APPENDIX C1: Essential Fish Habitat Assessment

Mid-Chesapeake Bay Islands Ecosystem Restoration Project:
Barren Island Borrow Area
Dorchester County, Maryland
Essential Fish Habitat Impacts Assessment April 2023

Prepared by U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers, Baltimore District, (USACE) in partnership with the Maryland Department of Transportation Maryland Port Administration (MDOT MPA), the non-federal sponsor, has prepared this essential fish habitat (EFH) impacts assessment for The Mid-Chesapeake Bay Island Ecosystem Restoration Project (Mid-Bay Island Project) at Barren Island. This EFH impacts assessment evaluates dredging of a sand borrow area in the Barren Island vicinity as part of the Mid-Bay Island Project. USACE prepared prior EFH impact assessments for the Mid-Bay project in 2005, 2017, and 2022. The 2022 EFH assessment provided an update to the prior work. This EFH assessment is specific to the dredging of a sand borrow area in the Barren Island vicinity to provide material for construction of the project.

I. Description of the Proposed Action

The Feasibility Phase for the Mid-Bay Island Project started in 2002. The feasibility report culminated in the recommendations for large-island restoration at James Island as well as island restoration actions to conserve and restore Barren Island. The study's Chief's Report (USACE, August 2009) and the Mid-Bay EIS were completed in 2009. The record of decision was signed in July 2019 initiating the current phase of the study, Planning, Engineering, and Design (PED).

Mid-Bay will restore remote island habitat, a scarce and rapidly vanishing ecosystem component within the Chesapeake Bay region. Loss of remote island habitat within the middle eastern Chesapeake Bay has been estimated at approximately 10,500 acres (ac) in the last 150 years, a trend that will continue because of erosive forces and sea level rise. Remote islands in the Chesapeake Bay serve as an important stop-over point for migratory avian species, providing forage and protected resting habitat during spring and fall migration along the Atlantic Flyway. Additionally, the remote island habitat restored and conserved at Barren Island will provide valuable wetlands and a vital connection between open-water and mainland terrestrial habitats within the region as well as valuable nesting habitat for a variety of colonial nesting and wading bird species.

The Barren Island Project component was formulated to provide minor dredged material placement capacity, protect the existing island resources, reduce erosion of the existing shoreline at Barren, create wetlands, and protect areas of SAV from high wave energy. To complete the restoration work at Barren Island, it was determined that 258,000 cy of suitable material (sand with <20% fines) would be needed to complete restoration efforts such as foundation replacement, containment, and bird island development.

The preferred alternative for the Barren Island Borrow Area sEA includes dredging sand from the South borrow area adjacent to Barren Island and the Honga River channel to meet the project's needs (Figure 1). Impacts to be evaluated by this EFH assessment focus on those from dreding the South borrow area. Impacts associated with maintenance dredging of the Honga River Channel will be evaluated in a separate EFH assessment.

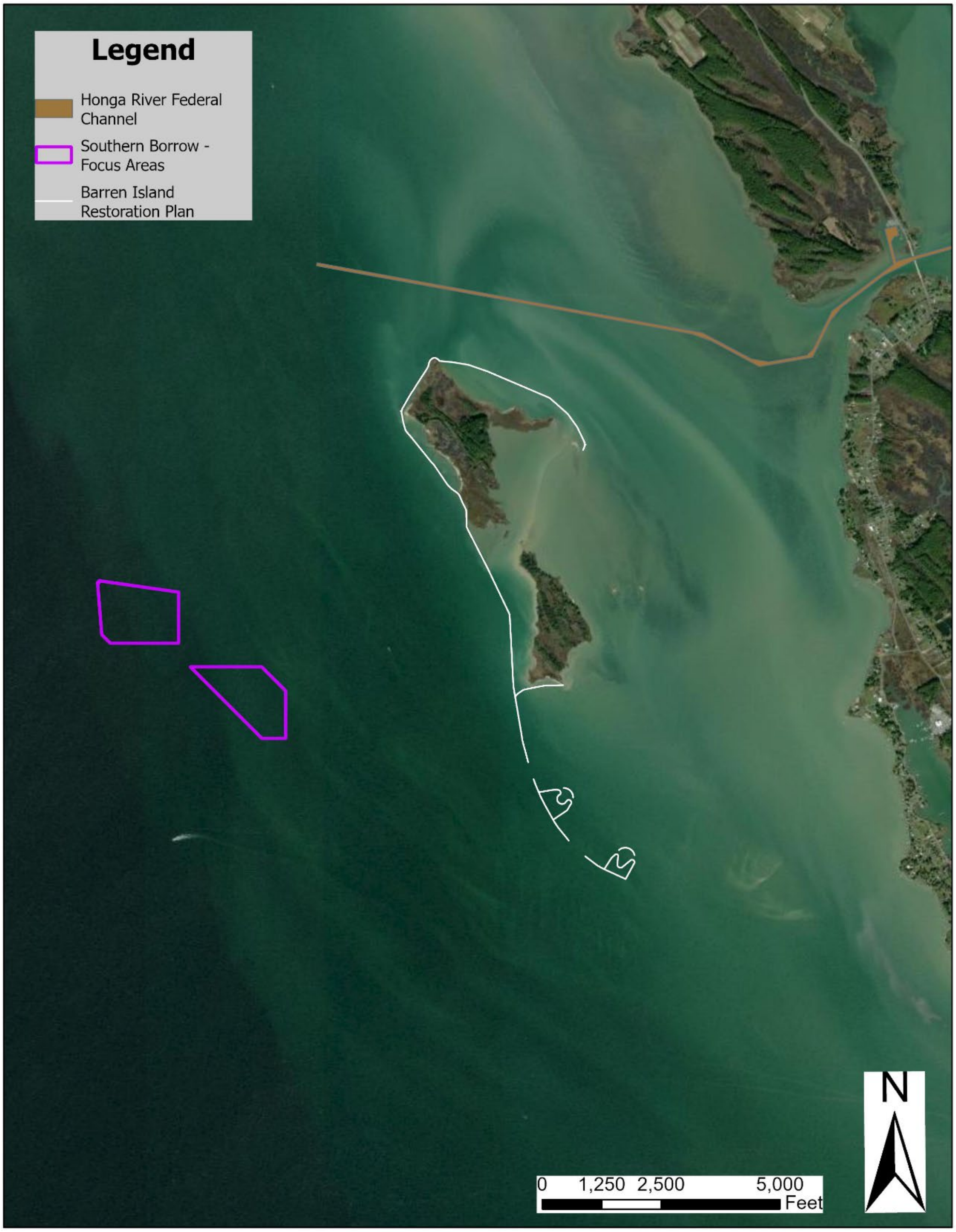

Figure 1. South Borrow Area

The area referred to as the South borrow area, consists of a relatively flat area, west of Barren Island, but east of the mainstem Bay channels, with water depth ranging between 8 to 16 ft. The South borrow area was narrowed down to two focus areas, Focus Areas A and B, where approximately 258,000 cubic yards (cy) of material would be dredged. Focus Area A is typically greater than -14.3 ft NAVD88. The mean depth of Focus Area A is -15 ft NAVD88 with depths ranging from -13.5 – -15.9 ft NAVD88. Focus Area B is shallower than focus area A with depths ranging from -15.5 – -8.7 ft NAVD88, and a mean of -12.7 ft NAVD88. Most depths in Focus Area B range between -11.5 – -13.6 ft NAVD88. Focus Area B will be preferred area for dredge material and dredging depths are expected to be approximately 5 ft deep.

A. Affected Environment

A summary of environmental conditions pertinent to this EFH impacts assessment drawn from the sEA and other sources are provided below.

1. Geotechnical Investigations

In 2022, subsurface investigations were conducted to investigate the material composition of the South borrow area. Within the South borrow area, the results of the 25 borings identified silty sand to the full depth of the boring (15 feet). Results of these borings identified that substrates of Focus Area A and B is comprised of sand with suitable fines content. Focus Area B contains less fines and slightly coarser material than Focus Area A.

Table 1. South Borrow Area: Area A Material Properties

Elevation Range (NAVD88, ft)	% Gravel	% Sand	% Fines	D_{50} (mm)
0 to -20	0	80.5	19.5	0.12
-20 to -25	0	78.1	21.9	0.12
-25 to -30	1.4	75.3	23.3	0.13
-30 to -35	4.5	73.5	22.0	0.20
0 to -35	0.9	77.5	21.7	0.13

Table 2. South Borrow Area, Area B Material Properties

Elevation Range (NAVD88, ft)	% Gravel	% Sand	% Fines	D_{50} (mm)
0 to -20	0	82.6	17.4	0.17
-20 to -25	0	84.9	15.1	0.19
-25 to -30	0.3	87.7	12.0	0.22
-30 to -35	1.6	92.8	5.6	0.29
0 to -35	0.1	84.7	15.2	0.20

2. *Water Quality*

Surface water sampling was completed at 11 locations around Barren Island in the summer (September) and fall (October) of 2020, and winter (March) and spring (May) of 2021. A full description of the methods and results of the samples taken at all sampling events is available in Appendix C1. Of the 11 locations, sites BI-WQ-01, BI-WQ-02, BI-WQ-03 and BI-WQ-04 were in the vicinity of the South borrow area. BI-WQ-03 is the closest to the South borrow area and specifically to Focus Area B. A water quality meter was used to measure water temperature, salinity, dissolved oxygen (DO), turbidity, and pH (Table 3). The measurements were recorded at the surface, mid-depth, and bottom (within 1 meter) of the water column at each location.

Table 3. Water Quality Parameters

Season	Sample ID	Water Depth (feet)	Temp (°C)	DO (mg/L)	Salinity (ppt)	pH	Turbidity (NTU)
Summer	BI-WQ-01	6	25.1	7	13	8.2	8.7
Summer	BI-WQ-02	4.5	25.3	7	13.3	8.3	4.8
Summer	BI-WQ-03	4.5	24.6	7	12.8	8.2	13.3
Summer	BI-WQ-04	4	24.7	7	13	8.2	10
Fall	BI-WQ-01	11	19.5	8.5	15.9	8.1	3.6
Fall	BI-WQ-02	7.5	19.9	8.6	16.3	8.2	1.4
Fall	BI-WQ-03	8.2	19.5	8.5	15.9	8.1	3.8
Fall	BI-WQ-04	8.7	19.6	8.6	15.9	8.1	1.9
Winter	BI-WQ-01	11.8	6.9	12.5	13.4	8.2	3.5
Winter	BI-WQ-02	9.1	6.2	12.9	13.8	8.2	2.3
Winter	BI-WQ-03	8.9	6.9	12.6	13.5	8.2	2.9
Winter	BI-WQ-04	7.2	6.5	12.6	13.6	8.2	2.8
Spring	BI-WQ-01	10.8	22.1	9.2	11.3	8.4	2.0
Spring	BI-WQ-02	8.8	22.1	8.8	11.7	8.3	1.5
Spring	BI-WQ-03	8.2	23.0	8.7	11.6	8.3	2.9
Spring	BI-WQ-04	7.5	24.7	7.5	12.6	7.8	5.3

Lowest salinities typically occurred in the spring, with mean salinity of 11.8 parts per trillion (ppt), and highest salinity occurs in fall with mean monthly salinity of 16 ppt. Sampling conducted in

2020 and 2021 recorded a salinity range of 11.3 to 16.3 (MPA, 2021). Water temperature ranged from 43.2°F to 77.5 °F, with an average of 63.9°F. Warmer water temperatures were generally recorded during the summer (ranging from 58.5°F to 77.5°F) and coolest water temperatures recorded during the winter (43.2°F to 44.4°F). DO concentrations varied seasonally. DO concentrations tend to be lower in the summer compared to the winter because warm water has less ability to hold DO than cold water. The lowest DO levels were measured during the summer season (7 milligrams per liter [mg/L]) and maximum DO levels were measured in the winter (12.5 to 12.9 mg/L). During all seasons, DO values were greater than 5.0 mg/L, which is considered healthy and allows the Chesapeake Bay's aquatic system to thrive.

3. Benthic Macroinvertebrates

Macroinvertebrate sampling was conducted in the Barren Island area in 2002/2003 during preparation of the 2009 USACE feasibility report and in 2020/2021 during the current project phase. All investigations found that the benthic macroinvertebrate assemblage is typical of mesohaline, shallow Bay waters (Anchor QEA, 2022). In the South borrow area a total of 23 unique benthic taxa were collected. Bivalves (specifically *Ameritella mitchelli*, *Gemma*, and *Mulinia lateral*is) and polychaetes (specifically *Alitta succinea*, *Mediomastus ambiseta and Polydora cornuta*) were the dominant taxa in the South borrow area. Within Focus Area A, survey locations SSB-01 and SSB-02 contained 21 and 17 respectfully of unique taxa. Dominant species within SSB-01 was *Glycinde multident* (81), while SSB-02 was dominated by *Ameritella mitchelli* (62). Within Focus Area B SSB-05 contained 20 unique taxa with *Mediomastus ambiseta* (147) being the dominant species.

During feasibility, total B-IBI scores ranged from 2.2 to 5.0 for all locations at Barren Island, and the total B-IBI calculated for the summer 2002 samples were all greater than 3.0. As a result, B-IBI scores were determined that indicated a healthy benthic community that meets the Chesapeake restoration goals. The South borrow area contained 10 sampling benthic sampling locations which all except site SSB-09 (degraded) met restoration goals. B-IBI scores of the sites designated as meeting restoration goals were 3 to 3.67, while the degrade site score was 2.67. These scores were compared to the data from the 2015 through 2021 Chesapeake Bay Benthic Monitoring Program (Anchor 2022, Table 11). In general, the B-IBI scores from the proposed South location graded slightly higher and would be considered a healthier benthic ecosystem. Within Focus Area A, survey locations SSB-01 and SSB-02 B-IBI scores were 3 and 3.67 respectfully. Within Focus Area B SSB-05, the B-IBI score was 3.

4. Fisheries Surveys and Relevant Data

Surveys were conducted in the summer and fall of 2002 and winter and spring of 2003 for fish and crab species in the proximity of Barren Island. The results are provided in the 2009 Barren Island Feasibility Report (USACE, 2009). Updated surveys were completed in the summer and fall of 2020, as well as winter and spring of 2021 within the proximal waters around Barren Island. Of the sampling sites, bottom trawl FT-03 was located closest to the South borrow area. Table 4 provides the total number of species caught during all fishing trawl surveys and specifically FT-03.

Table 4. Bottom Trawl (Net) Surveys

Species		Comprehensive 2020-2021 Bottom Trawl Surveys			Bottom Fishing Trawl FT-03		
		2020 Survey		2021 Survey*	2020 Survey		2021 Survey*
Scientific Name	*Common Name*	*Summer*	*Fall*	*Spring*	*Summer*	*Fall*	*Spring*
Anchoa mitchilli	Bay anchovy	0	15	70	0	1	0
Symphurus plagiusa	Blackcheek Tonguefish	3	0	0	0	0	0
Callinectes sapidus	Blue Crab	3	4	1	0	0	0
Dorosoma cepedianum	Gizzard Shad	0	1	0	0	1	0
Leiostomus xanthurus	Spot	2	0	29	0	0	0
Urophycis regia	Spotted Hake	0	0	1	0	0	0
Peprilus triacanthus	Butterfish	0	0	1	0	0	0
Cynoscion regalis	Weakfish	1	0	0	1	0	0
Total Individuals		**9**	**20**	**102**	**1**	**2**	**0**
Total Number of Species Caught		**4**	**3**	**5**	**1**	**2**	**0**
*No fish were captured using the Bottom Trawl method in Winter 2021							

To provide additional supporting information on occurrence of juvenile and adult life history stages to verify potential EFH designations, the Virginia Institute of Marine Science's Fisheries Analyst web application "ChesMMAP" sampling data was explored. The ChesMMAP survey uses a large-mesh bottom trawl to sample juvenile-to-adult fishes from the head to the mouth of the Bay. Species of interest to this assessment were detected in ChesMMAP surveys over the entire period of record available (2002 – 2022). The ChesMMAP data is limited to waters deeper than approximately 10 ft MLW (VIMS, 2012). Although no ChesMMAP sample data is available in the immediate vicinity of Barren Island as the water depths around the island are 5 ft deep MLW or shallower, ChesMMAP is representative to borrow area waters. During a March 2022 survey, a location closer in vicinity to the borrow area, did obtain 9 different species including blue crab, alewife, Atlantic herring, American shad, striped bass, white perch, Atlantic menhaden, spotted hake, bay anchovy. The ability of the trawl to adequately sample species and life history stages would depend on additional factors, such as species vulnerability to sampling. To explore the latter topic, ChesMMAP data for the entire MD Chesapeake Bay for numerous species was visually explored.

All the species of interest to this assessment are displayed within the Chesapeake Bay with generally much higher catch-counts occurring in the Virginia waters of the southern bays. Overall, the basic pattern of ChesMMAP having numerous total catch-counts in Virginia waters but substantially fewer total catch-counts in Maryland waters supports that salinity is a primary driver of these species' distribution (such as Buccheister et al., 2013). Salinity is generally less in shallower waters of the Bay. Accordingly, the sampling by ChesMMAP which occurs at greater depths would tend to catch numerous fish species for which the lower salinity shallows of Barren Island would be less suitable.

II. Listing of Life Stages of Species with EFH Designated in the Project Area

The NOAA EFH mapper website was consulted in July 2021 to generate an initial listing of the species and life history stages for which the Barren Island project area could potentially constitute EFH. This potential list was then screened in comparison to EFH textual descriptions and maps linkable from EFH mapper. The list was finalized in coordination with NMFS on August 11, 2021, and is provided in Table 5.

Table 5. List of Species and Life History Stage to be Evaluated

Species	Life History Stage			
	Eggs	Larvae	Juveniles	Adults
Bony Fish				
Atlantic butterfish (*Peprilus triacanthus*)	X	X		X
Black sea bass (*Centropristus striata*)			X	X
Bluefish (*Pomatomus saltatrix*)			X	X
Scup (*Stenotomus chrysops*)			X	X
Summer flounder (*Paralicthys dentatus*)[2]		X	X	X
Windowpane flounder (*Scopthalmus aquosus*)			X	X
Cartilaginous Fish				
Clearnose skate (*Raja eglanteria*)			X	X

III. Analysis of Effects of the Proposed Action

A. General Description of Impacts Applicable to All Species Evaluated

The sEA provides a detailed overview of the environmental consequences of the proposed action. A summary of those effects is included below to facilitate consideration of potential EFH impacts in this assessment. The project involves the dredging of approximately 182,000cy of material from the South borrow for the Barren Island Restoration project. The south borrow area would be dredged to a depth of 5 feet across approximately 25 to 30 acres to provide the needed sand. Dredging activities will cause minor and temporary impacts to water quality and long-term impacts to the benthic community and bathymetry. Minor impacts to water quality includes increase of turbidity which will cease upon completion of dredging activities. As a result of dredging, current habitat and non-motile species within the dredging footprint would be destroyed while mobile species are expected to move from the area. Comparable organisms would likely recolonize the channel within approximately 2 years.

A. Species-Specific Analysis of Effects

Species life history and other information pertinent to assessing effects of the proposed action is provided below. Table 6 provides a summary of information on habitat preferences of the managed species and life history stages of interest with respect to salinity, temperature, and substrate. Impacts of the proposed action upon individuals of the managed species, and their habitat, prey, and predators are then evaluated.

1. ATLANTIC BUTTERFISH (egg, larvae, adult)

a. Background Information

Butterfish winter near the outer edge of the continental shelf in the mid-Atlantic Bight and migrate inshore in the spring. During the summer, they occur over the entire mid-Atlantic shelf, including estuaries. In late fall, butterfish move southward and offshore in response to falling winter temperatures (Cross et al., 1999). In the Chesapeake Bay region, Butterfish spawn offshore in the Atlantic from May through July, and then move into coastal ocean waters and estuaries. Butterfish are common to abundant in the lower Chesapeake Bay, but only occasional in the upper Bay, ranging as far north as the Patapsco River. Butterfish occur in the middle and upper Chesapeake Bay from about May through November. All butterfish migrate out of the Chesapeake Bay by December to overwinter in deeper water offshore (Murdy et al., 2013).

No identified butterfish eggs or larvae were caught in ichthyoplankton sampling conducted for the study in 2002/2003 (MPA, 2005). No butterfish juveniles or adults were caught in finfish sampling conducted for the study in 2002/2003 (USACE 2009). Regionally, VIMS Fishery Analyst ChesMMAP total catch count data over the period of record (2002 through 2021) shows butterfish (juveniles and adults) strongly concentrated in VA waters (more than 20 miles south of Barren Island) versus MD waters of Chesapeake Bay. However, several ChesMMAP stations within approximately 2 miles of Barren Island show total catch counts of 15 to 150 individuals. In spring 2021 sampling, one butterfish was caught in bottom trawl sampling at Barren Island (Anchor QEA, 2021).

Table 6. Occurrence and habitat preferences by life-stage in the mid-Atlantic, with focus on preferences applicable or potentially applicable to estuaries.

Species Common Name	Regulated EFH Life Stages	Habitat, Geomorphic Features	Substrate	Salinity (ppt)[a]	Depth (m)	Depth (ft)	Water Temperature (C)	Water Temperature (F)	References (except a)
Atlantic Butterfish	eggs	Surface waters		25 to 33			Most 11-17	Most 52-63	Cross et al., 1999
	larvae	Surface waters		6 to 37			Most 9-19	Most 48-66	"
	adult	Surface waters	Mud and sand	4 to 33	<120	<400	3 to 28	37 to 82	NMFS 2000 (Summary Tables); Cross et al., 1999
Black sea bass	juvenile	YOY: Estuarine - coastal; salt marsh edges & channels; high habitat fidelity. Winter: Continental Shelf	YOY: Rough bottom, shellfish, sponge, eelgrass beds, nearshore shell patches, manmade objects. Winter: nearshore shell patches, other shelter on sandy bottoms	YOY: prefer 18-20. Winter: prefer>18	1 to 38	3 to 125	>6, prefer 17 to 25	>43, prefer 63 to 77	Steimle et al., 1999

Species Common Name	Regulated EFH Life Stages	Habitat, Geomorphic Features	Substrate	Salinity (ppt)[a]	Depth (m)	Depth (ft)	Water Temperature (C)	Water Temperature (F)	References (except a)
	adult	Summer: Larger fish stay in deeper water. Winter: Continental Shelf	Summer: Mussel beds, rock, artificial reefs, wrecks and other structures. Winter: poorly known.	Summer: >20. Winter: 30 to 35	2 to 38	6 to 125	>6, prefer 13 to 21	>43, prefer 55 to 70	Same as above
Bluefish	juvenile	Day: shorelines, tidal creeks; night: open waters, channels	Sand, mud, sea lettuce patches, eelgrass beds, salt marshes	23 to 36			>20 immigrate into estuaries; 15 emigrate from estuaries	>68 immigrate into estuaries; 59 emigrate from estuaries	Fahay et al., 1999;
	adult	Oceanic, Not uncommon in bays		Oceanic			>14 to 16	>57 to 61	Shepherd and Packer, 2006
Scup	juvenile	YOY: Estuarine - coastal; Winter: most offshore	Sand, mud, mussel and eelgrass beds	YOY: >15; Winter: mostly >30, except in estuaries	0 to 38	0 to 125	9 to 27, prefer 16 to 22	48 to 81, prefer 61 to 72	Steimle et al., 1999
	adult		Sand, mud, mussel beds, rock, and	Summer: >15, Winter: >30	2 to 38	6 to 125	7 to 25	44 to 77	Same as above

Species Common Name	Regulated EFH Life Stages	Habitat, Geomorphic Features	Substrate	Salinity (ppt)[a]	Depth (m)	Depth (ft)	Water Temperature (C)	Water Temperature (F)	References (except a)
			manmade features						
Summer flounder	larvae	Shallow estuarine	Sand				6 to 20	43 to 68	Packer et al., 1999
	juvenile	Lower estuary flats, channels, salt marsh creeks, eelgrass beds.	Mud and sand	10 to 30	0.5 to 5	1.5 to 15	>11	>52	NMFS 2000 (Summary Tables); Packer et al., 1999
	adult				0 to 25	0 to 80			Same as above
Windowpane flounder	juvenile	Nearshore bays and estuaries	Fine sandy sediment	5.5 to 36	1 to 75	3 to 250	<25	<77	Chang et al., 1999
	adult		Mud and sand	5.5 to 36	1 to 75	3 to 250	<27	<80	Same as above
Clearnose skate			Sand	1-33 m, most 7-15 m	3-110 ft, most 20-50 ft	8-20C	46-68F	Range > 12 ppt, most at >22 ppt.	Packer et al., 2003

Butterfish are fast-growing and short-lived. Eggs, larvae, and adults are pelagic (live in open water) in inshore waters and estuaries (NOAA, 2021 [EFH text link]). Butterfish form loose schools, often near the surface (Cross et al., 1999). Butterfish adults feed on jellyfish, small fish, crustaceans, and worms (Murdy et al., 2013).

