Draft

NASA WFF Shoreline Enhancement and Restoration Project Environmental Assessment

Prepared for

National Aeronautics and Space Administration

Goddard Space Flight Center

Wallops Flight Facility

Wallops Island, VA

December 2018

In Cooperation with
Bureau of Ocean Energy Management
U.S. Army Corps of Engineers

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INTERNAL DRAFT NASA WFF SHORELINE ENHANCEMENT AND RESTORATION PROJECT ENVIRONMENTAL ASSESSMENT

Lead Agency: National Aeronautics and Space Administration (NASA)

Cooperating Agencies: U.S. Bureau of Ocean Energy Management
U.S. Army Corps of Engineers

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Abstract:

In accordance with the National Environmental Policy Act, NASA has prepared this Environmental Assessment to assess the restoration of the Wallops Island shoreline at the Wallops Flight Facility, located in Accomack County, Virginia. Under the Proposed Action, NASA would fund the placement of up to approximately 1.3 million cubic yards of sand sourced from either the north Wallops Island beach or dredged from offshore Unnamed Shoal A. Additionally, NASA could construct a series of offshore parallel breakwaters approximately 200 feet offshore from the renourished beach. Resources evaluated in detail include coastal geology; water quality; the coastal zone; air quality; noise; benthos; wildlife; fish and Essential Fish Habitat; marine mammals; special status species; cultural resources; and recreation.

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Abbreviations and Acronyms

APE	area of potential effect
APHIS	U.S. Department of Agriculture Animal and Plant Health Inspection Service
ASTM	American Society for Testing and Materials
ATV	all-terrain vehicle
BMP	best management practice
BO	Biological Opinion
BOEM	Bureau of Ocean Energy Management
CAA	Clean Air Act
CEA	cumulative effects analysis
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNWR	Chincoteague National Wildlife Refuge
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CWA	Clean Water Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
dBA	A-weighted decibel
dBpeak	instantaneous peak sound pressure level
dBRMS	root mean square sound pressure level
EA	Environmental Assessment
EPA	Environmental Protection Agency
EFH	Essential Fish Habitat
ESA	Endangered Species Act
°F	degrees Fahrenheit
FCD	Federal Consistency Determination
FONSI	Finding of No Significant Impact
GCM	Global Climate Model
GHG	greenhouse gases
HABS	Historic American Building Survey
HAP	Hazardous Air Pollutants
HAPC	Habitat Areas of Particular Concern
HIF	Horizontal Integration Facility
mm	millimeter
mm/year	millimeters per year
MMPA	Marine Mammal Protection Act
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NPR	NASA Procedural Requirement
NPS	National Park Service
NRHP	National Register of Historic Places
O_3	ozone
OCS	Outer Continental Shelf
Pa	Pascal
Pb	lead
PEIS	Programmatic Environmental Impact Statement
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
PM_{10}	Particulate matter less than 10 microns in diameter
ROD	Record of Decision
SERP	Shoreline Enhancement and Restoration Project
SHPO	State Historic Preservation Office
SL	sound level
SO2	sulfur dioxide
SPL	sound pressure level
SRIPP	Shoreline Restoration and Infrastructure Protection Program
TSS	Traffic Separation Schemes

U.S.	United States
U.S.C.	U.S. Code
VDHR	Virginia Department of Historic Resources
VDEQ	Virginia Department of Environmental Quality
VDOT	Virginia Department of Transportation
VMRC	Virginia Marine Resources Commission
WFF	Wallops Flight Facility

1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

The National Aeronautics and Space Administration (NASA) has prepared this Environmental Assessment (EA) to evaluate the potential environmental impacts of both enhancing and restoring the shoreline on Wallops Island. This Shoreline Enhancement and Restoration Project (SERP) EA has been prepared by NASA in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended (42 United States [U.S.] Code [U.S.C.] 4321-4347); the Council on Environmental Quality (CEQ) regulations implementing NEPA (Title 40 of the Code of Federal Regulations [CFR] Parts 1500-1508); NASA procedures for implementing NEPA (14 CFR 1216.3); and NASA Procedural Requirement (NPR) *Implementing the National Environmental Policy Act and Executive Order 12114* (NPR 8580.1). The U.S. Department of Interior Bureau of Ocean Energy Management (BOEM) and U.S. Army Corps of Engineers (USACE) Norfolk District are Cooperating Agencies with NASA in preparation of this EA, with NASA serving as the lead agency.

NASA has prepared this EA as a document tiered from the *2010 Final Shoreline Restoration and Infrastructure Protection Program (SRIPP) Final Programmatic Environmental Impact Statement (PEIS)*[1] with information and project components as presented in the *2013 Final Post-Hurricane Sandy EA*[2]. The *2010 Final SRIPP PEIS* and *2013 Final Post-Hurricane Sandy EA* are incorporated by reference with new information and analysis provided as appropriate.

1.2 BACKGROUND

On December 13, 2010, NASA issued a Record of Decision (ROD) for the Wallops Flight Facility (WFF) SRIPP PEIS, hereafter referred to as the *2010 Final SRIPP PEIS*. The U.S. Department of the Interior's BOEM and the USACE, Norfolk District were Cooperating Agencies. The primary goal of the SRIPP is to reduce direct damage to Wallops Island's infrastructure; however, its true benefit is the continued use of the island to support the aerospace programs that are at the core of WFF's mission (NASA 2010). The *2010 Final SRIPP PEIS* analyzed three action alternatives including structural and non-structural options, varying beach berm widths, and multiple sources of fill material. In its ROD, NASA selected *Alternative 1: Full Beach Fill, Seawall Extension* and adopted a suite of mitigation and monitoring protocols to both reduce potential environmental impacts and track project performance. Implementing the initial phase of Alternative 1 entailed: 1) the placement along the Wallops Island shoreline of approximately 3.2 million cubic yards of sand dredged from Unnamed Shoal A, located on the Outer Continental Shelf (OCS) in the Atlantic Ocean under BOEM jurisdiction; and 2) an initial 1,430 foot southerly extension of the Wallops Island rock seawall with future extensions completed as funds are available to a maximum length of 4,600 feet. An estimated nine beach renourishment cycles at approximately five year intervals would be implemented. The ROD stated that fill material for future renourishment cycles could be taken from either Unnamed Shoal A, Unnamed Shoal B, or north Wallops Island beach and left the specifics of how and when the fill material would be obtained to be addressed in future action-specific NEPA documentation.

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[1] The *2010 Final SRIPP PEIS* is available online at: https://code200-external.gsfc.nasa.gov/250-wff/programmatic-environmental-impact-statement-shoreline-restoration-and-infrastructure-protection

[2] The *2013 Final Post-Hurricane Sandy EA* is available online at: https://code200-external.gsfc.nasa.gov/250-wff/wallops-island-post-hurricane-sandy-shoreline-repair-final-environmental-assessment-fea-and-finding

In October 2012, Hurricane Sandy made landfall. Monitoring surveys following the storm event identified the need to repair a section of the seawall and the southern two-thirds of the recently nourished beach. Public Law 113-2, *Disaster Relief Appropriations Act, 2013*, was signed into law on January 29, 2013. The bill included a provision for NASA to repair facilities that sustained damage during the hurricane. NASA signed a Finding of No Significant Impact (FONSI) on June 6, 2013, for the *Wallops Island Post-Hurricane Sandy Shoreline Repair Final Environmental Assessment* (NASA 2013), hereafter referred to as the *2013 Final Post-Hurricane Sandy EA*. Repairs to the seawall and beach renourishment were completed in September 2014. Subsequent storms including Hurricane Joaquin in 2015 and Winter Storm Jonas in 2016 reduced the sand volume in the southern portion of the project area by an average of 1,014,337 cubic yards as compared to volumes present after 2014 shoreline repair (USACE 2018a). Additional sand volume reduction occurred most recently in 2018 with Winter Storm Riley.

1.3 Cooperating Agencies

NASA, as the WFF property owner and project proponent, is the lead agency in preparing this EA. As with the *2010 Final SRIPP PEIS*, BOEM and USACE Norfolk District have served as Cooperating Agencies because they each possess both regulatory authority and specialized expertise regarding the Proposed Action. A Cooperating Agency, as defined in 40 CFR §1508.5, is "any federal agency other than a lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in a proposal (or a reasonable alternative) for legislation or other major federal action significantly affecting the quality of the human environment."

BOEM has jurisdiction over mineral resources on the federal OCS. A Negotiated Noncompetitive Agreement pursuant to Section 30 CFR Part 583, would be negotiated among BOEM, USACE, and NASA to allow the dredging of sand from the OCS. Under Section 404 of the Clean Water Act (CWA), the USACE Regulatory Program has jurisdiction over the disposal of dredged and fill material in waters of the U.S. Similarly, under Section 10 of the Rivers and Harbors of Act of 1899, the USACE has jurisdiction over the placement of structures and work conducted in navigable waters of the U.S. NASA would require authorizations from both the BOEM and the USACE to undertake the proposed project.

In addition to its regulatory role in the project, the USACE Norfolk District is involved in project design, construction, and monitoring of SRIPP on NASA's behalf. Since issuing its 2010 ROD and 2013 FONSI, NASA and USACE oversaw the initial seawall extension between August 2011 and March 2012 and have nourished the beach twice, once during initial construction in 2012 and again in 2014. Beginning prior to the initial beach fill, both agencies have sponsored biannual (spring and fall) topographic and hydrographic monitoring surveys of the Wallops Island shoreline, which have demonstrated a trend in sediment transport from the southern portion of the project area to the north. Additionally, the USACE Norfolk District has evaluated using breakwaters along the Wallops Island shoreline to reduce the intensity of wave action to valuable assets and slow the rate of sediment transport.

1.4 Purpose and Need for the Proposed Action

1.4.1 Purpose

The purpose of the Proposed Action is to restore the Wallops Island shoreline in order to reduce the potential for damage to, or loss of, NASA, U.S. Navy, and Virginia Commercial Spaceflight Authority's Mid-Atlantic Regional Spaceport assets on Wallops Island from wave impacts associated with storm events.

1.4.2 Need

The Proposed Action is needed because the shoreline's beach berm and dune system established to protect NASA's Wallops Island launch range infrastructure has been eroded through storm wind and wave damage; therefore, the existing beach cannot provide the level of storm damage reduction for which it was originally designed.

The constructed beach system has served its intended purpose of reducing damage to the range assets. However, a notable portion of sub-aerial (i.e., on land surface) sand has been relocated by storm winds and waves with a majority of this sand volume transported to the north end of Wallops Island. The effects of storms are most apparent within the southern half of Wallops Island, where the majority of the most critical launch assets are located. Within this area, the seaward half of the beach berm has been lowered by 3 feet or more. As such, the beach berm and dune system can no longer provide the level of storm damage reduction to which it was originally intended, without being restored to regain full functionality.

1.4.3 Cooperating Agencies Purpose and Need

BOEM and USACE, as cooperating federal agencies, would each undertake a "connected action" (40 CFR 1508.25) that is related to, but unique from, NASA's Proposed Action, the funding of the project. The purpose of BOEM's Proposed Action is to consider NASA's request for the use of OCS sand resources in renourishing the Wallops Island beach. The purpose of USACE's Proposed Action is to consider NASA's request for authorization to: 1) discharge fill material into waters of the U.S. under Section 404 of the CWA; and 2) conduct work in navigable waters of the U.S. under Section 10 of the Rivers and Harbors Act. The BOEM and USACE Proposed Actions are needed to fulfill each agency's jurisdictional responsibilities under the OCS Lands Act, the CWA, and the Rivers and Harbors Act, respectively.

1.5 Public Involvement

The steps taken to involve the public in the preparation of this SERP EA are outlined below.

- **Scoping** – Federal, state, and local agencies and members of the public were invited to provide input during the scoping period that began February 27, 2018, and ended March 29, 2018. Comments were received from the Accomack County Administrator, the Virginia Department of Environmental Quality (VDEQ), the Environmental Protection Agency (EPA), Virginia Marine Resources Commission, and the Pamunkey Indian Tribe. The comment letters received are provided in **Appendix A**. A project website has been established to keep all interested parties informed and to encourage public input: https://sites.wff.nasa.gov/code250/Tiered_Shoreline_Enhancement_and_Restoration_EA.html.
- **Draft EA** – This draft document analyzes the environmental consequences of the Proposed Action and a range of reasonable alternatives, including no action. It includes the purpose and need for the Proposed Action, the description of the alternatives, the existing environmental conditions where the Proposed Action would take place, and the environmental consequences of the alternatives. The Draft EA is supported by detailed technical studies.
- **Draft EA Notice of Availability (NOA) and Notice of Public Meeting** – Advertisements will be placed in the following newspapers: *Chincoteague Beacon, Eastern Shore News, Eastern Shore Post*, and *The Daily Times*. The advertisements will announce the availability of the Draft EA as well as the date, time, and location of the public meeting. An electronic

version of the Draft EA along with the advertisement of the public meeting will be available to the public on the NASA project website and a limited number of print copies will be available for review at local public libraries and upon request.

- **Public Comment Period** – Federal, state, and local agencies and members of the public will be invited to provide written comments on the Draft EA over a 30-day period. Electronic versions of all public meeting materials will be available to the public on the project website. Written comments will be accepted throughout the 30-day public comment period.
- **Final EA** – The Final EA will document the comments received on the Draft EA and include a response to all substantive comments. Responses may include supplementing, improving, or modifying the analyses; and factual corrections.
- **Final EA NOA and FONSI** – Advertisements will be placed in the following newspapers: *Chincoteague Beacon*, *Eastern Shore News*, *Eastern Shore Post*, and *The Daily Times*. The advertisements will announce the availability of the Final EA and the FONSI (if warranted). Electronic versions of the Final EA and FONSI (if warranted) will be available to the public on the NASA public website and a limited number of print copies will be available for review at local public libraries and upon request.

