resulting in multiple overlapping isopleths and therefore a larger overall ensonified area than would occur from a single pile being driven. As specific population data are not available at this time, estimates of the number of sea turtles expected to be exposed to injurious levels of noise cannot be determined; however, the MDTA will continue to coordinate with NOAA Fisheries and will calculate estimates if specific population data are made available.

As noted above, behavioral effects, such as avoidance or disruption of foraging activities, may occur to sturgeon exposed to noise above 150 dBRMS and to sea turtles exposed to noise above 175 dB RMS. Noise levels are expected to be below 150 dBRMS at distances beyond a maximum of approximately 32,808.4 feet from the pile being installed (during impact pile driving for 96-inch steel pipe piles). Noise levels are expected to be below 175 dB RMS beyond a maximum of approximately 706.8 feet from the pile being installed (during impact pile driving for 96-inch steel pipe piles).

Mitigative measures that will be employed during pile driving include the use of a bubble curtain system that achieves 10 dB or greater attenuation for bridge piles and 5 dB or greater attenuation for dolphin pier protection piles (effectiveness shall be demonstrated with a test pile and underwater noise program prior to initiating production pile driving activities); maintaining a ZSFP from January 15 through May 15 as outlined in Section 3.3; using a “soft start” or “ramping up” pile driving (e.g., driving does not begin at 100% energy) to allow listed sturgeon and sea turtle species to move away from areas that may be ensonified to potentially injurious levels; restricting pile driving activity to no more than 12 consecutive hours per day, to allow for a 12-hour effective rest period; initially driving steel piles with a vibratory hammer through softer, sandy soils prior to using an impact hammer through stiffer material, as practicable and appropriate; using cushion blocks to drive concrete piles with an impact hammer as practicable and appropriate; and developing an underwater noise monitoring plan to describe the underwater noise generated by project activities and adaptive management measures planned to address the underwater noise. Additional mitigative measures that could be employed during pile driving are outlined in Section 3.3.

Avoidance of the ensonified area during active pile driving represents a temporary loss of habitat; however, sturgeon and sea turtles are expected to return to the site when pile driving is not occurring (i.e., during breaks, after typical working hours, weekends). Use of soft start pile driving techniques would allow fish and sea turtles to move away from the area at the beginning of a workday and after a break, so they are not exposed to noise levels reaching the thresholds for

physical injury under most pile-driving scenarios. Injury to listed species resulting from underwater pile-driving noise may still occur due to large sea turtle injury-threshold isopleths expected during the impact pile driving of the 96-inch diameter steel pipe piles, and as no active sturgeon removal will occur prior to pile-driving.

Based on the information above, the MDTA has determined that noise from pile driving is likely to adversely affect listed sturgeon and sea turtle species in the action area. Further evaluation of potential noise impacts will be conducted during final design, and the effects determination will be re-assessed as more detailed construction means and methods are made available.

The MDTA will continue to coordinate with NOAA Fisheries on mitigative measures through the design process and an Underwater Noise Monitoring Plan will be developed during final design and permitting to ensure that underwater noise thresholds are maintained during construction.

5.2 Dredging

Based on existing conditions within the Chesapeake Bay, it is expected that dredging would be necessary to create access channels to support construction and demolition activities for the Preferred Alternative. Considering input from the MDTA and previous similar dredging efforts, mechanical dredging will be used and a dredging target depth of nine feet below water level is assumed. The dredging areas were established using the "Maryland bathymetry Chesapeake Bay contours" data at both shorelines of the Chesapeake Bay (Western and Eastern Shores). The northern limit of dredging is assumed to occur approximately 50 feet north of the existing westbound span piers (to be demolished) and the southern limit is assumed to be approximately 60 feet from the southern edge of a new eastbound span.

Atlantic and shortnose sturgeon could potentially be affected by dredging activities due to their utilization of the area during seasonal breeding migrations. Their presence may be more often found in deep water habitat such as the federally maintained channels; however, they are bottom feeders and therefore found where suitable forage (e.g., benthic invertebrates such as mollusks and crustaceans) and appropriate habitat conditions (e.g., areas of SAV) are present in shallower waters. The physical disturbance of sediments and entrainment of associated benthic resources could reduce the availability of sturgeon prey species, although recolonization of the opportunistic benthic species would occur relatively quickly. Studies of anadromous fish such as striped bass indicate that adverse effects to fish typically occur at 1,000 mg/L (Burton, 1993), and effects to certain benthic communities could occur at 390 mg/L (EPA, 1986). Both Atlantic sturgeon and shortnose sturgeon are thought to be at least as tolerant of elevated turbidity as other anadromous fish.

Dredges and other mechanisms have the ability to impinge or entrain sturgeon during routine operation. Impingement/entrainment may cause injury or death in certain cases. Sturgeon are not typically susceptible to entrainment in mechanical dredges, because bucket dredges are relatively stationary, and the operation entails lowering the open bucket through the water column, closing the bucket after impact on the bottom, lifting the bucket up through the water column, and emptying the bucket into a barge at a slow pace. Additionally, mechanical dredging lacks suction, and the culmination of these factors allows fast, strong swimming sturgeon to move away from dredging activities. The risk of capture by mechanical dredges is higher in areas where large numbers of sturgeon may aggregate, such as overwintering sites or foraging areas. Additionally,

overwintering sturgeon may be less responsive to stimuli and more at risk. Overwintering sturgeon in the action area include juvenile Atlantic sturgeon and adult shortnose sturgeon.

Sturgeon species may be susceptible to entrainment or impingement by dredge equipment used for construction. However, the mobility and ability of adult and sub-adult sturgeon to avoid the low intake velocities of the dredge equipment make impingement unlikely, though juvenile sturgeon may be more susceptible. A list of all documented interactions between dredges and sturgeon reported along the U.S. East Coast was provided to NOAA Fisheries by the USACE in 2012, and included documentation dating back to 1990. One report of a live shortnose sturgeon captured in a dredge bucket in 2009 was not included in the report. The list included four sturgeon captures in dredge buckets: one live Atlantic sturgeon, one recently dead shortnose sturgeon, one decomposed Atlantic sturgeon considered to have been dead prior to the dredge interaction, and one report of capture which was not verified (B. Hopper, personal communication, February 3, 2026).

The documentation by USACE indicates that capture of both Atlantic and shortnose sturgeon by mechanical dredging is possible, though the number of captures due to mechanical dredging is low. Based on this summary data, the project location and the short mechanical dredge window, Atlantic and shortnose sturgeon capture by mechanical dredging associated with construction of the Preferred Alternative, if any, is anticipated to be very low. The MDTA and FHWA are estimating the potential take of one individual of each sturgeon species for each dredging event (total of 4 sturgeon) during project construction.

Turbidity effects from dredging are not anticipated to affect sturgeon species, as the life stages most vulnerable to increased sediment are eggs and non-mobile larvae, which would not be present in the action area. Any sturgeon in the vicinity would be sufficiently mobile to avoid any sediment plume or reductions in dissolved oxygen (NOAA Fisheries, 2017a).

Sea turtles are typically not susceptible to entrainment in mechanical dredging because bucket dredges are relatively stationary, and the operation entails lowering the open bucket through the water column, closing the bucket after impact on the bottom, lifting the bucket up through the water column, and emptying the bucket into a barge at a slow pace. Additionally, mechanical dredging lacks suction, and the culmination of these factors allows fast, strong-swimming sea turtles to move away from dredging activities (NOAA Fisheries, 2017a).

Sea turtle species could potentially be affected by dredging activities due to their utilization of the area (generally during the warmer months of April to November). Their presence would most likely be where suitable forage (e.g., benthic invertebrates such as mollusks and crustaceans) and appropriate habitat conditions are present (e.g., areas of SAV). The physical disturbance of sediments and entrainment of associated benthic resources could reduce the availability of sea turtle prey, but the impacted benthic habitat represents a minimal amount of the available habitat in the region, and recolonization of the opportunistic benthic species would occur quickly, making these localized impacts to sea turtle habitat and prey too small to be meaningfully measured.

Dredged areas will be in place throughout the construction duration, although the exact timing of the dredging is unknown. An estimated two thirds of the dredging will take place in the first year of construction to accommodate the eastbound bridge span. This initial dredged area will remain in place for up to 15 years. The remaining one third of dredging will take place at the start of

construction of the westbound bridge span. It is anticipated that dredging during construction of the first span will take approximately 14 days and will occur during year 1 to year 2 of construction, and dredging during construction of the second span will take approximately 7 days and will occur during year 7 to year 8 of construction.

The MDTA will continue to coordinate with NOAA Fisheries regarding mitigative measures through the design process. Avoidance and minimization measures that will be employed include employing an IEM; conducting SAV surveys during the growing season, prior to construction, within nearshore areas of the Action Area to determine the presence and extent of SAV beds; and evaluating dredge material to determine appropriate disposal method and location and use of mechanical dredging methods. The MDTA will commit to the use of an observer during mechanical dredging in case of an accidental capture. A NOAA-Fisheries approved observer will be present to observe the bucket as it comes out of the water and as the load is deposited into the scow during each dredge cycle for sturgeon and sea turtles and/or their parts. The observer will contact NOAA Fisheries and submit an incident report within 24 hours of the capture of any sturgeon or sea turtle (or their parts). Additional avoidance and minimization measures that could be employed to address potential impacts related to dredging are outlined in Section 3.3, and include implementing TOYRs to avoid impacts during sensitive life stages.

The MDTA will prepare a Dredge Material Management Plan, which will include final dredging methods proposed, minimization measures specific to dredging operations, and detailed information regarding the transport and disposal of dredged materials. Required TOYRs for dredging will also be coordinated with the resource agencies. Conditions would include:

- Dredging will be prohibited during certain times of the year to protect shellfish, including oysters. Mechanical dredging within 500 yards of shellfish areas will be prohibited from December 16 through March 14 and from June 1 through September 30 of any year. Hydraulic dredging (which includes hopper dredging and cutterhead pipeline dredges) within 500 yards of shellfish areas will be prohibited from June 1 through September 30. (COMAR 26.24.02.06)
- Dredging within 500 yards of SAV beds will be prohibited between April 15 and October 15 of any year.

Based on the foregoing, the MDTA has determined that dredging may affect but is not likely to adversely affect listed sea turtle species, and is likely to adversely affect listed sturgeon species within the action area. Further evaluation of potential dredging impacts will be conducted during final design, and the effects determination will be re-assessed as more detailed construction means and methods are made available.

5.3 Turbidity and Habitat Modification

Turbidity due to new bridge construction, existing structure demolition, and land-based activities such as clearing, culvert replacements or in-water fill is expected to occur. Sediment and turbidity impacts are expected to occur up to 300-feet from pile driving locations, and up to 2,000 feet from dredging locations (NOAA Fisheries, 2025). Fill will be placed in-water to accommodate the roadway widening along the south side of the approach to the Cox Creek bridge (approximately 0.6 acres) and the abutments supporting the extension of the widening of the existing bridge (approximately 2.9 acres) though the extent of turbidity resulting from this activity is expected to be contained within the LOD due to the use of sedimentation and turbidity controls. Appropriate

sedimentation and turbidity controls will be used during construction to prevent sediment plumes and sediment movement downstream. Construction timing will be coordinated with the resource agencies with the goal implementing the TOYR for Use I and II streams.

Permanent impacts within the Chesapeake Bay are anticipated to occur in areas of permanent fill within the substrate from bridge substructure elements including piers and pier protection systems (e.g. islands, dolphins, or fender system), as well as any impacts that last longer than one year. Final design will dictate the size and type of piles or footings proposed for pier construction and impacts will be calculated based on the area of new structure/fill at or below the mudline. Estimates of the number of piers, pier size, and area of construction are preliminary but have been developed to provide a conservative estimate of potential impacts. At this preliminary stage of design, quantitative impact calculations include both permanent and temporary effects to the Chesapeake Bay as a total combined impact. Temporary impacts may include geotechnical investigations, temporary mooring piles or mooring ball anchors to stabilize the barges and vessels at the staging areas, in-river BMPs, and removal of existing bridge piers/piles. Approximately 134.8 acres of tidal water bottom impacts are expected due to construction impacts associated with the Preferred Alternative. Anticipated turbidity impacts specific to pier placement, clearing, and dredging include:

- The generation of suspended solids/turbidity and the resultant degradation of surface water quality and sediment quality.
- A decreased photic zone due to increased turbidity.
- Elimination of benthic populations within the dredging zone.
- Deposition of dredge-induced suspended sediment on benthic populations downstream of the dredging zone.

While the temporary increase in suspended sediments may cause Atlantic and shortnose sturgeon to alter their normal movements, these minor movements would be too small to be meaningfully measured or detected. Turbidity is most likely to affect sturgeon if a plume causes a barrier to normal behaviors. However, it is expected that sturgeon would swim through the plume to avoid the area with no adverse effects.

Increased turbidity effects from dredging are not anticipated to affect sturgeon species, as the life stages most vulnerable to increased sediment are eggs and non-mobile larvae, which would not be present in these areas. Any sturgeon in the vicinity would be sufficiently mobile to avoid any sediment plume or reductions in dissolved oxygen. Changes in water quality parameters resulting from discharges, construction activities, and demolition may adversely affect sturgeon. Both species of sturgeon are similarly sensitive to certain water quality parameters. Dissolved oxygen levels below 4.0 mg/L have been shown to have deleterious effects on sturgeon. Likewise, temperatures above 28 degrees C have also been demonstrated to be harmful. Lowered DO, changes in temperature, addition of pollutants, and increased sedimentation may interrupt the basic life functions of sturgeon such as their behavior, foraging ability, migration, and reproduction (NOAA Fisheries 2017a). The action area is located within a large tidal system that experiences substantial natural variability in temperature and DO, and these parameters are also influenced by various local and regional anthropogenic factors. Given the scale of the Chesapeake Bay, and that multiple external factors contributing to temperature and DO would be present throughout the project duration, the effect of the action on changes to these water quality parameters would be insignificant.

Turbidity effects to sea turtles from bridge expansion due to in-water fill are extremely unlikely. One major issue associated with suspended sediments is its effect on the respiration of marine fauna. However, sea turtles breathe air and increased suspended sediments are not likely to affect turtle respiration. The most likely effect is if a sediment plume causes a barrier to normal behaviors. As sea turtles are highly mobile, they are likely to be able to avoid any sediment plumes, which typically only last for a short duration near the bottom (NOAA Fisheries 2017a).

Sea turtles can be affected by impaired water quality through their inability to forage due to sedimentation of their food sources. Sedimentation can bury benthic organisms and SAV and suspended sediments reduce the availability of sunlight to SAV. Because sea turtles breathe air, direct effects of elevated turbidity levels are not likely as many pollutants are not absorbed through sensitive gill structures or during development phases as is the case for fish; however, low DO levels, high temperatures, or release of pollutants that do not adhere to water quality standards may all detrimentally affect benthic communities and small pelagic fish that serve as forage. As noted in **Section 5.2**, recolonization of the opportunistic benthic species would occur relatively quickly (NOAA Fisheries 2017a). As noted above, given the scale of the Chesapeake Bay, and that multiple external factors contributing to temperature and DO would be present throughout the project duration, the effect of the action on changes to these water quality parameters would be insignificant.

Water quality may also be impacted by introducing construction materials to the action area. Materials such as pressure-treated lumber may adversely impact water quality due to leaching, though impacts are expected to be greater in low-flow areas (Metz 2019). Therefore, impacts are expected to be minimal as the action area is in a large tidal system. The MDTA will consider alternatives to the use of pressure-treated lumber and other materials that may have the potential to impact water quality, as applicable and as appropriate.

Rubble will drop to the bottom of the Bay as a result of demolition of the existing concrete bridge piers. A detailed description of the assumed demolition procedures and anticipated impacts can be found in the *Demolition of the Existing Eastbound and Westbound Bridge Piers Conceptual Analysis* (**Appendix F**). During explosive demolition, blast containment measures will be implemented to ensure the rubble produced from the blast is controlled and therefore will likely drop in the immediate vicinity of the piers. The rubble can be removed or used to fill scour holes as appropriate, if scour holes are found to be present and pending coordination with NOAA Fisheries. The degree to which all or some of the debris will be removed will depend on the size of the debris and on environmental factors including depth and composition of the Bay bottom. Bathymetric surveys will be conducted closer to the start of construction, and the data collected will be used to determine the feasibility of removing rubble. Rubble will be removed to the maximum extent practicable, and to the extent that removal would not result in greater harm to benthic environments compared to leaving the rubble in place. Beneficial re-use of suitable rubble for artificial reef sites or restoration may be considered. Removal of rubble would be by clamshell bucket and is anticipated to have similar impacts, and avoidance and minimization measures, to dredging as described in Section 5.2. The decision to remove, re-use, or leave rubble in place, or to use rubble to fill scour, will be determined prior to the start of demolition, using the best available data at the time and in coordination with NOAA Fisheries.

Rubble that drops to the bottom of the Bay has the potential to impact soft bottom substrates and benthic communities; however, these impacts are limited to an area within and immediately

surrounding the footprint of each blasted pier. The area that would be impacted by falling rubble is relatively small compared to the overall action area, and an even smaller area compared to the soft substrate that is available for foraging throughout the Chesapeake Bay. Therefore, effects on sturgeon and sea turtles from reductions in benthic resources from falling rubble will be too small to be meaningfully measured or detected.

The MDTA will continue to coordinate with NOAA Fisheries on mitigative measures through the design process. Avoidance and minimization measures that will be employed for in-water activities to address potential impacts related to turbidity and habitat modification include only using clean fill; employing an IEM; conducting SAV surveys during the growing season, prior to construction, within nearshore areas of the action area to determine the presence of SAV beds; minimizing the suspension of sediments and disturbance of the substrate when removing piles by implementing applicable techniques outlined in Section 3.3; prevent sediment and debris from entering the water using geo-textile fabric, hay bales or other methods; removing demolition debris that falls into the water; limiting the amount and extent of turbidity and sedimentation by using appropriate sedimentation and turbidity controls such as silt curtains, settling basins, and cofferdams; removal of cofferdams or other diversion structures only after water quality is consistent with ambient levels outside the structure; removal of contaminants and sediments from water discharge prior to entering aquatic habitats; evaluate dredge material to determine appropriate disposal method and location; manage concrete wash water and cooling water effluent from concrete saw operations to ensure they do not enter the Bay untreated; remove all obsolete and temporary structures and fills including monitoring devices in their entirety; and return aquatic habitats impacted by temporary activities, fills, or structures to pre-construction or better condition, including contours, elevations, substrate, and vegetation. Additional avoidance and minimization measures that could be employed to address potential impacts related to turbidity and habitat modification are outlined in Section 3.3.

The MDTA will approach design and development with the goal of minimizing and further mitigating potential impacts to water quality associated with the Preferred Alternative. Typically, the most important and easily attainable minimization efforts during construction include successful implementation of strict ESC measures and SWM techniques, which can reduce both impacts to a waterway and its water quality. The MDTA will coordinate with the regulatory agencies regarding any required water quality monitoring program associated with the Preferred Alternative. Development and implementation of a water quality monitoring plan prior to construction will provide real-time comparable data to support consistent management and attainment of water quality standards.

Based on the information above, the MDTA has determined that turbidity and habitat modification may affect but is not likely to adversely affect listed sturgeon and sea turtle species in the action area. Further evaluation of potential turbidity and habitat modification impacts will be conducted during final design, and the effects determination will be re-assessed as more detailed construction means and methods are made available.

5.4 Increased Vessel Traffic

During construction of the Preferred Alternative, an increase in vessel traffic in the Chesapeake Bay will occur (i.e., barges, support vessels, etc.). The approximate size and type of vessel, travel routes, and number of trips is currently unknown. Sturgeon may be injured or killed as a result of being struck by boat hulls or by propellers. The factors relevant to determining the risk to these

species from vessel strikes vary, but may be related to the size and speed of the vessels, navigational clearance (i.e., depth of water and draft of the vessel) in the area where the vessel is operating, and the behavior of individuals in the area (e.g., foraging, migrating, overwintering, etc.). Most vessel traffic will be slow moving in the construction area, minimizing potential for collisions with sturgeon. Strikes from construction vessels are possible, but extremely unlikely. Construction vessels will be within deeper waters and have shallow drafts, and, though sturgeon use the upper water column during non-foraging movements and migration and sometimes jump out of the water, sturgeon will typically be at greater depths, substantially reducing construction vessel strike risk (Balazik et al., 2012). In addition to vessel traffic in the immediate Tier 2 Study area, vessel traffic will also result from transportation of dredge material from the Tier 2 Study area to disposal sites. The MDTA has begun preliminary coordination to identify potential dredge disposal sites that may have space for dredge spoils. Dredge spoils associated with the Preferred Alternative are anticipated to be 317,400 cubic yards. As noted in section 5.2, potential dredge disposal sites under consideration and likely to be utilized include Masonville Cove in Baltimore County, MD and Cox Creek in Anne Arundel County, MD.