Proposed Action Effects

a. Impacts to Individuals

Eggs are unlikely to be present because the South borrow area waters are substantially fresher than egg salinity preferences (Table 6). Barren Island waters are within habitat preferences of larvae. Larval butterfish may be present from May to November and could potentially be impacted by construction disturbance and turbidity but would likely be widely dispersed in the Barren Island vicinity. South borrow area waters are within habitat preferences of adult butterfish from May to November. Adult butterfish would not likely be present in cold weather months based on their migration patterns. Adult butterfish are good swimmers and should easily be able to avoid disturbance and turbidity from construction in warm weather months. Accordingly, minimal to no impacts to butterfish individuals of any life history stage of interest are expected from dredging.

b. Habitat Impacts

South borrow area waters are fresher than butterfish egg salinity preferences. It is unlikely that the South borrow area constitutes EFH for butterfish eggs. Accordingly, no impacts to butterfish egg EFH are expected.

South borrow area waters are within butterfish larvae and adult salinity preferences. South borrow area waters appear to constitute only marginal EFH for butterfish adults, based on substantial differences in sampling results between MD and VA Chesapeake Bay waters. Other than short-term impacts during dredging, no long-term impacts to butterfish habitat are expected from implementation of the Preferred Alternative. Following dredging, the South borrow area is expected to provide comparable habitat for butterfish larvae and adults compared to existing conditions.

In summary, the proposed action would not impact butterfish egg EFH. The South borrow area is expected to provide comparable habitat for larval and adult butterfish following dredging as currently exists.

c. Impacts to Prey and Predators

South borrow waters are substantially fresher than egg habitat preferences. Therefore, the proposed action would have no effect on butterfish egg predators.

Fish larvae feed on plankton generally produced over large areas. Fish larvae often are distributed over large areas and the temporary disruption to the open water of the South borrow area would likely have negligible impacts on organisms that prey on butterfish larvae.

Butterfish adults appear to be only minimally present in the South borrow area waters. Thus, project effects on their prey such as worms would be minimal to negligible. The benthic community is expected to recover within 2 years following dredging. Because adult butterfish are minimally present in South borrow area waters, they are presumably minimally preyed upon by other species there. Accordingly, there would likely be negligible impacts to predators of butterfish.

d. Summary for Species

South borrow area dredging would have minor adverse impacts on the use of the area by butterfish. Butterfish and their prey and predators would be displaced during the dredging and construction activities. Given their mobility, adult butterfish would be expected to relocate to adjacent waters where comparable habitat exists. Any butterfish that venture too close to the dredge intake could be entrained and destroyed, but the risk is low given their mobility. Egg staged butterfish would have minimal to no impacts due to the project area not containing proper habitat.

2. BLACK SEA BASS (juveniles, adults)

Background Information

Black sea bass is a warm temperate species. Their distribution changes seasonally as they migrate from coastal areas to the outer continental shelf while water temperatures decline in the fall and migrate from the outer shelf to inshore areas as temperature warms in the spring (Steimle et al., 1999). Black sea bass occur commonly in Chesapeake Bay from spring through late fall, ranging as far north as the Chester River (Murdy et al., 2013).

Virginia Institute of Marine Science (VIMS) trawl surveys of the lower Chesapeake Bay and tributaries show juvenile black sea bass commonly occurring in higher salinity waters above 19 ppt, and most abundant in April through July. Juveniles were uncommon in beach seine surveys. VIMS trawl and beach seine surveys of Lower Chesapeake Bay and tributaries show that adults were more common during late summer and early fall on the eastern side of the Bay (Drohan et al., 2007).

No black sea bass were caught in sampling of Barren Island conducted for this study in 2002/2003 (MPA, 2005). Regionally, VIMS Fishery Analyst ChesMMAP total catch count data shows black sea bass strongly concentrated in VA waters of Chesapeake Bay versus MD waters. Several ChesMMAP stations within approximately 2-miles of Barren Island show total catch counts of four or less over the 2002 – 2021 period of record. No black sea bass were caught at Barren Island in sampling conducted in 2020 and 2021 (MES, 2021).

Black sea bass utilize open water and structured benthic habitats for feeding and shelter (Steimle et al., 1999). Juvenile black sea bass are generally associated with structurally complex habitats and steep depth bottom slopes (Drohan et al., 2007). Estuarine habitat used as nurseries by juveniles is shallow, hard bottom with structure. Structures utilized include shells, sponge beds, sea grass beds, cobbles, and manmade objects. Juveniles are not as common on open unvegetated bottoms. Older juveniles may occur at the mouths of salt marsh creeks and along salt marsh edges. Adult black sea bass are also strongly associated with structurally complex habitats and tend to orient to structures during their summer residency in coastal waters. Unlike juveniles, adults tend to enter only larger estuaries, and are most abundant along the coast. Oysters were once important juvenile black sea bass habitat in estuaries. Larger fish occur in deeper water than smaller fish. Adults remain near structures during the day but can move away to feed on open bottom at dawn and dusk (Steimle et al., 1999; Drohan et al., 2007).

Juveniles in estuaries prey upon small epibenthic invertebrates, especially crustaceans and mollusks. Crustaceans eaten include shrimp, isopods, and amphipods. Adults in estuaries prey upon benthic and near-bottom invertebrates and small fish. Fish eaten include sand lance, scup, sheepshead minnow, and butterfish. Invertebrates eaten by adults include crustaceans (particularly crabs), squid, mussels, razor clams, sand dollars, and polychaetes (Drohan et al., 1997; Murdy et al., 2013; Steimle et al., 1999).

Proposed Action Effects

a. Impacts to Individuals

As the South borrow area is open, unvegetated bottom black sea bass are unlikely to use the habitat that would be impacted. If dredging activities occur during cooler weather months, the likelihood of finding black sea bass in the area is further reduced. Because South borrow area waters are generally fresher than black sea bass salinity preferences, black sea bass would only likely be present in drought years during times of higher salinities. Water depths in the South borrow area vicinity are marginal with respect to adult black sea bass preferred depths, although they are within juvenile habitat preferences. Accordingly, juveniles would more likely be present than adults, but black sea bass aren't likely to occur in substantial numbers in the project area. Juvenile and adult black sea bass are good swimmers and should easily be able to avoid disturbance and turbidity from construction. However, any Black seabass that venture too close to the dredge intake could be entrained and destroyed. In summary, minimal to no direct physical impacts to individuals are expected.

b. Habitat Impacts

Based on black sea bass juvenile and adult salinity preferences as well as the lack of structure (Table 6), South borrow area waters likely constitute marginal EFH or non-EFH for these black sea bass life history stages. VIMS Fishery Analyst data supports this determination for Barren Island vicinity waters indirectly based on the substantial total catch count data for VA waters versus comparatively minimal count for MD waters.

During time periods when salinities are sufficiently high in the South borrow vicinity, such as during drought years, the material provided by the borrow area could enhance EFH habitat for black sea bass via the Barren Island restoration project. Juveniles and adults could utilize the exotic rock structure along the outer perimeter of Barren Island and the breakwaters, as well as the constructed salt marsh and channels. However, there are no rock structures within the vicinity of the South borrow area.

c. Impacts to Prey and Predators

Black sea bass juveniles and adults forage on organisms originating over large areas, although they likely would forage only minimally in South borrow area waters because there is a lack of structured habitat. As shallow water habitat that provides no structure, the South borrow area impacts from dredging would likely have negligible effect on black sea bass foraging in the Bay. Black sea bass predators likely thrive minimally on black seabass, within the South borrow area waters because of the infrequency of individuals in the area. Prey such as butterfish are also not expected to be a substantial component of the South borrow area assemblage. In summary, the proposed action would have negligible impacts on black sea bass prey or predators.

d. Summary for Species

As existing project area waters appear to constitute only marginal black sea bass adult and juvenile EFH due to salinity, water depths and lack of structure, and the species is mobile, negative effects of proposed dredging of the South borrow area are anticipated to be minimal to negligible. Although the risk exists for individuals to be destroyed by the dredge, due to their great mobility, black sea bass should easily be able to relocate elsewhere and avoid the dredge.

3. BLUEFISH (juvenile, adult)

Background Information

Bluefish are predominantly use pelagic habitats. Bluefish undertake seasonal migrations, moving into the mid-Atlantic Bight during spring, and south or farther offshore during fall (Fahay et al., 1999). Juvenile and adult bluefish enter the Chesapeake Bay during spring through summer, leaving the Bay in late fall. Adults are uncommon north of Annapolis, and generally do not occur above the U.S. 50 bridge, except during years of greater up-Bay salt wedge encroachment. Juveniles tolerate lower salinities than adults and are therefore common in the upper Bay above the U.S. 50 Bridge (Lippson, 1973).

Bluefish juveniles and adults were among the most frequently caught fish in Barren Island waters in sampling conducted for the study in 2002/2003 (MPA, 2005). From a regional perspective though, VIMS Fishery Analyst ChesMMAP data over the 2002 to 2021 period of record shows bluefish strongly concentrated in VA waters of Chesapeake Bay versus MD waters, with some MD stations having total catch counts of 5 – 15 and 15 – 100 up the bay to the vicinity of Rock Hall (north of the Route 50 bridge). Conversely, ChesMMAP data shows maximum total catch counts of only 5 or less at several stations within approximately 2 miles of Barren Island. Sampling conducted for this study collected several bluefish at Barren Island in Summer 2020 and several in Spring 2021 (Anchor QEA, 2021). It appears possible based on ChesMMAP data that bluefish once reaching the middle Bay may choose to proceed further north to the Bay Bridge vicinity rather than remain in the waters around Barren Island. Thus, there could be a situation wherein disjunct EFH occurs in the northern Bay physically separate from the lower Bay.

Bluefish travel in schools of like-sized individuals (Fahay et al., 1999). Adults are pelagic and not typically bottom feeders and are strong swimmers. Juveniles prefer shallower waters and tend to concentrate in shoal waters, and are opportunistic feeders, foraging on a wide variety of estuarine life in the pelagic zone and over a variety of bottom types (including SAV) (Lippson, 1973). Smaller individual bluefish prey upon a wide variety of fish and invertebrates. Large bluefish feed exclusively on fish (Murdy et al., 2013). Fish preyed upon by bluefish include Atlantic silversides (Menidia menidia), herrings, striped bass (Morone saxatilis), bay anchovy, and other fish (Fahay et al., 1999).

Proposed Action Effects

a. Impacts to Individuals

As pelagic species, direct impacts to bluefish are unlikely, even if dredging occurs during warmer months, because juvenile and adult bluefish are good swimmers and can easily avoid dredging activities. However, any bluefish that venture too close to the dredge intake could be entrained and destroyed. Bluefish are unlikely to be present around the project from late October through early May based on their temperature preferences (Table 6).

b. Habitat Impacts

Bluefish juvenile and adult EFH salinity preferences are higher than occurs in the South borrow area waters (Table 6). However, sampling data demonstrates bluefish can occur in substantial numbers within the project area at least in some years. Thus, South borrow area appears to constitute EFH for bluefish juveniles and adults in at least occasional years. Similar habitat is plentiful within the vicinity. Bluefish would be displaced during dredging activity. The South borrow area is expected to provide suitable adult and juvenile EFH following dredging as bluefish habitat requirements are not sensitive to the bathymetric change or alterations of the benthic community. The value of EFH habitat for juvenile bluefish foraging may be diminished until the benthic community recovers.

c. Impacts to Prey and Predators

Overall, the dredging of the South borrow area would have minimal impacts to species preyed upon by bluefish. There may be minor temporary impacts to juvenile predation on benthics due to dredging activities. Bluefish adults and juvenile, although minimally present in South borrow area waters, prey upon other motile fish. Dredging activities would have a negative effect to the water quality and clarity within the vicinity of the South borrow area causing adult bluefish and their prey to likely flee the area or be impacted. Poor water clarity will affect visibility or predators and prey, while poor water quality may affect non-motile prey populations within the area that juvenile bluefish would consume. It is expected that their prey, similar to adult bluefish, would leave the area while dredging is being conducted. Subsequently, project effects on their prey would be minimal to negligible. These impacts will only be temporary and will cease upon dredging completion. Accordingly, there would likely be negligible impacts to predators and prey of bluefish.

d. Summary for Species

Although the risk exists for individuals to be destroyed by the dredge, due to their great mobility, bluefish should easily be able to relocate elsewhere and avoid the dredge. While the proposed action would constitute minor impacts to bluefish EFH, the comparatively small size of the project area in comparison with open waters of the Bay suitable for bluefish, the natural trend of open water habitat increase, and long-term protection of SAV habitat, no detrimental impacts to bluefish from the proposed action are expected.

4. SCUP (juvenile and adult)

Background Information

Scup are a temperate species. During warmer months, juveniles live inshore in a variety of coastal habitats and can numerically dominate estuarine fish populations. Their distribution changes seasonally as fish migrate from estuaries to the edge of the continental shelf as water temperatures decline in the winter. They return from the edge of the continental shelf to inshore areas as water temperatures rise in the spring (Steimle et al., 1999). Scup occur commonly to abundantly in the lower Chesapeake Bay from spring to fall, ranging as far north as the York River, VA. Scup migrate offshore to deeper waters in winter. Young-of-the-year scup inhabit polyhaline (brackish) Chesapeake Bay waters from June to October (Murdy et al., 2013).

Finfish sampling conducted for this study in 2002/2003 did not collect any scup (MPA, 2005). VIMS ChesMMAP maps and data for the period of record (2002 – 2021) show only one station with a total catch-count of scup within approximately 2 miles of the Barren Island vicinity, or within Maryland waters generally. Conversely, ChesMMAP data show that scup was caught at numerous stations with total catch-counts of 10 – 250 in Virginia waters (VIMS, 2021). Sampling for this study conducted in 2020 and 2021 collected no scup at Barren Island (Anchor QEA, 2021). Scup thus appear likely to be only occasional transients in Barren Island waters.

Scup are a demersal species that use several benthic habitats from open water to structured areas for feeding and possibly shelter (Table 6; Steimle et al., 1999). Juveniles feed on small benthic invertebrates, fish eggs, and larvae. Adults prey on benthic and near bottom invertebrates, and small fish (Steimle et al., 1999).

Proposed Action Effects

a. Impacts to Individuals

Sampling results indicate that scup juveniles and adults do not appear to occur in substantial numbers in South borrow area waters. Scup juvenile and adult salinity preferences indicate that scup would only be in South borrow area waters during limited periods of a typical year. Scup are good swimmers and could easily avoid construction activities and turbidity disturbances if they are present. However, any scup that venture too close to the dredge intake could be entrained and destroyed. In combination, these considerations imply that minimal or negligible physical impacts to scup juvenile or adult individuals would be expected.

b. Habitat Impacts

The South borrow area waters appear to constitute only brief duration EFH in a typical year for scup juveniles and adults based on the species salinity preferences (Table 6). Sampling data does not support South borrow area having a substantial number of scup. Accordingly, any effects to the habitat would have minimal to negligible effects on scup.

Negative impacts to scup from the proposed action would be associated with reduced water clarity and quality during dredging activities, and removal of benthic macroinvertebrates from the dredging footprint. Water clarity and quality would be expected to return to existing conditions shortly after dredging is complete. Comparable benthic macroinvertebrates would be expected to return to the area within 2 years of dredging.

c. Impacts to Prey and Predators

Scup forage across a diversity of benthic habitats. However, the portion of prey that scup feed on that originate from the South borrow area waters is likely to be minor to negligible based on limited occurrence of scup within the vicinity of the borrow area. The reduction of prey caused by dredging of the South borrow area waters would have a minor to negligible impact on scup. Additionally, impacts to predators of scup would likely also be negligible as the borrow area waters present minimal opportunities for predators to forage on scup.

d. Summary for Species

Because project area waters appear to constitute only marginal scup juvenile or adult EFH and the species are mobile, negative effects of proposed dredging of the South borrow area are anticipated to be minimal to negligible to scup EFH. Short-term impacts would be associated with water clarity and quality impairments during dredging with longer-term impacts to foraging habitat until the benthic community recovers.

5. SUMMER FLOUNDER (larvae, juvenile, and adult life stages)

Background Information

Summer flounder exhibit strong seasonal inshore-offshore movements. Adult and juvenile summer flounder normally inhabit shallow coastal and estuarine waters during the warmer months of the year, and remain offshore during the fall and winter (Packer et al., 1999). Adult and older juvenile summer flounder enter the Chesapeake Bay during spring and early summer and exit the Bay in fall (Murdy et al. 1997). Adult summer flounder overwinter in the ocean and only enter the Bay in late spring. Larvae and young juveniles migrate into the Bay in October and prefer shallower waters; they typically overwinter and grow in the South portion of the Bay. Older juveniles are generally distributed inshore and in estuarine areas throughout their range during the spring, summer, and fall. During colder months they move into deeper (oceanic) waters and can be found offshore with adults (Murdy et al. 1997, Fahay et al. 1999).

No identified summer flounder larvae were caught in ichthyoplankton sampling conducted for the study in 2002/2003 (MPA, 2005). Finfish sampling in 2002/2003 caught 10 summer flounder individuals. The fish surveys identified summer flounder as a minor component (0.06%) of the fish community in the vicinity of Barren Island (MPA, 2005). However, VIMS ChesMMAP sampling data over the period of record (2002 – 2021) show summer flounder strongly present in both MD and VA waters of the Chesapeake Bay. Multiple stations within approximately 2-miles of Barren Island show total catch counts of 10 – 100 individuals, and numerous other stations within approximately 2-miles show lesser total catch counts. No summer flounder were caught in sampling conducted for this study in 2020 and 2021 (Appendix C, Anchor QEA, 2021).

Summer flounder smaller juveniles feed upon infauna such as polychaetes; larger juveniles feed upon fish, shrimp, and crabs in relation to their environmental abundance. Adults feed opportunistically on fish, crustaceans, and squid (Murdy et al., 2013; NMFS, 2000 [Summary Tables]; Packer et al., 1999). Summer flounder feed on a variety of small fish, shrimp, and crabs that occur in the Chesapeake Bay. Prey include species such as grass shrimp (*Palaemonetes pugio),* Atlantic silversides (*Menidia menidia*), and bay anchovy (*Anchoa mitchilli*). Grass shrimp prefers sand bottom and/or SAV, similar to summer flounder preferences, while forage finfish are generally widespread in occurrence in shallow waters. Each of these food items occurs in the vicinity of the study area (MPA, 2005).

Proposed Action Effects

a. Impacts to Individuals

Direct impacts to summer flounder juvenile and adult individuals are unlikely, even if construction occurs during warmer months, because those life history stages are strong swimmers and would be able to avoid construction disturbances. However, any summer flounder that venture too close to the dredge intake could be entrained and destroyed. During cooler weather months no direct physical impacts to individuals are expected because they are unlikely to be present. MDNR monitoring data for the Barren Island area (Table 3) indicates that water temperatures are below the optimum temperature for summer flounder (52°F (11.1°C), Table 3) from November through April. Larvae are not expected to be in the project area due the borrow area not containing larvae habitat.

b. Habitat Impacts

South borrow area waters constitute EFH for summer flounder, as evidenced by sampling data and EFH habitat preferences (Table 6). The proposed action would produce a net loss of summer flounder EFH for juveniles and adults, but similar habitat is plentiful within the vicinity. Within the borrow area there are no identified SAV beds that are Habitat Areas of Particular Concern (HAPC) for summer flounder. Summer flounder juvenile and adults would be displaced during dredging activity. The South borrow area is expected to provide suitable adult and juvenile EFH following dredging as summer flounder habitat requirements are not sensitive to the bathymetric change or alterations of the benthic community. There could be a minor loss to foraging by juveniles until polychaetes recover. Impacts to summer flounder in the South borrow area is minor or negligible.

c. Impacts to Prey and Predators

Overall, the dredging of the South borrow area would have minimal impacts to species preyed upon by summer flounder. Forage fish and invertebrates consumed by summer flounder occur over a broad area of the Bay. Smaller juveniles prey upon polychaetes which would be removed from the dredging footprint, but otherwise summer flounder prey are motile. Dredging activities would have a negative effect to the water quality and clarity within the vicinity of the South borrow area causing summer flounder and their prey to likely flee the area or be impacted. Poor water clarity will affect visibility of predators and prey, while poor water quality may affect non-motile prey populations within the area that juvenile summer flounder would consume. It is expected that their prey, similar to adult and juvenile bluefish, would leave the area while dredging is being conducted. Subsequently, project effects on their prey would be minimal for smaller juvenile and negligible for larger juvenile and adults. These impacts will only be temporary and will cease upon dredging completion. Benthic macroinvertebrate populations are expected to recover to existing conditions in approximately 2 years.

d. Summary for Species

Direct impacts to summer flounder juvenile and adult individuals are unlikely, even if construction occurs during warmer months when individuals are more likely to be in the Barren Island vicinity due to the species' mobility. Although the risk exists for individuals to be destroyed by the dredge, due to their great mobility, summer flounder should easily be able to relocate elsewhere and avoid the dredge. Long-term impacts to adult habitat are not expected. Juvenile foraging habitat could be impaired until the benthic macroinvertebrate assemblage recovers. Short-term impacts to the species, prey, and predators include displacement to adjacent waters, and reduced water quality and clarity during dredging activities that could affect visibility. These impacts are expected to temporary and cease upon dredging completion.

6. WINDOWPANE FLOUNDER (juveniles, adults)

Background Information

Windowpane inhabit estuaries, nearshore waters, and the Continental Shelf (Chang et al., 1999). Windowpane reside year-round in Chesapeake Bay. Windowpane occur commonly to abundantly in the lower Bay, occasionally to commonly in the middle Bay, and range as far north as the Choptank River (Murdy et al., 2013).

Sampling conducted for the study in 2002/2003 caught no juvenile or adult windowpane flounder (MPA, 2005). VIMS ChesMMAP data show minimal total catch-counts of windowpane flounder in the Barren Island vicinity or within Maryland waters generally over the period of record (2002 – 2021). Conversely juveniles and or adults of this species were caught in comparatively large numbers at numerous stations in Virginia waters near the Bay mouth over the same time period. Sampling conducted for this study in 2020 and 2021 caught no windowpane flounder juveniles or adults (Anchor QEA, 2021).

Windowpane feed on small fish, shrimp, and other crustaceans (Murdy et al., 2013). Major predators of windowpane include spiny dogfish, thorny skate, goosefish, Atlantic cod, black sea bass, weakfish and summer flounder. These fish prey primarily upon juvenile windowpane (Chang et al., 1999).

Proposed Action Effects

a. Impacts to Individuals

While the South borrow area is within EFH salinity preferences of windowpane juveniles and adults (Table 6), multiple sampling data sets fail to support that windowpane flounder juveniles or adults are present. Juvenile and adult windowpane flounder are good swimmers, and any present should be able to avoid disturbance and turbidity from construction activities in warm weather months. However, any windowpane flounder that venture too close to the dredge intake could be entrained and destroyed. During cooler weather months direct physical impacts to individuals are more likely because the fish may be more sluggish.

b. Habitat Impacts

Sampling in the South borrow area vicinity does not clearly support that windowpane flounder occur in sufficient numbers to warrant considering the South borrow area consistent EFH for this species. Because the South borrow waters likely constitute only occasional or periodic EFH, minor to negligible short-term impacts to windowpane flounder EFH would be expected from dredging the South Borrow area substrate. No long-term impacts to windowpane flounder habitat are expected from implementation of the Preferred Alternative. Following dredging, the South borrow area is expected to provide comparable habitat for windowpane flounder juvenile and adults compared to existing conditions.

c. Impacts to Prey and Predators

Based on minimal windowpane juvenile and adult presence in South borrow waters, project effects on their prey would be minimal to negligible. Also, because juveniles and adult windowpane are minimally present in the South borrow area waters, they are presumably minimally preyed upon by other species there such as summer flounder and black sea bass. Accordingly, there would likely be negligible impacts to predators of windowpane flounder.

d. Summary for Species

Windowpane flounder may be present in the South borrow area during the dreading process, and during this time, potential minor to negligible impacts could occur. Although the risk exists for individuals to be destroyed by the dredge, due to their great mobility, windowpane flounder should easily be able to relocate elsewhere and avoid the dredge. Because project area waters appear to constitute only marginal windowpane flounder, negative and positive effects of proposed dredging of the South borrow area is anticipated have minimal to negligible impacts.

7. CLEARNOSE SKATE (juveniles and adults)

Background Information

Clearnose skate has been the most abundant inshore skate in the mid-Atlantic inshore waters from late spring to early fall (Robins et al., 1986). North of Cape Hatteras, it moves inshore and northward along the Continental Shelf during the spring and early summer, and offshore and southward during autumn and early winter. In estuaries, clearnose skate occur mostly in mainstem channels and near the mouth. In trawl surveys of Chesapeake Bay, most juvenile and adult clearnose skate appear in catches between April and December with peak catch per unit effort between May and August. Clearnose skate were most abundant near the Bay mouth during spring and summer but appeared throughout the Bay mainstem during all four seasons, although they rarely appeared in the tributaries (Packer et al., 2003). Clearnose skates are common in the lower Chesapeake Bay from mid-spring to mid-autumn but may move into deeper bay waters or into nearshore coastal waters in mid-summer when water temperatures are high. They are rare or absent in Chesapeake Bay in winter (Murdy et al., 2013).

No skate were captured in sampling conducted for this study in 2001/2002 (MPA, 2005). VIMS ChesMMAP data show no catches over the period of record within approximately 2-miles of Barren Island, and only one station in MD waters with a total catch count of at least one. Conversely, ChesMMAP data shows abundant catches of clearnose skate in VA waters, concentrated near the mouth of Chesapeake Bay where total catch counts over the period of record reach a maximum of 15 – 150 individuals. No skate were captured in sampling conducted for this study in 2020 and 2021 (Anchor QEA, 2021).