1.5.1 Scoping Comment Summary

Table 1.5-1 provides a brief summary of the issues raised during the scoping period. Refer to **Appendix A** for the comment letters received during the scoping period.

Table 1.5-1. Summary of Scoping Issues

Comment	Addressed in EA?	If yes, location in PEIS; if no, rationale
EPA requests the list of federal and state permits required to implement the Proposed Action.	Yes	Section 3.1
How has shoal A diminished in volume since the 2013 Shoreline Repair EA; can it sustain additional dredging as a source of material for beach nourishment?	Yes	Section 2.3.3.2
What impacts would dredging Shoal A have on the habitat it provides for birds and invertebrates such as annelids, mollusks and crustaceans?	Yes	Sections 3.7 and 3.8
Please evaluate and discuss any impacts the Proposed Action may have on herpetofauna and any proposed avoidance and minimization measures.	Yes	Sections 3.8 and 3.11
Please include discussion of any anticipated habitat creation for species such as the Piping Plover or Diamondback Terrapin and any monitoring of these species that will be conducted.	Yes	Sections 3.8 and 3.11

Table 1.5-1. Summary of Scoping Issues (cont.)		
Comment	**Addressed in EA?**	**If yes, location in PEIS; if no, rationale**
It would be helpful if the EA documented if offshore sandbars have formed since the additional sand was incorporated into the nearshore system. Please describe how any offshore sandbars formed since the Shoreline Repair EA may influence the construction of offshore breakwaters proposed in the SERP.	Yes	Section 3.2
Virginia Marine Resources Commission is concerned that a southern end jetty would affect longshore transport of sand to Assawoman Island.	No	No jetty is proposed.
Pamunkey Indian Tribe has requested notification of an inadvertent discovery of a cultural or religious site of significance	Yes	Section 3.12.3

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2.0 DESCRIPTION OF PROPOSED ACTION AND NO ACTION ALTERNATIVE

2.1 INTRODUCTION

This section provides a discussion of the alternatives under consideration for the restoration of the Wallops Island shoreline. The *2010 Final SRIPP PEIS* considered in detail a range of potential storm damage reduction alternatives, including structural and non-structural options, varying beach berm widths, and multiple sources of fill material. Based upon a combination of economic, engineering, and environmental factors in its ROD, NASA selected for implementation *Alternative 1: Full Beach Fill, Seawall Extension*. The initial phase of the 50 year SRIPP project was completed in August 2012. However, within two months of completion, the effects of Hurricane Sandy damaged the southern two-thirds of the recently renourished beach including a portion of the rock seawall; post-Hurricane Sandy repairs were completed in 2014. The effects of subsequent storms have greatly reduced the shoreline most notably within the southern half of the Wallops Island beach where many of the most critical launch assets are located. Therefore, the focus of this EA is to regain function of the Wallops Island beach berm and dune system to reduce storm damage as described and analyzed in the *2010 Final SRIPP PEIS*.

2.2 PROPOSED ACTION

Consistent with the renourishment component of Alternative 1 described in detail in the *2010 Final SRIPP PEIS* and reexamined in the *2013 Final Post-Hurricane Sandy EA*, NASA's Proposed Action is to renourish the beach along the Wallops Island shoreline infrastructure protection area. Before the renourishment, NASA may construct a series of parallel nearshore breakwater structures that would reduce the intensity of wave action and slow sediment transport.

2.2.1 ELEMENTS COMMON TO ALL ALTERNATIVES

2.2.1.1 Beach Renourishment

Approximately 1.3 million cubic yards of sand material would be placed on the shoreline areas that have sustained berm and dune system reductions (**Figure 2.2-1)**. Material for renourishment could come from the north Wallops Island beach, an area that has been accreting due to transport of material from the south, or from Unnamed Shoal A, which was used as a sand source for previous renourishment projects. Detailed descriptions of these two alternatives are provided in **Section 2.3, Alternatives Carried Forward for Detailed Analysis**.

If work were conducted between April and September, NASA would ensure that the work site and adjacent areas would be surveyed for nesting birds and sea turtles by a biological monitor on a daily basis. Survey protocols would be the same as those developed for the initial beach fill and seawall extension (NASA 2011a). The biological monitor would coordinate directly with onsite project employees to ensure that all parties are made aware of nesting status and any need to suspend or relocate work activities until chicks have fledged and/or sea turtles have hatched.

Figure 2.2-1. Approximate Beach Renourishment Area

2.2.1.2 Post-Renourishment Activities

Once renourishment and grading are complete, dune grasses would be planted along the renourished dune (**Figure 2.2-2**). As described in detail in the *2010 Final SRIPP PEIS*, NASA and USACE would also resume the regular beach profile monitoring of the project site once beach renourishment activities have been completed.

Figure 2.2-2. Beach Post-Renourishment Activity, Planting Dune Grasses

2.3 Alternatives Carried Forward for Detailed Analysis

2.3.1 No Action Alternative

CEQ regulations require that an agency "include the alternative of no action" as one of the alternatives it considers (40 CFR 1502.14[d]). The No Action Alternative serves as a baseline against which the impacts of the Proposed Action are compared. Under the No Action Alternative for this SERP EA, NASA would not restore the Wallops Island shoreline infrastructure protection area beach and dune system to their full functionality or construct nearshore breakwater structures.

2.3.2 Alternative 1: Renourishment Only with Sand from North Wallops Island Beach

Alternative 1 would use sand from an existing beach at the northern end of Wallops Island to renourish the beach along the shoreline infrastructure protection area. USACE modeling showed that prior to the initial shoreline restoration, on average, approximately 40,000 cubic yards of sediment per year was accumulating at the northern end of Wallops Island by longshore transport from the south (NASA 2010). A requirement of the *2010 Final SRIPP PEIS* was the establishment of semiannual (fall and spring) beach monitoring. The Fall 2017 Monitoring Report (USACE 2018a), which described high erosion rates and substantial losses of sediment in the southern portion of the project area and significant accretion resulting from longshore transport in the northern portion of the project area.

USACE calculated that 1.7 million cubic yards of sand is available at the north Wallops Island borrow area, more than enough to provide the 1.3 million cubic yards required for the proposed renourishment. Based on vegetation and wildlife habitat constraints (such as avoiding areas of most dense vegetation and bird and sea turtle nesting season), the total potential area for sand removal is approximately 200 acres. Excavation depth would be to an average of -2.35 feet above mean sea level (**Figure 2.3-1**).

Figure 2.3-1. Approximate Backpassing Borrow Area

Using sand from the northern end of Wallops Island would offer a material without the mobilization and operational costs associated with offshore dredging. Sediment transported alongshore to the north from a previous fill cycle would be of the proper grain size and could be effectively recycled, or "backpassed" by excavating it and placing it in eroding areas in the southern project area.

A pan excavator would likely be used to remove sand from north Wallops Island beach. Because it runs on several rubber tires with a low tire pressure, it can work in areas of the beach where typical equipment may be bogged down in unstable sand. The sand would be stockpiled and then loaded onto dump trucks for transport down the beach. Based on an average 12 cubic yard capacity of a 10 wheel dump truck, is estimated that 108,000 loads would be required to move the sand. Bulldozers would be used to spread the fill material once it is placed on the beach. Other onshore equipment may include all-terrain vehicles (ATVs), an office trailer, mobile generators, construction site lighting, and mobile fuel tanks. All heavy equipment would access the beach from existing roads and established access points. No new temporary or permanent roads would be constructed to access the beach or to transport the fill material to renourishment areas.

Prior to excavation, a pre-project topographic and hydrographic survey would be conducted. Multiple survey crews would employ ATVs and light trucks to conduct pre-project surveys of the project site.

2.3.3 Alternative 2: Renourishment Only With Sand from Unnamed Shoal A

Alternative 2 would renourish the beach along the Wallops Island shoreline infrastructure protection area using material from OCS Unnamed Shoal A, an offshore sand ridge located at the southern end of the Assateague ridge field. In 2010, the surface area was measured at approximately 1,800 acres. Up to 515 acres of the shoal (sub-area A-1) were dredged to produce approximately 3.2 million cubic yards of material for the initial beach fill cycle. An additional 800,000 cubic yards were dredged from the same area (sub-area A-1) for the post-Hurricane Sandy repairs.

2.3.3.1 Beach Fill Mobilization

The first phase of the beach fill portion of the project would involve the dredge contractor transporting equipment and materials to the project site. Offshore equipment would include at least several miles of discharge pipe, pumpout buoys, multiple barges, tugboats, derricks, and smaller crew transportation vessels (**Figure 2.3-2**).

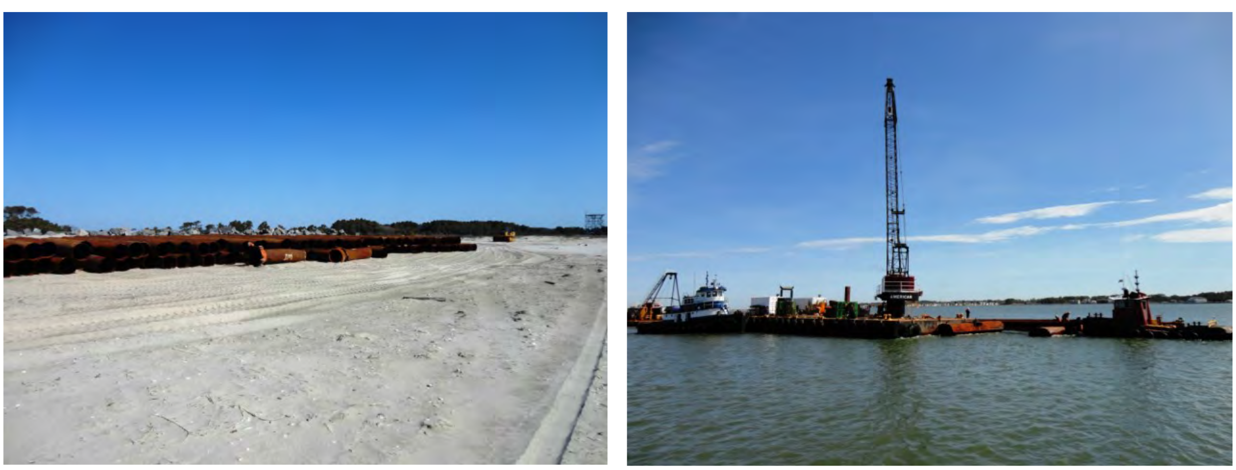

Figure 2.3-2. Beach Fill Mobilization, Onshore Staging (left) and Offshore Equipment (right)

Based on experience gained during the initial beach fill cycle in 2012 and implemented during the post-Hurricane Sandy restoration in 2014, it is expected that the discharge lines would be assembled inside the protected waters of Chincoteague Inlet, then "rafted" together, and floated to their ultimate placement site as weather conditions allow. Onshore, it is expected that sections of the discharge lines would be trucked in, staged, and placed using a front-end loader or crane. Other onshore support equipment would likely be trucked in and include multiple bulldozers, several ATVs, an office trailer, mobile generators, construction site lighting, and mobile fuel tanks. The mobilization is expected to take 30 to 45 days.

2.3.3.2 Dredging and Sand Placement Process

Upon receipt of all necessary authorizations, the USACE (on NASA's behalf) would contract the placement of approximately 1.3 million cubic yards of sand. The dredging process would employ one or more munitions and explosives of concern (MEC) screened trailing suction hopper dredges to obtain material. The dredging process would be cyclic in nature, with the vessel transiting to the borrow area, lowering its dragarms, filling its hopper, and returning to a discharge site. Approximately 2 miles east of Wallops Island in 25 to 30 feet of water, the dredge would connect to the floating end of the submerged pipeline temporarily placed on the seafloor. The sand/water slurry would be pumped through this pipeline to the beach. All dredging and equipment placement would take place in areas previously surveyed as part of the analyses associated with the *2010 Final SRIPP PEIS* and the *2013 Post-Hurricane Sandy EA.*

Once the hopper has discharged its entire load, the dredge would return to the borrow area to remove more material.

Because of overflow from the hopper dredge at the borrow area during dredging and losses during discharge and placement, a larger volume of material would need to be dredged to meet the targeted fill volume. As with the *2013 Post-Hurricane Sandy EA*, sediment losses during dredging and placement operations are assumed to be up to 25 percent. Using this estimate, the dredged volume for the proposed renourishment would be approximately 1.625 million cubic yards.

Dredging would be conducted in a manner generally consistent with the recommendations of two publications examining the effects of dredging of offshore shoals in the mid-Atlantic as presented in the *2010 Final SRIPP PEIS*. More specifically, NASA would:

- Dredge offshore sand from Unnamed Shoal A sub-area A-1 (an accretional area);
- Dredge over a large area and not create deep pits;
- Require that cut depth not be excessive (approximately 7 to 10 feet);
- Require that dredging not occur over the entire length of the shoal;
- Require MEC screening at the drag head; and
- Ensure that if dredging occurs during migration season, certified whale and/or sea turtle watchers would be required on the dredging vessel.

The ROD for the *2010 Final SRIPP PEIS* states that dredged depth be limited to not more than 9.8 feet. To date, an average cut of 4 feet occurred in 2012 and 1.1 foot in 2014 (Bonsteel 2015).