Sea turtles are more susceptible to vessel strikes from construction vessels than sturgeon, since sea turtles spend more time closer to the surface; however, sea turtles are more vulnerable to being struck by faster moving vessels. Typically, dredge equipment, barges, and support vessels that will be used will move at slow speeds (i.e., on average 8 to 10 knots) and have shallow drafts. Thus, it is extremely unlikely for sea turtles to be struck by these vessels during construction.

Transport of dredge material is expected to take 14 days during construction of the first bridge span, to occur during year 1 to year 2 of construction, and seven days during construction of the second bridge span, to occur during year 7 to year 8 of construction. The exact timing of dredging, and therefore the exact timing of transport of material, is unknown. Additionally, specific timing and duration of vessel traffic beyond transport of dredge material is unknown at this time.

The MDTA will continue to coordinate with NOAA Fisheries on mitigative measures through the design process. Avoidance and minimization measures that will be employed are to avoid mooring vessels in SAV or in such a way that could shade SAV. Additional avoidance and minimization measures that could be employed to address potential impacts resulting from increased vessel traffic are outlined in Section 3.3.

Based on the information above, the MDTA has determined that vessel traffic may affect but is not likely to adversely affect listed sturgeon and sea turtle species in the action area. Further evaluation of potential vessel traffic impacts will be conducted during final design, and the effects determination will be re-assessed as more detailed construction means and methods are made available.

5.5 Blasting

With the Preferred Alternative, demolition of the existing structure is assumed to occur in two phases. It is anticipated that the first new bridge span will be built, then one existing bridge span will be demolished, and the new bridge span will be in use while the second new bridge span is built. Once both new bridge spans are complete, the second span of the existing bridge will be demolished.

Demolition of the existing structures may include both mechanical means and blasting. Anticipated effects from mechanical demolition are discussed in **Section 5.3**. It is anticipated that blasting will not occur concurrently with pile driving, based on the expected project phasing. If construction of the second new span does begin while demolition of the first existing span is underway, blasting will still not occur concurrently with pile driving as construction would be paused during blasting events. Controlled explosive demolition (blasting) has the potential to impact fish and sea turtles. Negative pressure waves from blasting have been shown to cause swim bladders to rupture, killing fish. Fish species lacking swim bladders are more resistant to explosive pressure waves (Keevin and Hempen, 1997). As sturgeon species do contain swim bladders, Atlantic and shortnose sturgeon are susceptible to impacts from blasting. Limited data is available regarding impacts of blasting on sea turtles, though some studies have demonstrated that blasting can result in mortality to sea turtles. The likelihood of nonlethal damage or delayed mortality in sea turtles resulting from blasting is unknown (Keevin and Hempen 1997). Quantification of impacts to sea turtles from blasting is not possible at this time for the Tier 2 Study due to the lack of specific population data available in the vicinity of the Chesapeake Bay Bridge.

Blasting is anticipated to include 18 blast events during demolition of the first bridge span, to occur during years 6 to 7 of construction, and 16 blast events during demolition of the second bridge span, to occur during years 14 to 15 of construction. As noted in Section 3.3, the MDTA has committed to maintaining a minimum contiguous 7,000-foot-wide ZSFP from January 15 through May 15. Any required blasting will take place during times of lower biological activity (October 1 – December 15); specific dates will be determined during the development of the Demolition Plan and will incorporate the best available data including any updated telemetry data. Adult and subadult Atlantic sturgeon, and adult and juvenile green, Kemp's ridley, leatherback and loggerhead turtles may still be present in the action area through November; juvenile Atlantic sturgeon and adult shortnose sturgeon may be present year-round. Therefore, all life stages of the listed species discussed in this BA may be impacted by blasting, including potential for injury or mortality.

For planning purposes, demolition of the original (1940) Nice-Middleton Bridge (N-MB) performed in late 2023 was used as a proxy for the proposed demolition of the existing Bay Bridge, as the Demolition Plan for the existing Bay Bridge will not be developed until final design and permitting. The MDTA and FHWA have developed demolition assumptions based on the N-MB project due to the similarities in structural components and surrounding habitat when compared to the existing Chesapeake Bay Bridge. If blasting is used on another East Coast project prior to demolition of the existing Bay Bridge, the analysis will be updated using the newer data as the best available science. A detailed description of the assumed demolition procedures and anticipated impacts, as well as justification for using the N-MB project as a proxy, is included in the *Demolition of the Existing Eastbound and Westbound Bridge Piers Conceptual Analysis* (**Appendix F**) and is summarized below.

The superstructure for the existing Bay Bridge spans will likely be demolished similarly to the N-MB. The concrete decks will likely be removed using mechanical means in a way that prevents the materials from falling into the water. Steel beams will likely be lifted off the existing piers. The original steel truss sections from N-MB were rigged in a manner that allowed for quick removal of sections that were dropped in the water with shaped explosive cutting charges. The above water portion of the deep water Bay Bridge piers will likely be removed to an elevation where explosive demolition preparation can be facilitated. The pile bents that are located over shallow water and

the piers that are in less than 40 feet of water (moderate depth) can likely be demolished mechanically. The piers that are in deep water (over 40 feet deep) may need to be demolished mechanically or explosively above the water level and with explosives below the water. The MDTA proposes to leave the four anchor piers and two islands in place.

The N-MB underwater demolition processes were used as a proxy to estimate the impacts of using similar processes for demolition of the Bay Bridge on federally-listed species. It is assumed that the piers will be mechanically demolished above the water surface to an elevation that best facilitates the drilling of vertical holes and loading explosives, typically 6 to 10 feet above the water surface to match deck barge working surfaces. Holes will be drilled and explosives loaded as needed to break apart the piers underwater into pieces that can be removed if necessary. For planning purposes, the general parameters from the approved blast design from the N-MB project are assumed for the proposed Bay Bridge demolition, including:

- 5 decks of explosives per hole.
- 30 pounds of explosives per delay.
- Minimum of 9 milliseconds (ms) delay between explosives.
- Maximum of 17ms delay between decks in the same hole.

The MDTA will evaluate the parameters needed for actual conditions when developing the final blast design for the Bay Bridge. Based on recent similar and nearby projects (e.g., Francis Scott Key Bridge Rebuild, N-MB replacement), the MDTA assumes a time-of-year restriction (TOYR) from December 16 to September 30 on subaqueous blasting will be implemented for the Bay Bridge. Therefore, it is assumed subaqueous blasting of the Bay Bridge would be permitted from October 1 to December 15.

The most appropriate Mortality Zone and Exclusion Zone designations were calculated based on a review of existing published documents and studies used for the N-MB project. The Mortality Zone includes areas where lethal effects to fish are anticipated due to the proximity to blasting and lethal levels of underwater noise. The Exclusion Zone includes areas where effects are expected on fish such as injury and harassment and potential mortality for more susceptible fish.

The formula in Hempen et al. (2007) was used to calculate the Mortality Zone, as described in **Appendix F**. The mortality radius for single, confined shots (MRC) was calculated to be approximately 52 meters (174 feet) around each of the 15 eastbound and 15 westbound piers. For conservative planning, the MRC is added to half the width of the largest piers to be blasted for an adjusted radius of 215 feet around each eastbound pier and 220 feet around each westbound pier. The combined MRC areas result in approximately 5 hectares (13 acres) for each span. The assumed maximum charge to be used is 13.6 kilograms (30 pounds) per delay but these charges will be in the center of the pier. The charges closest to the exterior of the pier will likely be less per delay. Therefore, this Mortality Zone is a conservative (i.e., worst-case scenario) estimate, and a smaller Mortality Zone is anticipated during blasting. The extent of the estimated Mortality Zone is included in the Action Area Map (**Appendix B**).

This planning level demolition analysis uses the Hempen et al. (2005) formula to calculate the conservative (i.e., worst-case scenario) Exclusion Zone, as described in **Appendix F**. The calculations yield an Exclusion Zone radius of 640 meters (2,100 feet) around each pier, for a total combined area of approximately 486 hectares (1,200 acres) for the entire Exclusion Zone

along each span. Similar to the Mortality Zone, this is considered a conservative estimate, as the blast design uses 13.6-kilogram (30-pound) charges located in the interior of the piers and it's likely that lesser charges will be used closest to the exterior of the piers. Therefore, the actual Exclusion Zone where injury and harassment could occur is expected to be smaller for each blast. The extent of the estimated Exclusion Zone is included in the Action Area Map (**Appendix B**).

For subaqueous blasting, avoidance and minimization measures that will be employed include use of scare charges and fish deterrent boats, and monitoring for the presence of tagged surgeon, ahead of blasting activities; developing an underwater noise monitoring plan to describe the underwater noise generated by project activities and adaptive management measures planned to address underwater noise; using nets, tarps, and pans when demolishing bridge superstructures; removing demolition debris that falls into the water; and developing a detailed Demolition Plan in coordination with NOAA Fisheries and submitting to NOAA Fisheries for review and approval in advance of any detonation activity. Fish scare charges will follow the guidance outlined in Managing the Impacts of Blast-Induced Vibration and Overpressure on Fish and Fish Habitat (FHWA, 2019), which states that the use of scare charges using small blasting caps can be effective and should be deployed 30 to 60 seconds prior to the main production blast. Higher charge weight scare charges can be more harmful than effective (McAnuff et al., 1994; Keevin et al., 1997). For this project, it is anticipated that scare charges will follow the procedures used on the N-MB project, and would consist of a series of blasting caps, each containing 0.75 grams of explosives, suspended in the water column surrounding the structure to be blasted. The scare charges would be detonated 15 to 30 seconds prior to the main blast. The location of the scare charges is based on past experience and the intent to drive fish away from the structure being blasted. The MDTA and FHWA believe that placing the charges at far distances from the bridge may potentially drive fish back towards the structure. Therefore, the scare charges will likely be placed in very close proximity to the bridge. Additional avoidance and minimization measures that could be employed to address potential impacts resulting from blasting are outlined in Section 3.3.

Based on the information above, the MDTA has determined that the demolition of the existing Bay Bridge is likely to adversely affect listed sturgeon and sea turtle species under NOAA Fisheries jurisdiction in the action area. Further evaluation of potential demolition impacts will be conducted during final design, and the effects determination will be re-assessed as more detailed construction means and methods are made available.

5.6 Cumulative Effects

Cumulative effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. Future Federal actions that are unrelated to the proposed action are not considered in this section because they will be subject to separate consultation pursuant to Section 7 of the ESA. Any in-water construction or coastal development projects within the action area are activities that would likely need a permit or authorization from the USACE and would therefore be subject to Section 7 consultation.

The MDTA has not identified any future state or private actions that are reasonably certain to occur in the action area that do not have a Federal nexus. Through correspondence with MDE staff, MDE has noted that they are not aware of any state issued projects in the action area that are exempt from Federal authorization. Current conditions include recreational and commercial

fishing activities and point and non-point source pollution through the National Pollution Discharge and Elimination System (NPDES) may affect shortnose sturgeon, Atlantic sturgeon, and sea turtle species in the action area. These activities will continue in some form into the future. The MDTA does not have information on specific interactions between shortnose sturgeon, Atlantic sturgeon, or sea turtle species and state or commercial fisheries operating and point and non-point discharges in the action area.

6 CONCLUSION AND EFFECTS DETERMINATIONS

This Biological Assessment evaluated the potential effects of the proposed Chesapeake Bay Crossing project on Atlantic sturgeon, shortnose sturgeon, loggerhead sea turtle, Kemp's ridley sea turtle, green sea turtle, and leatherback sea turtle based on preliminary design and construction methods. The proposed action is Alternative C from the Tier 2 Study EIS. A summary of the stressors and effect determinations for each species is included in **Table 6-1**. The project has the potential for both lethal and non-lethal take of individuals of these species in various life stages. Noise generated from pile driving has the potential to cause injury or mortality to shortnose sturgeon, Atlantic sturgeon, and sea turtle species. There is potential for interaction with dredge equipment that could result in injury or mortality to shortnose sturgeon and Atlantic sturgeon. Blasting used for demolition of the existing bridge structures also has the potential to result in injury or mortality to shortnose sturgeon, Atlantic sturgeon, and sea turtle species. Additional project-related impacts include increased vessel traffic and habitat modification, though neither increased vessel traffic nor habitat modification are expected to result in adverse effects to listed sturgeon or sea turtle species in the action area.

Table 6-1: Species Effect Determinations by Stressor

Species	Federal Status	Distinct Population Segment (DPS) Potentially Occurring in the Action Area	Stressor	Stressor Effect	Species Determination
Atlantic sturgeon (*Acipenser oxyrinchus*)	Threatened/ Endangered[1]	Gulf of Maine; New York Bight; Chesapeake Bay; Carolina; South Atlantic	Pile driving	LAA	LAA
			Dredging	LAA	
			Turbidity and habitat modification	NLAA	
			Increased vessel traffic	NLAA	
			Blasting	LAA	
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered	Range-wide[2]	Pile driving	LAA	LAA
			Dredging	LAA	
			Turbidity and habitat modification	NLAA	
			Increased vessel traffic	NLAA	
			Blasting	LAA	
Loggerhead sea turtle (*Caretta caretta*)	Threatened	Northwest Atlantic	Pile driving	LAA	LAA
			Dredging	NLAA	
			Turbidity and habitat modification	NLAA	
			Increased vessel traffic	NLAA	
			Blasting	LAA	
Kemp's ridley sea turtle (*Lepidochelys kempii*)	Endangered	Range-wide[2]	Pile driving	LAA	LAA
			Dredging	NLAA	
			Turbidity and habitat modification	NLAA	
			Increased vessel traffic	NLAA	
			Blasting	LAA	

Species	Federal Status	Distinct Population Segment (DPS) Potentially Occurring in the Action Area	Stressor	Stressor Effect	Species Determination
Green sea turtle (*Chelonia mydas*)	Threatened	North Atlantic	Pile driving	LAA	LAA
			Dredging	NLAA	
			Turbidity and habitat modification	NLAA	
			Increased vessel traffic	NLAA	
			Blasting	LAA	
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered	Range-wide[2]	Pile driving	LAA	LAA
			Dredging	NLAA	
			Turbidity and habitat modification	NLAA	
			Increased vessel traffic	NLAA	
			Blasting	LAA	

NLAA = Not likely to adversely affect
LAA = Likely to adversely affect
[1]Gulf of Maine DPS is threatened. New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are endangered.
[2]DPS has not been designated for this species.

FHWA, in coordination with the MDTA, has determined that the action is likely to adversely affect Atlantic sturgeon, shortnose sturgeon, loggerhead sea turtle, Kemp's ridley sea turtle, green sea turtle, and leatherback sea turtle. FHWA, in cooperation with the MDTA, will continue to coordinate with NOAA Fisheries through final design of the project to ensure implementation of appropriate avoidance, minimization, and mitigative protection measures.

7 REFERENCES

Balazik, M.T., K.J. Reine, A.J. Spells, C.A. Fredrickson, M.L. Fine, G.C. Garman, and S.P. McIninch. 2012. The Potential for Vessel Interactions with Adult Atlantic Sturgeon in the James River, Virginia. North American Journal of Fisheries Management, 32:6, 1062-1069, DOI: 10.1080/02755947.2012.716016.

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. Columbia, MD.

California Department of Transportation (Caltrans). 2020. Technical Guidance for the Assessment of Hydroacoustic Effects of Pile Driving on Fish. Caltrans Division of Environmental Analysis. Retrieved August 2025: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/hydroacoustic-manual-a11y.pdf.

Chesapeake Bay Program (CBP). 2023. DataHub, Version 4.9.2. Retrieved December 2023: https://datahub.chesapeakebay.net/.

Clark, D. 2011. Sturgeon Protection. Dredged Material Assessment and Management Seminar. 24-26 May, 2011. Jacksonville, FL. Presentation.

Environmental Protection Agency (EPA). 1986. Quality Criteria for Water. EPA 440/5-86-001.

FHWA. 2019. Managing the Impacts of Blast-Induced Vibration and Overpressure on Fish and Fish Habitat. Publication No. FHWA-FLH/TD-19-001. Retrieved January 2026: https://www.fhwa.dot.gov/clas/pdfs/fhwa-flh-td_19001.pdf.

Hempen, G.L., T.M. Keevin, and H.J. Ruben. 2005. Underwater blast pressures from confined rock removal shots: The Kill van Kull Deepening Project. Pp. 91-100. In: Proceedings of the Thirty-first Annual Conference on Explosives and Blasting Technique, Volume 1, Orlando, Florida. International Society of Explosive Engineers, Cleveland, OH.

Hempen, G.L., T.M. Keevin, and T.L. Jordan. 2007. Underwater blast pressures from a confined rock removal during the Miami Harbor deepening project. International Society of Explosives Engineers. Vol. 1. 12 pp.

Keevin, T.M., and G.L. Hempen. 1997. The Environmental Effects of Underwater Explosions with Methods to Mitigate Impacts. U.S. Army Corps of Engineers St. Louis District. Retrieved September 2025: https://semspub.epa.gov/work/01/550560.pdf.

McAnuff, A.L., M.V. van Bers, and A.C. Curic. 1994. Environmental Effects of Marine Blasting in Canadian Game Rivers. Pp. 479-490. Proceedings of the Twentieth Annual Conference on Explosives and Blasting Techniques, Austin, TX. International Society of Explosive Engineers.

Metz, V. 2019. Use of Preservative-Treated Wood and Alternative Materials for Building Overwater and Waterfront Structures. Factsheet for the Marinas Interagency Coordinating

Committee meeting, May 30, 2019. Coastal Water Quality Program, California Coastal Commission.

NOAA National Marine Fisheries Service (NOAA Fisheries). 2017a. NOAA Fisheries/Federal Highway Administration Best Management Practices Manual For Transportation Activities in the Greater Atlantic Region. Retrieved July 2025: https://media.fisheries.noaa.gov/dam-migration/nmfs-garfo-fhwa-bmp-manual-cover-v1-2017_0.pdf.

NOAA Fisheries. 2017b. Tappan Zee Bridge Replacement Section 7 Biological Opinion NER-16-13822 GARFO-2016-00729. https://doi.org/10.25923/tdgc-t615

NOAA Fisheries. 2018. Recovery Outline for the Atlantic Sturgeon Distinct Population Segments. Office of Protected Resources. Available online: https://www.fisheries.noaa.gov/s3//dam-migration/ats_recovery_outline.pdf

NOAA Fisheries. 2022a. Greater Atlantic Region ESA Section 7 Mapper. Retrieved December 2023: https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=a85c0313b68b44e0927b51928271422a

NOAA Fisheries. 2022b. Loggerhead Turtle. Retrieved December 2023: https://www.fisheries.noaa.gov/species/loggerhead-turtle.

NOAA Fisheries. 2022c. Gulf of Main Distinct Population Segment of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) 5-Year Review: Summary and Evaluation.

NOAA Fisheries. 2023a. Atlantic Sturgeon. Retrieved December 2023: https://www.fisheries.noaa.gov/species/atlantic-sturgeon.

NOAA Fisheries 2023b. National Marine Fisheries Service: Summary of Endangered Species Act Acoustic Thresholds (Marine Mammals, Fishes, and Sea Turtles). Retrieved August 2025: https://www.fisheries.noaa.gov/s3/2023-02/ESA%20all%20species%20threshold%20summary_508_OPR1.pdf.

NOAA Fisheries. 2023b. Shortnose Sturgeon. Retrieved December 2023: https://www.fisheries.noaa.gov/species/shortnose-sturgeon.

NOAA Fisheries. 2023c. Kemp's Ridley Turtle. Retrieved December 2023: https://www.fisheries.noaa.gov/species/kemps-ridley-turtle.

NOAA Fisheries. 2023d. Green Turtle. Retrieved December 2023: https://www.fisheries.noaa.gov/species/green-turtle.

NOAA Fisheries. 2023e. Leatherback Turtle. Retrieved December 2023: https://www.fisheries.noaa.gov/species/leatherback-turtle.

NOAA Fisheries. 2024a. Section 7: Consultation Technical Guidance in the Greater Atlantic Region. https://www.fisheries.noaa.gov/new-england-midatlantic/consultations/section-7-consultation-technical-guidance-greater-atlantic

NOAA Fisheries. 2024b. FHWA Programmatic Essential Fish Habitat Consultation and General Concurrence for Select Transportation Actions in the NMFS Greater Atlantic Region. Retrieved October 2025: https://www.fisheries.noaa.gov/s3/2024-03/FHWA-Programmatic-EFH-Consultation-2024.pdf.