Clearnose skate is a bottom-dweller. Clearnose skate feed on polychaetes, amphipods, shrimp, crabs, bivalves, squids, and small fish such as soles, weakfish, butterfish, and scup. Sharks, such as the sand tiger, regularly prey on the clearnose skate (Packer et al., 2003).

Proposed Action Effects

a. Impacts to Individuals

Based on salinity preferences, clearnose skate would most likely be present in summer and fall. However, it appears unlikely that clearnose skate would be present in substantial numbers in the Barren Island vicinity based on existing survey data and their general preference for higher salinities and greater depths (Table 6). If skates are present, juvenile and adults are good swimmers and should easily be able to avoid disturbance from dredging and construction in warm weather months. However, any windowpane flounder that venture too close to the dredge intake could be entrained and destroyed. Individuals may be less able to physically avoid disturbance in cold water months if they are present. Overall, direct impacts to clearnose skate individuals appear to be unlikely to occur.

b. Habitat Impacts

While the South borrow area lies within clearnose skate EFH salinity preferences, the waters are generally shallower than clearnose skate preferences. Sampling data from multiple sources do not clearly support that South borrow area waters constitute EFH for clearnose skate. Accordingly, it appears likely that South borrow area waters constitute marginal clearnose skate EFH, or perhaps do not constitute clearnose skate EFH. As such, any impacts to clearnose skate open water EFH would be negligible to minor.

c. Impacts to Prey and Predators

The proposed dredging of the South borrow area would remove polycheaetes and displace other likely clearnose skate prey. The portion of prey that clearnose skate feed upon which originate from the South borrow area waters is likely to be minor to negligible based on limited occurrence of clearnose skate withing the project area. The reduction of prey caused by dredging of the South borrow area would have a minor to negligible impact on clearnose skate. Additionally, impacts to predators of clearnnose skate would likely also be negligible as South borrow area waters are unlikely to support sharks that prey on clearnose skate.

d. Summary for Species

Clearnose skate may be present in the South borrow area during the dredging process. During this time, potential minor impacts could occur. Although the risk exists for individuals to be destroyed by the dredge, due to their great mobility, clearnose skate should easily be able to relocate elsewhere and avoid the dredge. Due to the project area waters appearing to constitute only marginal clearnose skate, negative and positive effects of proposed dredging of the South borrow area for the restoration of Barren Island is anticipated to be minimal to negligible.

B. Cumulative Impacts

Collectively, all species that have EFH listed for the South borrow area would be displaced during dredging activities and experience decreased water quality and clarity. Impaired water quality and clarity could affect predator/prey interactions for black sea bass, scup, juvenile summer flounder, and bluefish until dredging commences. The South borrow area is expected to provide marginal to little EFH value to Atlantic butterfish, black sea bass, scup, windowpane flounder, and clearnose skate. All species are mobile, reducing the risk of entrainment and destruction by the dredge. All species except winter flounder and clearnose skate are expected to migrate from the project area in the late fall/winter, returning with warming waters in the spring. Black sea bass, scup, summer flounder, clearnose skate, and younger juvenile bluefish feed to some extent on benthic invertebrates. The habitat value of the South borrow area to these species would be diminished until the benthic community is re-established.

Cumulative effects from the full Barren Island restoration project include the placement of stone sills and breakwater along the northeast to southwest shoreline of Barren Island, dredging of sand from the borrow area, dredging the Honga River Channel, and placement of dredged material behind the stone sills to restore wetlands and behind the breakwater to restore bird island habitat. The project would convert 1.4 ac of existing wetlands and ~121 ac of shallow water habitat to ~31 acres of sill/breakwater, 8.5 ac of bird island habitat, and 83 ac of wetlands. Cumulatively, there would be a loss of natural shoreline on the northeastern and western Barren Island shorelines. This constitutes a long-term loss of shallow water near-shore habitat and associated benthic macroinvertebrate assemblages and foraging habitat.

Further, there would be a minor and temporary impact to water quality in the South borrow area and in the vicinity of the Honga River Channel during dredging, as well as along the Barren Island shoreline during active construction. Water clarity and quality in these areas is expected to return to ambient levels within several days following the cessation of activities.

As nearshore waters are not a preferred habitat for butterfish, no significant impact to butterfish eggs, larvae, or adults are projected. However, the conversion of shallow water habitats would constitute a net loss of EFH habitat for summer flounder and occasionally-used EFH for juvenile and adult bluefish.

Some of the project's impacts to EFH would be offset by providing inlets and tidal connection through tidal channels to the existing shorelines on the northeast and northwest, and rock structure which could benefit black sea bass. As existing project area waters appear to constitute only marginal black sea bass adult EFH, negative effects of proposed dredging of the South borrow area in conjunction with the other restoration activities at Barren Island could net value to black sea bass EFH.

Sandy substrates are predominant along the shoreline in much of this reach of the Bay. Thus, this loss of preferred habitat is not expected to impact summer flounder populations. Site filling (i.e. dredged material placement operations) would result in no additional alterations to or displacement of summer flounder habitat (post-construction). In fact, summer flounder utilize salt marsh creeks, which would be created as part of the proposed Barren Island activities. This habitat enhancement is expected to compensate somewhat for proposed conversion of open water and benthic habitats to island habitat.

The project would directly contribute to the net loss of occasionally- used EFH for juvenile and adult bluefish. However, the proposed restoration at Barren Island is expected to contribute significantly to further protection of SAV habitat documented over the last several years in the waters to the east of Barren Island (by preventing wave erosion of the bottom and consequent deepening). As a result, indirect impacts of the project should benefit SAV, and thus provide for the sustainability of summer flounder HAPC and habitat for juvenile summer flounder and bluefish.

Other dredging and placement actions occur in the vicinity of the South borrow area. Periodic maintenance dredging is conducted in small navigation channels including: Knapps Narrows, the Honga River, and the Chester River. Maintenance dredging of the federal channels in these locations would result in displacement of fish and forage resources immediately after dredging. Honga River and other local channels are expected to require periodic future dredging that would provide material for the proposed wetland creation at Barren Island. These dredging projects would cause only temporary bottom disturbance and loss of benthos that could serve as forage. Beneficial use projects are ongoing at Swan and Deal Islands to restore tidal wetlands. There is also periodic maintenance dredging and beneficial placement activities associated with other portions of the Baltimore Harbor and Channels federal project in the Patapsco River, the Swan Point Channel, Tolchester Channel, and the approach channels to the Chesapeake & Delaware Canal. Activities north of the Bay Bridge, however, should have little additional impact on EFH habitat in the Mid-Chesapeake Bay region.

The Bay is increasing in area by up to several hundred acres per year driven by rising sea level (USACE, 2011), with the rate of rise accelerating. Concomitantly, the Bay is undergoing a net loss of tidal wetlands via erosion and drowning-in-place. The new open water habitat being created regionally would be expected to support bluefish, with such habitats in southerly areas of the Bay where higher salinities occur likely constituting regular-year, rather than occasional- year (such as at Barren), EFH. Accordingly, the future for tidal wetlands is looking increasingly bleak on a regional scale, and society is increasingly relying on engineering measures to maintain this diminishing resource. Acreage that can be maintained via engineering would be on a much smaller scale than historic acreage. The proposed Barren Island project with support from the material of the South Borrow area, in combination with other large USACE beneficial use and restoration projects that restore tidal wetlands, are seen as being of increasing importance as a means to maintain diminishing tidal wetland resources along the Eastern Shore of Maryland. The new open water habitat being created regionally would be expected to provide EFH.

The State of Maryland and Baltimore District are presently completing the expansion of the Poplar Island Environmental Restoration Project (PIERP). PIERP is currently restoring 1,100 ac of open water to island habitat, half uplands and half tidal wetlands. Poplar Island Expansion has a target to restore approximately 600 ac of additional remote island habitat. This represents an additional conversion of EFH to uplands/wetlands within about 30 miles of James Island in areas that are known to support EFH habitat. The PIERP expansion also proposes dredging sand for dike construction from an open water area west/southwest of the current project, potentially impacting between 49 and 230 ac. Once Poplar Island has reached full capacity, placement needs will be met by the James Island component of the Mid-Chesapeake Bay Islands Project. James Island will be developed to restore 2,072 acres of uplands and wetlands within the island's prior location north of Taylors Island in Dorchester County. The James Island restoration project would covert 2,072 acres of shallow-water habitat to uplands and wetlands with similar impacts and benefits to EFH species as the PIERP and Barren Island projects, but on a larger scale.

Cumulatively, the multiple, on-going and proposed beneficial use USACE projects would constitute a loss of EFH, and thus an adverse effect, with some associated benefits to EFH that prefer tidal inlets, marshes, structured habitat, and SAV. Regulations serve to present other large-scale conversions of open water to non-habitat, such as commercial or industrial islands that would not provide ecological benefits compensating for open water habitat loss. However, considering ongoing habitat changes concomitant with rising sea-level as described above, these losses would largely be offset by natural processes and no detrimental effect overall to species with EFH in the region.

Privately-owned commercial fishing gear, such as hydraulic escalator dredges used to harvest soft clams (*Mya arenaria*), can also impact bottom habitat used by EFH species. Escalator dredges produce short-term modifications to bottom topography, which are generally not detrimental to EFH if occurring on non-vegetated bottoms. Operation of escalator dredges in SAV beds has been restricted within Maryland waters so minimal impact to SAV is occurring from these clamming activities.

The largest direct impact to some EFH species such as bluefish and summer flounder populations regionally is likely recreational and commercial fishing pressure, as well as water quality impairments. Proper management of fishing is of continuous importance to ensure stable fish populations. Bever and others (2013) determined that from 1985 to 2011, a median of 20 percent of the Bay volume was seasonally hypoxic in its bottom waters. Improvement of Bay water quality, particularly dissolved oxygen, would increase the volume of oxygenated open water habitat in the Bay suitable for fish, especially demersal species such as flounder, scup, and black sea bass in warm water months. To achieve this would depend primarily upon anthropogenic nutrient load reduction, as is required under the Chesapeake Bay Total Maximum Daily Load (TMDL).

Accordingly, the proposed dredging of material for the Barren Island restoration project work would not have a cumulatively negative contribution to other actions and stressors affecting EFH in the mid-Chesapeake Bay.

IV Federal Agency's Opinion of Project Impacts to EFH

1. South Borrow area waters clearly constitute EFH for adult and juvenile summer flounder based upon EFH habitat preferences and documented occurrences. South Borrow area waters appear to constitute EFH for adult and juvenile bluefish in occasional years, based upon EFH habitat preferences and documented occurrences. Accordingly, potential effects to summer flounder EFH are of principal importance for this assessment to ensure compliance with the Magnuson-Stevens Fishery Conservation and Management Act. Potential effects upon bluefish EFH are also of importance, but less so than for summer flounder.

2. South Borrow area waters do not appear to constitute EFH (or are perhaps only infrequent or transient EFH) for Atlantic butterfish, black sea bass, scup, windowpane flounder, and clearnose skate. Conversely to summer flounder and bluefish, potential project effects upon species for which the Barren Island area does not likely constitute EFH (Atlantic butterfish, black sea bass, scup, windowpane flounder, and clearnose skate) are of minimal or negligible concern with respect to the Magnuson-Stevens Act.

3. The proposed project would result in the dredging of sand from a maximum of 40 to 50 acres of open water habitat in the South borrow area to a depth of approximately 5-feet.

4. The proposed action would have no negative impacts on SAV or oyster reefs. SAV, oyster reefs, or other structured habitat do not exist within the footprint of the South borrow area.

6. Dredging of sand from the South borrow areas would be subject to compliance with state water quality standards, resulting in only short term, minor perturbation to water quality.

7. Although other federal, state and private sponsored projects occur in the project vicinity that cause the disturbance of bottom habitat, these projects are not expected to significantly affect EFH. Proposed large-scale island restoration and dredging projects would cause a loss of bottom and open water habitat for these species, however, regionally this habitat is abundant. Therefore, no significant cumulative impacts to habitat or populations of these species are expected to result from this project.

8. After reviewing relevant information and analyzing potential project impacts, USACE Baltimore District has determined that the proposed action would not have a substantial adverse effect on EFH, HAPC, or on species with designated EFH in the project area. Overall, direct, secondary, and cumulative impacts to EFH, associated species, and HAPC would be minimal, and,

in the long term, the current project and proposed expansion would enhance some habitat features for species managed under the Magnuson-Stevens Act.

V. Proposed Mitigation

No mitigation specific to protection of populations of these species or their habitat has been proposed due to the proposed action resulting in minor, adverse impacts to summer flounder and bluefish EFH. Conversely, the proposed action is designed to protect and enhance EFH and HAPC over the long-term. The proposed project incorporates numerous mitigation measures designed to maximize the environmental benefits of the project, while minimizing adverse impacts. Additional monitoring would be undertaken at Barren Island to avoid impacting viable SAV beds. USACE will be performing pre- and post-dredging monitoring to umderstand how the borrow area recovers following dredging.

VI. References

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APPENDIX C2: Fish and Wildlife Coordination and Endangered Species Acts

USFWS Planning Aid Report

Draft
Planning Aid Report:
Mid-Chesapeake Bay Island Ecosystem Restoration Project

Prepared for:
U.S. Army Corps of Engineers
Baltimore District

Prepared by:
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Chesapeake Bay Field Office
U.S. Fish and Wildlife Service
March 2021

Executive Summary

This constitutes the planning aid report (PAR) of the U.S. Fish and Wildlife Service (Service) to assist the U.S. Army Corps of Engineers (Corps) with the development of the Barren Island and James Island ecosystem restoration projects. The first project focuses on restoration/expansion of island habitat at Barren Island. The second project focuses on creation/expansion of James Island. Though these are two separate projects, they occur in close proximity and are on similar timelines. Many of the natural resources overlap between the potential areas of effect of these two projects. In an effort to be efficient, the Service and the Corps agreed to evaluate both projects through a single PAR. Where a resource only occurs in the vicinity of one project site it is noted in the report. Otherwise, the resources are assumed for both projects.

The Mid-Chesapeake Islands Restoration Project is authorized to restore remote island habitat at James Island and Barren Island, in Dorchester County on the Eastern Shore of Maryland, through the beneficial use of dredged material. Section 7002 of the Water Resources Reform and Development Act of 2014 authorized the Maryland Mid-Chesapeake Bay Island Project, as described in the Chief's Report (https://planning.erdc.dren.mil/toolbox/library/Chief Reports/mid_chesapeake.pdf, accessed by the Corps) dated August 24, 2009 and the *Mid-Chesapeake Bay Island Ecosystem Restoration Integrated Feasibility Report and Environmental Impact Statement (EIS)*, dated June 2009. The project is being completed in partnership with the nonfederal sponsor, the Maryland Port Administration. The project is focused on restoring/expanding island habitat to provide over a thousand acres of wetland and terrestrial habitat for fish, shellfish, reptiles, amphibians, birds, and mammals through the beneficial use of dredged material.

Contents

Introduction

The U.S Army Corps of Engineers (Corps) requested assistance from the U.S. Fish and Wildlife Service (Service) in identifying positive and/or negative effects from two projects located on two islands in western Dorchester County, Maryland. The Service developed this Planning Aid Report (PAR) to help the Corps identify, with respect to fish and wildlife resources, the least harmful and most beneficial alternatives for these projects. The project focuses on restoring/expanding the area of James and Barren Island to provide wetland and terrestrial habitat for fish and wildlife through the beneficial use of dredged material. The recommended plan consists of constructing environmental restoration projects to restore 2,144 acres of remote island habitat (2,072 acres at James Island and 72 acres at Barren Island). Though these are two separate projects, they occur in close proximity and are on similar time lines. Many of the natural resources overlap between the potential areas of effect of these two projects. In an effort to be efficient, the Service and the Corps agreed to evaluate effects to fish and wildlife resources for both projects through a single PAR. Where a resource only occurs in the vicinity of one project site it is noted in the report. Otherwise, the resources are assumed for both projects. The PAR only evaluates impacts to fish and wildlife resources and their habitats and is not meant to be the sole document in which decisions are made on the preferred alternatives for this project.

Project History

The projects are located in the Chesapeake Bay, on the islands of James and Barren in western Dorchester County, Maryland. Barren Island lies due west of Upper Hooper's Island, and James Island lies near the mouth of the Little Choptank River, northwest of Taylors Island. Presently, James Island is privately owned. Barren Island is federally owned and managed by the Service as part of the Chesapeake Marshlands National Wildlife Refuge Complex. Tar Bay, a small section of Barren Island, is owned by Maryland's Department of Natural Resources (MDNR) and managed by the Wildlife and Heritage Service to conserve and enhance wildlife and their habitats and provide recreational use of the wildlife resources (MDNR Tar Bay WMA 2020).

In the fall of 1981, the Corps dredged the Federal channel leading from the Chesapeake Bay to the Honga River, accumulating over 135,000 cubic meters of fine-grained material to deposit nearby. For economic purposes, the site needed to be within 3.2 kilometers (km) of the dredging area. The decision was made to deposit the material in a shallow water area off of the northeast corner of Barren Island. This cove area had a moderate erosion rate ranging from 1.2 to 2.4 meters (m) per year; north of this area was an accretion area dominated by smooth cordgrass (*Spartina alterniflora)*, south of the cove and into the interior of the island was dominated by loblolly pine (*Pinus taeda*). Seeding of the site with *S. alterniflora* following dredge disposal was completed in spring 1982, and saltmarsh hay (*Spartina patens)* was transplanted at uppermost elevations. A ditch (3.0m wide, 365.7m long, and -0.3m MLW) was developed using high pressure water along the western end of the disposal site. This was done to encourage tidal

flushing to a pond area, to improve access for fish and to discourage access to the disposal site by predators, ideally to maintain it as a predator-free least tern (*Sterna antillarium*) nesting site. In order to encourage nesting, 1,000 m^2 of shell was deposited at this location (Earhart and Garbisch 1983). This site was subsequently used by least terns in the summer of 1982, and the Corps estimated a minimum of 462 least terns in the area, 30 black skimmers (*Rynchops nigra),* 5 common terns (*Sterna hirundo*), herring gulls (*Larus argentatus*, and killdeer (*Charadrius vociferous*). To further enhance the nesting area, an additional 460 m^2 of oyster shell was placed in the winter of 1982 and then raked to create documented nesting preferences of the aforementioned species. *Spartina patens* was transplanted to the uppermost elevations of the disposal site in summer of 1982 (Earhart and Garbisch 1983).
In 1984, the same channel was dredged again, and the Corps deposited about 38,000 cubic meters of material on the northeast edge of the original wildlife habitat island that was established in 1981. North of the habitat island, over 76,000 cubic yards of material was deposited, and this created a 4.7 hectare (ha) island to provide additional protection, and habitat was developed by controlled elevation of material, and post-disposal landscaping. Following the dredging, *Spartina alterniflora* was planted in some areas, and sand and shell deposited in others to provide nesting substrate for the terns and skimmers that had historically been present (Earhart and Garbisch 1986).

Detailed Plan Description

Alternatives proposed by the Corps are addressed within this report. If another preferred alternative is proposed by the Corps in the future, an addendum will be needed.
Plans for Barren Island incorporate the use of sills to protect the current shoreline of the island and the SAV/shallow water habitat situated east and southeast of the existing island, and to create wetland habitat using dredged material. The plan includes modification of existing 4 foot (ft) sills (4,900ft in length), construction of a northern sill (9,760ft in length), and construction of a breakwater at the southern end (6ft in height, 8,200ft in length). Approximately, 23 and 49 acres of island habitat (72 acres total, with 65 acres for placement) will be created by dredged material placement on the north and west shoreline of the island, respectively. The Barren Island portion would protect up to 1,325 acres of SAV habitat that has been recorded east and southeast of the existing island since 1994. The capacity of Barren Island is 0.38 million cubic yards, and placement duration is expected to be approximately 7 years and planned to be 100 percent wetland creation/restoration. Barren Island will accept material from nearby shallow-draft channels. Additionally, Barren Island's existing wetland, upland, and intertidal areas would also be protected by the project (USACE MidBay Site 2020).

The design for James Island features a 20ft upland dike, access channel dredging and habitat design, and a total planned acreage of 2,072ac. The capacity of James Island is 90-95 million cubic yards of material, and placement duration is expected to last 28-30 years. James Island will accept material from channels in the Maryland waters of the Chesapeake Bay used by ships going to and from the Port of Baltimore (USACE MidBay Site 2020). This will provide direct benefits of improved health, richness, and sustainability to aquatic and wildlife species. In addition, it will provide indirect benefits of navigational safety, education, and passive recreation. The conceptual plan for the feasibility study proposes 55 percent wetland and 45 percent upland habitats. Habitat may include submerged aquatic habitat, mudflat, low marsh, high marsh, islands, ponds, channels and upland areas. The project develops a long-term strategy for providing placement alternatives that meet the dredging need of the Port of Baltimore while also maximizing the use of dredged material as a beneficial resource. Restoration of island habitat is necessary and valuable to the Chesapeake Bay ecosystem. In the last 150 years, it is estimated that 10,500 acres of this habitat has been lost in the middle-eastern portion of the Chesapeake Bay. Remote island habitat is a valuable resource with its ideal nesting and resting sites for migratory birds and shorebirds (USACE MidBay Site 2020). For the purpose of this PAR, which is being written without any design proposal, the alternatives of the project are simply restoring land with dredge material and a no action alternative.

Resources Without the Project

Baseline Environmental Conditions

Dorchester County's land mass, including wetlands is 350,000 acres. The landscape is characterized by long narrow peninsulas scored with numerous creeks, guts, streams and ditches. Extensive areas of tidal marshland lie along these peninsulas, with country roads cutting across the marshes to reach settlements on the southern tips. Nearly 60 percent of the county lies in the 100-year floodplain, and over 50 percent of the county is below elevation of 4.9ft above sea level (Cole 2008). This elevation is at risk to damage during storm surges, even those not related to tropical disturbances. It is inevitable that Dorchester County will experience significant loss of wetlands, with an increase in open water. Aerial photography of the last 50 years shows shifts in types of wetland habitat and increases in open water. Areas that were once hummocks and high marsh have converted to low marsh or open water habitat (Cole 2008).

Maryland is highly vulnerable to sea level rise; this has become apparent with shoreline erosion and deterioration of tidal wetlands. The State has warmed up by two degrees Fahrenheit in the last century, heavy storms have increased in frequency, and the sea is rising an inch every 7 to 8 years (Boesch et al. 2018, EPA Fact Sheet 2016). It is predicted that the relative rise of mean sea level between 2000 and 2050 will be 0.8 to 1.6 feet. If emissions continue to grow into the second half of the 21st century, sea level rise will likely be 2.0 to 4.2 feet (Boesch et al. 2018). Sea level rise is a major factor for wetland loss; the Chesapeake Bay's rate of sea level rise is higher than the current global rate of 3.2mm/yr due to regional subsidence. To avoid submergence, the surface elevation of coastal marshes must increase vertically in the tidal frame at rates that are equal to or exceed the increase in sea level rise. Coastal marshes are extremely dynamic, and surface elevation change is controlled by several different factors including accretion, decomposition, vegetation type and productivity, as well as sea level trends. Marshes are able to build through organic and inorganic inputs including root production, litter fall, and sediment capture. Up to a certain point, sea level rise increases marsh elevation; there is an increase in mineral sediment input, reducing decomposition rates and stimulation of plant growth which enhances sediment trapping. However, if sea level rise is too fast, plants will die from inundation. Accretion of mineral and organic matter was deemed uniformly high across the estuary, leading the conclusion that elevation loss is not due to a lack of accretion input (Beckett et al. 2016). A study inspecting land loss within the Chesapeake Bay estimates that since 1848, James and Barren Island have been reduced in size by more 88 percent and 89 percent, respectively. Long term land loss has remained somewhat constant for James and Barren Island, mean rates of loss from 1848 to 1987 are 1.9ha/yr and 2.1ha/yr, respectively (Wrayf et al. 1995).