Nearshore, it is expected that the contractor would employ one or more anchored pumpout stations approximately 2 miles east of Wallops Island in 25 to 30 feet of water. Up to several miles of submerged steel pipeline would be temporarily placed on the seafloor in areas previously cleared for cultural resources and/or on hard bottom. The sand/water slurry would be pumped from the dredge through the pipeline to the beach.

As the sand slurry is discharged onto the shoreline, bulldozers would grade the material (**Figure 2.3-3**) to the desired design template, which is proposed to include an additional foot of berm elevation (raised from +6 feet to +7 feet referencing North American Vertical Datum of 1988) as compared to the initial beach fill. The purpose of this design change would be to provide an additional buffer during storm conditions.

Figure 2.3-3. Dredging and Sand Placement Process, Trailing Suction Hopper (left) and Bulldozers Grading Discharge Sand (right)

The time in the tidal cycle would factor into the location on the beach within which the equipment would work for a given dredge load. During low tide, the equipment would likely concentrate on the intertidal and subtidal zones, whereas during high tide, work would be focused on the upper beach berm and dune. After each section of beach is confirmed to meet design criteria, the process would continue in the longshore direction, with sections of discharge pipe added as it progresses.

The dredging and beach fill portion of the project is expected to take 3 months. At the conclusion of dredging and beach fill, the construction contractor would begin the demobilization phase of the project, the largest task of which would be the disassembly, staging, and loading of discharge piping for transport offsite.

2.3.3.3 Pre- and Post-Dredging Surveys

Another important component of the mobilization phase is the performance of pre-project topographic and hydrographic surveys. Offshore, the dredge contractor would employ vessels to conduct pre- and post-dredging surveys at the borrow site to assess morphological changes of the shoals. Surveys would also be conducted of the nearshore zone within which dredge pumpout equipment would be placed, and the shallower areas of proposed transit routes. Onshore, multiple survey crews would employ ATVs and light trucks to conduct pre- and post-renourishment surveys of the project site.

2.3.4 Alternative 3: Renourishment and Construction of Nearshore Detached Parallel Breakwaters

Nearshore breakwaters reduce the amount of storm related wave energy reaching protected upland areas as well as slow the rate of longshore sediment transport thereby increasing the longevity of a beach fill project. Under Alternative 3, prior to the renourishment actions described in either Alternative 1 or Alternative 2, a series of rubble mound breakwaters would be constructed approximately 200 feet offshore from the mean high water line of the Wallops Island shoreline infrastructure protection renourishment area. Each breakwater would be constructed of Virginia Department of Transportation (VDOT) Type I armor stone for the outer layer, which ranges from 0.75 to 2 tons, and VDOT Class II Stone for the core layer, which ranges from 150 to 499 pounds. All stone would be placed parallel to the shore on top of approximately 130 feet long of prefabricated geotextile marine mattresses. The breakwaters would measure approximately 10 feet wide at top crest elevation and would be placed approximately 100 feet apart from each other. Water depths in these areas is approximately 4 to 8 feet. The breakwaters would be positioned offshore of Launch Pad 0-B and continue north to the Horizontal Integration Facility (HIF; Building X-079). Depending upon economic, engineering, and environmental factors, the initial series may be broken into smaller series of three breakwaters offshore of Launch Pad 0-B and another three offshore of the HIF (**Figure 2.4-1**).

The rocks for constructing each breakwater would be transported to the breakwater construction area by barge or to the WFF area by rail, offloaded, and then trucked to the handling or placement site on Wallops Island. Construction, estimated to last approximately 6 to 9 months, would take place in the water using a barge and heavy lifting equipment. These breakwaters would be permanent structures as removal would be impractical and cost prohibitive (NASA 2010).

Once offshore breakwaters are constructed, beach renourishment would occur using material sourced from either the north Wallops Island beach or Unnamed Shoal A, as described above in Alternatives 1 and 2, respectively.

2.4 Alternatives Considered But Not Carried Forward

2.4.1 Excavation from North Wallops Island Beach and Dredging from Unnamed Shoal A

One alternative considered was to source sand from both the north Wallops Island beach and from Unnamed Shoal A; however, it was determined that utilizing sand from both sources would be inefficient and too costly. Vessel mobilization and demobilization costs associated with dredging Unnamed Shoal A would be the same whether sourcing sand for either a partial or a full beach renourishment from the borrow site.

2.4.2 Excavation from North Wallops Island Beach Via Sand Slurry Pipeline

Using a system of pipes to move sand from the north Wallops Island beach in slurry form was also considered. This alternative was also eliminated from detailed consideration because water would have to be added to dry sand and a number of pumping stations would be required to transfer the resulting slurry over the distance of more than four miles. Additionally, if launches were scheduled during the renourishment, piping would have to be removed prior to launch and remobilized afterward, thereby, requiring additional cost and delays in the project schedule.

Figure 2.4-1. Proposed Locations of Offshore Parallel Breakwaters

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3.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 ANALYSIS APPROACH

NEPA requires focused analysis of the areas and resources potentially affected by an action or alternative. It also provides that an EA should consider, but not analyze in detail, those areas or resources not potentially affected by the proposal. NEPA also requires a comparative analysis that allows decision makers and the public to differentiate among the alternatives. CEQ regulations (40 CFR §§ 1500-1508) for NEPA require an EA to discuss impacts in proportion to their significance and present only enough discussion of other than significant issues to show why more study is not warranted.

The analysis in this EA considers the existing conditions of the affected environment and compares those to conditions that might occur should WFF implement the alternatives under the Proposed Action or the No Action alternative.

The *2010 Final SRIPP PEIS* presented a complete description of all project related resource areas with relevant, updated descriptions and information presented in the *2013 Post-Hurricane Sandy EA*. As such, only those resources that have measurably changed or would be notably affected are discussed in this SERP EA; all other resources are incorporated by reference.

3.1.1 AFFECTED RESOURCES

Resources that have the potential to be affected by implementing the Proposed Action are carried forward for detailed analysis in this SERP EA. **Table 3.1-1** provides the list of resources carried forward for detailed analysis, the section the analysis is located, and regulatory permits that would be required prior to implementing the Proposed Action.

Table 3.1-1. Resources Carried Forward for Detailed Analysis in this SERP EA

Resource	Analysis Section	Regulatory Consultation or Permit
Coastal Geology and Processes	Section 3.2	none
Water Quality	Section 3.3	Individual Permit from USACE Dune and Subaqueous Permits from VMRC
Coastal Zone Management	Section 3.4	Federal Consistency Determination with DEQ
Air Quality	Section 3.5	none
Noise	Section 3.6	none
Benthos	Section 3.7	none
Wildlife	Section 3.8	none
Fisheries and Essential Fish Habitat	Section 3.9	Essential Fish Habitat Assessment with NMFS
Marine Mammals	Section 3.10	MMPA Consultation with NMFS
Special Status Species	Section 3.11	ESA Consultation with NMFS and USFWS
Cultural Resources	Section 3.12	NHPA Consultation with SHPO
Recreation Resources	Section 3.13	none

Legend: USACE – US Army Corps of Engineers; VMRC – Virginia Marine Resources Commission; DEQ – Virginia Department of Environmental Quality; NMFS – National Marine Fisheries Service; MMPA - Marine Mammal Protection Act; ESA – Endangered Species Act; USFWS – U.S. Fish and Wildlife Service; NHPA – National Historic Preservation Act; SHPO – State Historic Preservation Office.

Numerous other resources were considered; however, the potential impacts would be negligible as documented in the *2010 Final SRIPP PEIS*. As such, the list of resources not carried forward for detailed analysis warrant no further evaluation. **Table 3.1-2** provides the list of resources not carried forward for detailed analysis.

Table 3.1-2. Resources Considered But Not Carried Forward for Detailed Analysis in this SERP EA	
Floodplains	*2010 Final SRIPP PEIS* concluded there would be a negligible impact to each of these resources.
Hazardous Materials and Waste	
Vegetation	
Plankton	
Invertebrate Nekton	
Land Use	
Infrastructure and Utilities	
Socioeconomics	
Health and Safety	
Environmental Justice	
Recreation – Offshore	

3.2 Coastal Geology and Processes

The interaction of wave, wind, and tidal energies determine how erosional and depositional processes shape coastlines. Sections 3.1.4 and 3.1.5 of the *2010 Final SRIPP PEIS* describe in detail the coastal processes influencing the project area and updated information is presented in Section 3.1.1 of the *2013 Post-Hurricane Sandy EA*. This section provides a summary of information presented in these documents and describes impacts expected to result from the Proposed Action.

3.2.1 Affected Environment

Wallops Island is one of the twelve Virginia barrier islands that front the Atlantic Ocean. Though it is morphologically similar to neighboring islands and is shaped by the interplay of waves and tide, localized processes occurring over both the short and long term have led to Wallops Island being distinct from other barrier islands in Virginia. Generally, net sediment transport along the Virginia barrier islands is from north to south. However, along much of Wallops Island, the direction of net longshore sediment transport is toward the north, due primarily to the growth and resulting wave sheltering effects of Fishing Point at the south end of Assateaugue Island (King *et al*. 2010). In addition to the northerly sediment transport, the westward drift of Chincoteague Inlet ebb shoals in the cross shore direction contributes to the rapid growth of north Wallops Island beach. This sediment accumulation is changing the existing north-south shoreline orientation to one that is oriented more east-west.

Of the Virginia barrier islands, Wallops Island is the only one that has been developed or nourished. With the exception of federally sponsored recreational beach parking area repairs on south Assateague Island, the other islands are managed for conservation and are driven by natural forces. Sediment samples collected on Wallops Island in 2007 and 2009 indicated native median grain sizes ranging from approximately 0.18 to 0.27 millimeter (mm), corresponding to fine sand per the American Society for Testing and Materials (ASTM) unified classification system. Samples collected during the initial beach fill indicate that the sediment within the nourished portion of the beach is coarser, with median grain sizes between approximately 0.28 and 0.54 mm, corresponding to fine to medium sand per ASTM (NASA 2013).

The *2010 Final SRIPP PEIS* included implementation of semiannual topographic and hydrographic beach profile monitoring to evaluate the performance of beach fill projects and to identify the need for future renourishment. Each spring and fall, data are collected from the southern tip of Assateague Island / Toms Cove through Wallops / Assawoman Islands south to Gargathy Inlet. The data collected to date illustrate a general trend of substantial loss of material in the southern portion of Wallops Island and significant volume gain to the north. The data show no evidence of formation of offshore sandbars or impacts to Chincoteague Inlet to the north (USACE 2018a).

Unnamed Shoal A is an unvegetated offshore sand ridge located approximately 7 miles east of Assateague Island and approximately 11 miles northeast of Wallops Island.

3.2.1.1 Consideration of Sea Level Rise

Coastal environments are highly dynamic and particularly vulnerable to climate change. The impacts of climate change at WFF includes rising sea levels, more frequent flooding, and increasingly intense, unevenly distributed rain events resulting in detrimental impacts to WFF infrastructure. Most of Wallops Island is less than 10 feet above mean sea level (MSL), with the sandy area approximately 6.9 feet above MSL and the highest elevation approximately 15 feet above MSL. Sea level rise, storm surges from hurricanes and nor'easters are increasingly make natural and built systems vulnerable to disruption or damage.

For the purposes of projecting changes affecting Wallops Island, MSL data collected by the National Oceanic and Atmospheric Administration (NOAA) from two stations nearest to WFF (Wachapreague, Virginia (VA) and Ocean City, Maryland) were examined. Data collected from long term tidal gauges in Wachapreague indicate that between 1978 and 2017, the relative sea level trend is 5.35 millimeters per year (mm/year) (+/-0.76 mm/year), the equivalent to a change of 1.76 feet in 100 years (NOAA 2018a). At Ocean City, data indicate the relative sea level trend is 5.59 mm/year (+/- 0.87 mm/year) based on monthly MSL data from 1975 to 2017 which is equivalent to a change of 1.83 feet in 100 years (NOAA 2018b).

3.2.2 Environmental Consequences

Sections 4.2.1 through 4.2.3 of the *2010 Final SRIPP PEIS* as well as Section 3.1.1.2 of the *2013 Post-Hurricane Sandy EA* describe in detail the expected effects of dredging and beach renourishment on coastal processes. This section provides a summary applicable to the No Action Alternative and the alternatives to the Proposed Action.

3.2.2.1 No Action Alternative

Under the No Action Alternative, renourishment of the Wallops Island shoreline infrastructure protection area would not occur. It is expected that the north Wallops Island beach would continue to grow, and the remaining areas to the south including the shoreline infrastructure protection area would continue to erode at historical rates exacerbated by the frequency and intensity of future storm events. Over time, the shoreline infrastructure protection area would continue to narrow until the rock seawall is undermined and eventually fails, jeopardizing the existing infrastructure.

3.2.2.2 Alternative 1

The removal of sand from the north end of Wallops Island would lower topography within the footprint of the excavated areas. This accretion area on the north end of Wallops Island is expected to continue to grow as a result of the littoral transport of sand from the renourished beach as well as from Assateague Island. Thus, the impacts from sediment removal from the north Wallops Island beach would be mitigated by the redeposition of sediment from ongoing littoral processes. While the use of the north Wallops Island beach as a sand source would result in direct, short term adverse impacts on the shoreline in that area for a few months, with full recovery projected 4 to 6 years after excavation activities, in the long term using the sand in this area is not anticipated to result in significant changes to the shoreline.