NOAA Fisheries. 2025. Section 7 Effects Analysis: Turbidity in the Greater Atlantic Region. Retrieved November 2025: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effects-analysis-turbidity-greater-atlantic-region.

NOAA Fisheries and U.S. Fish and Wildlife Service (USFWS). 1992. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. Available online: https://repository.library.noaa.gov/view/noaa/15994.

NOAA Fisheries and USFWS. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*). Available online: https://repository.library.noaa.gov/view/noaa/3720.

Park, C. 2012. A Dictionary of Environment and Conservation. Oxford University Press. Retrieved December 2023: 10.1093/acref/9780198609957.001.0001.

Popper, Arthur N., Michele B. Halvorsen, Brandon M. Casper, and Thomas J. Carlson. 2013. U. S. Dept. of the Interior, Bureau of Ocean Energy Management, Headquarters, Herndon, VA. Effects of Pile Sounds on Non-Auditory Tissues of Fish. OCS Study BOEM 2012- 105. 60 pp.

Reine, K., and D. Clark. 1998. Entrainment by Hydraulic Dredges – a Review of Potential Impacts. Technical Note DOER-E1. U.S. Army Engineer Research and Development Center, Vikcsburg, MS.

Shortnose Sturgeon Recovery Team (SSRT). 1998. Final Recovery Plan for the Shortnose Sturgeon (*Acipenser brevirostrum*). Prepared for the National Marine Fisheries Service, National Oceanic and Atmospheric Administration. Available online: https://repository.library.noaa.gov/view/noaa/15971.

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

The Loggerhead/Green Turtle Recovery Team. 1991. Recovery Plan for U.S. Population of Atlantic Green Turtle *Chelonia mydas*. Prepared for USFWS Southeast Region and National Marine Fisheries Service.

USACE. 2017. Baltimore Harbor and Channels Dredged Material Management Plan Update Final Report. Accessed October 15, 2025: https://www.nab.usace.army.mil/Portals/63/docs/Civil%20Works/DMMP/Balt_Harbor_DMMP_Update_October_2017.pdf?ver=2018-02-08-110956-717.

United States Fish and Wildlife Service (USFWS), NOAA Fisheries, Mexico Secretariat of Environment & Natural Resources, Mexico National Commission of Natural Protected

Areas, and Mexico Federal Attorney of Environmental Protection. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. Available online: https://repository.library.noaa.gov/view/noaa/4368.

University of Maryland Center for Environmental Science (UMCES). 2024. DolphinWatch. Retrieved March 2024: https://www.umces.edu/dolphinwatch.

APPENDIX A: AGENCY CORRESPONDENCE

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 01930-2276

June 30, 2023

Valeriya Remezova
Division Administrator
Federal Highway Administration
Maryland Division
31 Hopkins Plaza, Suite 1520
Baltimore, MD 21201

RE: Chesapeake Bay Crossing Study: Tier 2 National Environmental Policy Act Study
Cooperating and Participating Agency Invitation

Dear Ms. Remezova:

Thank you for your June 1, 2022, letter inviting us to be a cooperating and participating agency on the preparation of environmental documents pursuant to the National Environmental Policy Act (NEPA) for the Chesapeake Bay Crossing Tier 2 Study (the Study). The goals of the Study include evaluating the potential alternatives and their associated impacts for a new crossing of the Chesapeake Bay in the vicinity of the U.S. 50/ U.S. 301 corridor near Annapolis, Maryland. This corridor was previously identified as an outcome of the Tier 1 Environmental Impact Statement (EIS) for this project. In accordance with the Council on Environmental Quality's NEPA Implementing Procedures (40 CFR §1501.6, Cooperating agencies), we accept your invitation to participate as a cooperating agency to help foster a collaborative process and interagency coordination on these projects.

Our role and degree of involvement is dependent on existing staff and fiscal resources, and our contribution to the process will be limited to participating in project meetings and providing written comments in response to your documents prepared as part of the NEPA process. We will provide technical information identifying aquatic species and habitats of concern, identification of issues to be considered and evaluated during the NEPA process and guidance on evaluating, avoiding, and minimizing project effects to our trust resources. At this time, we are unable to undertake any data collection, conduct analyses, or prepare any sections of the NEPA document as our staff and resources are fully committed to other obligatory programs of NOAA Fisheries.

Please note that our involvement as a cooperating agency does not constitute an endorsement of this project, nor does it obviate the need for consultations required under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), Fish and Wildlife Coordination Act (FWCA), and the Endangered Species Act (ESA). As project design moves forward, should adverse impacts to essential fish habitat (EFH) or other NOAA trust resources be anticipated, consultation with us under the Section 305(b) of MSA and FWCA is required. Similarly, potential impacts to species protected under the ESA should be coordinated with our Protected

Resources Division. Please also be aware the proposed timelines for all projects posted on the Permitting Dashboard that include NOAA Fisheries milestones must be provided to us for review and approval prior to their posting.

Consultation Authorities

The estuarine waters in the Study corridor have been designated EFH for several federally managed species. The MSA requires federal agencies such as the U.S. Department of Transportation to consult with us on any action or proposed action authorized, funded, or undertaken by such agency that may adversely affect 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. Similarly, the FWCA requires that all federal agencies consult with us when proposed actions might result in modifications to a natural stream or body of water. It also required that they consider the effects that these projects would have on fish and wildlife and must also provide for improvement of these resources. Under this authority, 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 managed by the federal fishery management councils and do not have designated EFH. Please see our website (https://www.fisheries.noaa.gov/new-england-mid-atlantic/habitat-conservation/essential-fish-habitat-assessment-consultations) for further information regarding your agency's obligations under the MSA and FWCA.

Endangered species under the jurisdiction of NOAA Fisheries may be present in the project area. The federal action agency is responsible for determining whether the proposed action may affect these species. If you determine that the proposed action may affect a listed species, your determination of effects along with justification and a request for concurrence should be submitted to the Section 7 Program email account at nmfs.gar.esa.section7@noaa.gov. Guidance and tools to assist you in your effects determination are available on our website at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-consultations-greater-atlantic-region.

Conclusion

We look forward to working with you and the Bay Crossing Study team as the Study moves forward. If you have any questions regarding this matter, please contact staff in Annapolis, MD field office. For queries related to the MSA/FWCA, contact Jonathan Watson (jonathan.watson@noaa.gov) in our Habitat and Ecosystem Services Division. For queries regarding threatened and endangered species listed by us under the ESA, contact Brian Hopper in our Protected Resources Division (brian.d.hopper@noaa.gov).

Sincerely,



Louis A. Chiarella
Assistant Regional Administrator
for Habitat and Ecosystem Services

cc: J. Mar (FHWA)
J. DaVia (USACE)
H. Lowe (MDTA)
K. Greene, J. Watson (NMFS HESD)
J. Anderson, B Hopper (NMFS PRD)

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

January 13, 2025

Valeria Remezova
Maryland Division Administrator
USDOT Federal Highway Administration
31 Hopkins Plaza, Suite 1520
Baltimore, Maryland 21201

RE: Docket Number FHWA~~2024~~0073
Scoping Comments for the Notice of Intent to Prepare an Environmental Impact Statement for the Chesapeake Bay Crossing Study: Tier 2 National Environmental Policy Act (NEPA)

Dear Ms. Pavona:

We have reviewed the March 25, 2024, *Federal Register* Notice of Intent (NOI) for the Federal Highway Administration (FHWA) to prepare an Environmental Impact Statement (EIS) for the Chesapeake Bay Crossing Tier 2 National Environmental Policy Act (NEPA) Study (Study). The goals of the Study are to evaluate the impacts associated with a new crossing of the Chesapeake Bay along the U.S. Route 50/301 corridor (Rte. 50). This corridor, which contains existing Rte. 50 and the associated Gov. William Preston Lane Jr. Memorial Bridge (Bay Bridge), was selected as the Recommended Preferred Corridor Alternative for a new crossing at the conclusion of the Chesapeake Bay Crossing Tier 1 NEPA Study. In the NOI, FHWA proposes to evaluate the impacts associated with seven Alternatives Retained for Detailed Study (ARDS), including the No Action alternative. The ARDS include several different lane configurations for east-bound (EB) and west-bound (WB) sections of Rte. 50 within the defined study corridor.

We are responding to your request for information as a cooperating agency on this project with legal jurisdiction and special expertise over NOAA trust resources and as a consulting agency under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Fish and Wildlife Coordination Act (FWCA), and the Endangered Species Act (ESA). We are also an action agency for the Study to the extent that NMFS may issue Incidental Take Authorization (ITAs) under the Marine Mammal Protection Act (MMPA) in response to a request from the applicant.

Herein, we provide information and technical assistance related to resources in the Study area and recommended analyses for the EIS. We also provide technical assistance specific to consultation and authorization requirements and their respective sufficiency needs.

General Comments

Based on the information presented in the NOI, it is our understanding that there are two anticipated construction phases for the proposed project, as the proposed ARDS only includes two separate bridge crossings to replace the existing two spans of Rte. 50 over the Chesapeake Bay. We understand that certain ARDS, including a double-decker bridge and a tunnel, were

eliminated from further consideration based on various criteria. The double-decker bridge was screened from further evaluation because it would "not provide the redundancy" and "would not be reasonable from a resiliency perspective". Neither of these criteria are specifically highlighted in the Purpose and Need section of the NOI. In addition, a single span bridge with the proposed capacities was not evaluated as part of the ARDS. Because it may present fewer environmental impacts, we recommend that the Project team evaluate the impacts associated with a single bridge span and/or a double-span with shared in-water structures (e.g., similar to Mario M. Cuomo Bridge) in the EIS to compare with the impacts of the ARDS currently proposed in the NOI. This evaluation should include both temporary (e.g., construction infrastructure, underwater noise, turbidity, temporal disturbance) and permanent impacts (e.g., fills). This information and clarification will help inform our recommendations and understanding of feasible and reasonable Project alternatives at an early stage.

There are also several indirect impacts that should be fully described in the EIS, as they are reasonably-foreseeable outcomes resulting from the replacement of the existing Bay Bridge. We note that the study corridor was altered early in the Tier 2 NEPA process and no longer includes the existing Rte. 50 crossing of the Severn River. However, the proposed ARDS include expanding lanes on Rte. 50 immediately adjacent to this crossing. It seems likely that funneling down the proposed four or five WB lanes of traffic into the existing three WB lanes of traffic on the Severn River Bridge, where traffic bottlenecks are presently known to occur, would result in the need for roadway improvements and expansions to accommodate the anticipated traffic. As a result, the Study should consider the indirect impacts associated with expanding capacity (e.g., full bridge replacement) on the Severn River Bridge, as this is a reasonably-foreseeable outcome of expanded traffic capacity in the adjacent study corridor. We also recommend that the expansion (i.e., deepening, widening) of the existing shipping channel be evaluated as an indirect impact resulting from the project. Following the collapse of the Francis Scott Key Bridge in 2024, the existing Bay Bridge is the only major height-restricting structure that remains between the Port of Baltimore and the Atlantic Ocean. We anticipate that new Bay Bridge spans will present greater clearance and therefore will allow larger commercial vessels to call on the Port of Baltimore. This coupled with the proposed expansion of port facilities in the Baltimore area make it likely that the project could induce greater environmental impacts associated with waterborne commerce. Finally, we recommend that a hydrodynamic study be completed to evaluate the indirect effects of additional in-water structures (e.g., pier islands, culverted road crossings) on the movement of water through the Study corridor. This study should be specific to crossings of major tidal waterbodies (e.g., Bay Bridge, Kent Island Narrows) and should consider a range of tidal conditions that can be reasonably anticipated through the life of the project.

Resources under NOAA Fisheries Jurisdiction and for Which it has Special Expertise

The project overlaps with significant resources under NOAA Fisheries jurisdiction, including habitats important for federally managed fish species and protected species. The Study area supports fishery resources and overlaps with important regional commercial and recreational fisheries, including but not limited to striped bass (*Morone saxatilis*) and blue crab (*Callinectes sapidus*). Here we highlight some resources of concern for consideration in the EIS.

Essential Fish Habitat
The Project area includes important habitats for a range of federally managed fish species. Habitats in the Project area include soft bottom to structured habitats (e.g., oyster reef) as well as submerged aquatic vegetation (SAV) and shellfish beds. We provided technical guidance to FHWA as part of the Natural Resources Technical Report (NRTR) methodology document to ensure that these areas are fully described in the EIS.

The study corridor overlaps with designated Habitat Areas of Particular Concern (HAPC) for summer flounder (*Paralichthys dentatus*). The designation of HAPCs highlights the importance of juvenile summer founder rearing habitats and complex habitat in this area and creates an obligation to evaluate potential adverse impact to such habitats and consider measures which would minimize that adverse effect. Areas within the study corridor are also annually colonized by submerged aquatic vegetation (SAV), primarily widgeon grass (*Ruppia maritima*) and horned pondweed *(Zannichellia palustris*). SAV is designated a HAPC for summer flounder because it has been demonstrated to be preferred feeding and resting habitat (Orth and Heck, 1980; Lascara, 1981; Rogers and Van Den Avyle, 1983; Heck and Thoman, 1984) for this recreationally and commercially valuable species. HAPCs are a subset of EFH that are either rare, particularly susceptible to human-induced degradation, especially important ecologically, or located in an environmentally stressed area. Because of this, individual, cumulative and synergistic effects are a particular concern in these habitats. The Mid-Atlantic Fishery Management Council has defined the summer flounder HAPC 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. Because SAV, especially widgeon grass, can exhibit large spatial fluctuations from year to year the widely accepted practice for defining SAV habitat is to consider areas identified by the Virginia Institute of Marine Science (VIMS) as supporting SAV based on surveys conducted in the five most recent years. Any area mapped in those five years is considered to be habitat that supports SAV, even if SAV is not found there on a given date during the growing season. Furthermore, because the VIMS SAV survey does not occur during the height of the growing season for horned pondweed, additional surveys may be warranted to fully describe the occurrence of this species within the study corridor.

The project will likely also result in permanent and/or temporary impacts to other productive aquatic habitats. This includes emergent tidal wetlands, beach strand habitat, intertidal flats, sub-tidal shallows, and oyster reef habitat. Tidal marshes and mudflats are both designated as Special Aquatic Sites under the Clean Water Act due to their unique ecological functions and sensitivity to anthropogenic impacts. The spatial configuration of these habitats and their current habitat functions should be fully described as part of this EIS to allow for impacts associated with the project to be fully disclosed. Field surveys are likely necessary to ensure accurate delineation. This should include delineation of tidal wetlands, including details regarding dominant wetland vegetation type. Furthermore, the NOI details impacts to spawning habitat for horseshoe crab (*Limulus polyphemus*) spawning habitat. The prevalence of spawning activity in these areas should be further defined through surveys during the spawning season.

Protected Species
Threatened or endangered species under our jurisdiction including Atlantic sturgeon (*Acipenser oxyrhynchus*) and shortnose sturgeon (*Acipenser brevirostrum*) may be present in the Project

area. In addition, four species of federally threatened or endangered sea turtles under our jurisdiction occur seasonally in the waters of Chesapeake Bay from late April – mid November of each year: the threatened Northwest Atlantic Ocean Distinct Population Segment (DPS) of loggerhead (*Caretta caretta*), the endangered Kemp's ridley (*Lepidochelys kempii*), and the endangered leatherback (*Dermochelys coriacea*). On April 6, 2016, NMFS published the final rule listing eleven Green sea turtle (*Chelonia mydas*) DPSs. Eight DPSs were listed as threatened and three as endangered. The DPS found in U.S. Atlantic waters, the North Atlantic DPS, is listed as threatened. Due to the inability to distinguish between these populations away from the nesting beach, we consider green sea turtles endangered wherever they occur in U.S. waters.

We have created a new App, the Section 7 Mapper, to assist Federal action agencies in identifying the ESA-listed species and critical habitat in their project action area: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-critical-habitat-information-maps-greater. Within the Section 7 Mapper, we have included data layers that represent our best estimate of the spatial and temporal range of listed species' life stages, behaviors, and critical habitat in our Region. It is important to note that use of this App does not replace the section 7 consultation process. We are providing the Section 7 Mapper as a technical assistance tool and expect action agencies will use it as a first step in determining if a proposed federal action overlaps with listed species or critical habitat. In addition, NOAA's Chesapeake Bay Office operates and maintains the Chesapeake Bay Interpretive Buoy System (CBIBS) - a network of observing platforms (buoys) that collect meteorological, oceanographic, and water-quality data and relay that information in near real time. There is an active buoy at the mouth of the Severn River, approximately 3.5 miles south west of the Bay Bridge. The latest data from this buoy and key points up and down the Bay is available at a website (https://www.buoybay.noaa.gov/locations/annapolis) or via apps available for Android and iPhone/iPad. Data available at this site and on the mobile apps are "raw" and have not been scrubbed for any anomalies. The buoys also collect data from fish that have been collected and implanted with telemetry tags, including Atlantic sturgeon. This data is not publicly available, but can be accessed by contacting NOAA's Chesapeake Bay Office.

As the lead federal action agency, you are responsible for determining the nature and extent of effects and for coordinating with our Protected Resources Division as appropriate. Our website (https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-consultations-greater-atlantic-region) has guidance and tools to assist action agencies with their description of the action and analysis of effects to support their determination. Should you have any questions about the section 7 consultation process, please contact Brian Hopper at (301) 758-3074 or brian.d.hopper@noaa.gov.

Finally, species protected under the Marine Mammal Protection Act (MMPA) such as common bottlenose dolphin (*Tursiops truncatus*) have been identified in the Project areas. Our website (https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-protection-act-policies-guidance-and-regulations) has guidance and tools to assist action agencies with this consultation process. Please coordinate with Benjamin Laws (Benjamin.Laws@noaa.gov) at our Headquarters office as necessary to ensure adequate protection for these species.

Avoidance, Minimization, Mitigation and Monitoring Measures

In addition to alternatives, the EIS must evaluate mitigation measures to avoid and minimize adverse impacts to NOAA trust resources. As described in the NOAA Mitigation Policy for Trust Resources (NAO 216-123, Section 3.06) impact avoidance and minimization must be considered and fully and fairly evaluated through the alternative development process before compensatory mitigation is considered; this is known as the mitigation sequence. The mitigation sequence clearly dictates that compensating for unavoidable adverse impacts should be viewed as mitigation of last resort. As described in the NOAA Mitigation Policy, the level and type of uncertainty associated with compensatory mitigation may warrant increased amounts of compensation to assure that impacts are sufficiently offset.

Further, the EIS must clearly identify which mitigation measures are included as part of the proposed action and thus evaluated in the analysis, and the likelihood of selection and implementation of additional proposed measures (e.g., measures are proposed as required; measures are optional and could be implemented by the Project team at their discretion). The document should provide information on how mitigation measures are considered in the context of the effects level (negligible, minor, moderate, major), how mitigation would offset those levels, and the effectiveness of any proposed mitigation.

Conclusion

Thank you for considering our comments during this important scoping process. We will continue to support FHWA's efforts to advance this study through our participation in the regulatory and planning processes. We look forward to continuing to work with you as this study continues.

Should you have any questions regarding these comments and/or the EFH consultation, please contact Jonathan Watson in our Habitat and Ecosystem Services Division at (978) 675-2180 or jonathan.watson@noaa.gov. For questions regarding ESA and Section 7 comments, please contact Brian Hopper in our Protected Resources Division at (301) 758-3074 or Brian.d.Hopper@noaa.gov. For questions regarding MMPA Incidental Take Authorizations, please contact Ben Laws in the Office of Protected Resources at (301) 427-8425 or Benjamin.Laws@noaa.gov.

Sincerely,

Karen M. Greene
Mid-Atlantic Field Branch Chief
Habitat and Ecosystem Services Division

cc:
Jamie Pavona, FHWA
Alexander Bienko, FHWA
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Joesph DaVia, USACE
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Karen Greene, NOAA
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Timothy Cardiasmenos, NOAA
Dale Youngkin, NOAA
Jaclyn Daly, NOAA
Ray Li, USFWS
Christine Mazerella, USEPA
Mark Eberle, NPS
Tammy Roberson, MDE
Tony Redman, MDNR

Works Cited

Heck, K.L., T.A. Thoman. 1984. The nursery role of seagrass meadows in the upper and lower reaches of the Chesapeake Bay. Estuaries 7: 70–92.

Lascara, J. 1981. Fish predator-prey interactions in areas of eelgrass (*Zostera marina*). M.S. thesis, College of William and Mary, Williamsburg, VA. 81pp.

Orth, R.J., K.L. Heck, Jr. 1980. Structural components of eelgrass (*Zostera marina*) meadows in the lower Chesapeake Bay - fishes. Estuaries 3: 278–288.