Effects on Fish and Wildlife Resources

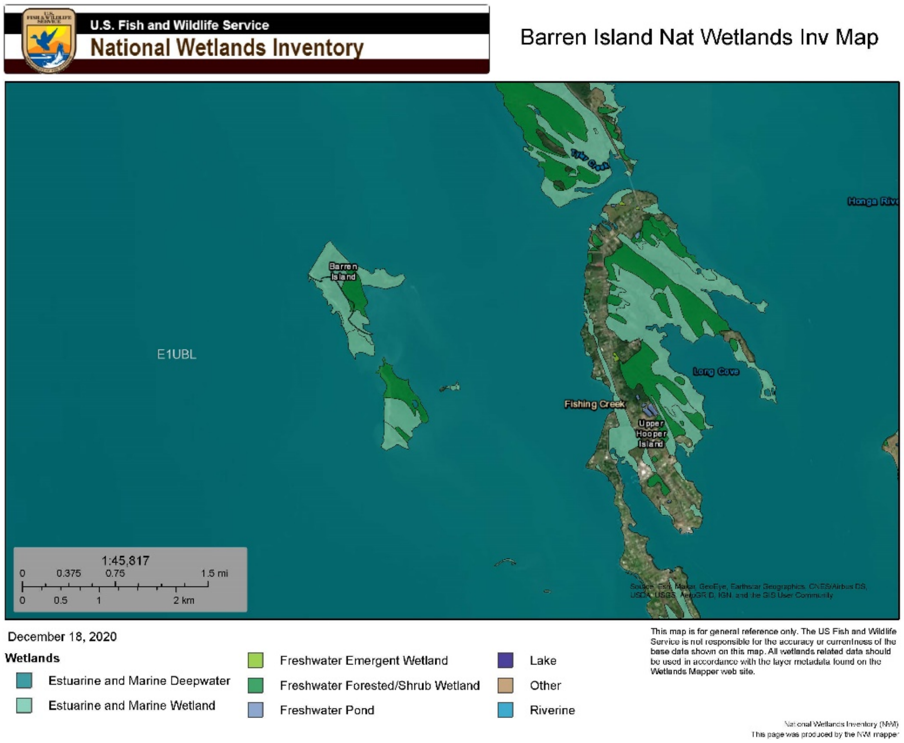
Data Quality

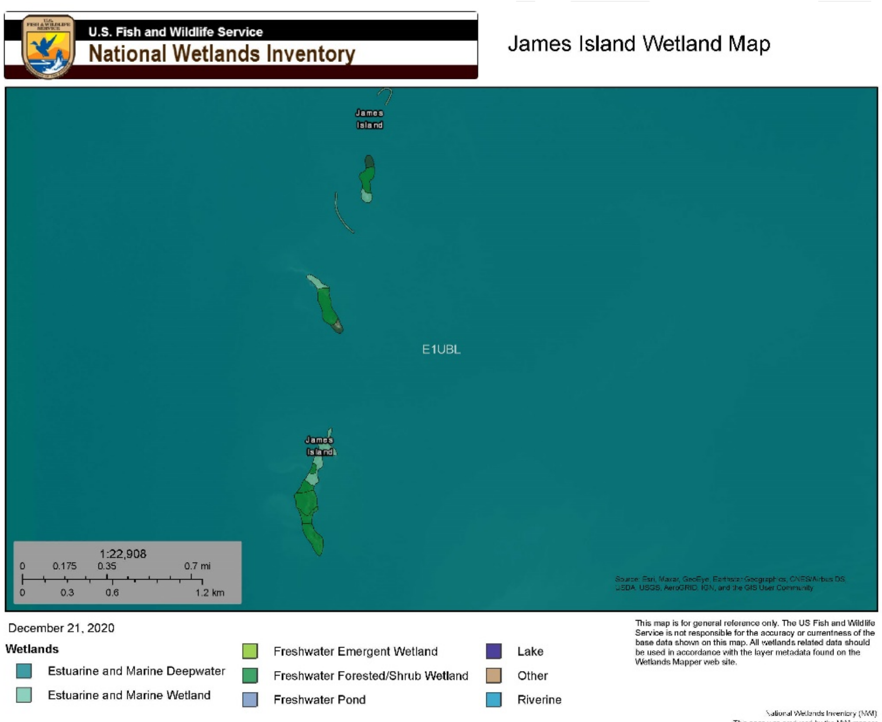
The following is a description of priority Service resources for the project area. The information represents the best available current information that could be gathered from existing sources. Whenever possible, project specific information was used. Many of the resources described may be relevant to the project area, or the overall species range as described in the supporting literature for each section.

Wetlands

The Service has always recognized the importance of wetlands to waterfowl, other migratory birds, and fish and wildlife, and considers this habitat a trust resource. Trust resources are natural resources that the Service has been entrusted with protecting for the benefit of the American people. The Service's responsibility for protecting wetland habitats comes largely from the Fish and Wildlife Coordination Act. Since the 1950s the Service has been particularly concerned about wetland losses and their impacts on fish and wildlife populations. According to the April 22, 2020 Information, Planning and Consultation (IPaC) report (Appendix A), there are two wetland types in the study area: freshwater forested/shrub wetland, and estuarine/marine wetland. Freshwater/shrub wetland are generally described as forested swamp or wetland shrub bog. Estuarine/marine wetland are vegetated and non-vegetated brackish and saltwater marsh, shrubs, beach, bar, shoal or flat (US Fish and Wildlife Wetlands Inventory 2020). The project is expected to grow and enhance marshes in the area, benefiting migratory birds and at-risk species especially restoration of high marsh areas. High marsh habitat is critical to many of our at-risk species and is a priority for the Service.

Figure 1. Wetland Maps of Barren Island and James Island from USFWS Wetland Inventory



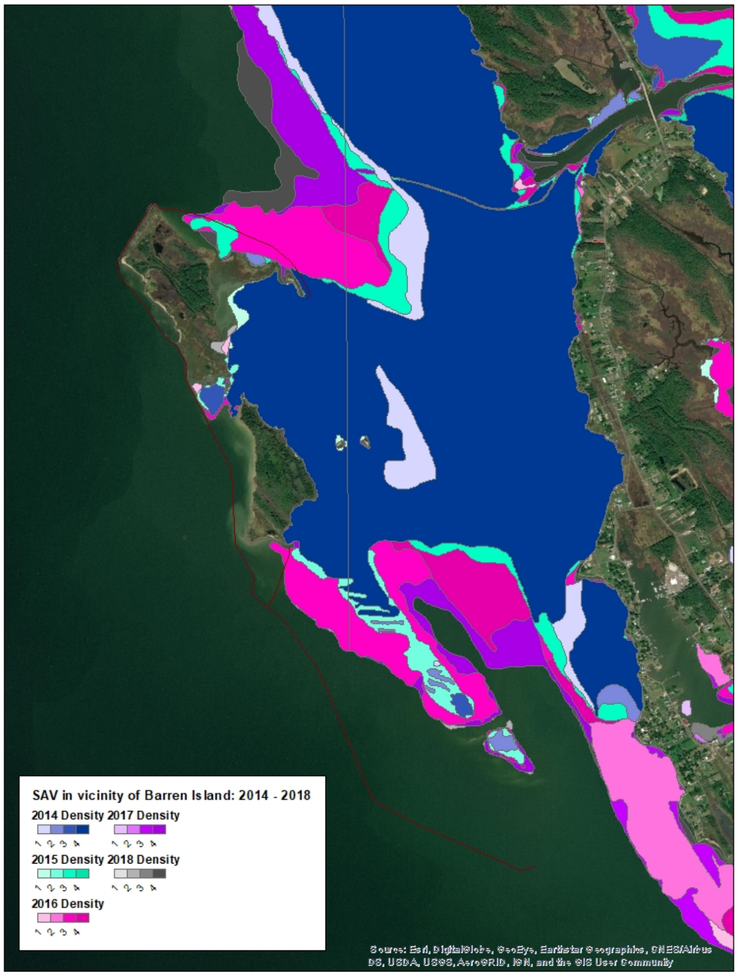


Submerged Aquatic Vegetation

Submerged aquatic vegetation (SAV) are vascular, rooted, underwater flowering plants, and they play an important role in the Chesapeake Bay (Bay). Researchers with Virginia Institute of Marine Science have monitored the Bay's SAV coverage since 1978. The Bay is home to over

20 species of SAV, including freshwater, estuarine and marine species. SAV beds provide habitat and nursery areas, food and refuge for many species including blue crab (*Callinectes sapidus*), striped bass (*Morone saxatillis)*, bay scallops (*Argopecten irradians*), waterfowl and other aquatic species (VIMS 2020a). SAV benefits the environment directly by taking up nutrients, reducing shoreline erosion, trapping suspended particles, stabilizing sediments and adding oxygen to the water. SAV requires a high level of sunlight for successful photosynthesis and growth. Runoff from deforestation, urban sprawl, and other watershed disturbances has increased the turbidity of water in the Bay, which blocks sunlight needed for SAV growth. Turbidity restricts grasses to shallow water and could even cause them to die back altogether. Excess nitrogen can fuel phytoplankton blooms that shade out underlying SAV beds. Boat propellers, fishing and shellfish equipment damage SAV beds by cutting shoots and uprooting the plants (VIMS 2020a). SAV is historically found at both project areas (Figure 2, VIMS 2020b). The restoration of Barren Island and the breakwater could benefit SAV in the project area where it would slow waves and create a more quiescent environment that is favorable for SAV growth.

Figure 2. SAV presence at Barren Island



Mammals

Through a cooperative agreement with U.S. Department of Agriculture (USDA) Animal and Plant Health Inspection Service (APHIS), qualitative surveys will be conducted to identify mammalian predators inhabiting Barren and James Islands (Appendix E). Remote cameras with scent stations will be used and transects will be walked to record wildlife species and signs (scat, tracks, etc). During these surveys, any observations of rare, threatened, or endangered species (state or federal), along with species being considered for listing under the Endangered Species Act (ESA) will be recorded. As of March 2021, species identified are red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), river otter (*Lontra canadensis*), white-tailed deer (*Odocoileus virginianus*), muskrat (*Ondatra zibethicus*). Other species noted were box turtle (*Terrapene carolina carolina*), diamondback terrapin (*Malaclemys terrapin*), and spotted turtle (*Clemmys guttata*). This section will be updated as data is collected and received from USDA.

Migratory Birds

Data Metrics

Migratory birds are an important trust resource, and the Service works with partners to protect, restore, and conserve bird populations and their habitats for the benefit of future generations. The following databases were used to gather information on migratory birds within the project area, including data from the Service's IPaC system (IPaC; Appendix A), eBird (Appendix B), Audubon Society (Appendix C), MDNR (Appendix D), and Atlantic Coast Joint Venture (ACJV). Avian surveys completed by USDA APHIS (Appendix E), Audubon Society (Appendix C), and Anchor Qea (Appendix F), specifically for this project, are discussed below. Surveys were recommended in order to provide a more complete analysis of the resources that are found within the described project area and represents the "best available science" for this project. IPaC is a project planning tool that is used to streamline the Service's environmental review process; it is used to identify migratory birds, endangered species, interjurisdictional fish, marine mammals, wetlands, and Refuge lands. IPaC official species list are valid for 90 days. After 90 days, project proponents should reconfirm their results by requesting an updated species list for their project area to ensure an accurate and up-to-date list. This area has a high level of bird diversity; southern Dorchester County is designated as an Important Bird Area by the National Audubon Society (Audubon Important Bird Areas 2020). Another resource used to examine bird presence in a geographic area is eBird, a website launched in 2002 by the Cornell Lab of Ornithology and National Audubon Society, which provides rich data sources for bird abundance and distribution at a variety of spatial and temporal scales (Sullivan et al. 2009). This site primarily uses data collected through citizen science, so data should be interpreted cautiously, however, when unusual birds or unusual high counts are reported, the regional experts review the data and verify the potential for incorrect species identification.

Survey data acquired from Audubon (marsh bird specific surveys) and USDA (avian point count surveys) will be incorporated into this section once it has been received.

A polygon of the project area was mapped in IPaC. From this data a list of migratory birds as well as Birds of Conservation Concern (BCC) was created (Table 1). IPaC identified migratory bird species for this site (accessed 12/21/2020). The relevant species of conservation concern are presented below and are the subset of birds identified in IPaC that relate to the 1988 Fish and Wildlife Coordination Act mandating the Service to, "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." There are also particular Time of Year (TOY) restrictions that need to be taken into account. TOY restrictions provide general guidance for the protection of wildlife; they focus on the time of year that species may be more sensitive to human activities. These should be considered as guidance for project planning, as well as the scheduling of construction activities that may impact the species identified (VDGIF 2020).

Table 1. Birds of Conservation Concern known to occur in the project area (data from USFWS IPaC Trust Resource Report).

Common Name	Scientific Name	Breeding Season/TOY Restrictions
American Oystercatcher*	*Haematopus pilliatus*	Apr 15 to Aug 31
Black-billed Cuckoo*	*Coccyzus erythropthalmus*	May 15 to Oct 10
Bobolink*	*Dolichonyx oryzivorous*	May 20 to Jul 31
Clapper Rail*	*Rallus crepitans*	Apr 10 to Oct 31
Dunlin*	*Calidris alpine arcticola*	Breeds elsewhere
King Rail*	*Rallus elegans*	May 1 to Sep 5
Least Tern*,***	*Sterna antillarum*	Apr 20 to Sep 10
Prairie Warbler*	*Dendroica discolor*	May 1 to Jul 31
Prothonotary Warbler	*Protonaria citrea*	Apr 1 to Jul 31
Purple Sandpiper*	*Calidris maritima*	Breeds elsewhere
Red-headed Woodpecker*	*Melanerpes erythrocephalus*	May 10 to Sep 10
Red-throated Loon	*Gavia stellate*	Breeds elsewhere
Ruddy Turnstone	*Arenaria interpres morinella*	Breeds elsewhere
Seaside Sparrow*	*Ammodramus maritimus*	May 10 to Aug 20
Semipalmated Sandpiper*	*Calidris pusilla*	Breeds elsewhere
Willet	*Tringa semipalmata*	Apr 20 to Aug 5
Wood Thrush	*Hylocichla mustelina*	May 10 to Aug 31

*Barren Island only ***State Listed T&E Species

Table 2. eBird data for bird species listed on Barren Island

American Crow	American Goldfinch	American Oystercatcher	American White Pelican
Bald Eagle	Barn Swallow	Blue Jay	Brown Pelican
Brown-headed Nuthatch	Canada Goose	Canvasback	Carolina Wren
Clapper Rail	Common Grackle	Common Tern	Common Yellowthroat
Double-crested Cormorant	Eastern Kingbird	Eastern Meadowlark	Forster's Tern
Great Black-backed Gull	Great Blue Heron	Great Egret	Greater Scaup
Greater Yellowlegs	Green Heron	Herring Gull	House Wren
Indigo Bunting	Killdeer	Laughing Gull	Least Sandpiper
Mourning Dove	Northern Cardinal	Northern Flicker	Northern Mockingbird
Orchard Oriole	Osprey	Palm Warbler	Purple Martin
Redhead	Red-winged Blackbird	Ring-billed Gull	Royal Tern
Ruddy Turnstone	Sanderling	Seaside Sparrow	Snowy Egret
Spotted Sandpiper	Tundra Swan	Turkey Vulture	Yellow-rumped Warbler

SHARP Surveys

Wetland bird abundance will be measured by Audubon at Barren Island and James Island in spring 2021 to document baseline conditions. The principal focus will be on saltmarsh sparrow (*Ammodramus caudacutus*) and black rail (*Laterallus jamaicensis*), although the methodology will document all wetland bird species, and most other bird species on the islands. Wetland birds will be quantified using the Saltmarsh Habitat & Avian Research Program (SHARP) callback survey protocol. Six SHARP survey points will be established on Barren Island and one point on James Island. Each point will be surveyed three times during May-July. Results (mean # individuals of each species detected per visit) will be tabulated.

To detect the presence of Black Rail, Autonomous Recording Units (ARUs) will be placed on both islands and left to record sounds overnight, in combination with call playbacks of Black Rail to solicit vocalizations of any birds present. Two ARUs will be placed on Barren Island and one on James Island on the day that SHARP surveys are completed, and will record for one night on each occasion.

This section will be updated once data is collected and received from Audubon.

Black Skimmer (*Rynchops niger*)

The black skimmer is the only American representative of the skimmer family *Rynchopidae,* and is listed as state endangered in Maryland. The bill of the black skimmer sets it apart from all other American birds. The large red and black bill is knife-thin and the lower mandible is longer than the upper. The bird drags the lower bill through the water as it flies along, hoping to catch small fish. Although the black skimmer is active throughout the day, it is largely crepuscular (active in the dawn and dusk). Its use of touch to catch fish allows it be successful in low light or darkness (MDNR Black Skimmer 2020). This species historically has nested within the project area. The alternatives that place sand material at historic nesting sites that mimics natural coastal features could be beneficial to black skimmer nesting habitat. The remaining alternatives would not change the current conditions for black skimmer, and population trends in the project area would remain the same.

Willet (*Tringa semipalmata*)

Willets are large shorebirds with grey-brown plumage and a long, thick, grey bill. They have a white rump, eyebrow, and wing stripe that is visible in flight. Willets also have long grey legs and slightly webbed toes. Plumage is similar for both sexes, but females are slightly larger. The eastern subspecies, which can be seen within the project area, are slightly smaller and darker than their western cousins (Ellison 2010). On the east coast, willets are commonly found on beaches, mudflats, and tidal salt marshes. Willets primarily breed in high marsh areas dominated by saltmeadow hay (*Spartina patens*) and in coastal dune areas dominated by beach grass (*Ammophila breviligulata*). Willets migrate south to winter on mudflats and beaches in northern South America. While willets are usually solitary, they may gather in flocks to migrate and roost (Ellison 2010). Willets feed by probing with their bills into mud and sand flats, searching for a wide variety of invertebrates. They eat insects, crustaceans, mollusks, worms, grasses, seeds, and occasionally fish. Aside from probing in the sand, willets also hunt by walking through shallow water and holding their bills open under the surface (Ellison 2010). Willets breed from May to July. They are monogamous each season, and males will even reunite with their previous mate if he can find her at their breeding grounds. To attract females, the males will fly with their wings high above their heads and use their "pill-will-Willet" call. Females fly beneath them and sing back, before the pair flies to the ground together. Once a pair has formed, the willets stop displaying, mate, and search for a nest site together. Nests are simple scrapes in the grass. Females lay three to four eggs over the course of 6 days. Both parents incubate the eggs for slightly less than a month. Within hours of hatching, Willet chicks are able to walk and feed themselves, and can fly within 4 weeks. Like many other shorebirds, the male, rather than the female, stays with the chicks longer (Ellison 2010). There is no current conservation status for willets within this region, as they have had no significant declines in population recently. However, habitat degradation in breeding, wintering, and migration areas may put this species at risk (Ellison 2010). None of the proposed alternatives are expected to impact willet habitat and the population trends would be expected to remain unchanged in the project area. If dredge material is used to restore marsh habitat such that it mimics the natural conditions of the coastal barrier island marshes, the Service would expect increased use of the marshes by willet for foraging, nesting and breeding.

Colonial Nesting Waterbirds

Colonial nesting waterbirds refer to species such as terns, cormorants, gulls, and wading birds which nest in dense colonies ranging from small numbers of single-species pairs to many thousands in mixed species colonies.

Brown pelicans (*Pelecanus occidentalis*) are huge, stocky seabirds. They have thin necks and very long bills with a throat pouch used for capturing fish. Their wings are very long and broad and are often noticeably bowed when the birds are gliding. Brown pelicans feed by plunging into the water, stunning small fish with the impact of their large bodies, and scooping them up in their expandable throat pouches. When not foraging, pelicans stand around fishing docks, jetties, and beaches or cruise the shoreline. Pelicans nest in colonies, often on isolated islands free of land predators. Breeding populations of brown pelicans in the project area are fairly low. Surveys completed by Anchor Qea showed brown pelicans inhabiting the island during the summer (Appendix F). Brown pelicans annually nest in Dorchester County and in the early 2000's on Barren Island. While the more recent nesting sites are south of the Barren Island project area, they are less than 20 miles from the project site. If habitat islands are planned for the islands, they could create nesting habitat for this species and allow them suitable habitat to breed on Barren Island again.

A large number of wading birds have used islands in the Bay to breed. Within the project area these species include great egrets (*Ardea alba*), snowy egrets (*Egretta thula*), green herons (*Butorides virescens*), and great blue herons (*Ardea herodias*) (D. Brinker Pers. Comm. Appendix B). They are all primarily fish eaters, but will also eat invertebrates, benthic organisms, reptiles, and amphibians. If the project includes marsh restoration with shrubs or trees in hummock areas, it is possible to create additional nesting habitat for these birds.

Gulls (Family *Laridae)* and double-crested cormorant (*Phalacrocorax auritus*) are common colonial nesting waterbirds found throughout Maryland, and are often thought of as nuisance species because of their abundance and ability to adapt to the human environment. Nesting cormorants compete with other priority colonial nesting birds and displace them. In addition, concentrated guano kills vegetation and exacerbates island erosion. Cormorants and several species of gulls (ring-billed (*Larus delawarensis*), herring (*Larus argentatus*), great black-backed (*Larus marinus*), Bonaparte's (*Croicocephalus philadelphia*), and laughing (*Leucophaeus atricilla*)), were identified in the preliminary screening, only cormorants, herring gull and great black-backed gull have been known to nest within the project area. The alternatives that create additional nesting habitat on beaches may create more preferred nesting habitat for gulls and cormorants. If nesting occurs, deterrents may be needed in order to decrease competition for other less abundant and high priority species, and to reduce damage on native vegetation.

Terns are seabirds in the family *Sternidae* that have a worldwide distribution and are normally found near the sea, rivers, or wetlands. They are slender, lightly built birds with long, forked tails, narrow wings, long bills, and relatively short legs. Most species are pale grey above and white below, with a contrasting black cap to the head. From late April to August, terns use barren to sparsely vegetated sandbars along shorelines for nesting. Terns feed in a variety of ways, including capture of prey while in-flight or by diving to the water's surface. Prey items include small fish, shrimp, and insects. Pairs generally occupy and defend a feeding territory, which may be more than 20 km away from the breeding colony. Terns are colonial breeders that often associate with gulls or other tern species. Nests are simple depressions in the sand or shallow cups of dead grass formed on beaches or open rocky areas. Typical clutch size is two to three eggs. One study found that 90 percent of terns observed had returned to the territory occupied the previous year. Data gathered from IPaC, eBird, and MDNR has shown presence and historic nesting of least (*Sterna antillarum*), royal (*Thalasseus maximum*), common (*Sterna hirundo*), and Forster's (*Sterna forsteri*) terns. Least terns are state listed as threatened, common tern is state listed as endangered, and royal tern is state listed as endangered. Much of the historic tern nesting habitat in Maryland has disappeared because of climate change or altered for human development. Placement of the dredge material and including a constructed habitat island could provide additional suitable nesting substrate for the terns within the project area.

Summary of the Alternatives on Black Skimmer, Willet, and colonial Nesting Waterbirds

Placement of the dredge material could provide additional suitable nesting substrate for black skimmers and some gull and tern species. Black skimmers along with least, royal and common terns are state listed, and restoration of breeding and nesting habitat for these species is particularly important. The populations of brown pelicans, cormorants, or non-nesting gulls and terns could benefit from beneficial reuse of dredge material as it would provide nesting substrate desirable for these species. The no action alternative will not change the overall health of habitat and will have a negligible impact on their populations. Trends for these species would likely continue to decrease in the project area.

Bald eagle (*Haliaeetus leucocephalus*)

The bald eagle is a North American species that historically occurred throughout the contiguous United States and Alaska. In 1978, it was listed under the ESA as endangered throughout most of the lower 48 states. This segment of the population was down-listed to threatened in 1995, and in 2007 it was deemed recovered and removed from the list of threatened and endangered species. The bald eagle is federally protected under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA) from a variety of human induced conditions and activities (BGEPA 1940, MBTA 1939). Bald eagle distribution varies seasonally; eagles nesting in southern latitudes frequently move northward in late spring, often summering as far north as Canada. Bald eagles have nested within the project area as recently as 2020. Nest building typically occurs between early December and early March, followed by egg laying/incubation between late January and early May, hatching/rearing of young between late February and early July, and fledging of young between late May and late August. Proposed projects in the Chesapeake Bay watershed region must consider the protection standards for bald eagles, which include: time-of-year restriction from activities (December to June); habitat/nest protection buffers (330-foot and 660-foot zones); and Important High Eagle Use Areas such as communal roosts/concentration area. “Take” includes pursuing, shooting, poisoning, killing, capturing, trapping, wounding, collecting, destroying, and disturbing (USFWS, 2011). An aerial survey in 2020 confirmed nesting activity in 2020, however, surveys have not been accomplished yet in 2021 due to COVID restrictions.

Other non-BCC Species

Other migratory bird species of concern that may be observed commonly migrating through the project area in spring and fall but do not breed near the project area include black scoter (*Melanitta nigra*), dunlin (*Calidris alpine arcticola*), golden eagle (*Aquila chrysaetos*), lesser yellowlegs (*Tringa flavipes*), long-tailed duck (*Clangula hyernalis*), northern gannet (*Morus bassanus*), purple sandpiper (*Calidris maritima*), red-breasted merganser (*Mergus serrator*), red-throated loon (*Gavia stellate*), ruddy ternstone (*Arenaria interpres morinella*), semipalmated sandpiper (*Calidris pusilla*), surf scoter (*Melanitta perspicillata*), and white-winged scoter (*Melanitta fusca).* Several species have been identified by IPaC as present and breeding in the project area, but these are terrestrial nesting species, and due to the lack of appropriate nesting habitat these species are not likely to breed within the project area. These species include black-billed cuckoo (*Coccyzus erythropthalmus*), bobolink (*Dolichonyx oryzivorus*), common loon (*Gavia immer*), prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea)*, red-headed woodpecker (*Melanerpes erythrocephalus*), and wood thrush (*Hylocichlia mustelina*). These species are identified as species of conservation concern for the Service, and it is possible that some of these species could experience temporary disturbance during construction, but the project area is not within their breeding habitat. Because it is not in their breeding habitat and forage areas are not limited, none of the proposed alternatives are expected to have any impacts on these species.