Renourishment of the beach at the Wallops Island shoreline infrastructure protection area (see **Figure 2.2-1**) would result in a new shoreline extending several hundred feet offshore from the current shoreline. The new beach profile would provide increased wave dissipation and added protection from storm events for the onshore infrastructure. After the initial placement, there would be an equilibration period during which there would be a rapid loss of sand offshore to fill in deeper portions of the beach profile. Analysis of sediment samples from the borrow area indicate only trace amounts of silt and other fine sediments (NASA 2010), which would result in limited increase of water turbidity during longshore sediment transport and equilibration of the borrow sand. The new beach profile would continue to adjust to the minor changes in borrow material sediment size, local wind and wave, climate and tidal action. Adjustments may be episodic as spring tides and/or storms result in transport of the borrow material.

Over time, the new beach would be reshaped until it is in equilibrium with the natural forces and assume a normal profile (Wilson *et al*. 2017). However, this profile would shift with seasonal differences in wave action. Higher wave energy during the winter would likely steepen the beach profile with some of the sand moved offshore into a bar system. During the lower energy summer months, the beach profile would tend to flatten out as sand from the offshore bar system is moved back onto the beach face. The onshore-offshore beach dynamics would also be influenced by the littoral transport of the sand both to the north and to the south depending upon the direction of incident wave action. Transport to the north should be recaptured at the north end as wave action is diminished in the lee of Assateague Island. Transport to the south would eventually provide additional sand resources to the barrier islands south of Wallops Island. The construction of the new dune would provide additional infrastructure protection during major storm events.

This alternative could have short term minor impacts to onshore and nearshore sediments resulting from the accidental release of petroleum products, or other contaminants from construction vehicles and heavy equipment used to remove, transport and deposit the sand. The potential for such construction-related impacts to occur would be minimal as contractors would implement best management practices (BMPs) for vehicle and equipment fueling and maintenance as well as site specific spill prevention and control measures (NASA 2010).

The primary offshore impacts of the beach renourishment would likely be the formation of an offshore bar system and changes in local bathymetry that reduce the slope of the offshore portion of the beach profile. Any offshore bar system that may form would be both dynamic and seasonal. Wave action would constantly form and reform these bars moving them onshore, offshore and along the shore. They may also appear and disappear depending on wind and wave action and storm events. There would also be a seasonal component to their location and configuration with bars being more prominent during the winter and less pronounced during the summer as described above.

The adjacent Chincoteague Channel would not likely be affected by use of the north Wallops Island beach as a sand source. Excavation within the proposed borrow area to -2.35 feet above MSL (**Figure 2.3-1**) would not likely alter the cross-sectional area of the channel or influence current velocities in any meaningful way. The Chincoteague Inlet is dynamic and periodically dredged for depth maintenance (see Table 3.2-1). The only likely consequence would be reestablishment of sand accumulation on the north end of Wallops Island.

Table 3.2-1. Historic Dredging of Chincoteague Inlet

Date	Volume Dredged (cubic yards)
April 1995	121,000
July 1996	120,000
November 1997	122,000
July 1998	69,000
December 1999	85,000
October 2002	91,000
March 2005	12,000
March 2006	70,000
March 2008	102,000
November 2009	17,000
October 2018	7,800

Sources: USACE 2018b; Guvernator personal communication 2018

3.2.2.3 Alternative 2

The onshore and nearshore impacts of Alternative 2 would be very similar to those for the beach renourishment component of Alternative 1. The only difference would be that the sand would be delivered as slurry from the dredge instead of being truck hauled.

As with previous renourishment projects, removal of material from Unnamed Shoal A would be done in a uniform manner across the areal extent of sub-area A-1 in accordance with the mitigation requirements described above in **Section 2.3.3.2, Dredging and Sand Placement Process**. Survey Area Cross-Section Profiles collected before and after the 2012 and 2014 dredge events show the effectiveness of these measures (Bonsteel 2015). For this renourishment, approximately two-thirds of the southern half of the shoal's elevation would be lowered by an additional 1.5 to 3 feet, with some areas approaching an additional 10 feet below the current profile. While cut depths on the order of 5 to 10 feet would not be necessary over the entire borrow area to obtain the targeted fill volume, they could occur in some places due to the inherent limitations in precision associated with operating a dredge in the open ocean. As proposed, the elevation of the northern portion of the shoal (sub-area A-2) would remain the same.

The conservative model-based analysis performed for the *2010 Final SRIPP PEIS* indicated that even if a 2 square mile area of the shoal was "planed" to an elevation necessary to obtain up to 10 million cubic yards of material, the induced effects on the Assateague Island shoreline could not be distinguished from those changes occurring as a result of natural variation in sediment transport. Therefore, it is not expected that the additional lowering of the shoal would cause any measurable reduction in wave sheltering effects on properties to the west of the borrow area. Dredging the borrow area would again create steeply sloped areas of micro-topography, which would be smoothed by tidal and wave energy in the years following the dredge event. The lowering of the shoal's topography would be a longer-term effect, with the shoal maintaining the same general morphology but at a lower elevation and different profile. Changes of this type and order would be expected based on past analyses of Unnamed Shoal A bathymetric surveys conducted before and after each prior dredging effort (Bonsteel 2015). Overall consequences to the offshore shoal would be further reduced because of NASA's commitment to implement the minimization measures detailed above in **Section 2.3.3.2, Dredging and Sand Placement Process**.

3.2.2.4 Alternative 3

Impacts resulting from the beach renourishment portion of Alternative 3 would be the same as those described for Alternatives 1 or 2, depending on the source of sand utilized. Additionally, construction of nearshore breakwater structures would result in a build-up of sediment along the shoreline perpendicular to the breakwaters. Temporary and minor adverse effects on sediments are anticipated in the immediate vicinity of the breakwater during the construction period. Use of offshore parallel breakwaters in conjunction with beach renourishment would allow an accumulation of the sand landward of the breakwaters without substantially interrupting the normal littoral transport. This would help provide an increased level of shoreline protection behind the breakwaters with the minimum possible impact on littoral processes. The greatest amount of erosion and accretion would occur immediately adjacent to each breakwater and would exponentially decrease with distance from the breakwater series. The fact that the breakwaters are designed to "leak" sand would help prevent the structures from impeding the normal transport of the sand south to Assawoman Island or to the north end of Wallops Island.

The offshore impacts of the breakwaters would be temporary alterations to littoral transport that diminish as the system approaches equilibration after beach renourishment. Relatively minor permanent changes in bathymetry adjacent to the breakwaters would be measurable as slight depressions immediately seaward of the breakwaters as the nearest sand bars would tend to be displaced toward the up-coast and down-coast ends of the structures.

Potential impacts to Chincoteague Inlet were discounted from the breakwater analysis, design, and modeling based upon biannual monitoring conducted by USACE, Norfolk District (USACE 2018b).

3.3 WATER QUALITY

This section briefly describes the surface and marine waters in and around Wallops Island. Refer to Section 3.1.6 of the *2010 Final SRIPP PEIS* for the detailed description of the water resources within and adjacent to the project area.

3.3.1 REGULATORY CONTEXT AND PERMITTING

The CWA of 1972 is the primary federal law that protects the nation's waters, including coastal areas. The primary objective of the CWA is to restore and maintain the integrity of the nation's waters. Section 404 of the CWA established a permit program to regulate the discharge of fill material into waters of the U.S. Managed jointly by the USACE and the EPA, the primary intent of the program is to minimize adverse effects to the aquatic environment. USACE is responsible for day-to-day administration and permit review while EPA provides program oversight.

On February 22, 2016, USACE extended the permit NAO-1992-1455 issued on March 10, 2011 for post-Hurricane Sandy renourishment. The permit expires on February 22, 2021. This permit authorizes the seawall extension and beach renourishment. A Joint Permit Application was submitted to USACE, VDEQ, VMRC, and Accomack County on October 1, 2018 (**Appendix B**). After receiving the JPA,USACE indicated that a new Individual Permit for the Proposed Action, including breakwater construction and dredging of sand at the north end of the island or Shoal A, whichever is selected as the preferred alternative would be required. VMRC has previously a issued an extension to Permit #10-2003, which was reissued on February 2, 2016, for rehabilitation of the seawall and beach renourishment. The permit expires in 2021 (VMRC 2016). Following receipt of the JPA, VMRC indicated that a new subaqueous permit that includes the current design for beach renourishment, and dredging at the north end of the Island and a dune/beach permit for dune impacts would be required. VDEQ is waiving the requirement for a permit for the proposed action in lieu of USACE and VMRC permits (VDEQ 2018)

3.3.2 Affected Environment

Inshore surface waters in the vicinity of Wallops Island are saline to brackish and are influenced by the tides. Marine waters in the affected environment, away from inlets, maintain a fairly uniform salinity range (32 to 36 parts per thousand) throughout the year (NASA 2003). Winter surface water temperatures average 57° Fahrenheit (°F) and average summer temperature is 77° F (Paquette *et al*. 1995).As reported in the *2013 Post-Hurricane Sandy EA*, Unnamed Shoal A shows bedforms (i.e., ripples) on its surface, indicating that wave energy reaches the seafloor and mixing occurs throughout the water column.

3.3.3 Environmental Consequences

3.3.3.1 No Action Alternative

Under the No Action Alternative, the proposed breakwater construction and beach renourishment would not occur. Therefore, there would be no project related impacts to water quality.

3.3.3.2 Alternative 1

The *2010 Final SRIPP PEIS* provides a detailed analysis of potential water quality impacts associated with moving sand from the north Wallops Island beach and placement in the shoreline infrastructure protection area. This alternative could have short term minor impacts on nearshore water quality resulting from the accidental release of petroleum products, or other contaminants from construction vehicles and heavy equipment used to remove, transport and deposit the sand. The potential for such construction-related impacts to occur would be minimal as contractors would implement BMPs for vehicle and equipment fueling and maintenance as well as site specific spill prevention and control measures (NASA 2010).

The beach fill material from the north Wallops Island beach has a grain size appropriate for use for renourishment. It is expected that the turbidity plume generated at the placement site would be comparable to those reported in similar projects: concentrated within the swash zone (the part of the beach extending from the edge of the surfzone landward to the limit of maximum inundation), dissipating between 1,000 to 2,000 feet alongshore; and short term, only lasting several hours.

Under this alternative there would be no dredging of sand from the offshore environment and no offshore impact to water quality.

3.3.3.3 Alternative 2

The impact to water quality nearshore would be the same as described for Alternative 1.The *2010 Final SRIPP PEIS* and the *2013 Final Post-Hurricane Sandy EA* provided an analysis of the potential offshore water quality impacts that could result from proposed dredging and pumpout buoy operations, which would cause sediment to be suspended in the water column. Studies of past similar projects specify that the extent of the sediment plume is normally limited to between 1,640 to 4,000 feet from the dredge operation and that elevated turbidity levels are usually short term, approximately an hour or less (NASA 2013).

The length and shape of the plume depends on the hydrodynamics of the water column and the sediment grain size. Given that the dominant substrate material at the borrow site is fine to medium sand, it is expected to settle steadily and cause less turbidity and oxygen demand than finer-grained sediments would cause. No appreciable effects on dissolved oxygen, pH, or temperature are anticipated because the dredged material has low levels of organics and low biological oxygen demand. Additionally, dredging activities would occur within the open ocean where the water column is subject to constant mixing and exchange with oxygen rich surface waters. Turbidity resulting from the dredging would be short term (i.e., present for approximately an hour) and would not be expected to extend more than several thousand feet from the dredging operation. Accordingly, it is anticipated that the project would have only temporary minor impacts on offshore water quality.

3.3.3.4 Alternative 3

The impacts to water quality from the renourishment portion of Alternative 3 would be the same as described above for Alternatives 1 and 2, depending on the sand source. Offshore impacts to water quality associated with the movement of sediment from either the north Wallops Island beach or Unnamed Shoal A to the renourishment area would be the same as described above for Alternatives 1 and 2, depending on the sand source. Additionally, offshore impacts to water quality could result from breakwater construction. Construction of the breakwaters would have the potential to result in sediment suspension during placement of the materials (e.g., marine mattresses, armor stone) and the movement of construction barges and vessels. Increases in suspended sediment would be temporary, localized, and would dissipate upon cessation of sediment disturbing activities. To construct the breakwater segments, each prefabricated geotextile marine mattresses would be floated out to its final location, and then lowered to the bottom by the weight of large rocks to minimize sediment resuspension. Rocks would be placed inside the geotextile mattress in a manner that limits sediment resuspension. Rocks used for armoring and to construct the breakwaters would be made of "clean" material, further minimizing the potential for release of suspended material into the water column. Crane barges would be continually moved during construction, and vessels carrying construction materials. Construction vessels would maintain at least 2 feet of clearance from the bottom of the ocean, or work only at tide levels sufficient to keep the barges off the ocean bottom to further minimize sediment disturbance. Expected increases to suspended sediment concentrations related to vessel activity during construction would likely be minimal relative to background levels. Breakwater construction activities may result in the accidental release of petroleum products, or other contaminants to offshore waters from the barge or tenders. Construction-related impacts would be considered temporary in nature, and would not likely be adverse; NASA would require its contractors to implement BMPs as well as site specific spill prevention and control measures for the water based activities.

3.4 COASTAL ZONE MANAGEMENT

The following discussion specifically refers to compliance with the Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. § 1451, et seq., as amended). In accordance with Section 307 of the CZMA and 15 CFR 930 subpart C, federal agency activities affecting a land or water use or natural resources of a state's coastal zone must be consistent to the maximum extent practicable with the enforceable policies of the state's coastal management program.