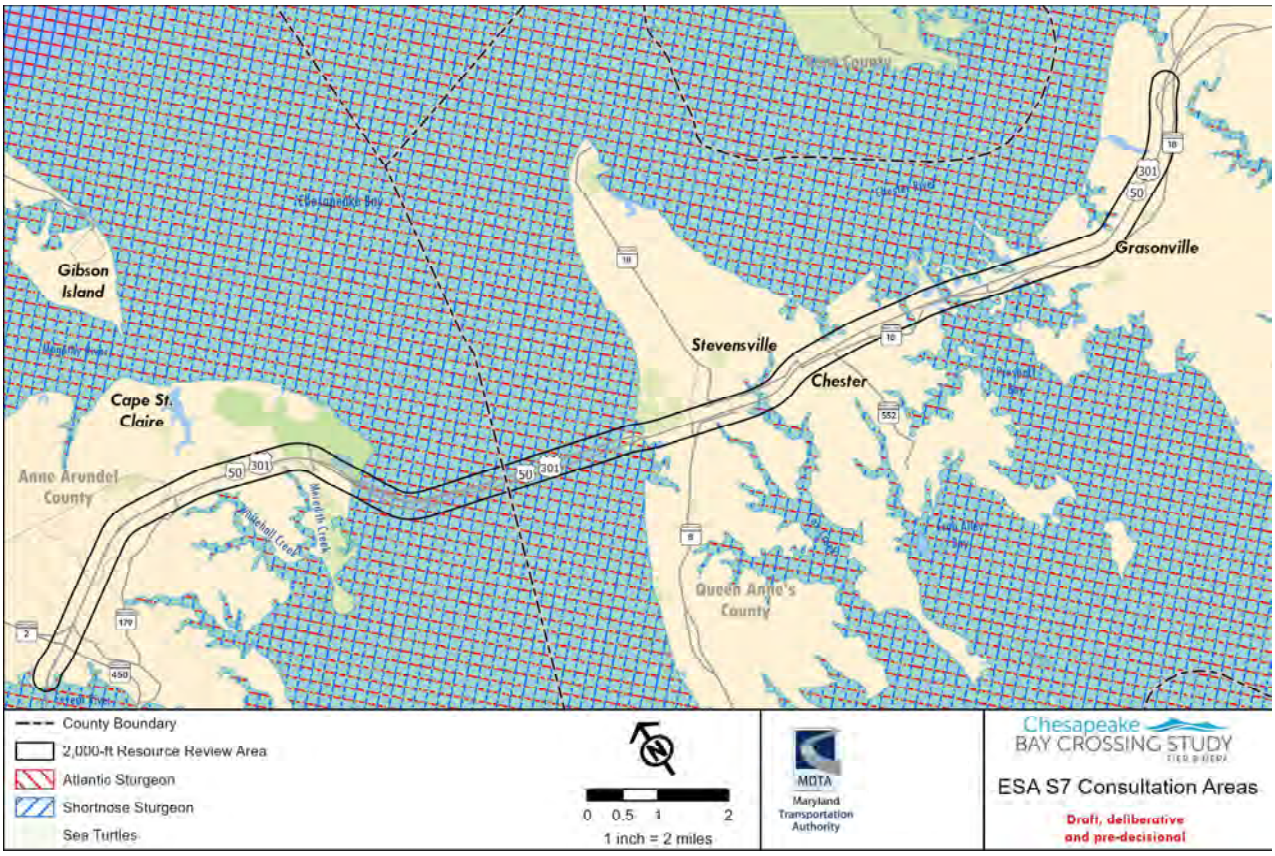
Rogers, S.G. M.J. Van Den Avyle. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic) – summer flounder. US. Fish and Wildlife Service. FWS/OBS-82/11.15 U.S. Army Corps of Engineers, TR EL-82-4. 14p.

Drawn Action Area & Overlapping S7 Consultation Areas

Area of Interest (AOI) Information

Area : 1,284.82 acres

Feb 5 2025 12:44:02 Eastern Standard Time



Summary

Name	Count	Area(acres)	Length(mi)
BCS 2,000 ft Corridor	1	1,118.33	N/A
Atlantic Sturgeon	3	3,492.69	N/A
Shortnose Sturgeon	2	2,328.46	N/A
Atlantic Salmon	0	0	N/A
Sea Turtles	4	4,656.93	N/A
Atlantic Large Whales	0	0	N/A
In or Near Critical Habitat	0	0	N/A

BCS 2,000 ft Resource Review Area

#	FID	Shape_Leng	BUFF_DIST	ORIG_FID	Shape_Le_1	Shape_Area	Area(acres)
1	0	105638.774992	1000	0	217554.745333	214414913.751	1,118.33

Atlantic Sturgeon

#	Feature ID	Species	Lifestage	Behavior	Zone
1	ANS_CHB_SUB_MAF	Atlantic sturgeon	Subadult	Migrating & Foraging	Chesapeake Bay
2	ANS_CHB_JUV_MAF	Atlantic sturgeon	Juvenile	Migrating & Foraging	Chesapeake Bay
3	ANS_CHB_ADU_MAF	Atlantic sturgeon	Adult	Migrating & Foraging	Chesapeake Bay

#	From	Until	From (2)	Until (2)	Area(acres)
1	03/15	11/30	N/A	N/A	1,164.23
2	01/01	12/31	N/A	N/A	1,164.23
3	03/15	11/30	N/A	N/A	1,164.23

Shortnose Sturgeon

#	Feature ID	Species	Life Stage	Behavior	Zone
1	SNS_CHB_ADU_WIN	Shortnose sturgeon	Adult	Overwintering	Chesapeake Bay
2	SNS_CHB_ADU_MAF	Shortnose sturgeon	Adult	Migrating & Foraging	Chesapeake Bay

#	From	Until	From (2)	Until (2)	Area(acres)
1	11/01	02/28	N/A	N/A	1,164.23
2	01/01	12/31	N/A	N/A	1,164.23

Sea Turtles

#	Feature ID	Species	Life Stage	Behavior	Zone
1	GRN_STS_AJV_MAF	Green sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia
2	KMP_STS_AJV_MAF	Kemp's ridley sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia
3	LTR_STS_AJV_MAF	Leatherback sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia
4	LOG_STS_AJV_MAF	Loggerhead sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia

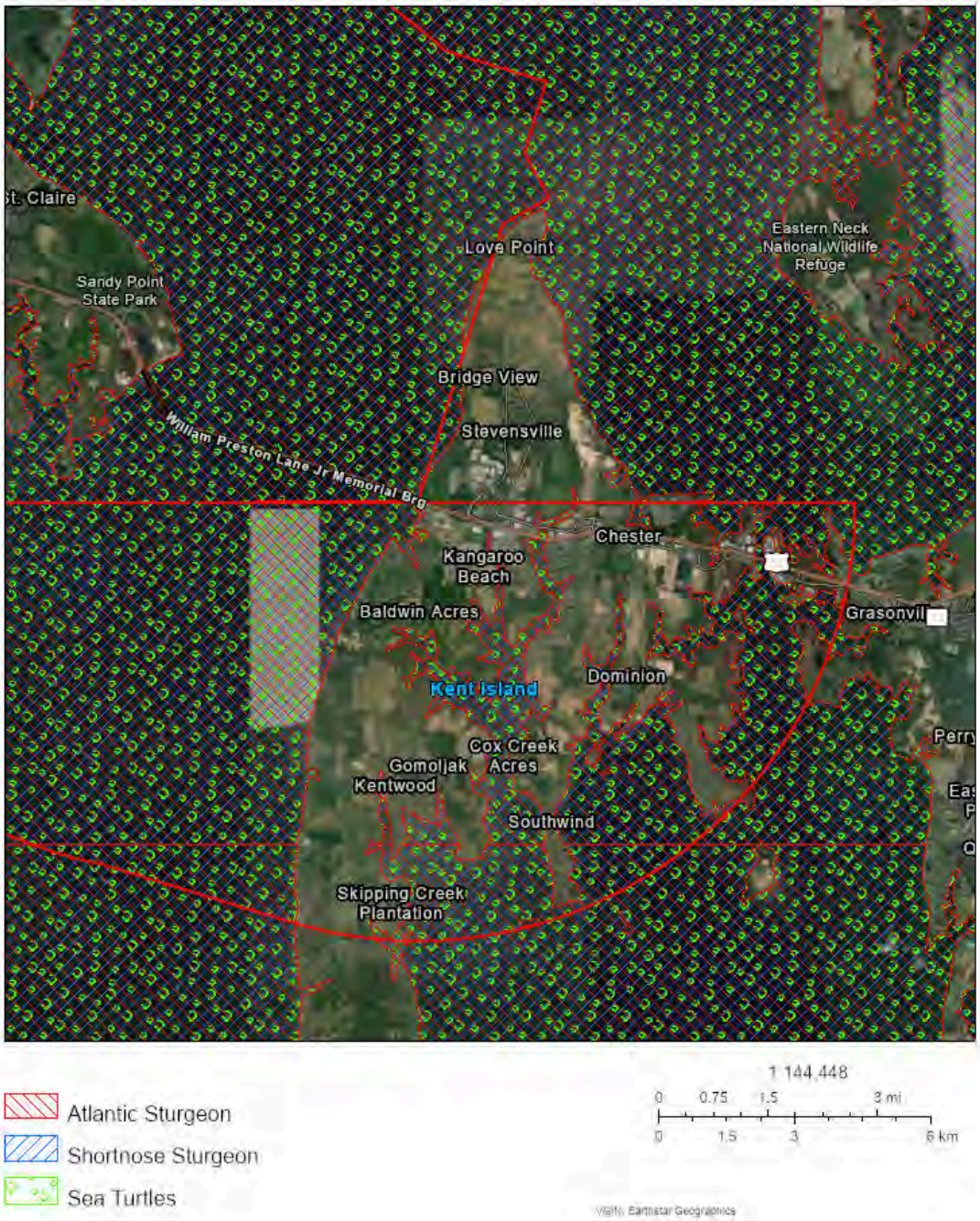
#	From	Until	From (2)	Until (2)	Area(acres)
1	5/1	11/30	*No Data*	*No Data*	1,164.23
2	5/1	11/30	*No Data*	*No Data*	1,164.23
3	5/1	11/30	*No Data*	*No Data*	1,164.23
4	5/1	11/30	*No Data*	*No Data*	1,164.23

Drawn Action Area and Overlapping Section 7 Consultation Areas

Area of Interest (AOI) Information

Area : 3,971,051,493.28 ft²

Mar 9 2026 7:26:23 Eastern Daylight Time



Summary

Name	Count	Area(ft²)	Length(ft)
Atlantic Sturgeon	6	7,643,946,869.06	N/A
Shortnose Sturgeon	4	5,095,964,579.37	N/A
Atlantic Salmon	0	0	N/A
Sea Turtles	4	10,140,666,755.31	N/A
Atlantic Large Whales	0	0	N/A
In or Near Critical Habitat	0	0	N/A

Atlantic Sturgeon

#	Feature ID	Species	Life Stage	Behavior	Zone
1	ANS_CHB_SUB_MAF	Atlantic sturgeon	Subadult	Migrating & Foraging	Chesapeake Bay
2	ANS_CHB_JUV_MAF	Atlantic sturgeon	Juvenile	Migrating & Foraging	Chesapeake Bay
3	ANS_CHB_ADU_MAF	Atlantic sturgeon	Adult	Migrating & Foraging	Chesapeake Bay

#	From	Until	From (2)	Until (2)	Area(ft²)
1	03/15	11/30	Sturgeon	Acipenser oxyrinchus oxyrinchus	2,547,982,289.69
2	01/01	12/31	Sturgeon	Acipenser oxyrinchus oxyrinchus	2,547,982,289.69
3	03/15	11/30	Sturgeon	Acipenser oxyrinchus oxyrinchus	2,547,982,289.69

Shortnose Sturgeon

#	Feature ID	Species	Life Stage	Behavior	Zone
1	SNS_CHB_ADU_WIN	Shortnose sturgeon	Adult	Overwintering	Chesapeake Bay
2	SNS_CHB_ADU_MAF	Shortnose sturgeon	Adult	Migrating & Foraging	Chesapeake Bay

#	From	Until	From (2)	Until (2)	Area(ft²)
1	11/01	02/28	N/A	N/A	2,547,982,289.69
2	01/01	12/31	N/A	N/A	2,547,982,289.69

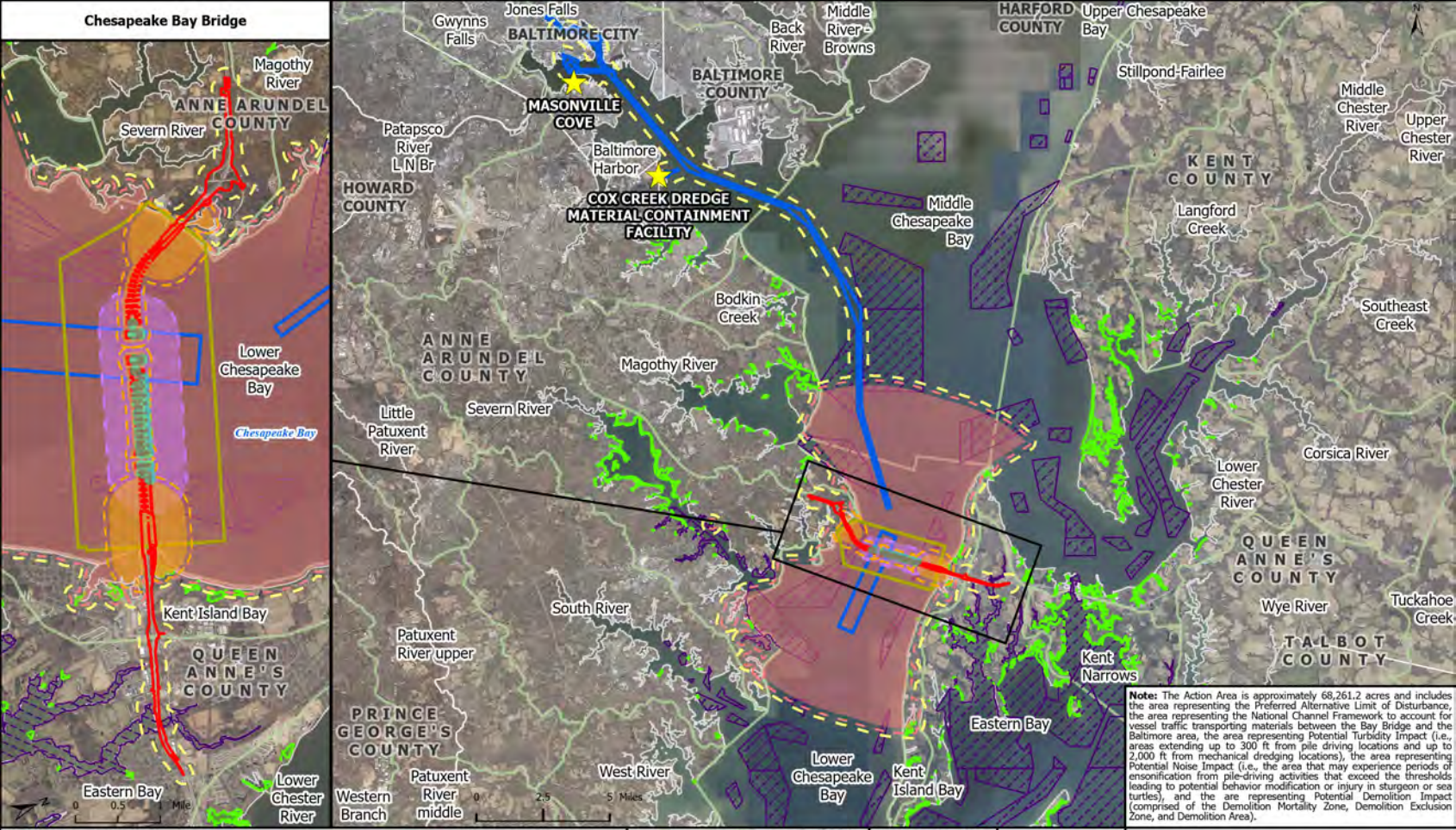
Sea Turtles

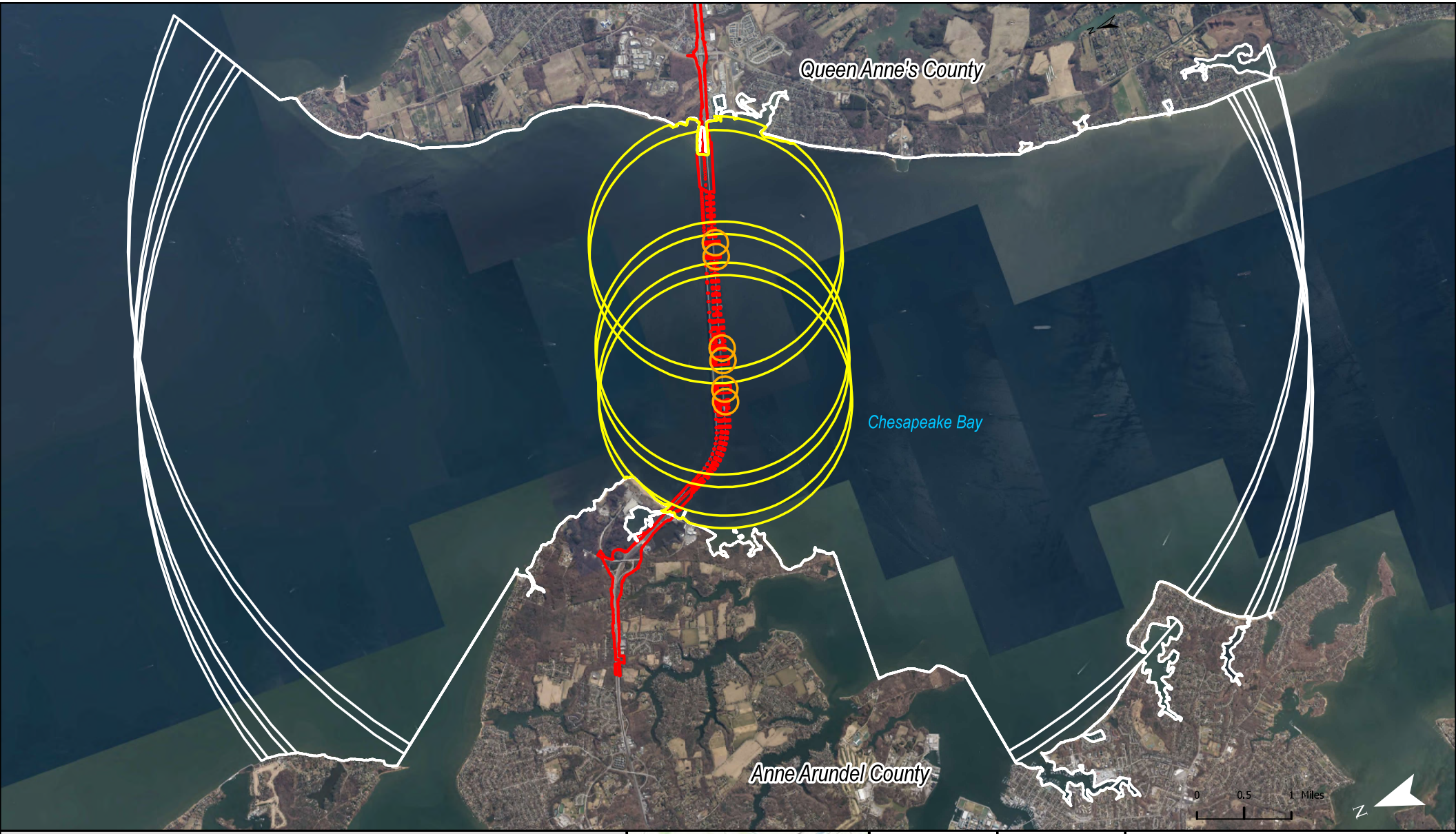
#	Feature ID	Species	Life Stage	Behavior	Zone
1	GRN_STS_AJV_MAF	Green sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia
2	KMP_STS_AJV_MAF	Kemp's ridley sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia
3	LTR_STS_AJV_MAF	Leatherback sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia
4	LOG_STS_AJV_MAF	Loggerhead sea turtle	Adults and juveniles	Migrating & Foraging	Massachusetts (S of Cape Cod) through Virginia

#	From	Until	From (2)	Until (2)	Area(ft²)
1	5/1	11/30	*No Data*	*No Data*	2,535,166,688.83
2	5/1	11/30	*No Data*	*No Data*	2,535,166,688.83
3	5/1	11/30	*No Data*	*No Data*	2,535,166,688.83
4	5/1	11/30	*No Data*	*No Data*	2,535,166,688.83

DISCLAIMER: Use of this App does NOT replace the Endangered Species Act (ESA) Section 7 consultation process; it is a first step in determining if a proposed Federal action overlaps with listed species or critical habitat presence. Because the data provided through this App are updated regularly, reporting results must include the date they were generated. The report outputs (map/tables) depend on the options picked by the user, including the shape and size of the action area drawn, the layers marked as visible or selectable, and the buffer distance specified when using the "Draw your Action Area" function. Area calculations represent the size of overlap between the user-drawn Area of Interest (with buffer) and the specified S7 Consultation Area. Summary table areas represent the sum of these overlapping areas for each species group.