Atlantic Coast Joint Venture

The ACJV has identified the project area as a landbird, shorebird, waterbird, and waterfowl focus area. The ACJV is another resource used to identify potential fish and wildlife resources that could be found within the project area. The bay and associated wetlands surrounding the project area support ACJV priority species such as bald eagle (*Haliaeetus luecocephalus*), black scoter (*Melanitta nigra*), clapper rail (*Rallus crepitans*), dunlin (*Calidris alpine arcticola*), golden eagle (*Aquila chrysaetos*), lesser yellowlegs (*Tringa flavipes*), long-tailed duck (*Clangula hyernalis*), northern gannet (*Morus bassanus*), purple sandpiper (*Calidris maritima*), red-breasted merganser (*Mergus serrator*), red-throated loon (*Gavia stellate*), ruddy ternstone (*Arenaria interpres morinella*), seaside sparrow (*Ammodramus maritimus*), semipalmated sandpiper (*Calidris pusilla*), surf scoter (*Melanitta perspicillata*), white-winged scoter (*Melanitta fusca).* Species that have been identified as present and breeding in the project area but are terrestrial and/or not likely to be found breeding in the project area include black-billed cuckoo (*Coccyzus erythropthalmus*), bobolink (*Dolichonyx oryzivorus*), common loon (*Gavia immer*), prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea)*, red-headed woodpecker (*Melanerpes erythrocephalus*), and wood thrush (*Hylocichlia mustelina*) (ACJV 2008, IPaC list Appendix A). With the exception of bald eagle, American black duck, saltmarsh sparrow, ruddy turnstone, and seaside sparrow, which are discussed further below, these species are not known to nest in the project area and other than the possibility of temporary disturbance during construction these species are not expected to see any impact from these projects.

At-Risk Species

At-risk species are those that are: already proposed but not finalized for listing under the ESA; candidates for listing under the ESA; or petitioned for listing under the ESA, which means a citizen or group has requested that the Service evaluate them to see if they need the ESA's protection. Many Species of Greatest Conservation Need (SGCN) identified in State Wildlife Action Plans may also be included as at-risk species based on their range and degree of rarity.

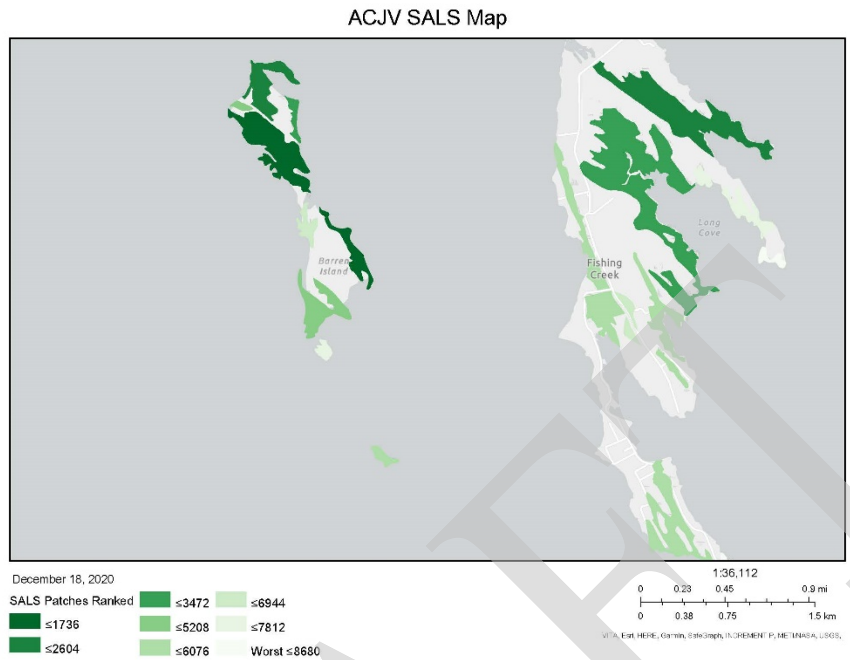
American Oystercatcher (*Haematopus palliates)*

The American oystercatcher is a common coastal salt marsh and sandy beach shorebird. Its bright red-orange bill is sturdy and laterally flattened, built for opening mussels and oysters. In young birds, the bill is pinkish brown and dusky black toward the tip. It has a yellow eye and an orange-red eye ring. Breeding and non-breeding plumage is almost identical in American oystercatchers. They have black heads and necks, dark blackish-brown underparts, and white wing and upper-tail patches. Their legs are a tan or sand color. Males and females look alike but females are larger and heavier (Prince William Network 2017). American oystercatchers are shy and intolerant of people. Since coastal property is always in demand for recreation and development, human disturbance is perhaps the greatest threat to breeding American oystercatchers. The American oystercatcher builds nests in open, sandy areas where they are vulnerable to predators like red fox, cats, dogs, or other birds (Prince William Network 2017). Pollution is another threat to the oystercatcher population if the levels are high enough to affect the shellfish these shorebirds feed on (Prince William Network 2017). Alternatives that place sand material on historic nesting sites that mimics natural coastal features could be beneficial to enhance oystercatcher nesting habitat. The remaining alternatives would not change the current condition for oystercatcher, and population trends in the project area would remain the same.

Saltmarsh Sparrow (*Ammodramus caudacutus*)

Saltmarsh sparrow is a species that is endemic to East Coast salt marshes, and has experienced an 80 percent decline in its population size during the last 15 years. They nest in high marsh grasses, just above mean high tide. Due to this precarious location of nesting habitat, they have adapted to occasional flooding events. Eggs can survive short periods of being underwater, and young birds are able to climb grass into high areas above the nest. However, due to increasing sea levels, their adaptive traits are not able to keep up with the higher frequency of flooding as well as the higher water levels. Nest flooding is their greatest threat, followed by depredation of eggs and young (ACJV Saltmarsh Sparrow 2020). Figure 3 shows the project area using the Saltmarsh Sparrow Habitat Prioritization Tool. This tool is intended to help identify areas of salt marsh that are likely to be valuable by looking at factors such as resiliency to sea level rise, tidal restriction, development potential, presence of *Phragmites*, potential for marsh migration, and other factors important for this sparrow's habitat. By identifying these areas, this tool can provide a way to focus work on high priority marshes. Currently, there are few marshes that provide high-quality habitat to support population growth. Patches in darker green color are assumed to have higher potential to provide higher quality habitat than those in lighter green, and should be focused on first when considering conservation action. The Barren Island project area was the only site that the tool designated as high-quality habitat for Saltmarsh Sparrow (ACJV Saltmarsh Sparrow 2020). If dredge material is used to restore high marsh habitat such that it mimics the natural conditions of the Bay's island marshes, with elevation high enough to reduce the potential for flooding nesting habitat, the Service would expect increased use of the marshes by saltmarsh sparrow for foraging, nesting, and breeding.

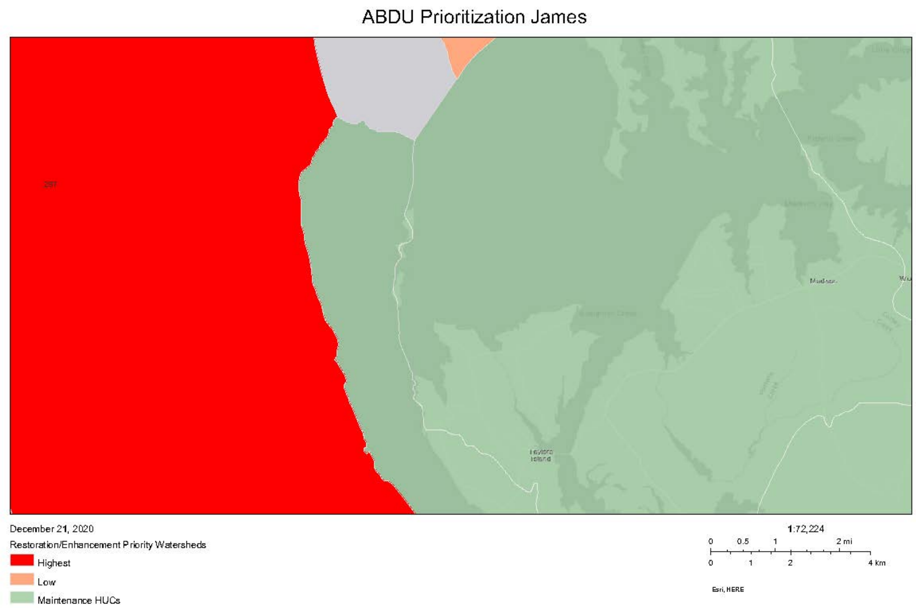
Figure 3. Priority areas for SALS habitat conservation

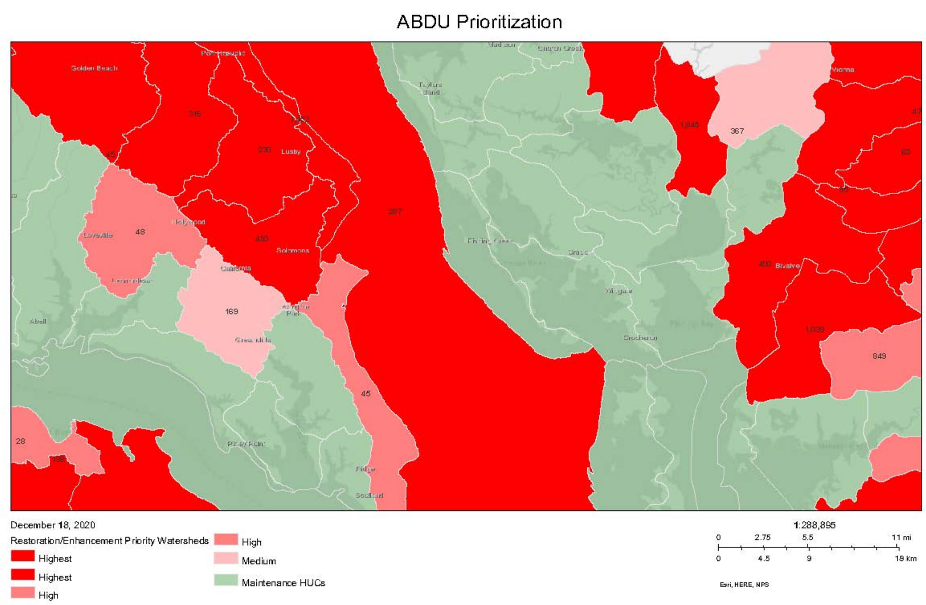


American Black Duck (*Anas rubripes*)

The American black duck was at one time one of the most abundant dabbling ducks in North American. Populations began to decline in the 1950s and by the 1980s this species had lost more than half of their population. While populations have stabilized since then, they are still below objectives set by the 2018 North American Waterfowl Management Plan (NAWMP 2018). The Atlantic Coast supports the majority of wintering populations, which are commonly found in coastal salt marshes. Threats to this species includes urbanization of coastal winter areas and sea level rise due to climate change. There is also an ACJV Prioritization Tool for black duck, which helps identify the number of acres to protect, restore, or maintain at the watershed scale (ACJV American Black Duck 2020). In Figure 4, the project area shows prioritized habitat for American black duck, highlighting the bay and essentially all marsh habitat within the project area. The project area is defined as a Maintenance HUC, which currently contains enough food to support population objectives. Work within these watersheds is focused on maintaining habitat quality to support the population, including restoring or protecting additional habitat. None of the proposed alternatives are expected to impact American black duck habitat other than possible temporary displacement during construction. The population trends for American black duck would be expected to remain unchanged in the project area. If dredge material is used to restore marsh habitat such that it mimics the natural conditions of the Bay's island marshes, the Service would expect increased use of the marshes by American black duck for foraging, nesting and breeding.

Figure 4. American Black Duck Habitat Prioritization Tool, https://acjv.org/american-black-duck/, accessed 12/18/2020





Seaside Sparrow (*Ammodramus maritimus*)

The seaside sparrow (*Ammodramus maritimus)* is a relatively common species found within its limited range on the east coast, and has been identified to be within the project area according to the IPaC report (Table 1). Similar to its close relative, the saltmarsh sparrow, the seaside sparrow is a tidal-marsh specialist found only in small localized populations (Post and Greenlaw 2009).

The extensive tidal saltmarshes of the lower Delmarva Peninsula counties (Dorchester, Wicomico, and Somerset) provide high quality nesting habitat for the species. Contraction of the species range has been associated with habitat degradation and loss (Ellison 2010). Their primary nesting habitat is at the summer high tide mark within saltmarshes, close to the ground, and typically in a clump of smooth cordgrass (*Spartina alterniflora)* or black needle rush (*Juncus roemerianus*). Periodic tidal flooding in many, perhaps most, salt marshes is the chief source of nest mortality in this species in our region. This species is a ground feeder that prefers to feed in open areas of vegetation and mud where it forages mostly for insects and other small invertebrates (Ellison 2010, Post and Greenlaw 2009). During the winter, when invertebrates are less available, seeds make up a good portion of their diet. Most seaside sparrows within this range typically migrate to saltmarsh systems located south of Chesapeake Bay, returning in April to breed; however, a few individuals do overwinter in the Delmarva peninsula, mixing in with migrants from the north (Ellison 2010). None of the proposed alternatives are expected to impact seaside sparrow habitat, other than possible temporary displacement during construction. The population trends for seaside sparrow would be expected to remain unchanged in the project area. If dredge material is used to restore marsh habitat such that it mimics the natural conditions of the Bay island marshes, the Service would expect increased use of the marshes by seaside sparrow for foraging, nesting and breeding.

Ruddy Turnstone *(Arenaria interpres*)

The ruddy turnstone is a chunky sandpiper with short legs. This species nests on high arctic tundra of North America and Eurasia, and is commonly found wintering along the coastlines of six continents. While migrating, it is seen mostly along the coast. Its preferred habitats are beaches, mudflats, jetties, and rocky shores. This bird is named for its unusual feeding habit; it inserts its bill under stones or shells, and flips them over to find food underneath. For a larger object, several will work together to flip it over. They lay up to 4 eggs which are olive-green with spots of brown. Their diet is variable and includes insects, crustaceans and mollusks. They have also been known to eat worms, small fish, sea urchins and other bird eggs (Audubon 2020b). This species is not known to nest within the project area, but summer surveys (Anchor Qea) has recorded their presence within the project area and it is not uncommon to see this species during migration periods. The proposed alternatives are not expected to impact population trends for ruddy turnstone other than temporary displacement during construction. If material used mimics preferred habitat for ruddy turnstone, it may benefit the species by offering substrate used for feeding.

Monarch (*Danuas plexippus plexippus*)

The monarch butterfly is a brush-footed butterfly with large, orange and black wings that uses open prairie, meadow, open woodland, gardens, and roadside habitat with suitable milkweed species for larvae and nectar plants for adults. This monarch butterfly subspecies is unique, however, in that its multi-generational migration life strategy necessitates widespread breeding and food resources at the right places at the right times (MAFWA 2018). Destruction and alteration of breeding, migrating, and wintering habitats, including loss of adult and larval food and places to live during critical stages of its life cycle, have reduced its range and abundance over the last 30 years. At one time, the monarch was common in most states east of the Rocky Mountains during the breeding season and gathered in large numbers on the wintering grounds in Mexico. Based on 20 years of wintering ground surveys, the eastern population has fallen from approximately one billion to fewer than 35 million monarchs, representing a decline of 97 percent from the 1997 high count and a 90 percent decline from the 20-year average (Rendon-Salinas and Tavera-Alonso 2014). Monarchs are considered vulnerable in Maryland (NatureServe 2019), a state that provides summertime breeding habitat. In 2014, the Service was petitioned to protect the monarch butterfly under the Endangered Species Act. On December 15, 2020, the Service announced that listing the monarch as endangered or threatened is warranted but precluded by listing of other species in greater need. This decision is the result of an extensive status review of the monarch that compiled and assessed the monarch's current and future status (USFWS 2020). The monarch is now a candidate under the ESA. The Service will review its status annually until a listing decision is made. In the interim, significant and expansive conservation measures are being undertaken throughout the species' range to boost populations (USFWS 2020b). These projects have the potential to create resting and feeding habitat for the monarch populations migrating through Maryland. Creating appropriate feeding sources will depend on the plantings associated with the project.

Spotted Turtle (*Clemmys guttata)*

Spotted turtles are aquatic turtles that are black in color with yellow spots. They are small, measuring between 3.5 and 4.5 inches. This species can be found throughout the east coast of the United States, and they favor shallow water habitats with vegetation. This includes ditches, bays, bogs and swamps. Their specific habitat requirements and slow reproductive rates are what designates them as an At-Risk species. Their primary threats are collection, habitat loss (isolated freshwater wetlands without protection), habitat fragmentation (contiguous habitat fragmented by development and roads) and climate change (changes in rainfall patterns may alter favored wetlands, and warming temperatures can skew sex ratios) (USFWS Spotted Turtle Factsheet 2021). Maintaining freshwater ponding and wetlands on Barren Island will allow for continued use of the island by spotted turtles, as well as maintaining upland habitat to enable this species to move between different wetlands on Barren Island.

Fish and Shellfish Resources

Eastern Oyster (*Crassostrea virginiana*)

The eastern oyster is a natural filter feeder, pumping water from their gills they trap particles of food, nutrients, suspended sediment and chemical contaminants. This keeps the water clean and lessens turbidity for other aquatic life. Oyster beds are formed in layers; larvae settle on top of

the adults, forming shelfs of oysters that spread up and out. They form numerous nooks and crannies, which in turn provides habitat for hundreds of other animals (CBP 2020).
The decline of oysters has been attributed to several factors: over-harvesting, disease, and habitat loss. The decline is further illustrated by the impact on water quality; in the late nineteenth century, the oysters present in the Bay could filter a volume of water equal to that of the entire bay in three to four days, the process today takes nearly a year to filter the same amount. Over-harvesting has removed huge volumes of oysters and led to a decline in the health of the Bay's reefs. Reefs have been further scraped away by dredges, so oyster habitat is limited to flat, thin layers of shell spread over the bottom. This is less beneficial for reef-dwelling organisms and can be easily buried by sediment (CBP 2020).
Disease events are attributed to Dermo (*Perkinsus marinus*), which infects oysters in their second year and slows growth rates and can lead to death, and MSX (*Haplosporidium nelsoni*), which leads to oyster death and effects all age groups of oysters. Overcoming the effects of these diseases has posed challenges to restoration efforts. It has been estimated that by age three over 80 percent of a single year class in a high disease area will die due to disease (CBP 2020).
Habitat loss over the past century has affected the watershed. This is mostly attributed to land use changes. It has caused an increase in the amounts of nutrients and sediment entering the watershed and contributes to poor water quality. Excess nutrients fuel growth of algae blooms which leads to low-oxygen zones that can hinder oyster development (CBP 2020). This project has the potential to increase quiescent conditions and decrease wave action, and could provide additional substrate along the shoreline of a newly constructed landscape for oyster reefs to develop and thrive.
In accordance with COMAR 23.02.04.13, dredging is prohibited during certain times of the year to protect shellfish. Mechanical dredging within 500 yards of shellfish areas is prohibited from December 16 through March 14, and June 1 through September 30. Hydraulic dredging within 500 yards of shellfish areas is prohibited from June 1 through September 30. MDNR has also requested TOY restrictions for non-dredging activities that are within 500 yards of shellfish resources and have potential to produce significant suspended sediment such as bank grading associated with shoreline stabilization or placement of dredge material for a living shoreline (R. Limpert, pers. comm). It is expected that the benefits this project provides will outweigh the negative effects. The use of oyster reef balls and/or castles could enhance oyster populations within the project area as well as provide wave attenuation for SAV in the area. During construction, it is possible that the disturbance could cause some negative effects to the oyster bars near the construction area, but without a construction plan it is not possible to predict the amount of disturbance.

Anadromous and Catadromous Fish

The Anadromous Fish Conservation Act (Act) is a Federal law enacted in 1965 to conserve, develop, and enhance the anadromous fish resources of the U.S. that are subject to depletion from water resources development and other causes, or with respect to which the U.S. has made conservation commitments by international agreements, and the fish in the Great Lakes and Lake Champlain that ascend streams to spawn. The provisions of the Act are found under 16 USCS §§ 757a-757f. Inter-jurisdictional, catadromous and anadromous fish are a Service trust resource. Anadromous fish spend most of their adult lives in saltier water but return each year to spawn in freshwater. Catadromous fish spend most of their adult lives in fresh water and return to salt water to spawn. The Service and our partners are working to protect the health of aquatic habitats, recover and restore populations of native fish, and provide opportunities to enjoy the many benefits of healthy aquatic resources. The Bay is a nursery area for summer flounder (*Paralichthys dentatus*), Atlantic butterfish (*Peprilus triacanthus*), and red hake (*Urophycis chuss*), see EFH section below. Many other species are often encountered (Table 3). The action of dredging disrupts sediments and buries benthic macroinvertebrates, which could temporarily negatively impact anadromous and catadromous fish. The placement of the dredge material is not expected to affect these species and has potential to benefit some species that use sandy substrate for spawning. Best management practices should be implemented to avoid detrimental impacts to aquatic resources.

Essential Fish Habitat

One of the priorities of National Oceanic and Atmospheric Administration (NOAA) is Essential Fish Habitat (EFH). Using the best available science, NOAA Fisheries along with regional fishery management councils identify and map EFH for each life stage of over 1,000 federally managed species (see species present within the project area in Table 3). EFH includes a variety of habitat in which fish are able to spawn, breed, feed, and grow to maturity; these habitats include wetlands, reefs, seagrass, rivers, and coastal estuaries. High priorities for EFH are referred to as Habitat Areas of Particular Concern (HAPC) due to major ecological functions, sensitivity to decline, stress from development, and/or rare habitat. Using NOAA's EFH Mapper, several species were identified to use the habitat around the project area (NOAA EFH 2020). The Service recommends that the Corps pursue appropriate coordination and consultation with National Marine Fisheries Service (NMFS) who has Federal jurisdiction over EFH.

Table 3. Species and Lifestage Associated with EFH

Little Skate (*Leucoraja erinacea*)	Adult
Atlantic Herring (*Clupea harenus*)	Juvenile, Adult
Red Hake (*Urophycis chuss*)	Adult, Eggs/Larvae, Juvenile
Windowpane Flounder (*Scophthalmus aquosus*)	Adult, Juvenile
Winter Skate (*Leucoraja ocellata*)	Adult
Clearnose Skate (*Raja eglanteria*)	Adult, Juvenile
Bluefish (*Pomatomus saltatrix*)	Adult, Juvenile
Atlantic Butterfish (*Peprilus triacanthus*)	Adult, Eggs/Larvae, Juvenile
Scup (*Stenotomus chrysops*)	Juvenile, Adult

Summer Flounder (*Paralichthys dentatus*)	Larvae, Juvenile, Adult
Black Sea Bass (*Centropristis striata*)	Juvenile, Adult

Marine Mammals

According to MDNR (MDNR Marine Mammals 2020), over 20 species are known to migrate through Maryland waters; the most common marine mammal species found in Maryland waters are the bottlenose dolphin (*Tursiops truncates*), harbor porpoise (*Phocoena phocoena*), harbor seal (*Phoca vitulina*), and humpback whale (*Megaptera novaeangliae*). In the warmer months, bottlenose dolphins are common sightings, and occasionally manatees are spotted as well (MDNR Marine Mammals 2020). Months where water temperatures are at their warmest (May to October) is when Maryland experiences their highest numbers of marine mammal sightings. The Service recommends that the Corps pursue appropriate coordination (confirming time of year restrictions) and consultation with NMFS who has Federal jurisdiction under the Marine Mammal Protection Act for species that may be using this area.

Threatened and Endangered Species

The following species were shown to be present in the project area as of an April IPaC report. This was done to provide a more complete analysis of the resources that are found within the described project area and represents the "best available science" for this project. The Service recommends that the Corps pursue appropriate coordination and consultation with NMFS who has Federal jurisdiction over the marine species detailed below.

Eastern Black Rail (*Laterallus jamaicensis jamaicensis*)

The eastern black rail (*Laterallus jamaicensis jamaicensis),* federally listed as threatened is now considered to be one of the rarest wetland birds in North America. Since the 1990s, rail populations have declined by more than 90 percent. They hide in dense grass, are often nocturnal, and are found in salt, brackish and freshwater marshes. They tolerate water that is only deep enough to wet the bottom of a boot. Black rail have suffered from conversion/alteration of wetland habitat, and declines are also believed to be driven by sea level rise and nest inundation. This species nests close to the ground so it is very vulnerable to fluctuating water levels (ACJV Saving the Eastern Black Rail 2020). Current surveys are underway to identify locations in Maryland being used by black rail. The IPaC search did identify Barren Island as a potential place that black rail could occupy. A Section 7 Consultation with the Service will be required if surveys detect the presence of the species on the Island. Saltmarsh specific surveys will be performed by Maryland Audubon Society this spring to identify presence of black rail at the project sites. If dredge material is used to restore high marsh habitat such that it mimics the natural conditions of the marsh, the Service would expect increased use of the marshes by black rail for foraging, nesting, and breeding.