NASA prepared a Federal Consistency Determination (FCD) in conjunction with the *2010 Final SRIPP PEIS*. VDEQ concurred with NASA's determination of consistency; however, subsequent discussions with VDEQ indicate that a new FCD would be required for each beach renourishment cycle, including this Proposed Action.

3.4.1 Regulatory Context and Permitting

The VDEQ is the lead agency for the Virginia Coastal Zone Management (CZM) Program. Although federal lands are excluded from Virginia's CZM Program, any activity on federal land that has reasonably foreseeable coastal effects must be consistent with the enforceable policies of the CZM Program (VDEQ 2018). Enforceable policies of the CZM Program that must be considered when making an FCD include the following:

- **Fisheries Management.** Administered by VMRC, this program stresses the conservation and enhancement of shellfish and finfish resources and the promotion of commercial and recreational fisheries.
- **Subaqueous Lands Management**. Administered by VMRC, this program establishes conditions for granting permits to use state-owned bottomlands.
- **Wetlands Management**. Administered by VMRC and VDEQ, the wetlands management program preserves and protects tidal wetlands.
- **Dunes Management**. Administered by VMRC, the purpose of this program is to prevent the destruction or alteration of primary dunes.
- **Non-Point Source Pollution Control**. Administered by the Virginia Department of Conservation and Recreation, the Virginia Erosion and Sediment Control Law is intended to minimize non-point source pollution entering Virginia's waterways.
- **Point Source Pollution Control**. Administered by VDEQ, the Virginia Pollutant Discharge Elimination System permit program regulates point source discharges to Virginia's waterways.
- **Shoreline Sanitation**. Administered by the Virginia Department of Health, this program regulates the installation of septic tanks to protect public health and the environment.
- **Air Pollution Control**. Administered by VDEQ, this program implements the Clean Air Act through a legally enforceable State Implementation Plan.
- **Coastal Lands Management**. Administered by the Chesapeake Bay Local Assistance Department, the Chesapeake Bay Preservation Act guides land development in coastal areas to protect the Chesapeake Bay and its tributaries.

On February 22, 2016, USACE extended the permit NAO-1992-1455 issued on March 10, 2011 for post-Hurricane Sandy renourishment. The permit expires on February 22, 2021. This permit authorizes the seawall extension and beach renourishment. The USACE has indicated that they will issue a new Individual Permit for the Proposed Action for breakwater construction and dredging of sand at the north end of the island or Shoal A, whichever is selected as the preferred alternative. VDEQ is waiving the requirement for a permit for the proposed action in lieu of USACE and VMRC permits (VDEQ 2018). VMRC has previously a issued an extension to Permit #10-2003, which was originally issued on February 2, 2016 for rehabilitation of the seawall and some beach renourishment. The permit expires in 2021

(VMRC 2016). VMRC will issue a new permit that includes the current design for beach renourishment, potential impacts to recently created primary dunes, and dredging at the north end of the Island.

3.4.2 Affected Environment

Barrier islands such as Metompkin, Assawoman, Wallops, and Assateague Islands are elongated, narrow landforms that consist largely of unconsolidated and shifting sand and lie parallel to the shoreline between the open ocean and the mainland. These islands provide protection to the mainland, recreation resources, important natural habitats, and valuable economic opportunities to the county. The northern end of Wallops Island also contains coastal primary sand dunes that serve as protective barriers from the effects of flooding and erosion caused by coastal storms. The Coastal Barrier Resources Act (Public Law 97-348, 16 U.S.C. 3501-3510), enacted in 1982, designated various undeveloped coastal barrier islands as units in the Coastal Barrier Resources System. Designated units are ineligible for direct or indirect federal financial assistance programs that could support development on coastal barrier islands; exceptions are made for certain emergency and research activities.

3.4.3 Environmental Consequences

3.4.3.1 No Action Alternative

Under the No Action Alternative, the proposed breakwater construction, dredging, and beach renourishment would not occur. Therefore, there would be no project related impacts to Virginia's CZM.

3.4.3.2 Alternative 1

The activities proposed would affect resources within Virginia's Coastal Zone. Therefore, NASA has prepared an FCD that finds its Proposed Action to be consistent with the enforceable policies of Virginia's CZM Program (**Appendix C**). NASA has submitted its FCD with this Draft EA to VDEQ for concurrence. VDEQ's response will be summarized in the Final EA.

3.4.3.3 Alternative 2

Impacts to Virginia's coastal zone from Alternative 2 would be similar to the impacts described under Alternative 1. NASA has prepared an FCD that finds its Proposed Action to be consistent with the enforceable policies of Virginia's CZM Program (**Appendix C**). NASA has submitted its FCD with this Draft EA to VDEQ for concurrence. VDEQ's response will be summarized in the Final EA.

3.4.3.4 Alternative 3

Impacts to Virginia's coastal zone from Alternative 3 would be similar to the impacts described under Alternatives 1 and 2. NASA has prepared an FCD that finds its Proposed Action to be consistent with the enforceable policies of Virginia's CZM Program (**Appendix C**). NASA has submitted its FCD with this Draft EA to VDEQ for concurrence. VDEQ's response will be summarized in the Final EA.

3.5 Air Quality

The discussion of air quality is focused on the atmospheric layer at or below 3,000 feet above ground level, which the EPA accepts as the nominal height of the atmosphere mixing layer in assessing contributions of emissions to ground level ambient air quality under the Clean Air Act (CAA) (EPA 1992) for criteria and hazardous air pollutants (HAPs).

Section 3.1.9 of the *2010 Final SRIPP PEIS* describes in detail the regulatory context and types and quantities of air pollutants emitted from NASA's activities on Wallops Island. This section provides both a summary and updated information obtained since that time.

3.5.1 Affected Environment

The affected region for the air quality analysis is limited to the Northeastern Virginia Intrastate Air Quality Control Region, as defined in 40 CFR Part 81.144, which includes Accomack County.

3.5.1.1 Criteria Pollutants

Air quality in a given location is described by the concentration of various pollutants in the atmosphere. The significance of the pollutant concentration is determined by comparing it to the federal and state ambient air quality standards. The CAA, and its subsequent amendments, established the National Ambient Air Quality Standards (NAAQS) for seven "criteria" pollutants: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 10 (PM_{10}) and 2.5 ($PM_{2.5}$) microns in diameter, and lead (Pb). These standards represent the maximum allowable atmospheric concentrations that may occur while ensuring protection of public health and welfare, with a reasonable margin of safety. Areas that exceed a federal air quality standard are designated as non-attainment areas. Wallops Island is located in Accomack County, an attainment area for all criteria pollutants; therefore, a General Conformity Review under Section 176(c) of the CAA does not apply to this project.

Hazardous Air Pollutants (HAPs)

In addition to the criteria pollutants, the EPA currently designates 187 substances as HAPs under the federal CAA. HAPs are air pollutants known or suspected to cause cancer or other serious health effects, or adverse environmental and ecological effects (EPA 2015). NAAQS are not established for these pollutants; however, the EPA developed rules that limit emissions of HAPs from specific industrial sources.

HAP emissions are typically one or more orders of magnitude smaller than concurrent emissions of criteria air pollutants, and only become a concern when large amounts of fuel are consumed during a single activity or in one location. Mobile sources operating as a result of the Proposed Action would be functioning intermittently over a large area and would produce negligible ambient HAPs in a localized area not located near any publicly accessible areas. For these reasons, HAPs are not further evaluated in the analysis.

3.5.1.2 Climate Change

Climate change refers to long term shifts in temperature, precipitation, and weather patterns which are the result of numerous natural and anthropogenic (human-induced) factors. Greenhouse gases (GHGs) are compounds that contribute to the greenhouse effect—a natural phenomenon in which gases trap heat within the lowest portion of the earth's atmosphere, causing heating at the surface of the earth. The EPA has specifically identified carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride as GHGs (EPA 2009). Carbon dioxide (CO_2), methane, and nitrous oxide occur naturally in the atmosphere. These gases influence the global climate by trapping heat in the atmosphere that would otherwise escape to space. The heating effect from these gases, primarily as a result of anthropogenic activities, is considered the primary cause of the global warming observed over the last 50 years (EPA 2009).

Each GHG is assigned a global warming potential (GWP), which is the ability to trap heat, and is standardized to CO_2, which has a GWP value of one. Six other primary greenhouse gases have GWPs: 25 for methane, 298 for nitrous oxide, 124 to 14,800 for hydrofluorocarbons, 7,390 to greater than 17,340 for perfluorocarbons, 17,200 for nitrogen trifluoride, and up to 22,800 for sulfur hexafluoride. Emissions of a GHG is multiplied by its GWP to calculate the total equivalent emissions of carbon dioxide (CO_2e). The dominant GHG emitted is CO_2, mostly from fossil fuel combustion (81.6 percent) (EPA 2018a).

Executive Oder 13834, *Efficient Federal Operations*, issued on May 17, 2018, establishes policy for federal agencies to reduce waste, cut costs, and enhance resilience of federal infrastructure and operations. On August 1, 2016, the CEQ issued final guidance on the consideration of GHG emissions and climate change in NEPA review (CEQ 2016). The guidance clarified that NEPA review requires federal agencies to consider the effects of GHG emissions and climate change when evaluating Proposed Actions:

> *"Analyzing a proposed action's GHG emissions and the effects of climate change relevant to a proposed action—particularly how climate change may change an action's environmental effects—can provide useful information to decision makers and the public."*

The guidance also emphasized that agency analyses should be commensurate with projected GHG emissions and climate impacts, and should employ appropriate quantitative or qualitative analytical methods to ensure useful information is available to inform the public and the decision-making process in distinguishing between alternatives and mitigations (CEQ 2016). Additionally, the guidance recommended that an agency should take into account the ways in which a changing climate may impact the proposed action and any alternative actions (CEQ 2016). However, pursuant to Executive Order 13783, *Promoting Energy Independence and Economic Growth*, CEQ's guidance was withdrawn for further consideration in March of 2017. Regardless, it is NASA's policy to continue to follow the CEQ guidance on GHG emissions and climate change in NEPA review until directed otherwise by amendments to the guidance or regulation.

3.5.2 Environmental Consequences

The primary emissions from the Proposed Action would result from the burning of fossil fuels in mobile sources (e.g., dredges, earth moving equipment, etc.). For the purposes of evaluating air quality impacts in this EA, emissions are considered to be minor if the Proposed Action would result in an increase of 250 tons per year or less for any criteria pollutant. The 250 tons per year value is used by the EPA in its New Source Review Prevention of Significant Deterioration standards for major stationary sources in areas that meet the NAAQS as an indicator for impact analysis. No similar regulatory thresholds are available for mobile source emissions. Lacking any mobile source emission regulatory thresholds, this threshold is used to equitably assess and compare mobile source emissions. Emission-assumptions and calculations are provided in **Appendix D**. A discussion of potential climate change impacts to Wallops Island is included in **Section 4.0, Cumulative Impacts.**

3.5.2.1 No Action Alternative

Under the No Action Alternative, the proposed breakwater construction, dredging, and beach renourishment would not occur. Therefore, there would be no project related impacts to air quality.

3.5.2.2 Alternative 1

Implementation of Alternative 1 would involve use of dump trucks, bulldozers, mobile generators, tractor scrapers, and loaders. Sand excavated from the surface of north Wallops Island beach by the scraper would be transported to the renourishment area, where it would be spread and graded by bulldozers. The operation would be a 24-hour, 7-day operation, over a 3-month period. The average distance traveled by dump truck would be 3.25 miles, with a maximum overall length from the northern area of north Wallops Island beach to the southern portion of the renourishment area extending 9 miles overall. Based on an average 12 cubic yard capacity of a 10 wheel dump truck, is estimated that 108,000 loads would be required to move the sand.

As shown in **Table 3.5-1**, Emissions would not exceed the comparative threshold for any of the criteria pollutants. As a result, no significant impacts on air quality would be anticipated from implementing this activity.

Table 3.5-1. Estimated Annual Emissions in Tons per Year from Implementation of Alternative 1

	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Alternative 1 Emissions Only	11.15	33.74	174.72	0.20	5.73	5.56	20,175
Comparative Threshold	250	250	250	250	250	250	NA
Exceeded (Yes/No)	No	No	No	No	No	No	NA

The proposed activities would contribute directly to GHG emissions from fossil fuel combustion. A total of 20,175 tons of CO_2e would be generated. To put these emissions in perspective, 20,175 tons of GHGs is the equivalent of 3,942 cars driving the national average of 11,500 miles for one year (EPA 2018b). These GHG emissions would only be generated during the activity period. While the GHG emissions alone would not be enough to cause global warming, in combination with past and future emissions from all other sources, they would contribute incrementally to the global warming that produces the adverse effects of climate change.

3.5.2.3 Alternative 2

Alternative 2 would remove sand from Unnamed Shoal A using a trailing suction dredge system. The material collected from the subsurface floor would be pumped into the self-contained hopper in the dredge vessel. When full, the vessel would move to the area where a submerged pipeline would be installed, approximately 17 miles from the dredge area. The contents of the hopper would be pumped into the pipeline, which itself would have pumps to move the materials to the renourishment area ashore. The pipeline is estimated to be up to 2 miles long. The vessel pumps are estimated to run 70 percent of the time and for 30 percent of the time the vessel is transporting materials to the pipeline and returning to the dredge area. It is assumed that two dredge vessels would be in operation for the time period. The pipeline is estimated to be located in 10 different locations during the course of the project (approximately every 0.2 miles along the renourishment stretch) and bulldozers would spread and grade the sand at each location. Because of losses associated with the hopper collection and transport, the total amount of sand estimated as required has been increased by 25 percent to 1.625 million cubic yards. Additionally, the hopper capacity has been reduced to 3,000 cubic yards. The process of dredging and placing the sand is expected to last approximately 3 months, with 10 percent of the schedule allocated for bad weather and/or equipment downtime.