APPENDIX B: ACTION AREA MAP

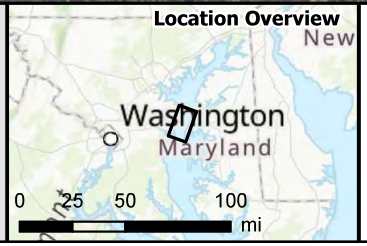

Chesapeake Bay Bridge
Magothy River
ANNE ARUNDEL COUNTY
Severn River
Lower Chesapeake Bay
Chesapeake Bay
Kent Island Bay
QUEEN ANNE'S COUNTY
Eastern Bay
Lower Chester River
0 0.5 1 Mile
Gwynns Falls
Jones Falls
BALTIMORE CITY
Back River
Middle River - Browns
HARFORD COUNTY
Upper Chesapeake Bay
Stillpond-Fairlee
BALTIMORE COUNTY
MASONVILLE COVE
Middle Chester River
Upper Chester River
Patapsco River L N Br
Baltimore Harbor
KENT COUNTY
HOWARD COUNTY
COX CREEK DREDGE MATERIAL CONTAINMENT FACILITY
Middle Chesapeake Bay
Langford Creek
Bodkin Creek
Southeast Creek
ANNE ARUNDEL COUNTY
Magothy River
Severn River
Little Patuxent River
Corsica River
Lower Chester River
QUEEN ANNE'S COUNTY
South River
Wye River
Tuckahoe Creek
Patuxent River upper
TALBOT COUNTY
Kent Narrows
PRINCE GEORGE'S COUNTY
Eastern Bay
Lower Chesapeake Bay
West River
Kent Island Bay
Western Branch
Patuxent River middle
0 2.5 5 Miles
N
Note: The Action Area is approximately 68,261.2 acres and includes the area representing the Preferred Alternative Limit of Disturbance, the area representing the National Channel Framework to account for vessel traffic transporting materials between the Bay Bridge and the Baltimore area, the area representing Potential Turbidity Impact (i.e., areas extending up to 300 ft from pile driving locations and up to 2,000 ft from mechanical dredging locations), the area representing Potential Noise Impact (i.e., the area that may experience periods of ensonification from pile-driving activities that exceed the thresholds leading to potential behavior modification or injury in sturgeon or sea turtles), and the are representing Potential Demolition Impact (comprised of the Demolition Mortality Zone, Demolition Exclusion Zone, and Demolition Area).
Potential Dredge Disposal Site
Preferred Alternative Limit of Disturbance
SAV (2019-2023)
Natural Oyster Bottom (NOB)
County Boundary
Action Area
Action Area - National Channel Framework
Action Area - Potential Turbidity Impact
Action Area - Potential Noise Impact
MDE 8-Digit Watershed
Action Area - Demolition Mortality Zone
Action Area - Demolition Exclusion Zone
Action Area - Demolition Area
Location Overview
New
Washington
Maryland
0 25 50 100 mi
Credits: MD iMAP, DNR, MD iMAP, SHA, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS
MDTA
Maryland Transportation Authority
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA
Action Area Map



Fish Disturbance Isopleths - 96 inch Steel Pipe Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification

MDTA RPA Limit of Disturbance

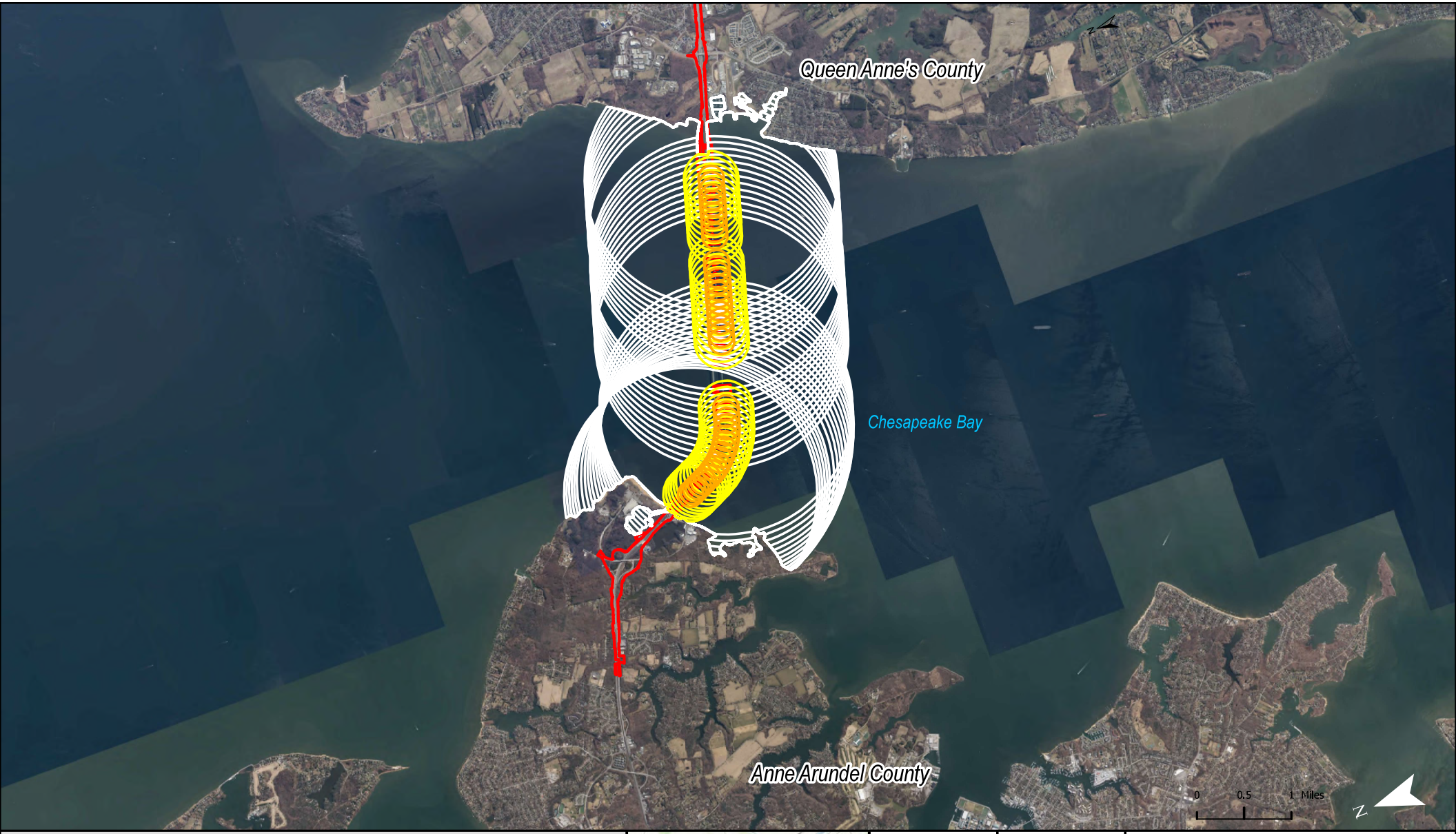


Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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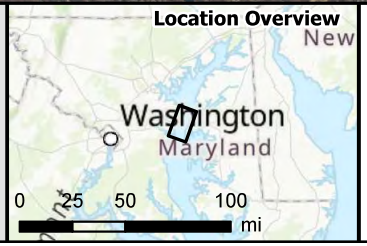
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 1 of 12



Fish Disturbance Isopleths - 48 inch Steel Pipe Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- MDTA RPA Limit of Disturbance

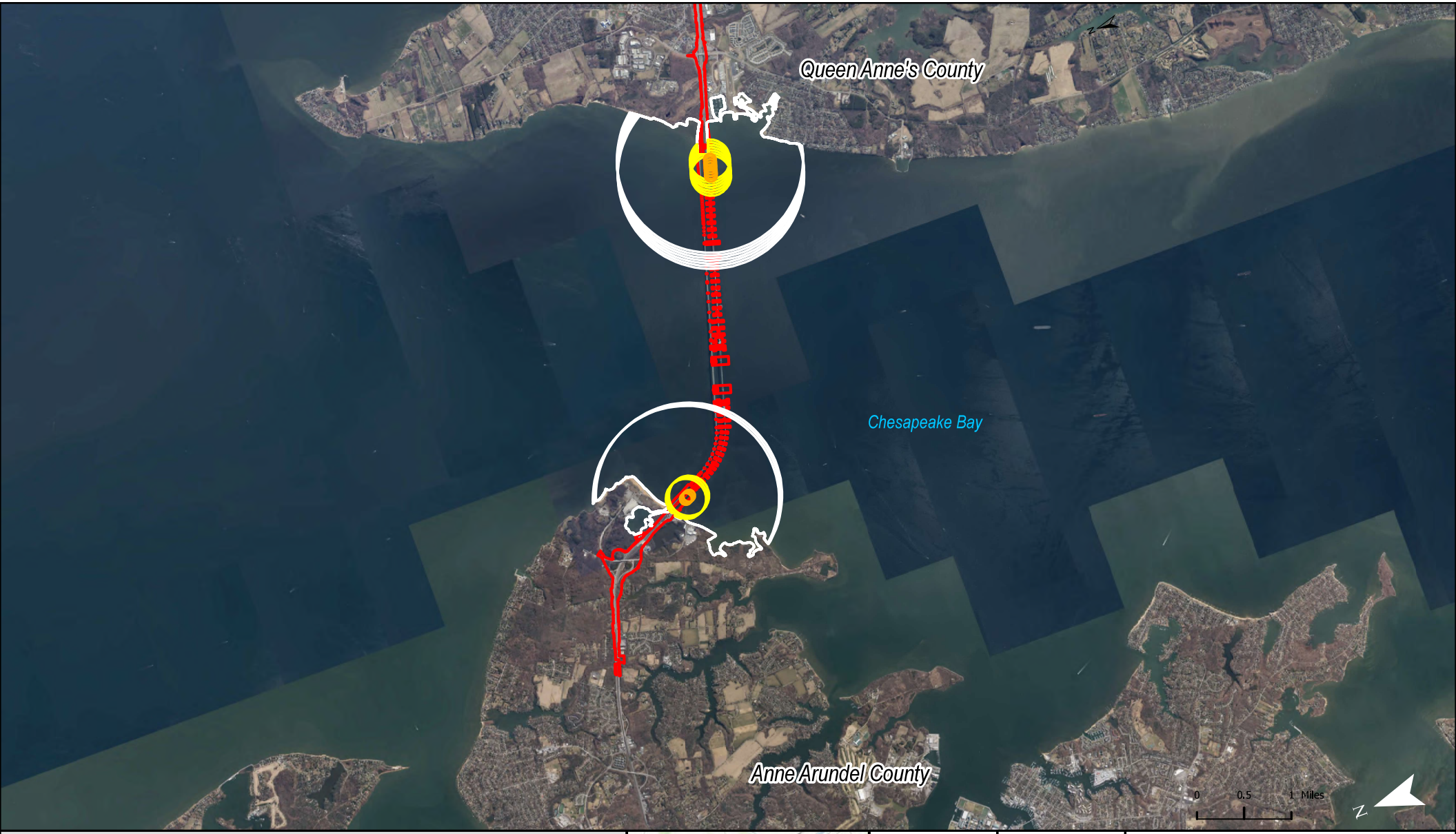


Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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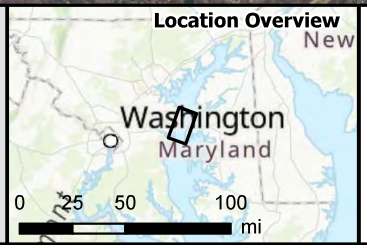
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 2 of 12



Fish Disturbance Isopleths - 36 inch Steel Pipe Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- MDTA RPA Limit of Disturbance



Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 3 of 12

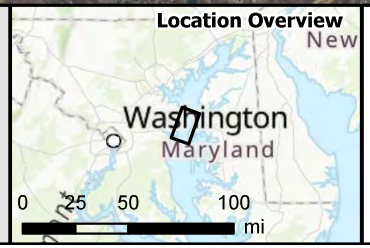


Fish Disturbance Isopleths - 36 inch Square Concrete

Impact Hammer - Behavior Modification

Impact Hammer - Potential Injury

MDTA RPA Limit of Disturbance



Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

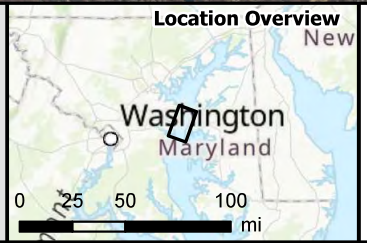
Action Area Map
Potential Noise Impacts
Series Page 4 of 12



Fish Distubance Isopleths - 14 inch H-pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification

MDTA RPA Limit of Disturbance



Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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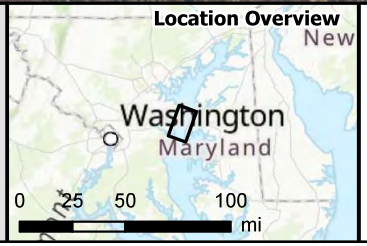
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 5 of 12



Fish Disturbance Isopleths - AZ Sheet Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- MDTA RPA Limit of Disturbance



Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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Maryland Transportation Authority

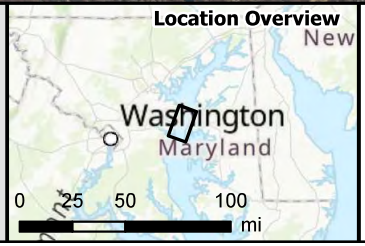
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 6 of 12



Sea Turtle Disturbance Isopleths - 96 inch Steel Pipe Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- Vibratory Hammer - Potential Injury
- MDTA RPA Limit of Disturbance



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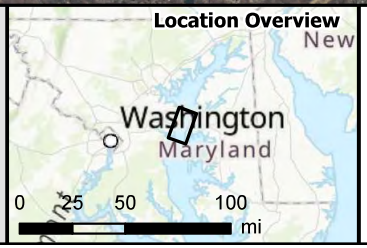
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 7 of 12



Sea Turtle Disturbance Isopleths - 48 inch Steel Pipe Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- Vibratory Hammer - Potential Injury
- MDTA RPA Limit of Disturbance

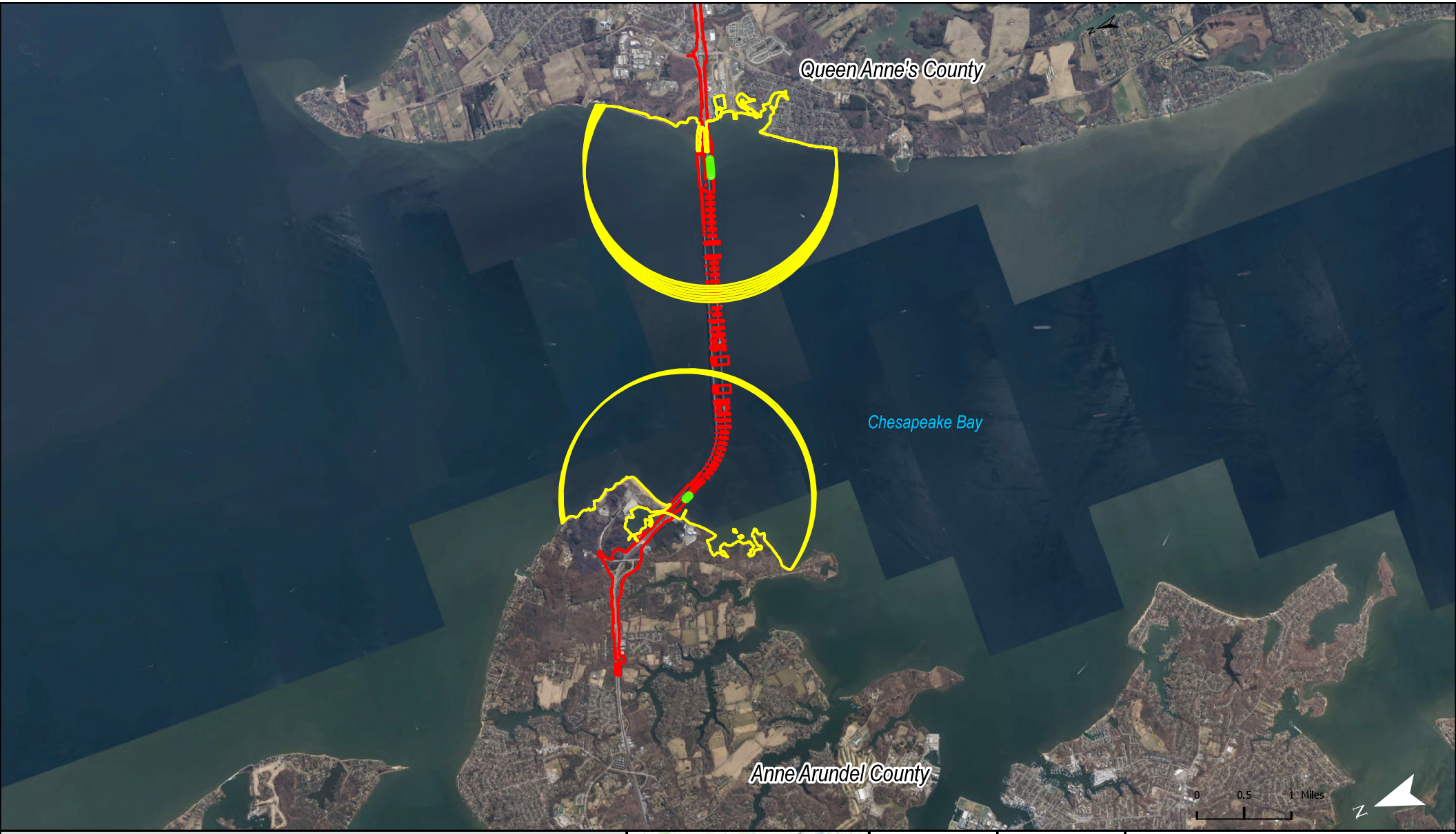


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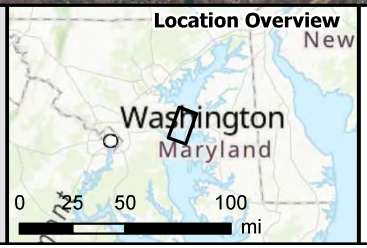
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 8 of 12



SeaTurtle Disturbance Isopleths - 36 inch Steel Pipe Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- Vibratory Hammer - Potential Injury
- MDTA RPA Limit of Disturbance



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Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 9 of 12