Green Sea Turtle (*Chelonia mydas*)

The green sea turtle, federally listed as threatened, grows to a maximum size of approximately 1 meter in shell length, and can weight nearly 200 kg. They have a small head, single-clawed flippers and a heart-shaped shell. The carapace of the shell has 5 vertebral scutes, 4 pairs of coastal scutes, and 12 pairs of marginal scutes. The head has a single pair of prefrontal scales and four postorbital scales behind each eye, with are distinguishing characteristics that differentiate this species from other hard-shell sea turtles. The term "green" refers to the subdermal fat, the carapace is generally light to dark brown and changes as the turtle grows from hatchling to adult. This species is globally distributed, and is believed to inhabit coastal waters of over 140 countries and nest in over than 80 countries worldwide (Seminoff et al. 2015). They spend a majority of their lives in coastal foraging grounds, including shallow waters on open coastline and in protected bays and lagoons. They rely primarily on marine algae and SAV for their diet, with some populations feeding extensively on invertebrates. Green turtles nest on sandy, ocean-facing beaches; characteristics vary but typically nesting beaches have intact dune structures and native vegetation. The clutches are laid at night at the base of a primary dune. Mean clutch size varies, an average is about 100 eggs per clutch (Seminoff et al. 2015). This species is regarded as a species of conservation concern; they are impacted by a variety of sources such as coastal development, beachfront lighting, erosion from sand mining, non-native vegetation, and sea level rise which affects hatchlings and nesting turtles. Fishing and marine pollution are shown to affect foraging and migrating green turtles, and fishery bycatch (trawling, gill net, and dredging) are also continued threats (Seminoff et al. 2015). Disease and predation are continuing threats to the North American population. The Service recommends that the Corps pursue appropriate coordination and consultation with NMFS who has Federal jurisdiction over the green sea turtle.

Atlantic Sturgeon (*Acipenser oxyriynchus oxyriynchus*)

Atlantic sturgeon, federally listed as endangered, is an anadromous species occurring on the Atlantic Coast of North America. Atlantic sturgeon are long-lived, anadromous fish reported to reach lengths of 459 cm and body weights of 364.9 kg. The Atlantic sturgeon is a bottom-feeder without teeth and has four whiskers halfway between its snout and mouth. The species has five rows of armor-like scales – called scutes – and the tail is longer on the top than on the bottom (ASSRT 2007). The species tends to reach maturity at 16 and 17 years for males and females, respectively. The number of eggs that can be produced is about 25,000 eggs per kg of body weight and females are thought to spawn once every 2 to 6 years, whereas males are thought to spawn every 1 to 5 years. Juveniles tend to spend 1 to 3 years in freshwater before spending their adult life in the marine environment. Spawning typically occurs in the spring over large gravel and other substrates when flow, pH, and other cues are optimal (ASSRT 2007). Populations of Atlantic sturgeon can be found from Quebec, Canada down along the Atlantic Coast and Gulf Coast to Louisiana with possible extirpation in Rhode Island and presumed extirpation in Washington, D.C. (NatureServe 2017). The primary threats for this species include habitat degradation including alteration and obstruction, vessel strikes, urbanization, pollution, and fishery by-catch (ASSRT 2007). The Service recommends that the Corps pursue appropriate coordination and consultation with NMFS who has Federal jurisdiction over Atlantic Sturgeon.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*)

The Kemp's Ridley sea turtle, federally listed as endangered, is one of the smallest of the sea turtles with adults reaching about 2 feet in length. The core habitat for Kemp's Ridley occurs in the nearshore and inshore waters of the northern Gulf of Mexico, 95 percent of worldwide nesting occurs in Tamaulipas, Mexico with occasional nesting in North Carolina, South Carolina, and Florida. Adult and sub-adult Kemp's Ridley primarily occupy nearshore habitat that contain muddy or sandy bottoms where prey can be found. Hatchlings typically associate with floating Sargassum seaweed and juveniles remain within Gulf of Mexico currents while others are swept into the Atlantic Ocean by the Gulf Stream. Nesting occurs from April into July along the coast of Mexico, with an average of 2.5 times per season. Clutch size is around 100 eggs. The decline of Kemp's Ridley is due primarily to human activities, including the direct harvest of adults and eggs and incidental capture in commercial fishing operations. Other threats include marine debris, disease, chemical pollution, noise, and habitat degradation (NMFS et al. 2011). The Service recommends that the Corps pursue appropriate coordination and consultation with NMFS who has Federal jurisdiction over Kemp's Ridley sea turtle.

Leatherback Sea Turtle (*Dermochelys coriacea*)

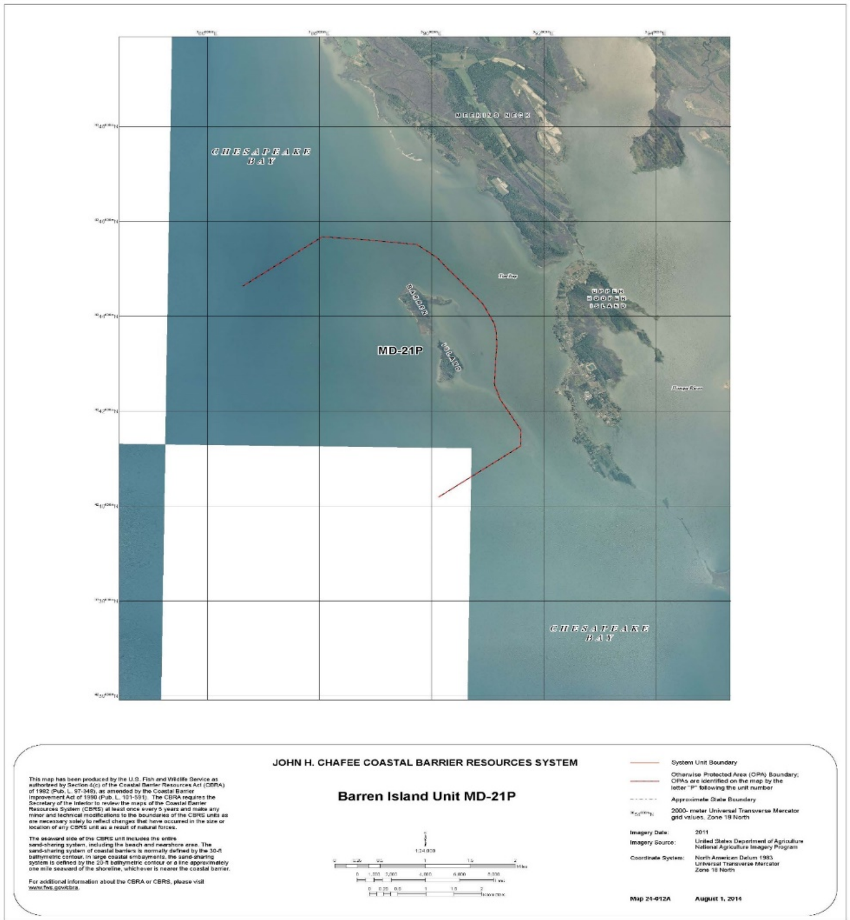
The leatherback, federally listed as endangered, is the largest, deepest diving, and most migratory and wide ranging of all the sea turtles. They inhabit open ocean and nest on sandy beaches backed with vegetation and sloped sufficiently so that distance to dry sand is limited. The leatherback sea turtle is distributed worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans. Nesting occurs from March to July at an average of five to seven times within the nesting season. Clutch size averages 80 to 85 eggs. The decline of leatherback sea turtles is attributed to exploitation by humans for their eggs and meat, as well as incidental take in numerous commercial fisheries in the Pacific. Other factors include degradation of nesting habitat from coastal development, disorientation of hatchlings by beachfront lighting, nest predation by native and non-native predators, degradation of foraging habitat, marine pollution and debris, and watercraft strikes (NMFS and USFWS 2013). The Service recommends that the Corps pursue appropriate coordination and consultation with NMFS who has Federal jurisdiction over leatherback sea turtle.

Loggerhead Sea Turtle (*Caretta caretta*)

The loggerhead sea turtle, federally listed as endangered, is characterized by a large head with blunt jaws. It is found worldwide in tropical and temperate waters of the Atlantic, Pacific, and Indian Oceans, and is widely distributed throughout its range. The loggerhead sea turtle may be found hundreds of miles out to sea as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers. Foraging occurs in coral reefs, rocky places, and ship wrecks. Nesting occurs mainly on open beaches or along narrow bays having suitable sand and it is often found in association with other species of sea turtles. Loggerheads are known to nest from one to seven times within a nesting season with an average of 4.1 nests. Average clutch size varies from 100 to 126 eggs. Threats include loss or degradation of nesting habitat from coastal development and beach armoring, disorientation of hatchlings by beachfront lighting, nest predation by native and nonnative predators, degradation of foraging habitat, marine pollution and debris, watercraft strikes, disease, and incidental take from channel dredging and commercial trawling, longline, and gill net fisheries (NMFS and USFWS 2008). The Service recommends that the Corps pursue appropriate coordination and consultation with NMFS who has Federal jurisdiction over loggerhead sea turtle.

Coastal Barrier Resources Act

The Coastal Barrier Resources Act (CBRA) and its amendments prohibit most new Federal expenditures that tend to encourage development or modification of coastal barriers. The laws do not restrict activities carried out with private or other non-Federal funds and only apply to the areas that are within the defined John H. Chafee Coastal Barrier Resource System (CBRS). The Barren Island project area is defined as an Otherwise Protected Area (OPA), therefore construction of the project would not be prohibited. The James project area has no CBRA areas. Figure 5 shows the extent of the mapped CBRA zone relative to the proposed Barrier Island project.



Invasive Species

The disturbance associated with the placement of fill material could encourage recruitment and/or spread of the invasive common reed (*Phragmites australis*) within or adjacent to the project area. Factors like construction, exposed soil, and the availability of nearby seed all contribute to the invasion of the species discussed in this section. The Service recommends that the project include a monitoring plan for this species pre- and post-construction, and include adaptive management measures such as identifying a threshold of acreage that would trigger implementing control measures if the need arises. The risk of common reed invasion will be greatest during the first years after construction and should decrease when the native vegetative cover becomes well established.

Nutria (*Myocastor coypus)* are large semi-aquatic mammals native to South America. They are about two feet long, with a large head, short legs and stout body; adults weigh 15-20 pounds, about one-third the size of a beaver, and 5-8 times larger than a muskrat. They are dark brown in color and are highly adapted for semi-aquatic life. The species was originally brought to the United States in the late 1800's for its fur. The nutria fur market collapsed about fifty years later, and subsequently thousands of nutria were released or escaped by those who could no longer afford to feed and house them. Nutria are herbivores, and can destroy crops, native aquatic vegetation and have been known to decimate marsh and wetland areas. Their preferred diet includes roots, rhizomes and tubers of cattails, cordgrass and bulrush. Nutria feed on these plants that hold wetland soil together, which intensifies the loss of coastal marshes that has been exacerbated by sea level rise (USDA Aphis 2020). Their style of eating, digging, rooting and swimming exacerbates erosion and accelerates the conversion of healthy marsh into open water. They have a high reproductive rate and have been found in over 20 states. Maryland's eastern shore has lost thousands of acres of marshland due to nutria's feeding habits. The Chesapeake Bay Nutria Eradication Project (CBNEP) began in 2002 to remove nutria from the marshes of the Delmarva and to protect, enhance and restore the ecosystems damaged by nutria feedings. Because of CBNEP's efforts, the team has nearly eradicated nutria from Blackwater National Wildlife Refuge and continues to monitor the area to confirm absence (USDA Aphis 2020). The Service recommends that the project include monitoring for the presence of nutria and provide for implementing control measures if the need arises.

Mute Swan (*Cygnus olor)* are an invasive species, native to Eurasia that was brought to the United States in the late 19th century. They are recognizable by their large size, all white feathers and orange bills (the bill color is what distinguishes them from other swan species). Their weight ranges from 16 to 25 pounds, with a wingspan of up to 8 feet. Their nests are 5 to 6 feet in diameter, and about 1.5 to 2 feet high. They typically use emergent wetland vegetation to construct their nests (USDA Aphis 2018). Mute swans have a clutch size of between 5 to 6 eggs and nesting begins around March. They are primarily diurnal and feed exclusively on submerged aquatic vegetation, up to 8 pounds of vegetation each day, which destroys a valuable resource for other wildlife and fish. Mute swans only consume about half of the SAV they uproot, remnant SAV is often found floating in areas where they have fed. SAV is critical to the health of many organisms, it protects water quality, prevents erosion and provides food and shelter for fish, shellfish, invertebrates and waterfowl. MDNR completed research that provided evidence that SAV grazing by mute swans, especially during spring and fall growth, during reproductive periods, and when SAV is planted is an impediment to achieving objectives that were identified in the Vital Habitat Protection and Restoration Section of the Chesapeake 2000 Agreement (MDNR 2011). The Chesapeake 2000 Agreement is a cooperative agreement that was signed by Governors of Maryland, Virginia, and Pennsylvania, Mayor of the District of Columbia, Chesapeake Bay Commission and the Environmental Protection Agency. It includes goals that address invasive species and SAV restoration. The Agreement directed jurisdictions to identify invasive species that were of significant negative impact to the Bay's ecosystem and required the formulation and development of management plans for those species. Mute swan was identified as one of the priority species requiring regional management and population control. They are direct competitors for other waterfowl with respect to food and nesting habitat and can be extremely aggressive when nesting and raising young. During one incident on Barren Island, a large flock of swans caused a colony of state-listed least terns and black skimmers to abandon their nesting colony, and had trampled nests, eggs and chicks (USDA Aphis 2018; Matt Whitbeck Pers. Comm.). MDNR promulgated regulations that guide captive swan management and prohibit the sale, transfer, importation, and exportation of mute swans. MDNR management objectives include reducing the mute swan population to as few birds as possible to restore and enhance the Bay's Living Resources (MDNR 2011). The Service recommends that the project include monitoring for the presence of mute swans and provide for implementing control measures if the need arises through coordination with MDNR.

Conclusion

The Mid-Chesapeake Bay Ecosystem Restoration Project at Barren and James Islands will use clean dredged material from the bay's channels to restore and create tidal wetland and upland areas. These newly created areas should provide critical island habitat for many of the Service's trust resources and priority species. Construction occurring in habitat areas where black rail is present will require a Section 7 consultation. Consultation pursuant to the Endangered Species Act of 1973 will also be required with the Service if the presence of any other threatened and endangered species occurs within the project area of impact. Additionally, there are several species that utilize the project area that are state listed as threatened or endangered (least tern, common tern, and royal tern). The Wildlife and Heritage Services within MDNR is responsible for the identification and protection of these species in Maryland. Invasive species detection and monitoring (principal concern being common reed, nutria, and mute swan) should be a component of project implementation. Best management practices should be implemented to avoid detrimental impacts to aquatic resources. Coordination with NMFS is recommended regarding potential impacts to EFH and NMFS trust resources.

The preferred alternative should minimize any adverse effects to Service trust resources by optimizing for environmentally compatible options such as maintaining and enhancing important habitats through beneficial use of dredge material. Many of the species mentioned require high marsh habitat and would benefit most with alternatives proposing a greater percentage of high marsh. Irregularly flooded high marsh is of particular value in this area. High marsh habitat is critical for the survival of several at-risk species, including black rail and saltmarsh sparrow. Maryland's Eastern Shore was historically a center of abundance for black rails, but populations have declined more than 90 percent in less than 25 years (Watts 2016). Saltmarsh sparrows are specialists of irregularly flooded high marsh habitat. Range wide, saltmarsh sparrow populations are estimated to have declined 87 percent since the late 1990s (USFWS 2020). Managing and restoring high marsh habitat is critical to the survival of these species in the Chesapeake Bay. From a longevity standpoint, maximizing the elevation of the marsh surface within the tide range will maximize the resilience of the marsh to relative sea level rise, as well as provide critical habitats for at-risk species. The higher the marsh surface within the tidal zone (i.e. elevation capital), the longer the marsh can remain vegetated given the pressure of relative sea level rise (Cahoon and Guntenspergen 2010). Equally important, belowground biomass for *Spartina* *patens* is highest at higher elevations and decreases with increasing rates of inundation (Kirwan and Guntenspergen 2015). Below ground plant biomass is an important biological mechanism for building marsh elevation and keeping pace with sea level rise (Kirwan and Megonigal 2013).

The Service also recommends placing bird islands on the southern boundary of the project area. These islands should be placed as far from Barren Island as possible. Increasing distance will create isolation for the nesting colonies and make it more difficult for predators to access the bird islands. The islands should be between 1-3ac (based on what has been successful at Poplar Island), and at least 12” of shell material placed on top to encourage colony nesting as well as discourage vegetation growth.

We also recommend that the Corps consider altering the design and direction of the breakwater proposed to be placed at the south end of the project area. We recommend extending the breakwater to allow for a more southern placement of bird islands. This could mean potentially encroaching on the natural oyster beds (NOB) and SAV sites. If the breakwater is extended in a more eastern direction this could affect SAV and oyster growth during construction phase, but would protect SAV and oyster beds in the long term, and could offer protection to the leeward side of Barren Island and the bird islands.

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Information for Planning and Coordination Report (IPaC) Updated - April 2023

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127

In Reply Refer To: April 25, 2023
Project Code: 2023-0073911
Project Name: Barren Island

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

To Whom It May Concern:

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

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

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

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- Coastal Barriers

OFFICIAL SPECIES LIST

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

This species list is provided by:

Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
(410) 573-4599

PROJECT SUMMARY

Project Code: 2023-0073911
Project Name: Barren Island
Project Type: Restoration / Enhancement - Wetland
Project Description: The project description includes the dredging of sand from a borrow area adjacent to Barren Island for use in restoration efforts at Barren Island as part of the Mid-Bay Island Project. The first phase of the Barren Island restoration consists of modification and creation of several thousand feet of stone structures. Future phases of the Barren Island restoration will include foundation removal and replacement in areas of poor foundation, creation of bird islands adjacent to the proposed breakwater, and placement of dredged material for wetland restoration. A source of sand borrow is needed to facilitate all these objectives.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.33416945,-76.27382556749424,14z

Counties: Dorchester County, Maryland

ENDANGERED SPECIES ACT SPECIES

There is a total of 0 threatened, endangered, or candidate species on this species list.

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

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

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

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

CRITICAL HABITATS

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

COASTAL BARRIERS

Projects within the John H. Chafee Coastal Barrier Resources System (CBRS) may be subject to the restrictions on Federal expenditures and financial assistance and the consultation requirements of the Coastal Barrier Resources Act (CBRA) (16 U.S.C. 3501 et seq.). For more information, please contact the local Ecological Services Field Office or visit the CBRA Consultations website. The CBRA website provides tools such as a flow chart to help determine whether consultation is required and a template to facilitate the consultation process.

OTHERWISE PROTECTED AREA (OPA)

OPAs are denoted with a "P" at the end of the unit number. The only prohibition within OPAs is on Federal flood insurance. ***CBRA consultation is not required for projects within OPAs.*** *However, agencies providing disaster assistance that is contingent upon a requirement to purchase flood insurance after the fact are advised to disclose the OPA designation and information on the restrictions on Federal flood insurance to the recipient prior to the commitments of funds.*

UNIT	NAME	TYPE	SYSTEM UNIT ESTABLISHMENT DATE	FLOOD INSURANCE PROHIBITION DATE
MD-21P	Barren Island	OPA	N/A	11/16/1991

IPAC USER CONTACT INFORMATION

Agency: Army Corps of Engineers
Name: Joseph Chandler
Address: 2 Hopkins Plaza
City: Baltimore
State: MD
Zip: 21201
Email joseph.w.chandler@usace.army.mil
Phone: 4109622809

APPENDIX C3: Clean Water Act Section 404(b)1 Evaluation

CLEAN WATER ACT
SECTION 404(b)(1) EVALUATION

MID-CHESAPEAKE BAY ISLANDS ECOSYSTEM RESTORATION PROJECT: BARREN ISLAND DORCHESTER COUNTY, MARYLAND

OCTOBER 2021

Prepared by:
U.S. Army Corps of Engineers
Baltimore District
2 Hopkins Plaza
Baltimore, MD 21021

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Clean Water Act Section 404(b)(1) Evaluation

Barren Island Ecosystem Restoration

LIST OF FIGURES

LIST OF TABLES

1.0 PROJECT DESCRIPTION

1.1 Location

The Mid-Chesapeake Bay Islands Ecosystem Restoration (Mid-Bay) Project is located at James and Barren Islands in Dorchester County, MD along the eastern shore of the Chesapeake Bay (Figure 1). James Island is situated north of Taylor Island. Barren Island is a small island located approximately 1 mile east of Hoopers Island. Originally attached to the Delmarva Peninsula, Barren Island has now eroded into two smaller, separate land masses. This 404(b)1 evaluation will focus on the Barren Island component of the project.

The project area lies within the Atlantic Coastal Plain physiographic province. The Coastal Plain is underlain by unconsolidated sediments including gravel, sand, silt, and clay. Barren Island is comprised of Holocene Tidal Marsh Deposits and the Kent Island Formation which primarily consist of silt and clay with thin beds of sand. Barren Island is situated within the Environmental Protection Agency's (EPA) Region III Middle Atlantic Coastal Plain – Chesapeake-Pamlico Lowlands and Tidal Marshes. This ecoregion is typically low in elevation generally ranging from 0 to 50 feet. The ecoregion has a maximum elevation of 6 feet above mean high tide, and is representative of flat terrain, tidal marshes, wetlands, and low-gradient streams. Due to its low elevation, unprotected shorelines, and vulnerability to wake caused by ship traffic, Barren Island has lost approximately 74 to 78% of its historical acreage, roughly 520-660 acres.

Barren Island was acquired in 1993 by the United States Fish and Wildlife Service (USFWS) and is managed as a satellite refuge of the Chesapeake Marshlands National Wildlife Refuge Complex. A small portion of the island on the northwest was restored by USACE-Baltimore District Operations and Navigation Division in 2003 using dredge material taken from the realignment of the adjacent Honga River channel. The Tar Bay Wildlife Management Area (WMA), a small section of Barren Island, originally a separate land mass off the northeast shoreline, is owned by the Maryland Department of Natural Resources (MDNR) and managed by its Wildlife and Heritage Service to conserve and enhance wildlife and their habitats and provide recreational use of the wildlife resources. Tar Bay WMA was created in the 1980s by placement of dredged material from the Honga River channel.

1.2 Project Background and Description

A full description of the history of the project is provided in supplemental Environmental Assessment (sEA) to which this evaluation is attached. The Mid-Bay Project is an environmental restoration/beneficial dredge use project proposed for the Chesapeake Bay. The project includes components at James Island and Barren Island. Dredged material from the Upper Chesapeake Bay Approach Channels to the Port of Baltimore will be beneficially used to restore wetland and upland habitat at James Island. Protective measures will be placed at Barren Island to protect the existing habitat and dredged material from federally-maintained small navigation channels utilized to restore wetlands habitat on the interior of the protective structures.

As determined by the 2009 *Mid-Chesapeake Bay Island Ecosystem Restoration Integrated Feasibility Report and EIS*, the Barren Island Project component was formulated to provide minor dredged placement capacity, protect the existing island resources, reduce erosion of the existing shoreline at Barren, create wetlands, and protect areas of submerged aquatic vegetation (SAV) from high wave energy. The feasibility design has undergone minor modifications to take into consideration existing conditions. The feasibility design provided for three protective measures as listed below, plus consideration of a breakwater element south of the island in the Preconstruction, Engineering and Design (PED) phase:

Figure 1. Study Area

- a western sill alignment of approximately 13,550 linear feet (lf),
- a northern sill alignment of approximately 3,840 lf, and
- a southern sill alignment of approximately 1,300 lf.

Each alignment was laterally located just offshore in relatively shallow water (est. 3-4 feet of depth at mean lower low water (MLLW)). The northern portion of the western protection included a modification to the existing sill (4,900 lf of 13,550 ft) and consisted of adding one layer of armor stone to the existing project to raise the top of the structure from the existing elevation +2 feet MLLW to +4 feet MLLW. The new and revised sills were planned to be built to an elevation of +4 MLLW. Planning, Engineering, and Design (PED) Phase was to determine the need for and if needed, extent of a southern breakwater following the historic shoreline in order to protect the SAV habitat to the south and southeast of Barren Island. This breakwater was proposed to be at a maximum 8,200 feet in length and built to and elevation of +6 feet MLLW. The recommended plan included backfilling between the created structures and the existing island in order to create approximately 72 acres of wetlands along the shoreline of the island. One additional feature included in the feasibility recommended plan was the consideration during PED of habitat enhancements. As part of the evaluation for the southern breakwater, a consideration was to be made for incorporating bird nesting habitat into the design. An addition of one or more islands isolated from the main Barren Island formation would provide high quality nesting habitat for birds. Nesting habitat for birds free of predators is becoming scarce in the Chesapeake Bay. This habitat would support nesting for various tern species (e.g., common and royal terns) and black skimmers.