As shown in **Table 3.5-2**, emissions would not exceed the comparative threshold for any of the criteria pollutants. As a result, no significant impacts on air quality would be anticipated from implementing this activity.

Table 3.5-2. Estimated Annual Emissions in Tons per Year from Implementation of Alternative 2

	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Alternative 2 Emissions Only	4.40	54.40	227.90	0.20	8.70	8.5	18,059
Comparative Threshold	250	250	250	250	250	250	NA
Exceeded (Yes/No)	No	No	No	No	No	No	NA

The proposed activities would contribute directly to GHG emissions from fossil fuel combustion. A total of 18,059 tons of CO_2e would be generated. To put these emissions in perspective, 18,059 tons of GHGs is the equivalent of 3,529 cars driving the national average of 11,500 miles for one year (EPA 2018b). These GHG emissions would only be generated during the activity period. While the GHG emissions generated alone would not be enough to cause global warming, in combination with past and future emissions from all other sources they would contribute incrementally to the global warming that produces the adverse effects of climate change.

3.5.2.4 Alternative 3

Under Alternative 3, in addition to renourishment of the shoreline infrastructure protection area, six breakwater structures would be constructed in the water approximately 200 feet offshore and parallel to the beach. Because the breakwaters are located offshore, it is assumed for the purpose of this analysis that the stone would be transported via barge from the Norfolk area. A barge-mounted excavator would be used to place the stone in the specified breakwater areas, and each breakwater structure would extend 130 feet with an exposed top width of 10 feet. The construction time for the breakwaters has been estimated at 6 to 9 months. Construction would occur daily for 16 hours/day. Approximately 5 barge loads of material would arrive daily for placement in the breakwater areas. Emissions have been estimated using 2 barges with excavators. **Table 3.5-3** provides the total emissions that would result from combining the breakwater construction with each renourishment alternative. Emissions from breakwater construction would not exceed the comparative threshold for any of the criteria pollutants. As a result, no significant impacts on air quality would be anticipated from implementing this activity.

Table 3.5-3. Estimated Annual Emissions in Tons per Year from Implementation of Alternative 3

	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Comparative Threshold	250	250	250	250	250	250	NA
Alternative 3 + Alternative 1	13.52	49.18	190.48	0.27	21.63	5.90	31,011
Exceeded (Yes/No)	No	No	No	No	No	No	NA
Alternative 3 + Alternative 2	7.38	71.91	249.89	0.25	25.93	8.99	29,679
Exceeded (Yes/No)	No	No	No	No	No	No	NA

The proposed breakwater construction would contribute directly to GHG emissions from fossil fuel combustion. Depending on the source of sand utilized, Alternative 1 or 2, a total of 31,011 or 29,679 tons of CO_2e, respectively, would, be generated as a result of implementing Alternative 3. To put these emissions in perspective, they represent the equivalent of 6,059 and 5,799 cars driving the national average of 11,500 miles for one year (EPA 2018b).

Combining the emissions from breakwater construction with beach renourishment activities would increase annual emissions, but would not exceed the comparative threshold for any of the criteria pollutants. Breakwater construction with beach renourishment using material from the north island (Alternative 3 + Alternative 1) would generate the largest increase in annual emissions, and would equal the comparative threshold for NO_x. For this reason, as well as to reduce GHG emissions, the following mitigation actions are recommended to ensure that no significant impacts to air quality from NOx emissions would be anticipated from Alternative 3:

- Implement and enforce idling restrictions,
- Mandate use of newer equipment meeting late-model (Tier IV) engine emission requirements,
- Require that equipment engines are maintained and tuned to meet EPA certification requirements, and control fugitive dust as practical.

3.6 NOISE

Noise is often defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, diminishes the quality of the environment, or is otherwise annoying. The impact of noise is described through the use of noise metrics which depend on the nature of the event and who or what is affected by the sound. The following section provides metrics for in-air and underwater noise.

3.6.1 AFFECTED ENVIRONMENT

3.6.1.1.1 Airborne Noise

Airborne noise is represented by a variety of metrics that are used to quantify the noise environment. Human hearing is more sensitive to medium and high frequencies than to low and very high frequencies, so it is common to use maximum A-weighted decibel (dBA) metrics (also shown as dB L_{Amax}) to represent the maximum sound level over a duration of an event such as an aircraft overflight. A-weighting provides a good approximation of the response of the average human ear and correlates well with the average person's judgment of the relative loudness of a noise event.

The project area would be dominated by noise from wind and wave action along the shoreline. Background noise levels in the area range from 30 to almost 50 dBA, with a constant low level of low-frequency sound likely caused by wind and waves. The southern end of Wallops Island has slightly higher sound levels ranging from 40 to 50 dBA, which is likely due to the proximity to the surf zone (NASA 2013). Noise levels increase during rocket launch activities and other operations at WFF; however, these noise levels are occasional and temporary in nature.

3.6.1.1.2 Underwater Noise

Underwater noise behaves much like noise in the air but, due to the denser medium, the sound waves can propagate much farther in-water. Unlike airborne noise, underwater noise is not weighted to match frequencies that can be heard by the human ear. Two common descriptors of underwater noise are instantaneous peak sound pressure level (dB_{peak}) and the Root Mean Square (dB_{RMS}) pressure level during the impulse. The dB_{peak} is the instantaneous maximum overpressure or underpressure observed during each sound pulse and can be presented in Pascals (Pa) or sound pressure level in dB, referenced to a pressure of 1 micropascal at one meter (dB re:1µPa-m). The dB_{RMS} is the square root of the energy divided by the duration of the sound pulse. This level is often used by the NMFS to describe disturbance related effects to marine mammals from underwater impulse sounds. Potential injury to fish from noise is estimated using the dB_{peak} metric (Washington State Department of Transportation [WSDOT] 2015).

During the initial beach fill in summer 2012, NASA partnered with BOEM and USACE to record background in-water noise levels at both the offshore borrow area and the nearshore pumpout area. Data were collected at two listening depths at each site; approximately 10- and 30-foot depths at Unnamed Shoal A and 10 and 20 foot depths at the nearshore sites. During the study, the majority of data were collected when winds were at least 4 to 7 miles per hour and wave heights were at least 1 to 2 feet. Therefore, the data do not reflect “calm” sea conditions.

Background sound pressure levels (SPLs) averaged 117 dB across all sampling days, sites, water depths and weather conditions. Minimum measured SPLs ranged from 91 dB to 107 dB depending on sampling location and water depth; maximum levels ranged from approximately 128 dB to just under 148 dB (Rein *et. al* 2014). Highest SPLs were found at frequencies of less than 200 hertz. The authors note that sea state and the associated sounds generated by waves interacting with the survey vessel likely contributed to the elevated readings.

3.6.2 ENVIRONMENTAL CONSEQUENCES

3.6.2.1 No Action Alternative

Under the No Action Alternative, breakwater construction and beach renourishment would not occur. As such, the shoreline would continue to be dominated by the sounds of winds and wave action.

3.6.2.2 Alternative 1

The operation of heavy equipment along the beach would be the most pronounced source of noise under Alternative 1. This would include engine noise, back-up alarms, and generators running lighting. Heavy construction vehicles, the major source of noise during construction projects, are constantly moving in unpredictable patterns; therefore no one receptor is expected to be exposed to construction noise of long duration. However, during the backpassing of sand from the north to the south, heavy equipment would continually traverse the length of the island. Therefore, conservative estimates of “point source” noise levels can be determined using construction equipment noise level data collected by the Federal Highway Administration (FHWA) (2006). Assuming the immediate work site would include four bulldozers, a front-end loader, and two generators (one for office power, one for nighttime lighting), the total received sound level at 50 feet from the site would be approximately 90 dBA. Typically, sound drops off at a rate of 6 dB for each doubling of the distance from a point source (FHWA 2007). Employing this methodology, noise levels would fall within the upper range of background levels (50 dBA) at approximately 0.9 mile from the work site. The nearest residence is over 1.5 miles away from the project area.

However, it should be noted that wind and surf conditions would play a major role in dictating the distances at which the construction-related sounds could be heard by nearby receivers. Studies have shown that the effects of wind on sound propagation can be substantial, with upwind attenuation approaching 25 to 30 dB more than downwind at the same distance from the source (Wiener and Keast 1959). Therefore, received construction-related noise levels would vary, however, they would not be expected to be substantial.

Under Alternative 1, the underwater noise environment could be altered by land-based equipment operating in and near the intertidal zone. Sand would be removed from the north Wallops Island beach and moved south to the deposition area and distributed using heavy equipment. Noise from the equipment may be detectable in the underwater environment, but may be masked by the noise of the surf. For instance, the noise of heavy D8 bulldozers was imperceptible through half-meter surf, to the unaided ear of scuba divers 260 feet offshore during a similar beach renourishment (M. Lybolt personal observation). The intensity of potential noise impacts to the underwater environment would be low and the duration of impacts, if created, would be temporary.

3.6.2.3 Alternative 2

Airborne noise for Alternative 2 would be very similar to that described in Alternative 1. Heavy equipment would continue to be the primary source of project related noise. Additionally, there would be some noise from the dredge outfall pipe, as it pumped the sand slurry onto the beach. Under this Alternative, noise would likely remain concentrated near the dredge discharge pipe and move steadily northward as the project progressed.

It is expected that in-water noise levels generated by the Proposed Action would be similar to those reported by Rein *et. al* (2014), which summarizes recorded noise levels from hopper dredges operating in the nearshore waters off Wallops Island. Though the referenced study presents noise levels from three individual dredges, the noise levels presented for this analysis were logarithmically averaged into a single SPL for each activity in the dredging cycle. Similar to in-air noise, the distance to which project related underwater noise would be potentially audible varies with environmental conditions like surf, wind, waves, and water temperature.

Based upon data collected by Rein *et. al* (2014), sediment removal and the transition from transit to pumpout would be expected to produce the highest noise levels at an estimated source level (SL) of 172 dB at 3 feet. The two quietest dredging activities would be expected to be seawater pumpout (flushing pipes) and transiting (unloaded) to the borrow site, with expected SLs of approximately 159 and 163 dB at 3 feet, respectively.

These expected noise levels generally correlate with those presented in the *2010 Final SRIPP PEIS*, which were based upon levels recorded by Clarke *et al.* (2003). However, the new information does suggest that SLs and the region of elevated noise around the dredges could be higher than originally anticipated, although not substantially different. In-water noise imparts are discussed in more detail in **Section 3.10, Marine Mammals**. Based upon attenuation rates observed by Rein *et. al* (2014), it would be expected that at distances approximately 1.6 to 1.9 miles from the source, underwater noise generated by the dredges would attenuate to background levels.

3.6.2.4 Alternative 3

In-air noise impacts would be the same as those identified for Alternatives 1 and 2.

In-water noise would be the same as those identified for Alternative 2, with the addition of the breakwater construction. This would involve the use of a barge and excavator to place large stone in the water to construct the breakwater. It is anticipated that the barge would be anchored in place using “spuds”, a set of 1 to 4 vertical steel beams that are lowered into the seafloor through slides on the barge hull and raised each time the barge is repositioned. Most spuds rely on gravity but some applications require spuds to be pressed into the sediment. Spuds are moved using mechanical or hydraulic winches; no additional vibratory or impact noise would be produced. Therefore, it is unlikely there would be any detrimental underwater noise impacts from breakwater construction.

3.7 BENTHOS

Bottom dwelling invertebrates provide a critical link in the productivity of the marine waters off of Wallops Island. The benthos includes organisms that live on the sediment surface (epifauna) such as starfish and sand dollars, as well as organisms that live within the sediment (infauna) such as clams and worms. The majority of the benthos live in the upper 6 inches of sediment. Benthic organisms are an important food resource for fish, including those caught by recreational and commercial fishermen.

Section 3.2.5 of the *2010 Final SRIPP PEIS* describes in detail the benthic organisms that inhabit the project site. This section provides a summary.

3.7.1 AFFECTED ENVIRONMENT

Air-breathing crustaceans such as ghost crabs (*Ocypode quadrata*) dominate the uppermost zone of the Wallops Island beach, while the swash zone is dominated by isopods, amphipods, polychaetes, and mole crabs (*Emerita talpoida*). Below the mid-tide line is the surf zone where coquina clams (*Donax variabilis*) and a variety of amphipods are prevalent. All such organisms are important prey species for a variety of waterbirds and fish. Studies reviewed in preparing the *2010 Final SRIPP PEIS* indicated that manually nourished beaches can be devoid of living benthos for up to a year following project completion.

As presented in Section 3.2.5 of the *2010 Final SRIPP PEIS*, 2009 underwater photographic studies conducted of Unnamed Shoal A during the development of the *2010 Final SRIPP PEIS* determined that the dominant epifaunal benthos included sand dollars (*Echinarachinus parma*), hermit crabs (*Pagurus* spp.), crabs (*Libinia* spp., *Cancer* spp.), moon shell (*Polinices* spp.), and whelk (*Busycon* spp.).

Similar to the discussion regarding onshore benthic resources, while the dredged area may not have fully recovered to 2014 pre-dredge conditions, it is reasonable to expect that the benthos in the affected area have recovered considerably.

3.7.2 ENVIRONMENTAL CONSEQUENCES

Section 4.3.5 of the *2010 Final SRIPP PEIS* describes in detail the expected effects of dredging and beach nourishment on benthic organisms. This section provides both a summary and updated information obtained since its publication.