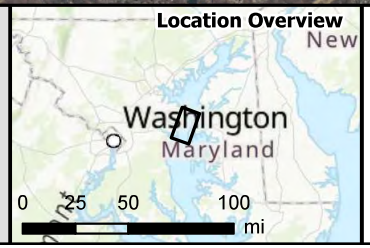


Sea Turtle Disturbance Isopleths - 36 inch Square Concrete

Impact Hammer - Behavior Modification

Impact Hammer - Potential Injury

MDTA RPA Limit of Disturbance

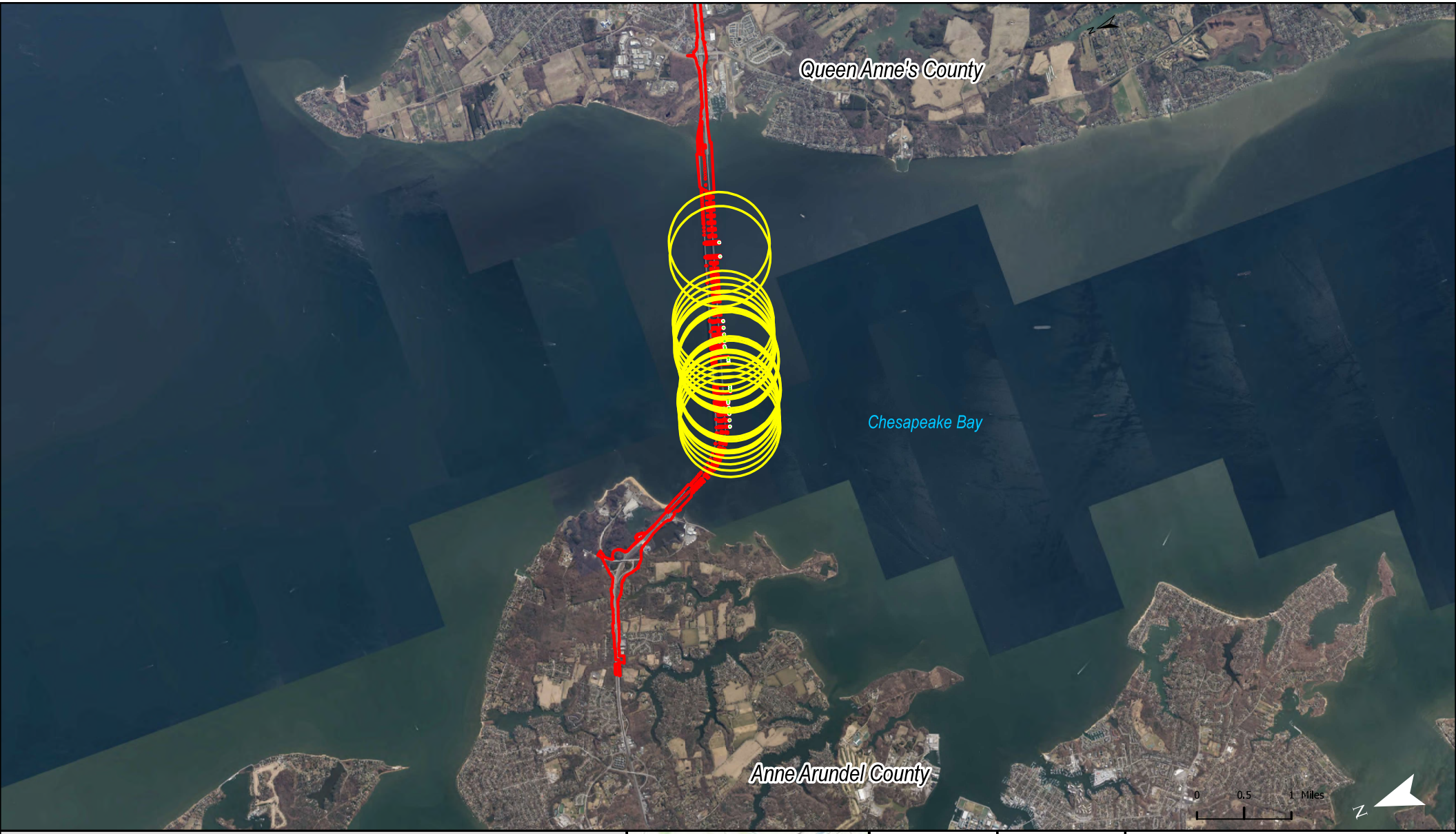


Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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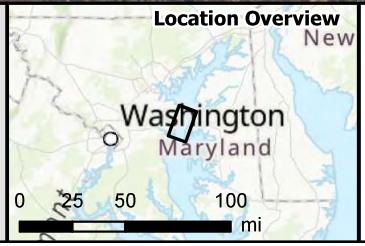
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 10 of 12



Sea Turtle Distubance Isopleths - 14 inch H-pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- Vibratory Hammer - Potential Injury
- MDTA RPA Limit of Disturbance



Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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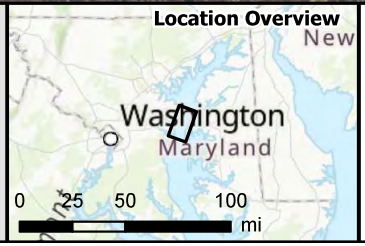
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 11 of 12



SeaTurtle Disturbance Isopleths - AZ Sheet Pile

- Impact Hammer - Behavior Modification
- Impact Hammer - Potential Injury
- Vibratory Hammer - Behavior Modification
- Vibratory Hammer - Potential Injury
- MDTA RPA Limit of Disturbance



Credits: MD iMAP, DNR, MD iMAP, DoIT, Sources: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community, Esri, USGS

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Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

Action Area Map
Potential Noise Impacts
Series Page 12 of 12

APPENDIX C: TELEMETRY DATA

Telemetry Data

Received from NOAA Fisheries 10/1/2025

We would like to acknowledge the contributions of the Atlantic Cooperative Telemetry Network and the following collaborations for providing fish tagging data: Robert Aguilar (Smithsonian Environmental Research Center), Matthew Balazik (Virginia Commonwealth University), Robert Bourdon and Sheila Eyler (U.S. Fish and Wildlife Service), Wilmelie Cruz Marrero (NOAA Chesapeake Bay Office), Benjamin Gahagan (Massachusetts Division of Marine Fisheries / University of Massachusetts), Craig King (Maine Department of Marine Resources), Patrick McGrath (Virginia Institute of Marine Science), Mike O'Brien and David Secor (University of Maryland Center for Environmental Science), Matthew Ogburn (Smithsonian Environmental Research Center), Ian Park (Delaware Department of Natural Resources), Ethan Simpson (Virginia Marine Resources Commission), Chuck Stence (Maryland Department of Natural Resources), and Bethany Williams (NOAA NCCOS).

From:	Jonathan Watson - NOAA Federal
To:	Jeff Gring
Cc:	Sarah Williamson; Wilmelie Cruz - NOAA Federal
Subject:	Figures for Inclusion in BCST2: Telemetry Data for Bay Bridge Array
Date:	Wednesday, October 1, 2025 9:16:42 AM

Hi Jeff,

Please find attached two figures that we would like to see included in the draft EIS for the Bay Crossing Study. We'd recommend that the following description accompany these figures:

Data collected from passive acoustic telemetry at the Chesapeake Bay Bridge North array (2021-2024) offers valuable insights into fish activity in the area, which may be impacted by bridge construction/demolition activities. This data, provided by 12 collaborating researchers, includes detections of 118 tagged individuals across 10 different species originating from the Chesapeake Bay, Delaware Bay, Maine, Massachusetts, and Virginia. The most commonly detected species near the bridge were striped bass, American eel, gizzard shad, cownose ray, and Atlantic sturgeon. Striped bass exhibited consistent detections throughout the year, indicating their year-round presence in the area (see Figures 1-2). In contrast, American eel detections were primarily concentrated at night, with significant seasonal activity in the spring and late fall to early winter. Atlantic sturgeon and cownose ray were detected mainly during the warmer months, while gizzard shad and white perch appeared less frequently. Daily detection patterns showed that striped bass and American eel were more prevalent during cooler periods, whereas migratory species like sturgeon and cownose ray were more commonly observed in the spring and summer. These findings emphasize that several ecologically and economically significant species, including the federally protected Atlantic sturgeon, actively use habitats near the bridge and may be sensitive to noise, habitat changes, or other impacts from construction activities.

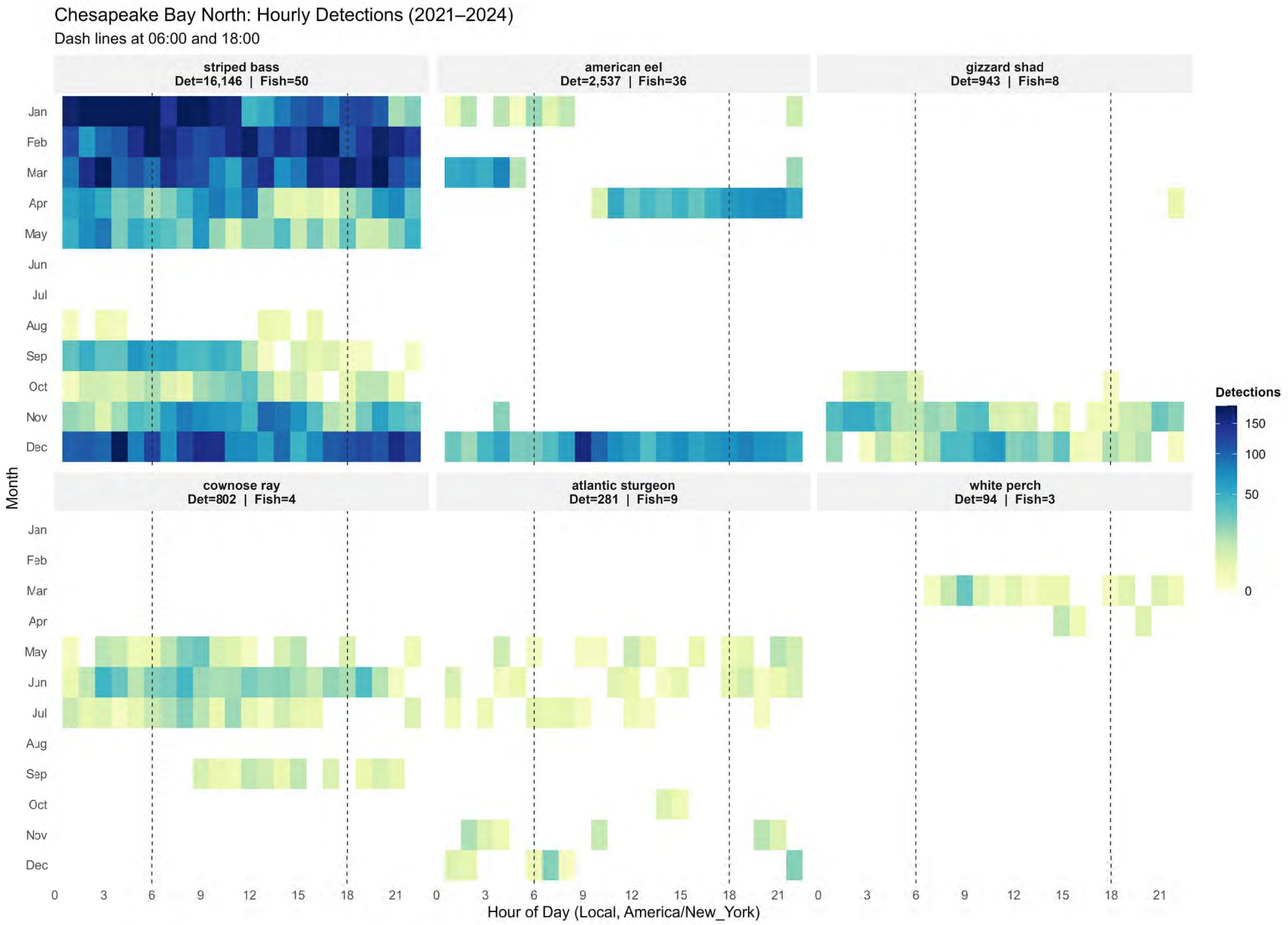
We would like to acknowledge the contributions of the Atlantic Cooperative Telemetry Network and the following collaborations for providing fish tagging data: Robert Aguilar (Smithsonian Environmental Research Center), Matthew Balazik (Virginia Commonwealth University), Robert Bourdon and Sheila Eyler (U.S. Fish and Wildlife Service), Wilmelie Cruz Marrero (NOAA Chesapeake Bay Office), Benjamin Gahagan (Massachusetts Division of Marine Fisheries / University of Massachusetts), Craig King (Maine Department of Marine Resources), Patrick McGrath (Virginia Institute of Marine Science), Mike O'Brien and David Secor (University of Maryland Center for Environmental Science), Matthew Ogburn (Smithsonian Environmental Research Center), Ian Park (Delaware Department of Natural Resources), Ethan Simpson (Virginia Marine Resources Commission), Chuck Stence (Maryland Department of Natural Resources), and Bethany Williams (NOAA NCCOS).

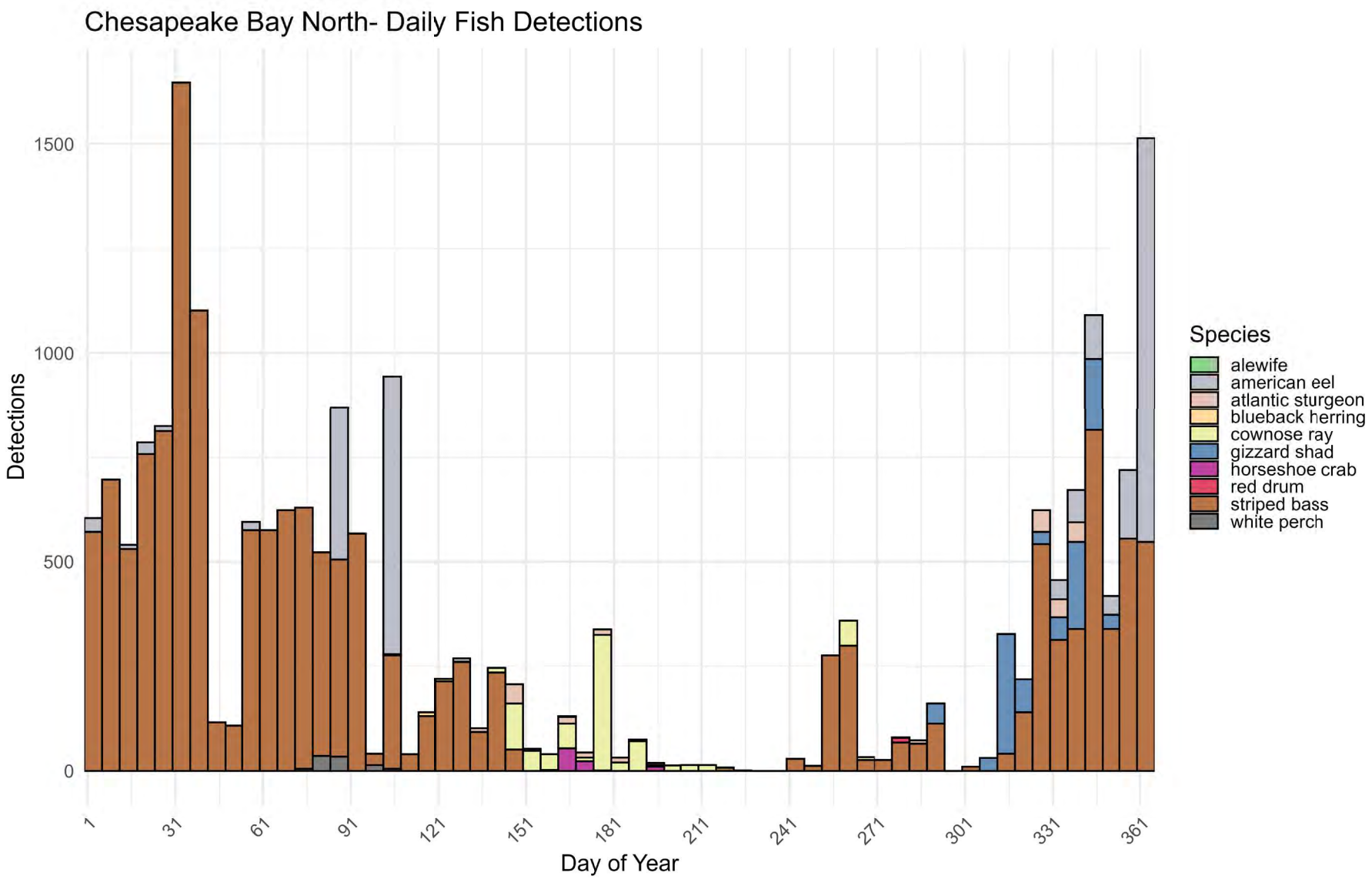
Thanks to both you and Wilmelie for leveraging these very informative data for the NEPA study. Should you have any questions regarding these figures or the accompanying text, please be advised that we will not be able to provide a response until congress appropriates funding.

Jonathan

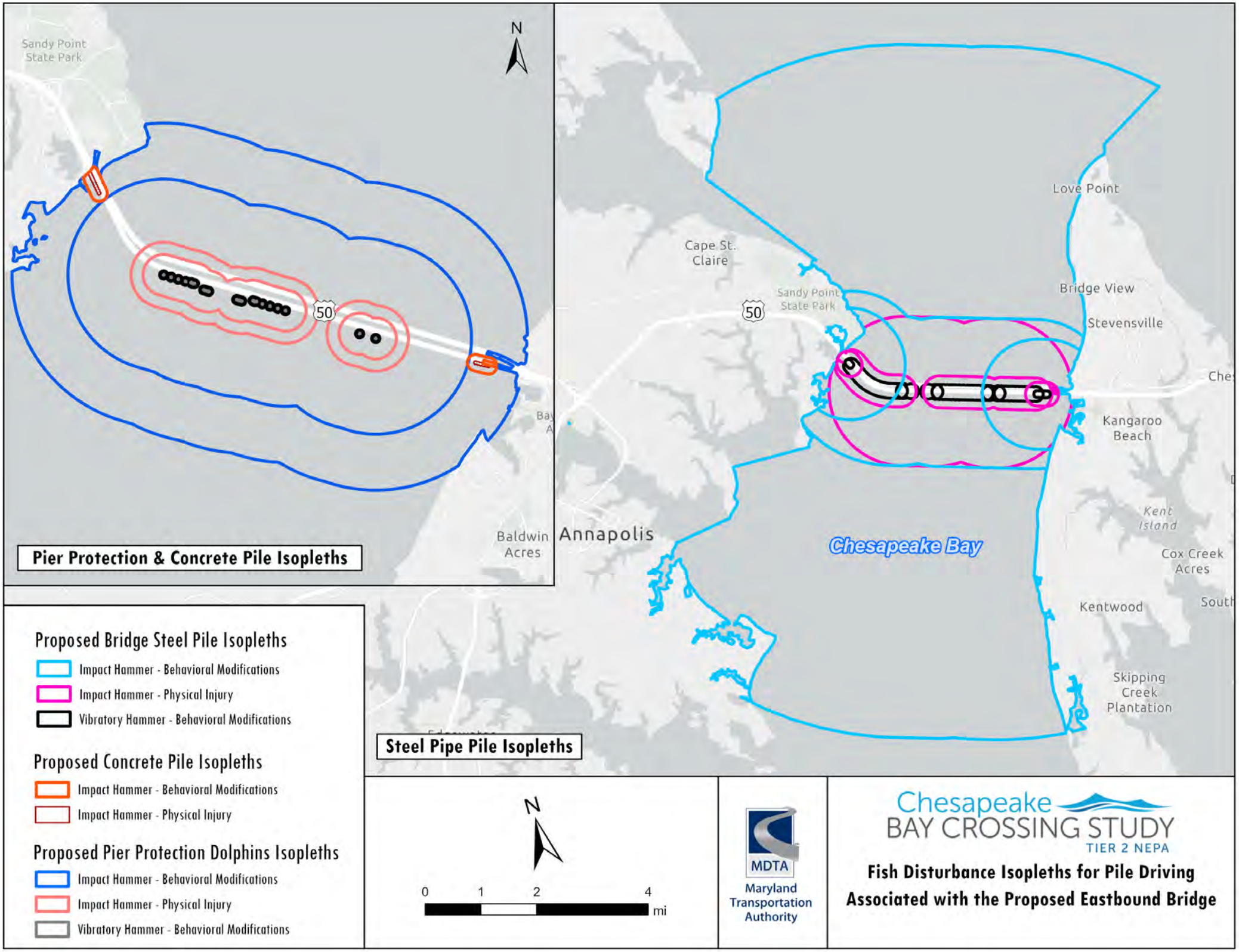
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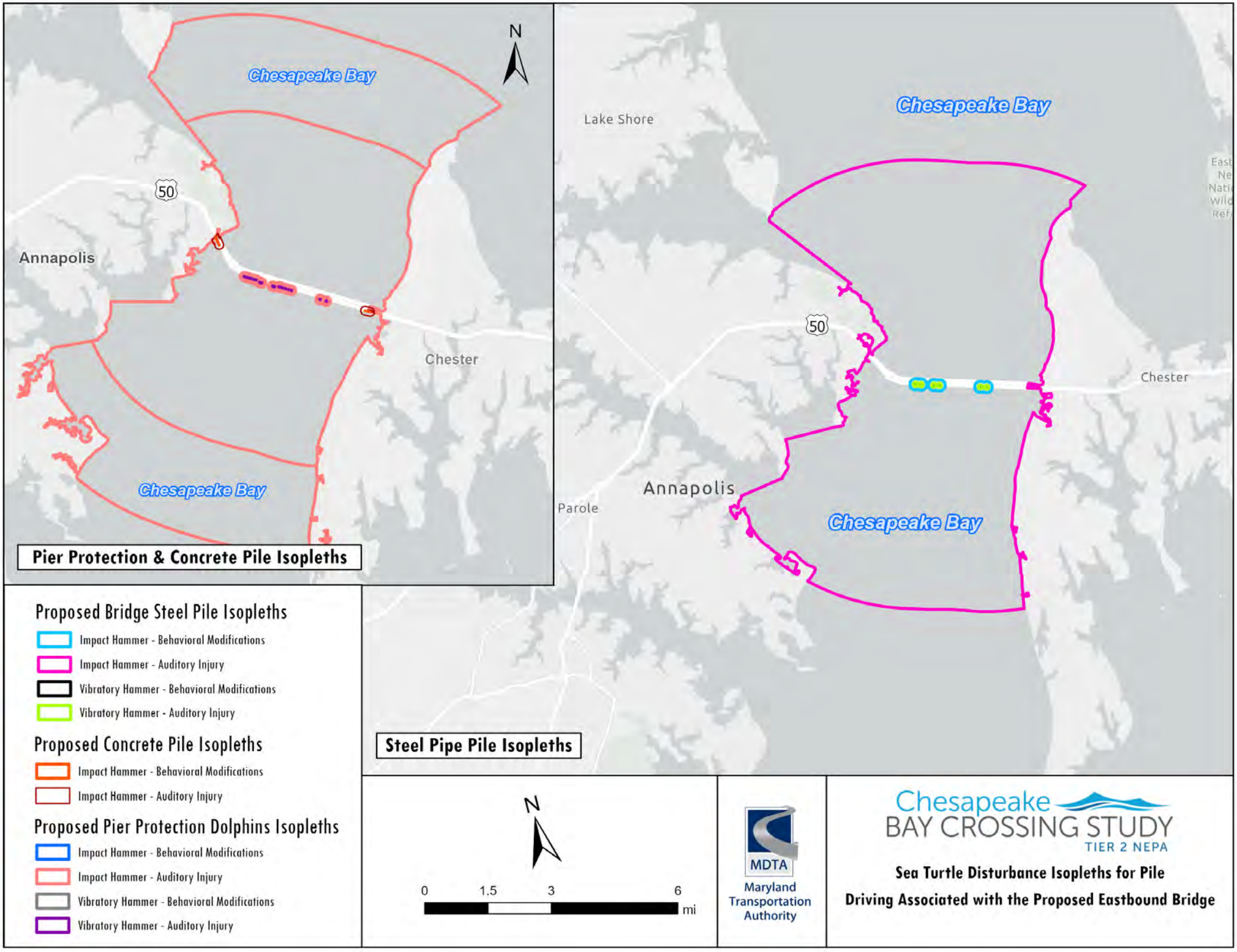
Jonathan Watson
Marine Habitat Resource Specialist, GARFO HESD
NOAA Fisheries | U.S. Department of Commerce
Office: (978) 675-2180
www.fisheries.noaa.gov