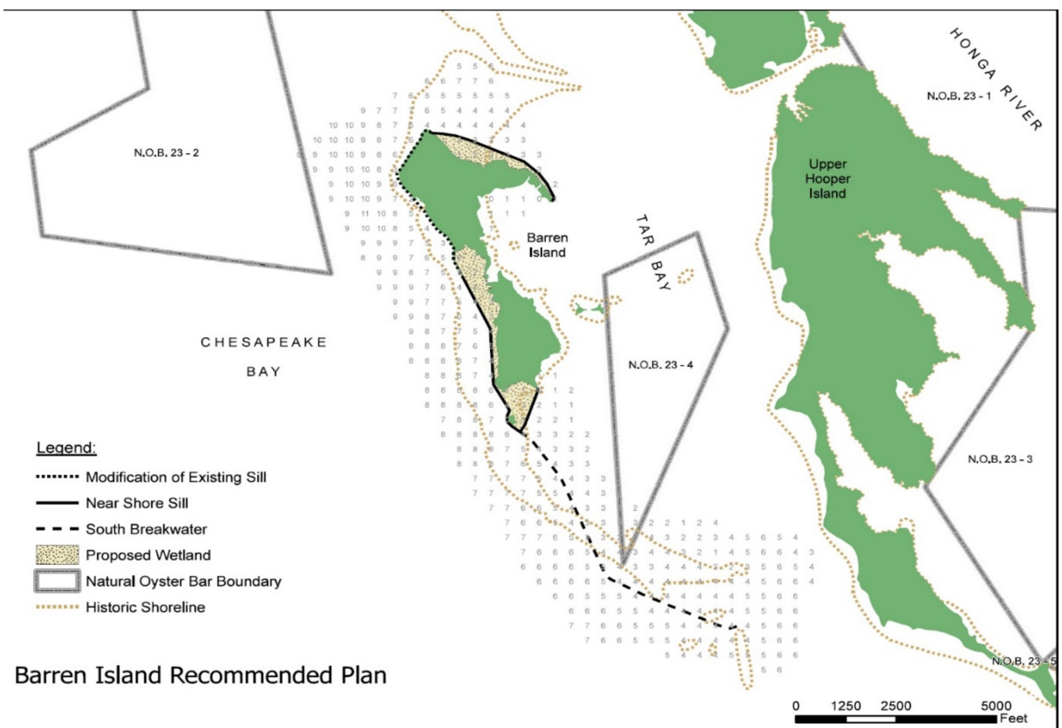

Figure 2. Barren Island Recommended Plan from the Feasibility Study

1.3 Purpose

The Mid-Bay study built upon the Federal and State's DMMP planning efforts to identify beneficial use sites to meet dredged material capacity needs and habitat restoration goals. The prior study determined the technical, economic, and environmental feasibility of protecting, restoring, and creating aquatic, intertidal wetland, and upland habitat for fish and wildlife within the Mid-Chesapeake Bay Islands study area using clean dredged material from the Baltimore Harbor and Channels Federal navigation project. The PED phase will incorporate current site conditions into an updated design and provide a complete design for construction of the Mid-Bay recommended plan.

1.4 Preferred Alternative

As part of the PED phase, the feasibility design has been updated to account for current conditions and consider inclusion of a southern breakwater and bird islands through evaluation of a No Actionand seven alternatives. The preferred alternative (Figure 3) includes the construction of approximately 13,046 linear feet of new and modified stone sills and 4,270 linear feet of segmented breakwater to immediately provide increased protection to the eroding Barren Island and to the extensive submerged aquatic vegetation (SAV) beds to the east of the Barren Island, and installation of 2 bird islands (approximately 8.5 acres total) and approximately 83 acres of wetlands. The stone sills will be constructed to an elevation of +3.52 feet NAVD88 and the breakwater to an elevation of +5.52 feet NAVD88.

The preferred alternative includes restoration of 83 acres of wetlands and 8.5 acres of bird islands. Authorized maintenance material dredged from small local federal navigation channels will be placed behind the confining stone sills up to the Mean High Water (MHW) elevation to restore wetlands habitat. Restoration of the full wetlands goal is expected to take multiple dredging cycles. Wetlands will include low and high marsh plantings as well as some intertidal mudflats. During final wetland development planning, current conditions will be evaluated with respect to sea level rise projections and determinations of sustainable marsh elevations to identify high to low marsh distributions.

At the southern end of the restoration Project, two small bird islands will be integrated into the breakwater. The bird islands will range from 3.5 – 5 acres for a total of approximately 8.5 acres. The bird island designs incorporated natural resource agencies' input to allow for greater distance from the main Barren Island and between the two islands to avoid predation, while maintaining benefits to SAV bed habitat with the use of a segmented breakwater design. The bird islands will have a natural connection to Tar Bay for access to the water. Based on the analysis completed, the Project includes the following (Figure 3):

- 13,046 linear feet of sill,
    - modification of 4,850 linear feet of current sill
    - creation of 8,173 lf new sills
- 4,270 linear feet of breakwater,
- 2 bird islands (8.5 acres total), and
- Approximately 83 acres of wetland and intertidal mudflats.

Figure 3. Barren Island Restoration Plan

constructed to an elevation of +3.52 feet NAVD88 and the breakwater to an elevation of +5.52 feet NAVD88. The existing sills are at an elevation of 0 – 1 ft NAVD88. They will be brought up to the 3.52 elevation by placing stone over the pre-existing structure until the desired elevation is reached. The completion of the sills and breakwaters will provide immediate protection to the eroding Barren Island shoreline. Additionally, the structures will help to provide conditions for SAV beds directly to the east of the island and protect the mainland shoreline from erosion.

Subsequent phases of the project will encompass dredging of sand for foundation replacement under the northeast sill, temporary dike construction for wetland restoration, and bird island habitat development. Approximately 52,500 cubic yards of unsuitable foundation material will be dredged from the northeast Barren Island stone sill location to an approximate depth of 7 feet. The dredged material will be placed hydraulically or mechanically within the confined area found behind the constructed sills at Barren Island. Approximately 63,000 cy of suitable/approved fill material will be placed in the void created by removal of the unsuitable material to create a solid structurally sound base for the northeast sill. While it is anticipated that sand material will be used to backfill the void created by removal of the unsuitable material at the northeast sill, stone materials from a local quarry may also be used. Identification of a clean sand borrow area for use in foundation replacement, construction of interior dikes for wetlands restoration, and bird island restoration is in progress. This 404(b)1 evaluation covers all project components except the borrow area. The borrow area will be covered by a future NEPA document once identified.

The final phase of the Project would be placement of dredged material for wetland restoration and development of wetland habitat. Once the confining sills are constructed, and dredged material is available, the Project's habitat components will be constructed. Approximately 429,000 cubic yards of authorized maintenance material dredged from small local federal navigation channels will be placed behind the confining stone sills up to the MHW elevation. Since several dredging cycles would be required to meet the material capacity of the proposed restored wetland acreage, this is considered a long-term restoration project. Placed dredged material will be used for the restoration of approximately 83 acres of wetlands/mudflats. Wetlands will include low and high marsh plantings as well as some intertidal mudflats. During final wetland development planning, current conditions will be evaluated with respect to sea level rise projections and determinations of sustainable marsh elevations to identify high to low marsh distributions. It is anticipated that a higher proportion of high marsh would be designed to enable migration of low marsh with sea level rise versus conversion to open shallow water. Tidal exchange will be established through use of open tidal guts or outfall structures after the material is stabilized. The design will aim to take advantage of any freshwater flow from the island to augment tidal gut flow. To the extent practicable, wetlands will be designed to allow for estuarine connectivity via gaps and tidal creeks to maximize value to fisheries resources. At the southern end of the restoration Project, two small bird islands will be integrated into the breakwater. The bird islands will range from 3.5 – 5 acres for a total of approximately 8.5 acres.

The bird islands are designed using tiered elevation control structures and stone sills to confine approximately 154,000 cubic yards of sand from the borrow area that will be used to construct the bird islands. Construction of the bird islands would utilize approximately 50% of the sand that would be dredged from the borrow area. The bird island designs incorporated natural resource agencies' input to allow for greater distance from the main Barren Island and between the two islands to avoid predation, while maintaining benefits to SAV bed habitat with the use of a segmented breakwater design. The stone confining units to the west are designed to withstand erosional forces based on H&H modeling, while the east side is designed to allow chicks to enter the tidal waters. Occasional wash over will assist with vegetation control.

1.5 Alternatives Considered

The 'No Action' alternative and five additional alternatives were initially formulated for evaluation within this sEA:

- Alternative 1 is the 'No Action' or base condition that represents existing conditions without any future Federal actions.
- Alternative 2 is protective structures (sills) around Barren Island only, without inclusion of a southern breakwater.
- Alternative 3 is Barren Island protection with the full breakwater proposed in the 2009 Feasibility Report.
- Alternative 4 is Barren Island protection plus a shortened southern breakwater.
- Alternative 5 is Barren Island protection plus a shortened southern breakwater and two remote bird islands south of the southern breakwater terminus.

- Alternative 6 is Barren Island protection plus a shortened breakwater and a segmented section that covers the extent of the full breakwater.
- Alternative 7 was developed through an iterative process and secondary analyses of Alternatives 5 and 6. This alternative includes three bird islands and optimizes the benefits of Alternatives 5 and 6 and minimizes the negative effects of an induced increase in velocity on SAV habitat.
- Alternative 8, the Preferred Alternative, has most of the components of Alternative 7; however, the bird islands have been reduced to from three to two islands. This reduction allows the two bird islands to have greater separation from one another and the main Barren Island. This configuration will provide additional predator free, remote island habitat specifically for shorebirds. Also, the wetland cell located at the southern tip of the southern remnant included in Alternatives 2 through 7 has been removed from Alternative 8. This is because foundation materials on the bay bottom in this area are not suitable for the construction of the sills necessary to contain the dredged material.

The full evaluation of the alternatives is provided in the sEA. Five factors were considered to evaluate the alternatives:

1. hydrologic and hydraulic (H&H) modeling
2. historic island footprint,
3. suitable foundation and need to perform foundation replacement,
4. ecosystem resources: oysters and SAV, and
5. ability to incorporate remote island bird habitat.

1.5.1 Alternative 1

The No Action Alternative would involve no further Federal actions to restore or conserve Barren Island.

1.5.2 Alternative 2

Alternative 2 (Figure 4) includes protective structures (sills) around Barren Island with no southern breakwater and includes restoration of 104 acres of wetlands.

1.5.3 Alternative 3

Alternative 3 (Figure 5) involves sills around Barren Island and the full southern breakwater along the alignment outlined in the 2009 Feasibility Report. The breakwater would be the maximum 8,200 feet in length and built to an elevation of +6 feet MLLW. Alternative 3 includes restoration of 104 acres of wetlands.

Figure 4. Alternative 2

Figure 4. Alternative 2

Figure 5. Alternative 3

1.5.4 Alternative 4

Alternative 4 (Figure 6) includes sills around Barren Island with a short southern breakwater of 5,350 ft and restoration of 104 acres of wetlands.

1.5.5 Alternative 5

Alternative 5 (Figure 7) includes sills around Barren Island, a short southern breakwater, restoration of 104 acres of wetlands, and two independent bird islands at the southern end of the breakwater. Each island is 590 ft in length and 350 ft wide.

1.5.6 Alternative 6

Alternative 6 (Figure 8) includes sills around Barren Island, a short southern breakwater, a segmented breakwater system at the southern end of the breakwater, and restoration of 104 acres of wetlands. The southernmost row of breakwaters is set in the same footprint as the full breakwater modeled in Alternative 3. Each breakwater is 360 ft in length.

1.5.7 Alternative 7

Alternative 7 was developed by refining and merging Alternatives 5 and 6 (Figure 8). The alignment was moved west to provide a position over historic island bottom to avoid the need for foundation replacement. An additional bird island was added to simulate a segmented breakwater. Alternative 7 includes sills around Barren Island, a shortened breakwater, and three distinct bird islands. A 480 ft long breakwater was added to the southern portion of the sill. Resource agency feedback was incorporated to establish distances to minimize the possibility of predator interactions from the main Barren Island. It was proposed that a 330 ft gap between the breakwater with bird islands and the southern breakwater would be sufficient to prevent predators from accessing the bird islands. The gap between the breakwater and the northernmost island is approximately 350 ft, and the islands range from roughly 480 to 710 ft in length along their western shorelines and are approximately 230 to 300 ft in width. Figure 8 depicts Alternative 7. This alternative minimizes impacts associated with the footprint of the breakwater, avoids foundation replacement associated with the breakwater and prior island alignments, provides conditions suitable for SAV in Tar Bay, and includes bird islands for nesting habitat. Additionally, Alternative 7 provides for restoration of approximately 104 ac of wetlands habitat.

1.5.8 Alternative 8 – Preferred Alternative

Following presentation of the alternatives evaluation and Alternative 7 to resource agencies, a number of revisions were made resulting in Alternative 8, the Preferred Alternative (Figure 9). Additional historical data on bird nesting on islands in the Barren Island vicinity was provided by the resource agencies. This information suggested that a greater distance was needed to make the habitat of value to nesting birds. At the request of the resource agencies, an evaluation was conducted to determine how to add distance between the bird islands and position the islands over the historic small islands that had provided nesting habitat prior to the 2000s. This resulted in the removal of the central island and shifting of the most southern bird island to the south. Additional modeling will be conducted on this selected alignment as the final design is completed, but it is expected that the preferred alternative will perform similarly to Alternatives 6 and 7 with respect to protection of SAV habitat. Alternative 8 (Figure 9) includes sills around Barren Island, a short southern breakwater, restoration of 83 ac of wetlands, and two independent bird islands (approximately 8.5 ac total) at the mid-point and southern end of the shortened breakwater.

Figure 6. Alternative 4

Figure 7. Alternative 5

Figure 8. Alternative 6

Figure 9. Alternative 7

Figure 10. Alternative 8 / Preferred Alternative

2.0 DISCHARGES

2.1 General Description of Discharge Material

2.1.1 Stone Sills

The design for Barren Island calls for 13,546 linear feet of trapezoidal stone sills to be constructed off the shoreline in relatively shallow water with portions of the sill incorporating the existing, smaller sill constructed under a previous island stabilization project. The proposed height of the sill is elevation 3.5 NAVD88 to protect the shore from a 30-year design storm water surface elevation. However, stone sizing computations used the wave energy from a 100-year storm to size the armor stone. Resiliency has been built into the sill design; the crest of the sill is 10.8 feet wide which allows for increasing the height of the sill to accommodate future sea level rise without increasing the footprint of the stone structures. The sills will act as the seaward protection to future, beneficial dredge-use, wetland creation, however, each sill is designed to be free-standing and independent of fill material.

2.1.2 Stone Breakwater

To minimize wave energy and prevent the loss of SAV habitat east of Barren Island, a total of 4,269 linear feet of stone breakwaters will be constructed. The stone breakwaters were designed to the water surface elevation of the 50-year storm with stone sized for the 100-year storm.

2.1.3 Bird Island Habitats

The Bird Island Habitats consist of two unvegetated islands, Island A (4.9 acres) and Island M (3.4 acres). The two islands are isolated from the main Barren Island by 366 feet of open water and will be incorporated into the breakwater alignment. The interior of the islands will be filled with a well-draining material and capped with a sand and clam shell mixture. The height of the island is set at the 10-year design storm water surface elevation to facilitate periodic overtopping for the purpose of vegetation management. The east end of the islands will step down in elevation until the edge reaches MHW so that bird hatchlings will be able to access the water. The back end of each island will be protected by a rock reef that will form a slight embayment along the eastern edge of each island. These islands will provide high quality nesting habitat for migratory birds.

2.1.4 Wetlands

The Design Team has identified three areas for dredge disposal acceptance: the northeast corner, the northwest corner, and the western edge of Barren Island. The boundaries of the wetlands will be defined by the stone sills and the MHW elevation along the shore of the Island; the majority of the wetlands will be created on the land controlled by the State with minor tie-ins to the property owned and maintained by USFWS. The wetlands will take multiple inflows of dredge material. Planting of the wetlands will commence after each backfilled portion or cell is filled and consolidated to the required elevations. Due to the availability of dredge material and the need for settling time between inflows, wetland design will not be incorporated into Phase 1. The table below displays approximate areas, average depths, and volumes associated with the island and its existing wetlands.

Table 1. Barren Island Proposed Wetland Volumes			
Wetland	**Area (ac.)**	**Average Depth (ft.)**	**Total Assumed Volume (cy)**
NE Wetland	22.19	4	145,000
NW Wetland	12.36	2	40,000
West Wetland	42.50	6	411,000

2.1.5 Outfalls

Outfalls were not identified under the 2009 Mid-Bay Feasibility Report because it was initially believed that source material for the wetlands would be clean sand. However, Honga River dredge material has been identified as silty material, and once hydraulically placed behind the stone sills, this material will need to be dewatered to provide clear effluent discharge into the Bay. Six outfalls, two for each proposed wetland, will be permitted. The proposed locations of these outfalls were chosen for the relatively deep discharge point along the sill alignment to promote future fish passage between the Bay and the wetland; however, they will not be constructed during Phase 1. The outfalls will not have electrical power provided from the mainland, and any mechanism, whether gate or valve, will need to be operated manually. After sufficient time has passed to allow for sediment to settle from the dredge material, the outfalls will be opened to allow for water to transfer from the spoil area. The outfalls will allow for control of clean effluent to discharge from the dredge material and provide control for flow to and from the bay while the new wetland material stabilizes. The completed design for each outfall will be conducted concurrent to the design of their relative wetland.

2.1.6 Source of Construction Material

An application for a Tidal Wetland License to use a sand borrow area first identified under the EIS was submitted to the Maryland Department of Environment (MDE). The intended use of the borrowed sand is for foundation remediation, wetland dikes, and possibly fill material for the bird island habitats. The total volume of sand needed will be calculated in later phases. MDE and local stakeholders have requested another source of sand be identified for use in the BIR. Dredging and stockpiling will not be a part of Phase 1.

2.1.7 Sill Alignments and Cross Sections

Phase 1 of the BIR will consist of design and construction of sills. Each sill will be constructed to an elevation of 3.5 NAVD88. Additionally, the sills will be 10.8 feet wide at the crest and extend to the sill apron at a 2:1 slope. A layer of geotextile will be placed along the sill alignment prior to installation of stone where possible. The interior of the sill will be constructed of quarry spalls, with the exterior constructed of two layers armor stone at a W_{50} varying according to the alignment. The existing sill will be raised to a design elevation with quarry spalls and capped with armor stone.

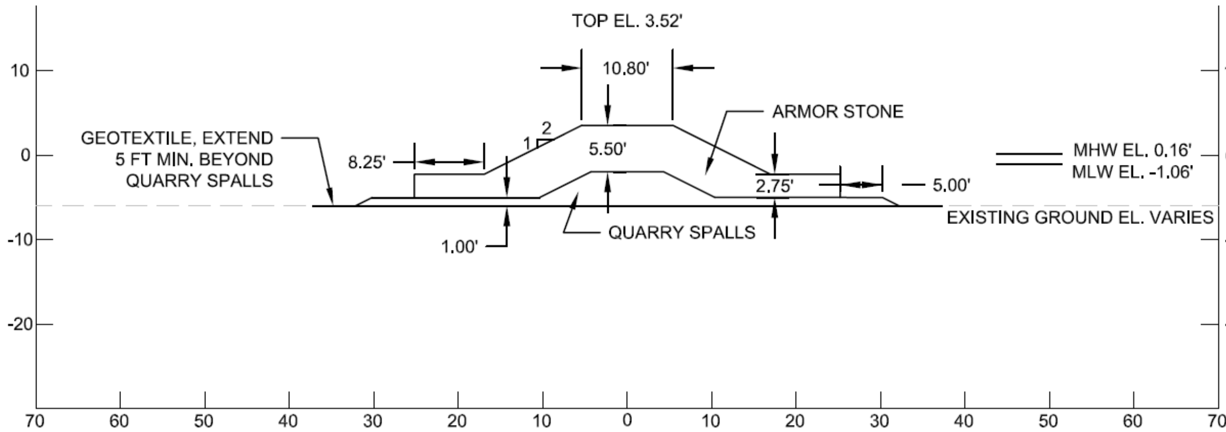

Figure 11. Typical Sill Cross Section

2.1.8 Breakwater Alignments and Cross Sections

Phase 1 of the BIR will consist of design and construction of a segmented stone breakwater. Each segment of the breakwater is designed to be constructed to an elevation of 5.52 NAVD88, have a crest width of 10.8 feet, extending to the breakwater apron at a 2:1 slope. A layer of geotextile will be placed along the breakwater alignment beneath the initial course of core spalls. The interior of the breakwater segments will be constructed of core stone, and an outer layer of armor stone with a W_{50} of 4200 pounds will be added.

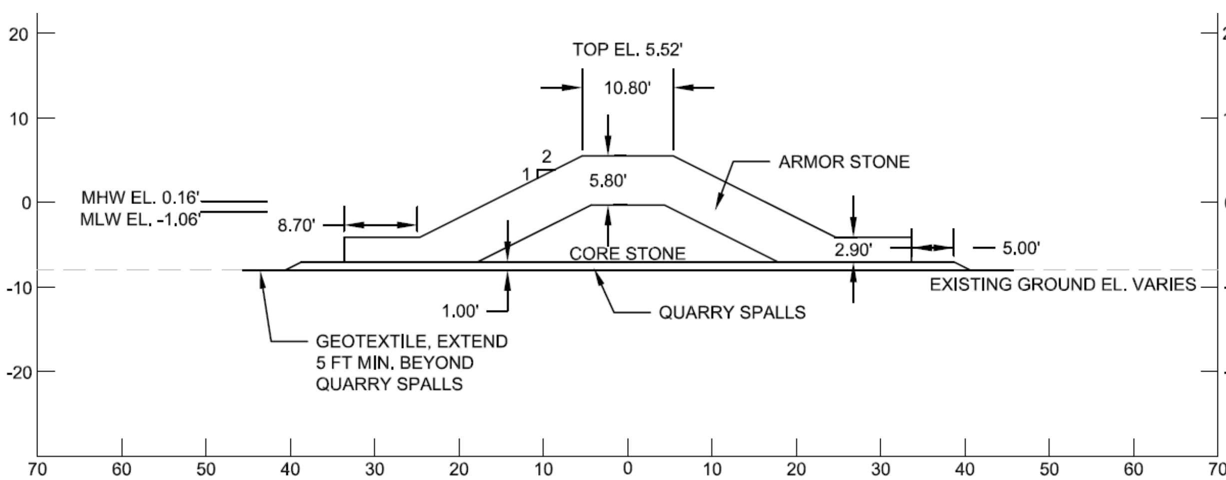

Figure 12. Typical Breakwater Cross Section

2.1.9 Exclusions

There will be no dredging or placement of dredge spoil in Phase 1 of the Barren Island Restoration. There will be no dredging for the purposes of foundation remediation. There will be no dredging for the purpose of sand borrow or stockpile. There will be no dredging of sand for the purposes of constructing the bird island habitat in Phase 1. There will be no wetland planting save for any re-seeding of disturbed areas where the stone structures may tie-in to Barren Island. There will be no outfall/spillway installed under Phase 1.

3.0 FACTUAL DETERMINATIONS

3.1 Physical Substrate Determinations

1) Topography and elevation – Barren Island is comprised of unconsolidated sediments including gravel, sand, silt, and clay. The Island is located at a very low topographic elevation, with a maximum elevation of 6-feet above mean high tide. The areas within the footprint of sills and breakwaters would experience a direct and long-term impact to elevations. Additionally, the areas planned for wetland restoration and bird island habitat would have a direct and long-term increase in elevation. These areas are currently submerged subtidal habitats with elevations ranging from – 1 ft MLLW to approximately – 11 ft MLLW. Bird island elevations would be +5.52 feet NAVD88 and grade down to provide a connection to Bay waters on the east. No impacts to topography, physiography, and the larger geologic context of the study area are anticipated.

2) Sedimentation, soils, and erosion – Waters around Barren Island are generally very shallow and contain an abundance of sediment from localized erosion of the island and urban runoff from the adjacent mainland. The soils are indicative of what is typically seen within tidally influenced Bay islands and consist of poorly to moderately well drained soils. Implementation of the preferred alternative would have a direct and long-term positive impact on erosion of Barren Island. Erosion would be reduced and likely eliminated in areas protected by sills. The soils on Barren Island would remain in place. This would also reduce the sedimentation in the shallow waters adjacent to Barren Island.

3) Physical Effects on Benthic Macroinvertebrates – There would be direct, long-term, negative impacts to benthic macroinvertebrates within the sill, breakwater, and bird island footprints that cover 81.4 acres of shallow, subtidal habitat. Non-motile species would be smothered. Mobile species would likely move from the area during construction. Areas adjacent to the footprint of the preferred alternative would likely experience a short-term, minor, and direct impact characterized by increased turbidity, reduced dissolved oxygen, and possibly a small increase in nutrients as bottom sediments are disturbed during construction. This impact would be expected to subside following the completion of construction. The stone sills and breakwaters constructed would provide structured habitat for colonization by a diverse assemblage of macroinvertebrates.

3.2 Water Circulation, Fluctuation, and Salinity Determinations

1) Water quality
    a. Salinity – No change expected.
    b. Chemistry – No change expected.
    c. Clarity – Water clarity is expected to decrease temporarily during construction and implementation of the various structures. However, long term water clarity is expected to increase as erosion along the island is projected to decrease.
    d. Color – Minor and temporary change is expected during construction due to minor increase in turbidity.
    e. Odor – No change expected.

f. Taste – Not applicable.
g. Dissolved Gas Levels – Activities such as placement of dredged material, rock structure placement and general construction activities may result is localized increases in turbidity and thus, decreasing dissolved oxygen levels.
h. Nutrients – Construction activities may cause unexposed nutrients within the sediment to become present; however, levels are anticipated to be within the state guidelines.
i. Eutrophication – No change expected.