3.7.2.1 No Action Alternative

Under the No Action Alternative, the proposed beach renourishment would not occur. Therefore, there would be no project related impacts to benthos, along the beach, in the intertidal zone, nearshore, or offshore. The offshore borrow area would continue to recover from previous dredging operations.

3.7.2.2 Alternative 1

Under Alternative 1, organisms living in the sandy beach area of the northern part of Wallops Island would experience direct mortality from the sand removal and relocation. This would be due to disturbance and crushing from excavators removing sand and burial in the renourishment area. The physical oceanographic conditions would be essentially unchanged, and after the renourishment reaches equilibrium, there would be no net change in the physical environment available for benthos.

Recovery time of benthos in the surf zone renourishment area under Alternative 1 could be more rapid than under Alternative 2 because the sediment is more closely matched. Burlas *et al.* (2001) estimated that the recovery time for benthos in a New Jersey study ranged from approximately 2 to 6 months when there is a good match between the fill material and the natural beach sediment. Dalfsen and Essink (2001) noted that recolonization is generally defined by two patterns: the rapid development of "opportunistic" species, and the subsequent recovery of community composition and structure. The USACE recently reviewed the subject, and benthos recovery times for scenarios similar to the proposed action ranged from about 6 months to about 2 years (USACE 2015). Under Alternative 1, it is expected that organisms from adjacent areas would recolonize the new beach in relatively short time (i.e., on the order of 6 to 12 months post-project).

Under Alternative 1, there would be no offshore dredging. Therefore there would be no project related impacts to benthic organisms at the offshore borrow area.

3.7.2.3 Alternative 2

Impacts from renourishment activities to benthic organisms living onshore and in the nearshore environment would be similar to those described under Alternative 1 with two differences. Impacts to onshore benthos at the north Wallops Island beach borrow area would be eliminated. Under Alternative 2, the fill material would be slightly different than native material and the rate of recovery could be slower than under Alternative 1.

Within the OCS borrow area, bottom dwelling organisms would be entrained in the dredge. Based upon reports by biological monitors onboard the dredges during the initial beach fill cycle, the most commonly encountered macrobenthos included horseshoe crab (*Limulus polyphemus*), whelk (*Busycon canaliculatum*), and blue crabs (*Callinectes sapidus*).

Because of the dynamic nature of OCS benthic communities and their variability over time, the recovery of benthos at offshore borrow areas varies. A summary of post-dredge faunal recovery rates in Europe by Hitchcock, Newell, and Seiderer (2002) show a range from several weeks to more than ten years. Recovery rates for borrow areas in a recent review by USACE were similar, and ranged from several months to no detectable recovery (USACE 2015). The most rapid recovery rates were observed for highly mobile organisms (i.e., several months up to two years); whereas the longest recovery periods (i.e., a decade or more) were associated with sessile and uncommon low-fecundity benthos. Given the benthic assemblages known from Unnamed Shoal A, recovery of most benthos would be likely within two years.

3.7.2.4 Alternative 3

Under Alternative 3, impacts to benthos living nearshore and onshore would be the same as those described for Alternative 1 or for Alternative 2, with the addition of bottom disturbance for the construction of the breakwaters. Direct mortality of all benthos within the footprint of breakwater construction would be likely. The footprint of the breakwaters would be permanently converted from sand to approximately 0.34 acres of new hardbottom habitat. However, because the regional coastline has very little hardbottom habitat in the surf zone the concept of recovery is not applicable and colonization of the breakwaters would provide habitat for an essentially novel community of benthos. Potential direct benefits to native benthos would be minimal, but the breakwaters would provide attachment points for sessile creatures as well as refuge and cover for mobile macrobenthos such as polychete worms or amphipods and could offer some minor beneficial impacts in the long term.

Offshore impacts to benthos from Alternative 3 would be identical to either Alternative 1 or Alternative 2, depending on the sand source.

3.8 WILDLIFE

This discussion of wildlife addresses the variety of species found on and near the onshore and offshore environments of Wallops Island.

3.8.1 AFFECTED ENVIRONMENT

Section 3.2.2 of the *2010 Final SRIPP PEIS* describes in detail the wildlife species that may inhabit the project site. This section provides both a summary and updated information obtained since its publication.

Wallops Island is home to a diverse array of wildlife species. The Assateague Island National Seashore extends from the northern (Maryland) portion of Assateague Island through Virginia. The southern (Virginia) portion located closest to Wallops Island is part of Chincoteague National Wildlife Refuge (CNWR). Assawoman Island to the south of Wallops is also owned by the USFWS and is part of CNWR. Both protected areas provide high quality habitat for a variety of wildlife.

3.8.1.1 Onshore

Avifauna: The Wallops Island beach provides important nesting and foraging habitat for a number of migratory waterbirds, including gulls, terns, and sandpipers. Waterbird numbers on the beach peak during the fall and spring migrations, during which the beach provides stopover habitat for resting and feeding as the birds transit between breeding and wintering grounds. Important food sources include fish mollusks, insects, worms, and crustaceans.

Recently filled beaches are expected to be mostly devoid of food sources making habitat value limited. However, since the post-Hurricane Sandy beach fill, recruitment has likely replenished the invertebrate food sources for foraging avifauna to near normal levels. Also noteworthy is that following the initial fill cycle, the most northern end of Wallops Island (which would remain unaffected by the Proposed Action) has developed an expansive area of tidal pools; these are expected to be important sources of forage for bird species.

In accordance with its Protected Species Monitoring Program, NASA continues to conduct regular monitoring of the Wallops Island beach between March and September to determine the level of bird nesting activity within and adjacent to the project area. The most recent Protected Species Monitoring Reports observed one American oystercatcher (*Haematopus palliatus*) nest in 2017 and in 2018 with no chicks surviving to fledge (NASA 2017, NASA 2018). No Wilson's plover (*Charadrius wilsonia*) nests were observed for 2017 or 2018. Wallop's staff also monitor for piping plover (*Charadrius melodus*) and the red knot (*Caladris canutus rufa*), and these are discussed in **Section 3.11, Special Status Species**. No colonial waterbird nesting activity has been observed on the Wallops Island beach since NASA began its regular beach nesting bird surveys in spring 2010 (NASA 2018). In general, the wildlife abundances measured under the monitoring program have remained constant since 2010, or have declined (NASA 2016, NASA 2017, NASA 2018).

Herpetofauna: Though Wallops Island is home to a number of amphibians and reptiles, the species most likely affected by activities on or adjacent to the beach is the diamondback terrapin (*Malaclemys terrapin*), which in the past has regularly nested on the north beach and locations on the west (bay) side of the island. However now that portions of the rock seawall have sand overtopping them, the species has easier access to the beach for its late spring to early summer nesting. During the initial 2012 beach fill, the diamondback terrapin was observed frequently within the project site during the late May to early June timeframe. Sea turtles are discussed in **Section 3.11, Special Status Species**.

3.8.1.2 Offshore

Seabirds including scoters, loons, and gannets use the offshore portion of the project area as foraging grounds during winter months.

Existing scientific literature supports that recovery of the forage value of a dredged shoal likely occurs within 2 years. Therefore, similar to the discussion above regarding the nearshore environment, given that the last dredging occurred within the borrow area on Unnamed Shoal A during 2014, it is expected that the forage value of the affected area has returned to pre-dredge conditions.

3.8.2 Environmental Consequences

3.8.2.1 No Action Alternative

Under the No Action Alternative, there would be no project related impacts onshore or offshore to wildlife in the vicinity of Wallops Island.

3.8.2.2 Alternative 1

3.8.2.2.1 Onshore

Avifauna: Temporary noise and visual disturbances from construction equipment and personnel could adversely affect beach foraging and nesting birds. Direct effects could include eliciting a startle or flee response, which for foraging birds could temporarily interrupt feeding activities or cause individuals to relocate to other areas of the beach. If nesting birds were to flush from nests, it could lead to an elevated risk of egg overheating or predation. It would also be possible for equipment to inadvertently crush or bury nests or chicks if the nests were undetected. Adverse effects would also occur from a reduction in available food sources during and following the placement of sand on the Wallops Island shoreline. Potential impacts to wildlife would be reduced by the avoidance measures employed for Special Status Species (i.e., no activity at the north Wallops Island borrow area from piping plover and loggerhead sea turtle nesting season).

However, beach renourishment would occur well south of the areas of the beach that have historically hosted the greatest level of nesting activity. It is unknown to what extent the newly created Wallops Island beach in the shoreline infrastructure protection area would be used by waterbirds. The actual usage patterns would play a large role in dictating potential impacts. Effects on prey availability are expected to be a contributing factor, and given that the newly placed beach is likely in a biologically suppressed state, it is possible that bird species would congregate closer to more forage-rich areas outside of the affected area. As discussed in **Section 3.7, Benthos**, available forage would most likely recover within one year.

Long term, the renourished beach could create suitable waterbird nesting habitat. At a time when storm intensity and frequency are expected to increase, having an elevated, sparsely vegetated beach and dune along the entire length of Wallops Island is expected to be of notable benefit to all beach nesting species.

Herpetofauna: Diamondback terrapins, while noted to be abundant on Wallops Island, have only been found on the west (bay) side of the island and are not a protected species. Therefore, no potential impact is anticipated to this species and no mitigation would be required. However, NASA would continue to monitor this species to the extent practicable.

3.8.2.2.2 Offshore

Under Alternative 1, there would be no project related impacts offshore, as no OCS dredging would occur.

3.8.2.3 Alternative 2

3.8.2.3.1 Onshore

Avifauna: Impacts to avifuana would be similar to those described under Alternative 1, as construction equipment would move sand pumped from the offshore borrow area into the areas to be renourished.

Herpetofauna: Impacts to herpetofauna would be similar to those described under Alternative 1, as construction equipment would move sand pumped from the offshore borrow area into the areas to be renourished.

3.8.2.3.2 Offshore

Dredging Unnamed Shoal A would be done in a way so as not to substantially change shoal topography and to minimize the impact to the availability of seabird food sources as considered in the *2010 Final SRIPP PEIS*. Though the additional dredging would increase the water depths at the borrow area, diving species could still effectively forage on the shoal. As discussed in **Section 3.7, Benthos**, forage sources would most likely recover within two years. All additional sand would be removed within areas already disturbed; therefore it would not expand the footprint of the area having reduced available forage following the dredge event. Both adjacent undisturbed areas on Unnamed Shoal A and neighboring shoals would provide adequate forage should seabirds avoid the directly affected area. Additionally, the dredge portion of the project is expected to be completed within a 3-month window. Impacts from disturbance would be limited to that active dredging phase.

3.8.2.4 Alternative 3

3.8.2.4.1 Onshore

Avifauna: Impacts to avifuana would be similar to those described under Alternative 1, as construction equipment would move sand pumped from the offshore borrow area into the areas to be renourished.

Herpetofauna: Impacts to herpetofauna would be similar to those described under Alternative 1, as construction equipment would move sand pumped from the offshore borrow area into the areas to be renourished.

3.8.2.4.2 Offshore

Impacts to wildlife under Alternative 3 would be similar to those described under Alternative 2, with the additional disturbance from the construction of offshore breakwaters. The breakwaters would alter the nearshore bottom and create adverse impacts from direct disturbance during construction. Post-construction of the breakwaters would potentially provide resting areas for avifauna. It is unlikely that the breakwaters would contribute to any lasting negative impacts to offshore wildlife in the vicinity of Wallops Island.

3.9 Fisheries and Essential Fish Habitat

3.9.1 Regulatory Context

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976, federal agencies must consult with the National Marine Fisheries Service (NMFS) for activities that may adversely affect Essential Fish Habitat (EFH) that is designated in a federal Fisheries Management Plan. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” Both the offshore borrow area and the nearshore discharge location are designated

EFH for multiple life stages of managed fish species, therefore the EFH consultation requirement applies to the Proposed Action.

A separate Essential Fish Habitat Assessment was prepared (**Appendix E**), which references extensive previous EFH consultations that occurred in conjunction with the *2010 Final SRIPP PEIS* and the *2013 Post-Hurricane Sandy EA* and summarizes the affected environment and environmental consequences to EFH under the Proposed Action. Previous EFH consultations concurred that beach restoration would not substantially adversely affect EFH. Note that using sand from the north Wallops Island beach for renourishment, under either Alternative 1 or Alternative 3, would result in a smaller spatial footprint and less intense stressors than use of materials from Unnamed Shoal A (under Alternatives 1 or 3) and prior actions. NASA anticipates that the magnitude of potential consequences under Alternative 1 and Alternative 3 would be smaller than similar actions.

3.9.2 AFFECTED ENVIRONMENT

Most major invertebrate groups are found on inshore and nearshore sandy areas including mollusks (e.g., clams and whelks), crustaceans (e.g., crabs, shrimp, and amphipods), and polychaetes (marine worms). Inshore tidal marsh grasses of WFF act as nursery grounds for a variety of fish species including the spot (*Leiostomus xanthurus*), the northern pipefish (*Syngnathus fuscus*), the dusky pipefish (*Syngnathus floridae*), and bay anchovy (*Anchoa mitchilli*) (USFWS 2015). Salinity and water depth play major roles in determining which coastal fish species are present in bays and inlets. An example of this is the sandbar shark (*Carcharhinus plumbeus*), which is common in summer months if the inshore channels are at least 12 feet deep and the salinity is at least 30 parts per thousand (Chesapeake Bay Program 2009).