Chesapeake Bay North: Hourly Detections (2021–2024)
Dash lines at 06:00 and 18:00
striped bass
Det=16,146 | Fish=50
american eel
Det=2,537 | Fish=36
gizzard shad
Det=943 | Fish=8
cownose ray
Det=802 | Fish=4
atlantic sturgeon
Det=281 | Fish=9
white perch
Det=94 | Fish=3
Month
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0 3 6 9 12 15 18 21
Hour of Day (Local, America/New_York)
Detections
150
100
50
0


Chesapeake Bay North- Daily Fish Detections
Detections
1500
1000
500
0
1
31
61
91
121
151
181
211
241
271
301
331
361
Day of Year
Species
alewife
american eel
atlantic sturgeon
blueback herring
cownose ray
gizzard shad
horseshoe crab
red drum
striped bass
white perch

APPENDIX D: PILE DRIVING NOISE ISOPLETH MAPS


Sandy Point State Park
N
50
Pier Protection & Concrete Pile Isopleths
Baldwin Acres
Annapolis
Cape St. Claire
Sandy Point State Park
Love Point
Bridge View
Stevensville
Kangaroo Beach
Kent Island
Chesapeake Bay
Cox Creek Acres
Kentwood
Skipping Creek Plantation
Steel Pipe Pile Isopleths
Proposed Bridge Steel Pile Isopleths
Impact Hammer - Behavioral Modifications
Impact Hammer - Physical Injury
Vibratory Hammer - Behavioral Modifications
Proposed Concrete Pile Isopleths
Impact Hammer - Behavioral Modifications
Impact Hammer - Physical Injury
Proposed Pier Protection Dolphins Isopleths
Impact Hammer - Behavioral Modifications
Impact Hammer - Physical Injury
Vibratory Hammer - Behavioral Modifications
N
0 1 2 4 mi
MDTA
Maryland Transportation Authority
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA
Fish Disturbance Isopleths for Pile Driving Associated with the Proposed Eastbound Bridge


Chesapeake Bay
N
50
Annapolis
Chester
Chesapeake Bay
Pier Protection & Concrete Pile Isopleths
Lake Shore
Chesapeake Bay
50
Chester
Annapolis
Parole
Chesapeake Bay
Steel Pipe Pile Isopleths
Proposed Bridge Steel Pile Isopleths
Impact Hammer - Behavioral Modifications
Impact Hammer - Auditory Injury
Vibratory Hammer - Behavioral Modifications
Vibratory Hammer - Auditory Injury
Proposed Concrete Pile Isopleths
Impact Hammer - Behavioral Modifications
Impact Hammer - Auditory Injury
Proposed Pier Protection Dolphins Isopleths
Impact Hammer - Behavioral Modifications
Impact Hammer - Auditory Injury
Vibratory Hammer - Behavioral Modifications
Vibratory Hammer - Auditory Injury
N
0
1.5
3
6
mi
MDTA
Maryland Transportation Authority
Chesapeake BAY CROSSING STUDY
TIER 2 NEPA
Sea Turtle Disturbance Isopleths for Pile Driving Associated with the Proposed Eastbound Bridge

APPENDIX E: NOAA FISHERIES MULTI-SPECIES PILE DRIVING CALCULATOR OUTPUT

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	190	156	166
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	202		

OTHER INFO 0

NOTES 36" Square Concrete Pile - Using Proxy of 30" Square Concrete Pile Tyle II

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	0.9	25.1	25.1	116.6
Isopleth (feet)	2.8	82.4	82.4	382.5

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.0	158.3	2.5
Isopleth (feet)	0.1	519.5	8.2

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.1	0.0	1.6	0.1	0.0
AUD INJ ONSET (Peak isopleth, feet)	0.2	0.1	5.2	0.2	0.1
AUD INJ ONSET (SEL_{cum} isopleth, meters)	184.4	23.5	285.4	163.9	61.1
AUD INJ ONSET (SEL_{cum} isopleth, feet)	605.1	77.2	936.4	537.6	200.4
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	25.1	NO LF CET.			
Behavior (RMS isopleth, feet)	82.4				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	200	173	183
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	219		

OTHER INFO 0

NOTES 36" Steel Pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	4.0	341.5	341.5	1,584.9
Isopleth (feet)	13.1	1,120.3	1,120.3	5,199.8

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.1	2152.4	34.1
Isopleth (feet)	0.3	7,061.8	112.0

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.3	0.1	7.4	0.3	0.1
AUD INJ ONSET (Peak isopleth, feet)	1.1	0.3	24.1	1.0	0.3
AUD INJ ONSET (SEL_{cum} isopleth, meters)	2,507.2	319.9	3,880.0	2,227.3	830.3
AUD INJ ONSET (SEL_{cum} isopleth, feet)	8,225.9	1,049.5	12,729.6	7,307.6	2,723.9
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	341.5	NO LF CET.			
Behavior (RMS isopleth, feet)	1,120.3				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	165
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	210

OTHER INFO 0

NOTES 36" Steel pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	100.0
ISOPLETHS (feet)	328.1

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	59.0	2.2
ISOPLETHS (feet)	193.7	7.1

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	68.2	26.2	55.7	87.7	29.5
AUD INJ ONSET (SELcum isopleth, feet)	223.6	85.9	182.7	287.9	96.9
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	10,000.0	NO LF CET.			
Behavior (RMS isopleth, feet)	32,808.4				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	203	169	182
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	215		

OTHER INFO 0

NOTES 48" Steel Pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	6.3	184.8	184.8	1,359.4
Isopleth (feet)	20.7	606.2	606.2	4,459.8

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.2	1164.8	29.3
Isopleth (feet)	0.5	3,821.6	96.1

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.5	0.2	11.7	0.5	0.2
AUD INJ ONSET (Peak isopleth, feet)	1.8	0.5	38.3	1.5	0.5
AUD INJ ONSET (SEL_{cum} isopleth, meters)	1,356.8	173.1	2,099.7	1,205.4	449.3
AUD INJ ONSET (SEL_{cum} isopleth, feet)	4,451.6	568.0	6,888.8	3,954.6	1,474.1
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	292.9	NO LF CET.			
Behavior (RMS isopleth, feet)	960.8				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	200	175	185
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	221		

OTHER INFO 0

NOTES 48" Steel Pipe - Using proxy for 60" steel pipe to assume higher SELss and RMS values

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	4.0	464.2	464.2	2,154.4
Isopleth (feet)	13.1	1,522.8	1,522.8	7,068.4

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.1	2925.9	46.4
Isopleth (feet)	0.3	9,599.5	152.3

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.3	0.1	7.4	0.3	0.1
AUD INJ ONSET (Peak isopleth, feet)	1.1	0.3	24.1	1.0	0.3
AUD INJ ONSET (SEL_{cum} isopleth, meters)	3,408.2	434.9	5,274.3	3,027.8	1,128.6
AUD INJ ONSET (SEL_{cum} isopleth, feet)	11,181.9	1,426.7	17,304.0	9,933.6	3,702.8
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	464.2	NO LF CET.			
Behavior (RMS isopleth, feet)	1,522.8				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	170
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	215

OTHER INFO 0

NOTES 48" Steel Pipe - Using 72" Steel Pipe Proxy

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	215.4
ISOPLETHS (feet)	706.8

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	127.2	4.6
ISOPLETHS (feet)	417.3	15.2

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	146.9	56.4	120.0	189.0	63.6
AUD INJ ONSET (SELcum isopleth, feet)	481.8	185.1	393.6	620.2	208.8
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	21,544.3	NO LF CET.			
Behavior (RMS isopleth, feet)	70,683.6				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	210	185	195
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	8		
Number of strikes per pile	2500		
Number of strikes per day	20000		
Cumulative SEL at measured distance	228		

OTHER INFO 0

NOTES 96" Steel Pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth	
		Fish ≥ 2 g	Fish < 2 g		
ISOPLETHS (meters)	18.5	2,154.4	2,154.4	10,000.0	Fishes present
Isopleth (feet)	60.6	7,068.4	7,068.4	32,808.4	

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth	
ISOPLETHS (meters)	0.5	8555.5	215.4	Sea Turtles present
Isopleth (feet)	1.5	28,069.2	706.8	

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	1.6	0.5	34.1	1.4	0.5
AUD INJ ONSET (Peak isopleth, feet)	5.2	1.5	112.0	4.5	1.5
AUD INJ ONSET (SEL_{cum} isopleth, meters)	9,965.8	1,271.5	15,422.0	8,853.2	3,300.1
AUD INJ ONSET (SEL_{cum} isopleth, feet)	32,696.1	4,171.6	50,597.2	29,045.9	10,827.1
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	2,154.4	NO LF CET.			
Behavior (RMS isopleth, feet)	7,068.4				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	170
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	8
Duration to drive pile (minutes)	30
Duration of sound production in day	14400
Cumulative SEL at measured distance	212

OTHER INFO 0

NOTES 96" Steel Pipe - Using 72" Steel Pipe proxy

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	215.4
ISOPLETHS (feet)	706.8

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	80.1	4.6
ISOPLETHS (feet)	262.9	15.2

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	92.5	35.5	75.6	119.1	40.1
AUD INJ ONSET (SELcum isopleth, feet)	303.5	116.6	247.9	390.7	131.5
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	21,544.3	NO LF CET.			
Behavior (RMS isopleth, feet)	70,683.6				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	203	172	182
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	218		

OTHER INFO 0

NOTES 14" Steel H-pile

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth	
		Fish ≥ 2 g	Fish < 2 g		
ISOPLETHS (meters)	6.3	292.9	292.9	1,359.4	Fishes present
Isopleth (feet)	20.7	960.8	960.8	4,459.8	

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth	
ISOPLETHS (meters)	0.2	1846.1	29.3	Sea Turtles present
Isopleth (feet)	0.5	6,056.9	96.1	

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.5	0.2	11.7	0.5	0.2
AUD INJ ONSET (Peak isopleth, feet)	1.8	0.5	38.3	1.5	0.5
AUD INJ ONSET (SEL_{cum} isopleth, meters)	2,150.5	274.4	3,327.8	1,910.4	712.1
AUD INJ ONSET (SEL_{cum} isopleth, feet)	7,055.3	900.2	10,918.1	6,267.7	2,336.3
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	292.9	NO LF CET.			
Behavior (RMS isopleth, feet)	960.8				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	145
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	190

OTHER INFO 0

NOTES 14" Steel H-pile

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	4.6
ISOPLETHS (feet)	15.2

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	2.7	0.1
ISOPLETHS (feet)	9.0	0.3

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	3.2	1.2	2.6	4.1	1.4
AUD INJ ONSET (SELcum isopleth, feet)	10.4	4.0	8.5	13.4	4.5
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	464.2	NO LF CET.			
Behavior (RMS isopleth, feet)	1,522.8				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	200	175	185
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	221		

OTHER INFO 0

NOTES 24" AZ Sheet Pile

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth	
		Fish ≥ 2 g	Fish < 2 g		
ISOPLETHS (meters)	4.0	464.2	464.2	2,154.4	Fishes present
Isopleth (feet)	13.1	1,522.8	1,522.8	7,068.4	

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth	
ISOPLETHS (meters)	0.1	2925.9	46.4	Sea Turtles present
Isopleth (feet)	0.3	9,599.5	152.3	

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.3	0.1	7.4	0.3	0.1
AUD INJ ONSET (Peak isopleth, feet)	1.1	0.3	24.1	1.0	0.3
AUD INJ ONSET (SEL_{cum} isopleth, meters)	3,408.2	434.9	5,274.3	3,027.8	1,128.6
AUD INJ ONSET (SEL_{cum} isopleth, feet)	11,181.9	1,426.7	17,304.0	9,933.6	3,702.8
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	464.2	NO LF CET.			
Behavior (RMS isopleth, feet)	1,522.8				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	160
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	205

OTHER INFO 0

NOTES AZ Steel Sheet - loudest

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	46.4
ISOPLETHS (feet)	152.3

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	27.4	1.0
ISOPLETHS (feet)	89.9	3.3

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	31.6	12.2	25.8	40.7	13.7
AUD INJ ONSET (SELcum isopleth, feet)	103.8	39.9	84.8	133.6	45.0
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	4,641.6	NO LF CET.			
Behavior (RMS isopleth, feet)	15,228.3				

APPENDIX F: DEMOLITION OF THE EXISTING EASTBOUND AND WESTBOUND BRIDGE PIERS CONCEPTUAL ANALYSIS

CHESAPEAKE
BAY CROSSING STUDY
TIER 2 NEPA

Appendix F

Demolition of the Existing Eastbound and Westbound Bridge Piers Conceptual Analysis

Maryland Transportation Authority
MDTA

DRAFT May 2026

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1 Comparison Between Nice-Middleton Bridge and Bay Bridge Structures

For planning purposes, proposed demolition of the existing Bay Bridge piers was compared to the demolition of the original (1940) Nice-Middleton Bridge (N-MB). The N-MB pier demolition performed in late 2023 was used as a proxy for the proposed demolition of the existing Bay Bridge to obtain a rough estimate for the magnitude of effects of explosive underwater demolition. When the project is under detailed design and construction, the demolition plans would be re-evaluated as necessary to facilitate the most efficient construction and demolition schedule.

The general sequence of demolition of the original N-MB included saw-cutting and lifting of roadway deck slabs, torch cutting and lifting of girders for low-level spans, shape charges to cut and drop truss sections into the river for retrieval (including the main span over the Potomac River Navigation Channel), mechanical demolition of the concrete piers in shallow water, and subaqueous blasting for the deep-water piers.

1.1 Key In-Water Substructural Comparisons

The original N-MB utilized similar structural components to the existing Bay Bridge eastbound (EB) and westbound (WB) spans. Over shallow waters, the bridges are constructed as simple span superstructure units founded on pile bents. Over deeper water, both bridges use truss span superstructure units founded on piers with bell shaped columns with 28-feet to 32-feet diameter footings below the mudline. The longest truss spans use piers with four columns to support the superstructure unit, while shorter spans are supported by piers with two columns. All the piers use concrete diaphragms to connect the columns. See **Figure 1** for a side-by-side comparison of typical piers for the original N-MB and the existing Bay Bridge.

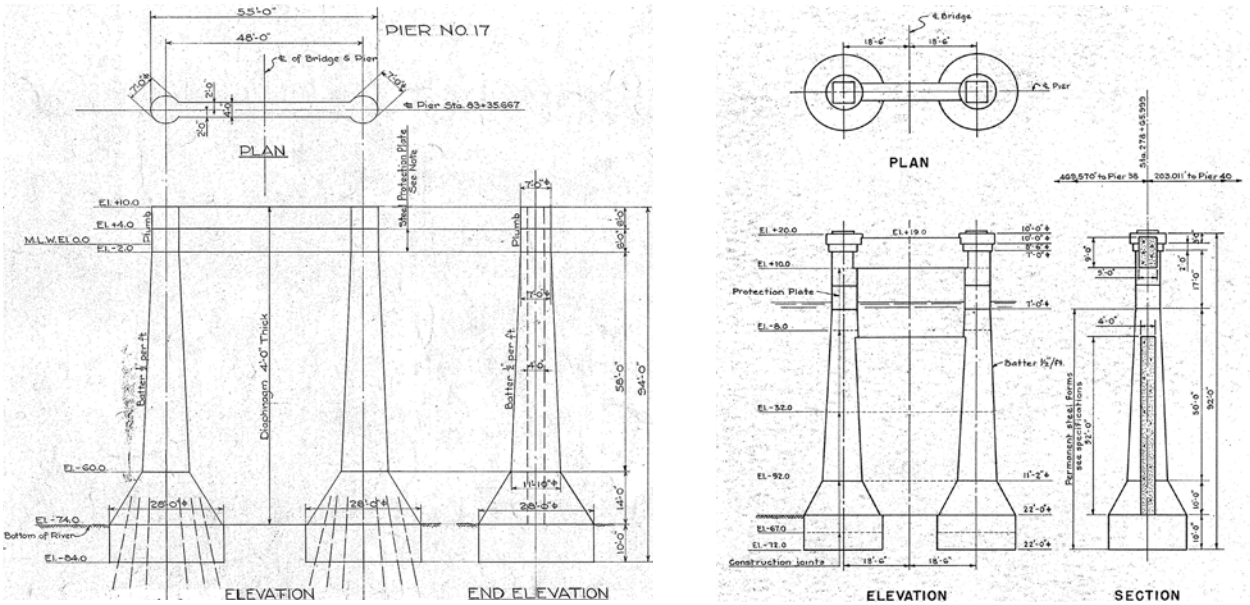


Figure 1 - Typical Piers for N-MB (Left) and Bay Bridge (Right)

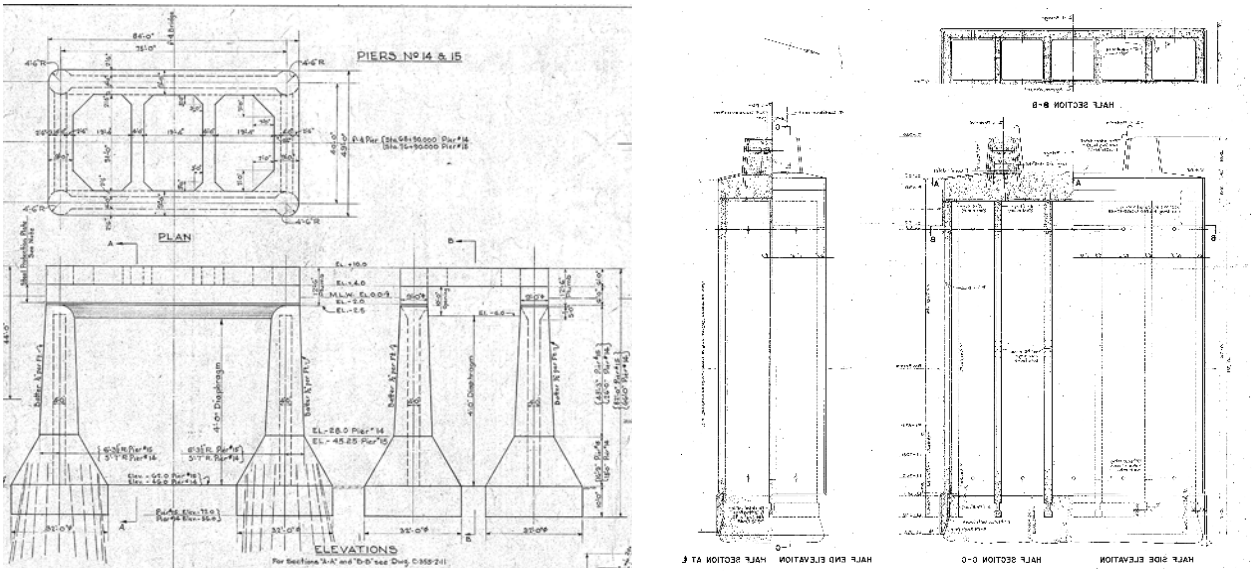


Figure 2 - Main Piers for N-MB Truss Span (Left) and Bay Bridge Suspension Span (Right)

The Bay Bridge differs from the original N-MB by using suspension spans instead of truss spans to cross the main navigation channel. The suspension cables are anchored in massive concrete piers, and the EB span has islands built around the anchorage piers. The suspension spans are supported at the quarter points by towers on large, solid concrete piers. These are similar in mass to the N-MB main span piers but are a different configuration. See **Figure 2** for a side-by-side comparison of the main piers for the original N-MB and the existing Bay Bridge.