2) Current patterns and Circulation
    a. Current Patterns and Flow – The Project is not expected to affect water currents in the mainstem of the Bay to the west of Barren Island. Implementation of the preferred alternative is expected to have direct and long-term, positive impacts on water currents within Tar Bay. By stabilizing Barren Island, the sills would enable Barren Island to continue to provide protection to the Tar Bay area from westerly winds and waves.
    b. Velocity – Current water velocities are expected to be maintained or slightly reduced throughout Tar Bay leeward of Barren Island. However, increased velocities are expected along the exposed face of newly constructed barriers and Bird Islands. Increased velocities may occur in the northeast in the Tar Bay Wildlife Management Area, particularly from storms driven by northerly winds.
    c. Stratification – No change expected.
    d. Hydrologic regime – No change expected.
3) Normal water level fluctuations – Ambient water levels would not be affected by implementation of the Project; however, water levels will fluctuate with the preferred alternative during storms. This impact would be temporary, intermittent, and direct. During storm conditions, the sills and breakwaters would have a direct and positive impact on water levels in the areas protected by the structures. Resiliency has been built into the sill design; the crest of the sill is 10.8 feet wide which allows for increasing the height of the sill to accommodate future sea level rise without increasing the footprint of the stone structures.
4) Salinity Gradients – No change expected.
5) Actions to Minimize Impacts – All construction activities will follow a sediment and erosion control plan. The plan will be developed, and specifications will state that compliance is mandatory for all applicable environmental protection regulations for pollution control and abatement.

3.3 Suspended Particulate/Turbidity Determinations

1) Expected changes in Suspended Particulates and Turbidity Levels within the vicinity of the Project site are expected to be minor and short-term. Turbidity is anticipated to subside to normal levels within a tidal cycle and upon construction completion. Best management practices would be implement during construction to further reduce excess sediment from reaching areas outside of the Project vicinity.
2) Effects on Chemical and Physical Properties of the Water Column
    a. Light Penetration – Minor, temporary decrease may occur during construction from turbidity.
    b. Dissolved Oxygen – A minor, localized and temporary depression of dissolved oxygen may occur during construction.

c. Toxic Metals and Organics – No evidence exists that suggests the presence of toxic metals or organics in the proposed project area.
d. Pathogens – N/A
e. Aesthetics – The aesthetics of the water column may be temporarily impacted due to the presence of equipment and materials, as well as increased turbidity. The impact is projected to be minor, localized, and temporary.

3.4 Contaminant Determinations

All the materials to be used to construct the projects would be free of contaminants. There is no knowledge of Hazardous, Toxic, or Radioactive Waste (HTRW) at the Project site. If HTRW is encountered during construction, the responsible party would be responsible for all HTRW response costs and solely responsible for ensuring that required HTRW response actions are accomplished in accordance with applicable requirements of Federal, State and local regulations.

3.5 Aquatic Ecosystem and Organism Determinations

1) Effects on Plankton – Some plankton may be destroyed during placement of materials during construction. No long-term effect is expected.
2) Effects on Benthic – There would be direct, long-term, negative impacts to benthic macroinvertebrates within the sill, breakwater, and bird island footprints that cover 81.4 acres of shallow, subtidal habitat. Non-motile species would be smothered. Mobile species would likely move from the area during construction. Areas adjacent to the footprint of the preferred alternative would likely experience a short-term, minor, and direct impact characterized by increased turbidity, reduced dissolved oxygen, and possibly a small increase in nutrients as bottom sediments are disturbed during construction. This impact would be expected to subside following the completion of construction. The stone sills and breakwaters constructed would provide structured habitat for colonization by a diverse assemblage of macroinvertebrates.
3) Effects on Nekton – Implementation of the preferred alternative would have a direct, short-term, and minor impact on nekton in the vicinity of Barren Island. Species affected are mobile and would be expected to vacate the Project area during construction. These impacts would cease when construction is over. Indirect, short-term, and minor impacts could result from disruptions to foraging during construction due to increased turbidity and the possibility that prey may move from the area.
4) Effects on Food Web – A temporary, minor reduction in benthic food sources may occur from the destruction of benthos within the project footprints, as well as disturbance of adjacent benthic habitat. These impacts would subside once construction has concluded.
5) Effects on Special Aquatic Sites
    a. Sanctuaries and Refuges – While the Project is located near the Blackwater National Wildlife Refuge, no structural or non-structural impacts are proposed for the wildlife management area.
    b. Wetlands – Implementation of the preferred plan would result in the restoration of approximately 83 acres of wetlands habitat along the shorelines of Barren Island. Overall, 27.9 acres of wetlands could be restored behind the northeast sill, 12.4 acres behind the northwest sill, and 42.5 acres behind the southwest sill. This would be a direct, positive, and long-term impact to wetlands resources at Barren Island that have continued to be lost due to shoreline erosion in recent decades. Wetlands will include low and high marsh

plantings as well as some intertidal mudflats. Authorized maintenance material dredged from small local federal navigation channels will be placed behind the confining stone sills up to the MHW elevation. It is anticipated that approximately 50% of the marsh acreage would be high marsh and 50% would be low marsh. Incorporating higher percentages of high marsh in the design than what was planned during the feasibility phase (80% low marsh to 20% high marsh) would add resiliency to sea level rise and enable migration of wetland habitat to low marsh as opposed to shallow, subtidal open water. Tidal exchange will be established through use of open tidal guts or outfall structures after the material is stabilized. The design will aim to take advantage of any freshwater flow from the island to augment tidal gut flow. To the extent practicable, wetlands will be designed to allow for estuarine connectivity via gaps and tidal creeks to maximize value to fisheries resources.

i. There would be a direct, but short-term impact to 1.41 acres of existing wetlands from construction of the preferred alternative. This acreage would be temporarily impacted by the construction of containment dikes but would be returned to wetland habitat once construction and wetland cell development is complete. The limit of disturbance (LOD) for construction would extend to MHW. Construction would occur from the water to avoid impacts to the island.

Table 2. Barren Island Existing Wetland Acreage

Wetland Class	Acres
Northern Extent	
E2FO	1.70
EUS	4.20
E2EM	67.25
Total	***73.19***
Southern Extent	
PEM	13.92
E2SS	8.73
E2EM	21.49
EUS	0.58
Total	***44.73***

6) Threatened and Endangered Species –USACE consulted Federal and State agencies including USFWS, NOAA NMFS, and MDNR on the potential impacts to rare, threatened, and endangered species. Additionally, USFWS has prepared a draft Planning Aid Report (PAR) that identifies species utilizing the habitat within the project area. Several T&E species were identified through the USFWS Information for Planning and Consultation (IPaC) report (included with PAR):
   - eastern black rail (*Laterallus jamaicensis jamaicensis),*
   - Green Sea Turtle (*Chelonia mydas*),
   - Atlantic Sturgeon (*Acipenser oxyriynchus oxyriynchus*),
   - Kemp's Ridley Sea Turtle (*Lepidochelys kempii*),
   - Leatherback Sea Turtle (*Dermochelys coriacea*), and

- Loggerhead Sea Turtle (*Caretta caretta*)

Although the Project will enhance and provide ample habitat for these species, precautions are continually made in order to not disrupt current habitats. Additionally, USFWS is reviewing the saltmarsh sparrow's status and, by the end of September 2023, will make a determination of whether or not the saltmarsh sparrow warrants protection under the Endangered Species Act. Restoration of high marsh may benefit salt-marsh sparrow.

Other Wildlife – An Essential Fish Habitat (EFH) Assessment has been prepared for the Project. Prior coordination with NMFS during feasibility and in 2017 to complete the Record of Decision identified that the proposed Project lies within waters designated as EFH; however, based on updated coordination the following species were the focus of the updated EFH Assessment:

- Atlantic butterfish (*Peprilus* triancanthus) – eggs, larvae, and adults;
- Black sea bass (*Centropristus* striata) – juveniles and adults;
- Scup (*Stenotomus chryops*) – juveniles and adults;
- windowpane flounder (*Scopthalmus aquosos*) - juvenile and adult stages;
- bluefish (*Pomatomus saltatrix*) - juvenile and adult stages;
- summer flounder (*Paralicthys dentatus*) – larvae, juvenile and adult stages; and
- Clearnose skate (*Raja eglanteria*) – juveniles and adults.

Based on the assessment completed, the Baltimore District, after reviewing relevant information and analyzing potential project impacts, has determined that the proposed action would not have a substantial adverse effect on EFH, HAPC, or on species with designated EFH in the project area. Overall, direct, secondary, and cumulative impacts to EFH, associated species, and HAPC would be minimal, and, in the long term, the current project and proposed expansion would enhance some habitat features for species managed under the Magnuson-Stevens Act.

3.6 Proposed Disposal Site Determinations

1) Mixing Zone Determinations – N/A
2) Determination of Compliance with Applicable Water Quality Standards – Work would be performed in accordance with all applicable State water quality standards. An application has been made to the Maryland Department of the Environment (MDE) for a Tidal Wetlands License including a Water Quality Certification (WQC) by the Maryland Department of Transportation Maryland Port Administration.
3) Potential Effects on Human Use Characteristics
   a) Municipal and Private Water Supply – No negative impacts expected.
   b) Recreational and Commercial Fisheries – There would be direct, long-term negative impacts to three of the four-pound net locations. These three pound nets lie within the sill and breakwater alignments of the preferred alternative and would be displaced. Only one of these pound nets is currently active. The fourth pound net would experience a direct, short-term, negative impact due to potential disruptions during construction. This pound net is off the western shore of Barren outside the preferred alignment. Construction may disrupt fish activity and affect use of this pound net. Impacts would cease when construction is complete.

c) Water Related Recreation – Implementation of the preferred alternative would be expected to result in a direct, minor, and short-term impact to recreational activities in the vicinity of Barren Island during construction. Construction activities would displace any recreational activities.
d) Aesthetics – Implementation of the preferred alternative would have a direct and permanent impact on the aesthetic view of Barren Island from close range where the addition of the stone sills and breakwaters will be an evident change to the natural shoreline. Over time and with the development of wetland habitat, the alternation is expected to be less noticeable. The change is typical of prior efforts along the northeast to protect Barren Islands. Viewing from a far distant, the aesthetics would not be discernible. Maintaining the existing extent of Barren Island and restoring additional habitat is expected to be direct, positive, and long-term impact to the aesthetic resources in the region.
e) Parks, National and Historical Monuments, National Seashore, Wilderness Areas, Research Sites and Similar Preserves – No impacts expected.

3.7 Determination of Secondary Effects on the Aquatic Ecosystem

The proposed project would have a direct, short-term, and minor impact on the area for fishing, boating and other water-based commerce and recreation.

4.0 FINDING OF COMPLIANCE

a. No adaptations of the Section 404(b)(1) Guidelines were made relative to this evaluation.
b. The proposed project will comply with State water quality standards.
c. The proposed placement of material will not violate the Toxic Effluent Standard of Section 307 of the Clean Water Act.
d. The proposed project will not negatively affect any rare, threatened or endangered species.
e. No Marine Sanctuaries, as designated in the Marine Protection, Research and Sanctuaries Act of 1972, are in the project area.
f. The proposed project will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, wildlife and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected.
g. Appropriate steps to minimize potential impacts to the aquatic ecosystem associated with construction of Barren Island will be followed.
h. On the basis of the guidelines, the Preferred Alternative is specified as complying with the inclusion of appropriate and practical conditions to minimize contamination or adverse effects to the aquatic ecosystem.

APPENDIX C4: Greenhouse Gas Emissions Analysis

Mid-Chesapeake Bay Island Ecosystem Restoration Project:
Barren Island Borrow Area sEA
Greenhouse Gas Emissions Analysis

Introduction

USACE is proposing to undertake dredging of sand from the South Borrow Area for use in the Mid-Chesapeake Bay Islands Restoration Project at Barren Island in Dorchester County, MD (Alternative 3). The project area is in attainment for all priority pollutants. This analysis estimates the Greenhouse Gas (GHG) emissions associated with dredging the sand required for the project (Alternative 3) as well as the alternative to acquire the needed sand from a quarry (Alternative 5).

ALTERNATIVE 3 – Dredge Southern Borrow Area

Methods

1. Compile equipment list and operating details

The following list of equipment and total hours of operation for this work was compiled using information in the project's cost-estimate as well as knowledge from past USACE dredging projects at Fishing Creek (2022) and Rhodes Point (2018).

Dredging:

- 24" Cutterhead dredge (1)
- Tug associated with dredge (1)
- Small pusher/tender tug (V8) (3)
- Crew boat (1)

Dredging Time [A (hr/yr)]: Bird islands - 23 days, Containment – 6 days, Foundation Replacement – 4 days; Total = 33 days or 792 hours

2. Identify emissions estimate model

The following equation from EPA (2022) was used to estimate air quality emissions from marine vessels:

$$\textbf{Emissions (per vessel)} = \textbf{Pop} \times \textbf{P} \times \textbf{A} \times \textbf{EF} \times \textbf{LLAF} \qquad \textbf{(1)}$$

where **Pop** is the equipment populations, **P = power** is the engine operating power (kW), **LLAF** is the load adjustment factor (a unitless factor that reflects increasing propulsion emissions during low load operations (always 1 for auxiliary engines and boilers), **A** is the engine operating activity (kW), and **EF** is the emission factor (g/kWh).

Project-specific emissions equation inputs were used whenever available. Default, average, and/or "worst case scenario" values were used when project-specific inputs were not available.

The source(s) of the equation inputs are as follows:

- **Population –** The equipment to be used and number of each item were determined based on the cost estimate generated by Cost Engineering and guidance from USACE Operations Division.
- **Power –** The power (HP) for the tender tug and crew boat were assigned as specified in the Fishing Creak Navigation Channel Project EA (USACE 2022). The dredge and associated tug were assigned based on USACE Operations Division experience.

- **LLAF -** LLAF were pulled from Table 4.4 for propulsion engine and Appendix G for dredge (USEPA 2022a).
- **EF -** As cylinder displacement is unknown, average harbor craft emission factors by engine group, power range, and model year from Port Emissions Inventory Guidance Table H.6 (USEPA 2022a) were used for non-dredging equipment.

To determine carbon dioxide equivalency, the emissions of relevant pollutants were converted to CO_2 using the following conversions: 1 kg of methane (CH_4) = 25 kg of CO_2, 1 kg of nitrous oxide (N_2O) = 298 kg of CO_2, and 1 kg of carbon monoxide (CO) = 1.1 kg of CO_2.

2. Assumptions

- All equipment is Category 1.
- Vessels are less than 10 years. Use vessel year of 2013 for all.

Table 1 details the equation input for each equipment type.

ALTERNATIVE 5 – Land-based source (quarry)

Methods

1. Compile equipment list and operating details

The following list of equipment and total hours of operation for this work was compiled using information in the project's cost-estimate as well as knowledge from past USACE dredging projects at Fishing Creek (2022) and Rhodes Point (2018).

- Tug – V8 (1)
- Tug associated with barge when offloading (3)
- Crew boat (2)
- Track dozer (1)
- Skid steer (1)
- Excavator (1)

Time – 40 hours of transit (over 5 days, 5 8-hour trips)

2. Identify emissions estimate model

Two models were needed to estimate the GHG emissions for this alternative. For marine vessels, the following equation from EPA (2022) was used to estimate air quality emissions (as defined previously):

$$\textbf{Emissions (per vessel)} = \textbf{Pop} \times \textbf{P} \times \textbf{A} \times \textbf{EF} \times \textbf{LLAF} \qquad \textbf{(1)}$$

Project-specific emissions equation inputs were used whenever available. Default, average, and/or "worst case scenario" values were used when project-specific inputs were not available.

The source(s) of the equation inputs are as follows:

- **Population –** The equipment to be used and number of each item were determined based on the cost estimate generated by Cost Engineering and guidance from USACE Operations Division.

- **Power –** The power (HP) for the tender tug and crew boat were assigned as specified in the Fishing Creak Navigation Channel Project EA (USACE 2022). The HP for the tug for transport of the barges was assigned based on guidance from USACE Operations Division.
- **LLAF -** LLAF pulled from Table 4.4 of 2022 EPA Port Guidance for propulsion engine (USEPA 2022a).
- **EF -** As cylinder displacement is unknown, average harbor craft emission factors by engine group, power range, and model year from Port Emissions Inventory Guidance Table H.6 (USEPA 2022a) were used for non-dredging equipment.

The second equation used was developed for MOVES Off-Road vehicles:

$$\textbf{Emissions} = \mathbf{n \times H \times EF} \qquad \textbf{(2)}$$

Where **n** is the number of pieces of equipment in a specified equipment category, **H** is the hours of equipment operation (hr) and **EF** is the emission factor (lb/hr).

The source(s) of the equation inputs are as follows:

- **H –** Assume 18 hours to transport a barge to the site from Havre de Grace, 4 hours to unload, plus 10 hours to return the tug to the quarry. Due to shallow depths, the barges would need to be light-loaded. As a result, it was assumed that each barge would be loaded with 2000 tons, rather than a full load of 3,000 tons. This results in 101 trips pushing 2 barges/trip to move the full 300,000 cy to the site. The tug associated with the barge would run for 2,835 hours (101 trips x 18 hours + 101 trips x 10 hours) to travel to and from the site. For unloading, assume 3 barges could be unloaded per day working 12 hour/days. This would require 68 days to unload all material (=203 barges/3). Crew boat and tugs (V8) are estimated to operate for 816 hours (=68*12).
- **EF –** Composite emission factors were used from MOVES Off-road Model Source Emission Factors (Scenario Years 2007-2025) table for the year 2024. (South Coast AQMD 2023).

To determine carbon dioxide equivalency, the emissions of relevant pollutants were converted to CO_2 using the following conversions: 1 kg of methane (CH_4) = 25 kg of CO_2, 1 kg of nitrous oxide (N_2O) = 298 kg of CO_2, and 1 kg of carbon monoxide (CO) = 1.1 kg of CO_2.

2. Assumptions

o Assume the skid steer would operate half the time to move material on the sand barges.
o Assume the track dozers would operate a third of the time once sufficient sand is placed in the island to provide a surface above the water elevation.
o Vessels are less than 10 years. Use vessel year of 2013 for all.

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Table 1. Equation Inputs for Alternative 3

Equipment	Vehicle type/class	Category	POP	POW (hp)	kw	Power Range	LLAF	A (hr/yr)
24" cutter head dredge (auxiliary for pump)	dredge	1	1	2000	1492	1400<kw<2000	0.66	792
24" cutter head dredge (auxiliary for remainder)		1	1	2250	1678.5	1400<kw<2000	0.66	792
tug - associated with dredge	tug boat	1	1	2000	1492	1400<kw<2000	0.5	792
tugs - V8	tender tug boat	1	3	350	261	37<kW<600	0.5	792
crew boat	crew and supply	1	2	150	112	37<kW<600	0.45	792

	EF (g/kWh)							
Equipment	NOX	PM10	PM2.5	BC	HC	VOC	CH4	CO
24" cutter head dredge (auxiliary for pump)	4.89	0.08	0.0776	0.0598	0.11	0.1158	0.0022	0.9
24" cutter head dredge (auxiliary for remainder)	4.89	0.08	0.0776	0.0598	0.11	0.1158	0.0022	0.9
tug - associated with dredge	5.3978	0.1	0.097	0.0747	0.0951	0.1002	0.0019	1.4048
tugs - V8	5.6678	0.105	0.1019	0.0785	0.1703	0.1794	0.0034	1.1019
crew boat	5.6678	0.105	0.1019	0.0785	0.1703	0.1794	0.0034	1.1019

Table 2A. Equation Inputs for Alternative 5 (Marine vessels – Equation 1)

Equipment	Vehicle type/class	Category	POP	POW (hp)	kw	Power Range	LF*	A (hr/yr)
tug - associated with transporting barge	tug boat	1	1	2000	1492	1400<kw<2000	0.5	2835
tugs - V8	tug boat	2	3	350	261	37<kW<600	0.5	816
crew boat	crew and supply	1	2	150	112	37<kW<600	0.45	816

	EF (g/kWh)							
Equipment	**NOX**	**PM10**	**PM2.5**	**BC**	**HC**	**VOC**	**CH4**	**CO**
tug - associated with transporting barge	5.3978	0.1	0.097	0.0747	0.0951	0.1002	0.0019	1.4048
tugs - V8	5.6678	0.105	0.1019	0.0785	0.1703	0.1794	0.0034	1.1019
crew boat	5.6678	0.105	0.1019	0.0785	0.1703	0.1794	0.0034	1.1019

Table 2B. Equation Inputs for Alternative 5 (Off-road vehicles – Equation 2)

			EF (lb/hr)						
Equipment	**n**	**H (hrs)**	**NOX**	**PM**	**SOX**	**CO2**	**ROG**	**CH4**	**CO**
D6 CAT High/Wide Track dozers	1	272	0.1980	0.0069	0.0008	66.8	0.0349	0.0031	0.3589
skid steer (composite)	1	408	0.1389	0.0023	0.0004	30.3	0.0190	0.0017	0.2107
excavator (composite)	1	816	0.2524	0.0101	0.0013	120	0.0585	0.0053	0.5091

Results

Table 3. Estimated Emissions for Alternative 3

Equipment	Emissions (tons)							
	NOX	PM10	PM2.5	BC	HC	VOC	CH4	CO
24" cutter head dredge (auxiliary for pump)	4.20	0.07	0.07	0.05	0.09	0.10	0.00	0.77
24" cutter head dredge (auxiliary for remainder)	4.73	0.08	0.08	0.06	0.11	0.11	0.00	0.87
tug - associated with dredge	3.52	0.07	0.06	0.05	0.06	0.07	0.00	0.91
tugs - V8	1.94	0.04	0.03	0.03	0.06	0.06	0.00	0.38
crew boat	0.50	0.01	0.01	0.01	0.01	0.02	0.00	0.10
TOTAL (tons)	14.89	0.26	0.25	0.19	0.34	0.35	0.01	3.03
(metric tons)	13.50	0.23	0.23	0.17	0.30	0.32	0.01	2.75

Equipment	Emissions as CO_2 equivalency (tons)		
	NOX*	CH4	CO
24" cutter head dredge (auxiliary for pump)	1252.76	0.05	0.85
24" cutter head dredge (auxiliary for remainder)	1409.35	0.05	0.96
tug - associated with dredge	1047.61	0.03	1.01
tugs - V8	577.51	0.03	0.41
crew boat	148.50	0.01	0.11
TOTAL (tons)	4435.74	0.17	3.34
(metric tons)	4024.03	0.15	3.03
Cumulative total =4027.21 metric tons of CO_2			

*Based on equivalency conversion available for N_2O = 298

Table 4. Estimated Emissions for Alternative 5

Equipment: Marine	Emissions (tons)							
	NOX	PM10	PM2.5	BC	HC	VOC	CH4	CO
tug - associated with transporting barges	12.58	0.23	0.23	0.17	0.22	0.23	0.00	3.27
tugs - V8	2.00	0.04	0.04	0.03	0.06	0.06	0.00	0.39
crew boat	0.51	0.01	0.01	0.01	0.02	0.02	0.00	0.10
TOTAL	15.09	0.28	0.27	0.21	0.30	0.31	0.01	3.76
Metric tons	13.69	0.25	0.25	0.19	0.27	0.28	0.01	3.41

Equipment: Off-road	Emissions (tons)						
	NOX	PM	SOX	CO2	ROG	CH4	CO
D6 CAT High/Wide Track dozers	0.03	0.00	0.00	9.08	0.00	0.00	0.05
skid steer (composite)	0.03	0.00	0.00	6.18	0.00	0.00	0.04
excavator (composite)	0.10	0.00	0.00	48.79	0.02	0.00	0.21
TOTAL	0.16	0.01	0.00	64.05	0.03	0.00	0.30
Metric tons	0.14	0.00	0.00	58.10	0.03	0.00	0.27

Equipment: Marine	**Emissions as CO_2 equivalency (tons)**			
	NOX*	**CH4**	**CO**	
tug - associated with transporting barge	3749.98	1.32	3.60	
tugs - V8	595.01	0.36	0.43	
crew boat	153.00	0.09	0.11	
Equipment: Off-road	**NOX***	**CH4**	**CO**	**CO_2**
D6 CAT High/Wide Track dozers	8.03	0.01	0.05	9.08
skid steer (composite)	8.44	0.01	0.05	6.18
excavator (composite)	30.68	0.05	0.23	48.79
TOTAL (tons)	4545.14	1.84	4.47	64.05
(metric tons)	4123.29	1.67	4.05	58.10
Cumulative total = 4187.12 metric tons of CO_2				

*Based on equivalency conversion available for N_2O = 298

Discussion

The emissions from either alternative would meet de minimus thresholds for priority pollutants as specified for EPA if the area were a non-attainment area for air quality. In terms of CO_2 equivalency (metric tons), Alternative 3 and 5 would produce a comparable amount of GHG emissions, between 4000 and 4200 metric tons. Alternative 5 is projected to produce a slightly greater amount of GHG emissions, approximately 160 metric tons of CO_2. EPA's Greenhouse Gas Equivalencies Calculator projects that the emissions for Alternative 3 would be similar to operating 896 gas-powered vehicles for one year or the energy consumed by 508 homes for a year (EPA 2023). Running 1.1 wind turbines for a year or preserving 26.7 acres of forest would offset these emissions.

References

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