1.2 Key Environmental Factor Comparisons

The N-MB carries U.S. 301 over a 1.7-mile-wide section of the Potomac River. The Potomac River is approximately 76 feet deep at its deepest point along the N-MB alignment. The segment of the Potomac River that the N-MB crosses is a tidal, mesohaline waterway. Several aquatic species occur in this segment of the Potomac River, including Atlantic and shortnose sturgeon, various game fish, marine turtles, and marine mammals (primarily dolphins).

The Bay Bridge carries U.S. 50/301 over a 4.5-mile-wide section of the Chesapeake Bay. The Chesapeake Bay is approximately 96 feet deep at its deepest point along the Bay Bridge alignment. The segment of the Chesapeake Bay that the Bay Bridge crosses is a tidal, mesohaline waterway. Several aquatic species occur in this segment of the Chesapeake Bay, including Atlantic and shortnose sturgeon, various game fish, marine turtles, and marine mammals (primarily dolphins).

During construction of the N-MB project, an approximately 2,400-foot-wide Zone of Safe Fish Passage (ZSFP) was maintained across the 1.7-mile-wide Potomac River to limit the effects of underwater noise on fish movement and migration. The MDTA worked with NOAA Fisheries to determine a practicable ZSFP for the Bay Bridge project and determined it will be 7,000-foot-wide across the 4.5-mile-wide Chesapeake Bay from January 15 to May 15. Pile driving and mechanical demolition activities will be staged so that noise levels do not exceed the behavioral modification threshold (150 dB RMS) within the ZSFP. The ZSFP will extend 7,000 feet parallel from each shoreline and would include a diversity of shallow and deepwater habitats. The ZSFP is effective for repetitive activities such as pile driving but won't be implemented for underwater explosive demolition, which is a single instantaneous activity. Explosive demolition will be conducted when fish are not migrating and Best Management Practices (BMPs) will be implemented that drive fish away from the blast site. Based on other similar recent and nearby projects, fish are not likely to be migrating from October through mid-December.

The Demolition Area **(Figures 3 and 4**) is the portion of the Action Area for this consultation that includes the middle Chesapeake Bay, specifically those areas of the Bay surrounding the Bay Bridge where demolition and blasting is proposed and the underwater areas where the consequences of the demolition could be experienced (e.g., increases in suspended sediment from blasting, noise, etc.), and monitoring for marine mammals and fish should be performed prior to blasting. The Demolition Area includes areas where vessels associated with blasting and demolition activities may travel or be anchored. The Demolition Area includes the project footprint of the areas where demolition, habitat modification, and blasting events are proposed, up to a 1,280-meter (4,200-foot) radius around the project site. The total Demolition Area comprises approximately 1,538 hectares (3,800 acres) of tidal open water.

The MDTA had to demolish one span for the N-MB. Whereas, the Bay Bridge has two spans to demolish, each of which are likely to be demolished separately depending on the sequence of

construction for the proposed EB and WB spans. The Demolition Areas are similar, with the WB span's Demolition Area shifted to the north of the EB Demolition Area by approximately 450-feet.

2 Demolition Planning for the Bay Bridge

The existing Bay Bridge EB span is approximately 21,286 linear feet long and the WB span is approximately 21,051 linear feet long. The total bridge length to be demolished is approximately 42,337 linear feet. When the project is under detailed design and construction, the sequencing of demolition would be re-evaluated as necessary to facilitate the most efficient construction and demolition schedule.

2.1 Superstructure and Substructure Above the Water

The superstructure for the existing Bay Bridge spans will likely be demolished similarly to the N-MB. For planning purposes, the anticipated demolition approach is to remove the concrete decks using mechanical means in a manner that prevents the materials from falling into the water. Steel beams will likely be lifted off the existing piers. The original steel truss sections from N-MB were rigged in a manner that allowed for quick removal of sections that were dropped in the water with shaped explosive cutting charges. The above water portion of the deep-water piers will likely be removed to an elevation where explosive demolition preparation can be facilitated (See **Section 3.1.1** for more information).

2.2 Piers – Suspension Span Anchor Piers

The existing Bay Bridge spans use solid concrete piers that are 55-feet wide by 123-feet long (EB) and 96-feet wide by 172-feet long (WB), constructed with a footing on piles below the mudline, to anchor the suspension cables for the span over the main navigation channel. The piers are in deep water (over 40 feet deep). The anchor piers for the EB span are surrounded by man-made islands that are approximately 10-feet above sea level. The anchor piers for the WB span are larger than the EB anchor piers and are not surrounded by islands. The MDTA is planning to leave the four anchor piers and two islands in place, but the decision will be made during final design.

2.3 Pile Bents – Shallow Depth Water

The existing Bay Bridge uses pile bents, a pier constructed with a concrete cap directly on piles, for support of the spans over shallow water. For planning purposes, the anticipated demolition approach is to remove pile bents in shallow water mechanically. There are 67 bents supporting the existing EB span and 89 bents supporting the existing WB span. The total length of bridge with pile bents is approximately 10,599 linear feet or approximately 25% of the total bridge length.

2.4 Piers – Moderate Depth Water

The existing Bay Bridge uses piers, constructed with a footing on piles below the mudline, columns, and a pier cap, for support of the spans over moderate depth water. For planning purposes, the anticipated demolition approach is to remove the piers that are in less than 40 feet

of water (moderate depth) mechanically. There are 39 moderate depth piers supporting the existing EB span and 11 moderate depth piers supporting the existing WB span. The total length of bridge with moderate depth piers is approximately 11,621 linear feet or approximately 27% of the total bridge length.

2.5 Piers – Deep Water

The existing Bay Bridge uses piers, constructed with a footing on piles below the mudline, columns, and a pier cap, for support of the spans over deep water. For planning purposes, the anticipated demolition approach is to demolish the piers that are in deep water (over 40 feet of water) mechanically or explosively above the water level and with explosives below the water. Mechanical means are ineffective in water deeper than 40 feet. Some of the pier will need to be left above the water to accommodate the underwater explosive demolition preparation. There are 15 deep water piers supporting the existing EB span and 15 deep water piers supporting the existing WB span. The total length of bridge with deep water piers is approximately 20,117 linear feet or approximately 48% of the total bridge length.

3 Environmental Effects of Underwater Demolition with Explosives

For planning purposes, the N-MB underwater demolition processes were used to estimate the environmental effects of using similar processes for demolition of the existing Bay Bridge. Given the similarities between the original N-MB and existing Bay Bridge substructure units, it was assumed that similar subaqueous blasting processes will be used for demolition of the Bay Bridge, in order to obtain a rough estimate for the magnitude of effects of explosive underwater demolition. There are 15 EB piers and 15 WB piers that will require subaqueous blasting.

3.1 Underwater Noise Estimation

The MDTA anticipates incorporating BMPs during subaqueous blasting of the deep water piers to minimize impacts to protected resources to the maximum extent practicable. For planning purposes, the N-MB underwater noise modeling process was followed to determine the Demolition Area, Exclusion Zone, and Mortality Zone.

3.1.1 Explosive Loading Assumptions per Pier

The pier concrete conditions will be determined during the final design; however, for planning purposes, the following assumptions were made.

The piers will be mechanically demolished above the water surface to an elevation that best facilitates the drilling of vertical holes and loading of explosives, typically 6 to 10 feet above the water surface to match deck barge working surfaces. Holes will be drilled and explosives loaded as needed to break apart the piers underwater into pieces that can be removed if necessary.

For planning purposes, the general parameters from the approved blast design from N-MB are assumed for the Bay Bridge demolition, including:

- 5 decks of explosives per hole.
- 30 pounds of explosives per delay.
- Minimum of 9 milliseconds (ms) delay between explosions.
- Maximum of 17 ms delay between decks in the same hole.

The MDTA will evaluate the parameters needed depending on actual conditions when developing the final blast design for the Bay Bridge.

3.1.2 Protection of Marine Life

Based on recent similar and nearby projects (e.g., Francis Scott Key Bridge Rebuild, N-MB Replacement), the MDTA assumes a time-of-year restriction (TOYR) from December 16 to September 30 on subaqueous blasting will be implemented for the Bay Bridge. Therefore, it is assumed subaqueous blasting of the Bay Bridge would be permitted from October 1 to December 15.

Two hours before the scheduled blast time, a sonar fish deterrent system should be deployed and swept through the water by boat in the vicinity of the piers to be detonated. Sonar should continue until just before the blast. If the blasting is delayed, sonar fish clearance should be restarted.

Prior to initiating the main blast, fish scare charges will be detonated. These fish scare charges should consist of a series of blasting caps, each containing 0.75 grams of explosives, suspended in the water column surrounding the structure to be blasted. The scare charges should be detonated 15 to 30 seconds prior to the main blast.

The blast should be designed to minimize the impact on marine life in the area through confinement of explosives within the concrete of the structures, using adequate stemming lengths, capping with stone between explosive layers/decks, controlling the weight of explosives detonating at a given time (pounds of explosives per delay), and using detonators to ensure precise firing times.

3.1.3 Subaqueous Blasting Considerations

Blasting of the Bay Bridge's concrete piers with a proper blast design and implementation of BMPs is considered confined blasting, which reduces the energy and shock wave released to the water column. Proper blast design includes the use of stemming and other techniques such as charge delays and proper sequencing to shoot larger charges in the center of the pier. The blast will radiate outward toward the outer edge of the pier so that most of the blast energy is contained to the pier and efficiently demolishes the pier. Mortality Zone and Exclusion Zone estimates were

calculated based on a review of existing published documents and studies used for the N-MB project. See **Figures 3 and 4** for the layout of the Mortality Zone and Exclusion Zone.

Mortality Zone: The Mortality Zone includes areas where lethal effects to fish are anticipated due to the proximity to blasting and lethal levels of underwater noise. The formula in Hempen et al. (2007) was used to calculate the Mortality Zone. Cole's equation for open-water pressures was manipulated using the Hubbs and Rechnitzer (1952) lower bound of lethal pressure value of 280 kilopascal (40 pounds per square inch). This equation was previously used by Hempen et al. (2005).

The mortality radius for single, open water shots (MROW) is calculated as:

$$MROW\ (feet) = 260\ wOW^{1/3}$$

where wOW = the maximum charge weight (in pounds) per delay of a single, open-water blast

This equation was developed as a conservative estimate of pressure from the closest confined holes. The mortality radius for confined shots may be resolved from the confined pressure of the equation and using the low lethal pressure of 40 psi.

The mortality radius for single, confined shots (MRC) is calculated as:

$$MRC\ (feet) = 56\ wC^{1/3}$$

where wC = the maximum charge weight (in pounds) per delay of a single, confined blast

The MRC calculation for the Bay Bridge explosive demolition is shown below.

$$MRC\ (feet) = 56*(30)^{1/3}$$

$$MRC\ (feet) = 174$$

To account for the size of the piers, the width of the largest pier is added to the MRC.

$$MRC\ EB = 174+41 = 215\ feet$$

$$MRC\ WB = 174+46 = 220\ feet$$

The MRC equation is most appropriate for the Bay Bridge explosive demolition. Assuming a maximum amount of explosive per delay of 13.6 kilograms (30 pounds), yields an MRC of approximately 52 meters (174 feet) around each of the 15 EB and 15 WB piers. For conservative planning, the MRC is added to half the width of the largest piers to be blasted for an adjusted radius of 215 feet around each EB pier and 220 feet around each WB pier. The combined MRC

areas result in approximately 5 hectares (13 acres) for each span. The assumed maximum charge to be used is 13.6 kilograms (30 pounds) per delay but these charges will be in the center of the pier. The charges closest to the exterior of the pier will likely be less per delay. Therefore, this Mortality Zone is a conservative (i.e., worst-case scenario) estimate. Based on N-MB, a smaller Mortality Zone is anticipated during blasting.

Exclusion Zone: The Exclusion Zone includes areas where effects on fish such as injury and harassment and potential mortality for more susceptible fish. This planning level demolition analysis used the Hempen et al. (2005) formula to calculate the conservative (i.e., worst-case scenario) Exclusion Zone with an added buffer to account for the sensitivity of marine mammals. This formula has been used in previous explosive demolition projects for Section 7 consultation with NOAA Fisheries and is considered conservative for preventing injury to protected species. This equation is the most appropriate for the Bay Bridge confined blasting pier demolition:

$R = [520 (W)^{1/3}]+500$
where R = the Exclusion Zone radius in feet
W = the maximum pounds of explosives per delay
500 = Conservative buffer added

As previously noted, the maximum pounds of explosive per delay for this project is 13.6 kilograms (30 pounds), which yields an Exclusion Zone radius of 640 meters (2,100 feet) around each pier, for a total combined area of approximately 486 hectares (1,200 acres) for the entire Exclusion Zone along each span. Similar to the Mortality Zone, this is considered a conservative estimate, as the blast design uses 13.6-kilogram (30-pound) charges are located in the interior of the piers and it's likely that lesser charges will be used closest to the exterior of the piers. Therefore, the actual Exclusion Zone where injury and harassment could occur is expected to be smaller for each blast.



Figure 3 - Mortality Zone and Exclusion Zone for Existing Eastbound Span

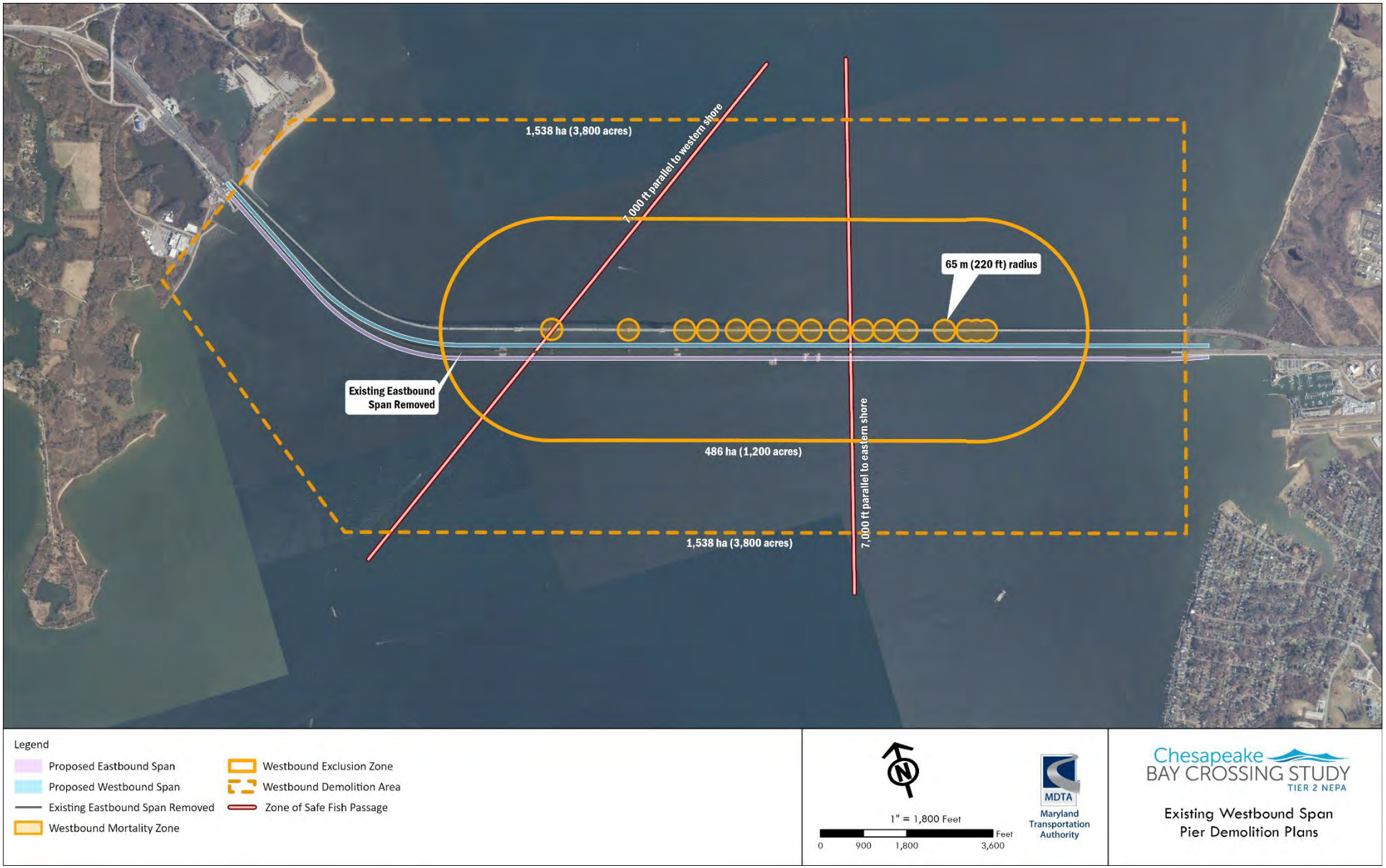


Figure 4 - Mortality Zone and Exclusion Zone for Existing Westbound Span

3.1.4 Monitoring and Reporting

Underwater noise monitoring will be conducted within the Demolition Area during blasting events. If underwater noise monitoring is found to be significantly more than anticipated, MDTA will coordinate with the agencies on potential adaptive management measures.

A sturgeon monitoring program will be implemented prior to blasting events and the blast will not be detonated until the observer confirms that no sturgeons are detected within the Exclusion Zone. If a tagged fish is detected in the Exclusion Zone, the blast would be delayed until the fish swims out of the Exclusion Zone. Boats with spotters will watch for marine mammals. If marine mammals are seen, blasting will be postponed until the Demolition Area is cleared.

Following each blasting event, a search for injured/killed fish using an adequate number of netters and vessels will begin immediately upon receiving the "all clear" and extend for at least 30 minutes. The search area will include all surface waters within at least 150 meters (450 feet) of the center of the blast area, with at least one vessel beginning at the centroid. The search area is more than twice the Mortality Zone and considers mortality and injury to sensitive individuals, the tidal drift, and gives the searchers a reasonably sized area to identify fish at the surface. All individuals of each species will be collected, identified, and enumerated. Within two hours of the blasting event, staff will collect any additional fish on the surface that are believed to be from the blasting event.

3.1.5 Demolition Rubble

Rubble will drop to the bottom of the Bay as a result of mechanical or explosive demolition of the existing concrete bridge piers. The rubble will likely drop in the immediate areas of the piers. The decision to remove, re-use, or leave rubble in place, or to use rubble to fill scour, will be determined prior to the start of demolition, using the best available data at the time and in coordination with NOAA Fisheries.

4 Conclusion

For planning purposes, the demolition of the original (1940) N-MB is a reasonable proxy for demolition of the existing Bay Bridge piers. The N-MB pier demolition process should be effective for the existing Bay Bridge piers due to the similarity of the structure designs, water depths, and anticipated species. This analysis used the most conservative (i.e., worst-case scenario), reasonably expected effects. Prior to demolition, the procedures and best management practices should be updated if new information becomes available. If blasting is used on another East Coast project prior to the demolition of the existing Bay Bridge, the analysis will be updated using the newer data as the best available science.

5 References

Hempen, G.L., T.M. Keevin, and H.J. Ruben. 2005. Underwater blast pressures from confined rock removal shots: The Kill van Kull Deepening Project. Pp. 91-100. In: Proceedings of the Thirty-first Annual Conference on Explosives and Blasting Technique, Volume 1, Orlando, Florida. International Society of Explosive Engineers, Cleveland, OH.

Hempen, G.L., T.M. Keevin, and T.L. Jordan. 2007. Underwater blast pressures from a confined rock removal during the Miami Harbor deepening project. International Society of Explosives Engineers. Vol. 1. 12 pp.