Common finfish in both inshore and nearshore waters of WFF include the Atlantic croaker (*Micropogonias undulates*), sandbar shark, sand shark (*Carcharisa taurus*), smooth dogfish (*Mustelus canis*), smooth butterfly ray (*Gymnura micrura*), bluefish (*Pomatomidae saltatrix*), spot, and summer flounder (*Paralichthys dentatus*) (NASA 2016).

The Endangered Species Act (ESA)-listed Atlantic Sturgeon and Giant Manta Ray are discussed briefly in **Section 3.11, Special Status Species**. They could be present, but their low abundance and distribution makes project related impacts possible but not plausible.

3.9.2.1.1 Fisheries

The project area associated with using sand from the north Wallops Island beach is geographically coincident with 21 managed fishery species. Unnamed Shoal A is geographically coincident with an additional nine managed fishery species. Commercially important shellfish fisheries include the sea scallop (*Plactopecten magellanicus*) and blue crab. Other nearshore shellfish fisheries species include decapod crustaceans, stomatopod crustaceans, and cephalopods. Common finfish fisheries in the waters near WFF include the menhaden (*Brevoortia tyrannus*), Atlantic croaker (*Micropogonias undulatus*), summer flounder, and bluefish.

Chincoteague is one of six major ports in Virginia where large, ocean-going fishing vessels unload their catches (McCay and Cieri 2000). Throughout Virginia, the total value of the commercial fishery is dominated by two species: sea scallop and menhaden. Prominent but relatively minor commercial and recreational fishery species also include blue crab, northern quahog clam (*Mercenaria mercenaria*), Atlantic croaker, summer flounder, and striped bass (*Morone saxatilis*) (NMFS 2018a; 2018b).

3.9.2.1.2 Essential Fish Habitat

The project area associated with using sand from the north Wallops Island beach is geographically coincident with eight EFH designations, no habitat areas of concern (HAPC) designations, and 21 managed species (**Table 3.9-1**). Unnamed Shoal A is geographically coincident with an additional three EFH designations, no HAPC designations, and an additional nine managed species. Only two EFH habitat types occur within the project area, water column and unconsolidated sand.

<table>
<tr><th colspan="7">Table 3.9-1. Essential Fish Habitat and Managed Species for the Proposed Action Area on north Wallops Island Beach</th></tr>
<tr><th rowspan="2">Species</th><th rowspan="2">Scientific Name</th><th colspan="5">Life Stage</th></tr>
<tr><th>Eggs</th><th>Larvae</th><th>Juveniles</th><th>Adults</th><th>Spawning Adults</th></tr>
<tr><td colspan="7">Northeast Multispecies Fishery Management Plan – Amendment 14 (New England FMC)</td></tr>
<tr><td>Red hake</td><td>Urophycis chuss</td><td>X</td><td>X</td><td>X</td><td></td><td></td></tr>
<tr><td>Windowpane flounder</td><td>Scopthalmus aquosus</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td colspan="7">Northeast Skate Complex Fishery Management Plan – Amendment 2 (New England FMC)</td></tr>
<tr><td>Clearnose skate</td><td>Raja eglanteria</td><td></td><td></td><td>X</td><td>X</td><td></td></tr>
<tr><td>Winter skate</td><td>Leucoraja ocellata</td><td></td><td></td><td>X</td><td>X</td><td></td></tr>
<tr><td colspan="7">Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan – Amendment 12 (Mid-Atlantic FMC)</td></tr>
<tr><td>Black sea bass</td><td>Centropristis striata</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td>Summer flounder</td><td>Paralichthys dentatus</td><td>X[1]</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td colspan="7">Atlantic Herring Fishery Management Plan – Amendment 3 (New England FMC)</td></tr>
<tr><td>Atlantic sea herring</td><td>Clupea harengus</td><td>X[2]</td><td>X</td><td>X</td><td>X</td><td>X[2]</td></tr>
<tr><td colspan="7">Atlantic Bluefish Fishery Management Plan – Amendment 1 (Mid-Atlantic FMC)</td></tr>
<tr><td>Bluefish</td><td>Pomatomus saltatrix</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr>
<tr><td colspan="7">Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan – Amendment 11 (Mid-Atlantic FMC)</td></tr>
<tr><td>Atlantic butterfish</td><td>Peprilus triacanthus</td><td>X[3]</td><td>X[3]</td><td>X[3]</td><td>X[3]</td><td>X[3]</td></tr>
<tr><td colspan="7">Coastal Migratory Pelagics[4] – Amendment 26 (South Atlantic FMC)</td></tr>
<tr><td>Cobia[4]</td><td>Rachycentron canadum</td><td>X[4]</td><td>X[4]</td><td>X[4]</td><td>X[4]</td><td></td></tr>
<tr><td>King mackerel[4]</td><td>Scomberomorus cavalla</td><td>X[4]</td><td>X[4]</td><td>X[4]</td><td>X[4]</td><td></td></tr>
<tr><td>Spanish mackerel[4]</td><td>Scomberomorus maculatus</td><td>X[4]</td><td>X[4]</td><td>X[4]</td><td>X[4]</td><td></td></tr>
<tr><td colspan="7">Atlantic Highly Migratory Species Fishery Management Plan – Amendment 10 (Secretarial)</td></tr>
<tr><td>Albacore tuna*</td><td>Thunnus alalunga</td><td></td><td></td><td>X[4]</td><td></td><td></td></tr>
<tr><td>Skipjack tuna*</td><td>Katsuwonus pelamis</td><td></td><td></td><td>X[4][5]</td><td>X[4]</td><td></td></tr>
<tr><td>Atlantic angel shark</td><td>Squatina dumeril</td><td colspan="5">X</td></tr>
<tr><td>Blacktip shark* (Atlantic stock)</td><td>Carcharhinus limbatus</td><td colspan="2">X</td><td>X</td><td>X</td><td></td></tr>
<tr><td>Common thresher shark</td><td>Alopias vulpinus</td><td colspan="5">X</td></tr>
<tr><td>Dusky shark</td><td>Carcharhinus obscurus</td><td colspan="2">X</td><td>X[5]</td><td>X[5]</td><td></td></tr>
<tr><td>Sand tiger shark</td><td>Carcharias taurus</td><td colspan="2">X</td><td>X</td><td>X</td><td>[6]</td></tr>
<tr><td>Sandbar shark</td><td>Carcharhinus plumbeus</td><td colspan="2">X</td><td>X</td><td>X</td><td>[6]</td></tr>
<tr><td>Smoothhound shark complex* (Atlantic stock)</td><td>Mustelus canis</td><td colspan="5">X</td></tr>
</table>

Notes: [*] Not covered under previous EFH consultations for the Proposed Action Area.
[1] Less likely in affected area under Alternative 1 and Alternative 3. Eggs are most likely from 30 to 360 feet. (9 to 110 meters [m]).
[2] Less likely in affected area under Alternative 1 and Alternative 3. Eggs and spawning adults are most likely from 15 to 300 feet. (5 to 90 m).
[3] Less likely in affected area under Alternative 1 and Alternative 3. All life stages are most likely deeper than 30 feet. (10 m).
[4] Coastal migratory pelagics and some highly migratory species are not year round residents of the Proposed Action Area and are generally absent in winter. These species are much less likely in the affected area under Alternative 1 and Alternative 3.
[5] Less likely in affected area under Alternative 1 and Alternative 3. Juveniles and adults are most likely deeper than 60 feet. (20 m).
[6] No HAPC near the Proposed Action area, but HAPC is approximately 60 mi (100 km) north and south, at Delaware Bay and Chesapeake Bay.
Legend: FMC = Fishery Management Council.

Completion of the proposed offshore breakwaters under Alternative 3 would convert approximately 0.34 acres of unconsolidated sand into hardbottom seafloor EFH. However, because the regional coastline has very little hardbottom habitat in the surf zone the potential direct benefits to designated EFH or managed species would be minimal.

Table 3.9-1 was excerpted from the separate EFH Assessment. Other EFH elements are incorporated by reference to minimize duplication.

3.9.3 Environmental Consequences

3.9.3.1 No Action Alternative

Under the No Action Alternative, the proposed breakwater construction, dredging, and beach renourishment would not occur. Therefore, there would be no project related impacts to fisheries and EFH.

3.9.3.2 Alternative 1

The nature and intensity of turbidity and water quality stressors imposed under Alternative 1 would be measurable, but would be substantially less than in previous consultations. Hauling sand by truck from the north Wallops Island beach would not require the large volumes of water to move sand slurries through pipes from a dredge site, and consequently would not produce a similarly intense turbidity plume. Taken together, turbidity and water quality stressors imposed on EFH and managed species would be substantially less than in previous consultations, e.g., stressors would be concentrated within the swash zone, projected to dissipate approximately 1,000 to 2,000 feet alongshore, and to last only several hours after cessation of work. Physical strike and disturbance stressors would be limited to vehicles operating in the surf zone. Other potential stressors imposed under Alternative 1 (i.e., artificial lighting, noise, ingestion, entanglement, and chemical stressors) are not relevant because their nature and magnitude is discountable, stressor and receptor are not co-located, and EFH and managed species have little to no meaningful susceptibilities in this context. Therefore, these other stressors were not carried forward for analysis for Alternative 1.

Most motile fishery species would be displaced from the project area under Alternative 1. Displacement would range from temporary to long term, and most consequences would be temporary or short term. Sessile fishery species (e.g., clams) are conservatively assumed to have 100 percent mortality within the project area under Alternative 1, and species recovery could begin almost immediately after completion of the renourishment activities.

3.9.3.2.1 Nearshore

Under Alternative 1, all of the nearshore intertidal and subtidal fishery species and EFH would be exposed to moderate and episodic turbidity stressors for the duration of the project. Construction equipment and materials would displace water column EFH, fish species, and their prey.

3.9.3.2.2 Offshore

Under Alternative 1 there would be no dredging of sand from the Unnamed Shoal A and no offshore impact to fishery species and EFH.

3.9.3.3 Alternative 2

The nature and intensity of turbidity and water quality stressors and physical strike and disturbance stressors imposed under Alternative 2 would be identical to prior permitted actions. Most motile fishery species would be displaced from the project area without injury or mortality under Alternative 2. Displacement would range from temporary to long term, with most consequences temporary or short term. Sessile fishery species (e.g., clams) are conservatively assumed to have 100 percent mortality within the entire project area under Alternative 2, and species recovery could begin almost immediately after completion of the action. Most consequences would be temporary to short term because the stressors are reduced to background intensity shortly after cessation of construction. Other potential stressors imposed under Alternative 2 (i.e., artificial lighting, noise, ingestion, entanglement, and chemical stressors) are not relevant because their nature and magnitude is discountable, stressor and receptor are not co-located, and EFH and managed species have little to no meaningful susceptibilities in this context. Therefore, these other stressors were not carried forward for analysis for Alternative 2.

3.9.3.3.1 Nearshore

The nature and intensity of stressors affecting nearshore fish and EFH under Alternative 2 would be identical to prior permitted actions (NASA 2010, 2013). Fishery species and EFH in the inshore waters of Chincoteague Bay could conceivably be temporarily affected by turbidity and vessel traffic but no other direct or indirect stressors would be imposed by the Proposed Action. Inshore impact is possible but not probable. At minimum, a conservative estimate is that impacts to nearshore fish would be temporary, and impacts to their benthic prey would be several months up to 2 years (see **Section 3.7.2, Benthos**).

3.9.3.3.2 Offshore

The consequences to fishery species and EFH under Alternative 2 would be identical to prior permitted actions (NASA 2010, 2013). Alternative 2 would affect approximately 206 acres of offshore shoal habitat, would have 100 percent mortality for sessile species in the area dredged, and would remove the seafloor habitat. Most motile fish species would be displaced without injury or mortality. But dredging Unnamed Shoal A under Alternative 2 would have greater incidence of injury or mortality to motile demersal species (e.g., flatfish, dogfish, angel shark), including mortality from entrainment into the sand excavation equipment. However, the probability of large-bodied animals being entrained through the dragheads is lower than during prior permitted actions because screening was added since 2014 to minimize potential uptake of Unexploded Ordnance (UXO). The overall magnitude of adverse impacts are expected to be minimal, temporary and localized.

3.9.3.4 Alternative 3

Under Alternative 3, impacts to fishery species and EFH nearshore and onshore would be the same as those described for Alternative 1 or for Alternative 2, with the addition of bottom disturbance for the construction of the breakwaters. The nature and intensity of turbidity and water quality stressors imposed by breakwater construction under Alternative 3 would be different, but not meaningfully increased relative to Alternative 1 and Alternative 2. Other potential stressors imposed under Alternative 3 by the addition of breakwater construction (i.e., artificial lighting, noise, ingestion, entanglement, and chemical stressors) are not relevant because their nature and magnitude is discountable, stressor and receptor are not co-located, and EFH and managed species have little to no meaningful susceptibilities in this context. Therefore, these other stressors were not carried forward for analysis for Alternative 3.

3.9.3.4.1 Nearshore

Most motile fishery species would be displaced from the entire breakwater footprint under Alternative 3. Displacement would range from temporary to long term, and most consequences would be temporary or short term, as recovery could begin almost immediately after completion of the action. Most motile fish species are attracted to structures, and the breakwater would likely cause localized increases in fish density. Sessile fishery species (e.g., clams) are conservatively assumed to have 100 percent mortality within the breakwater footprint. The footprint of the breakwaters would permanently convert approximately 0.34 acres of sand to hardbottom habitat. Colonization of the new habitat could begin almost immediately after completion of the breakwater construction. However, because the regional coastline has very little hardbottom habitat in the surf zone the concept of recovery is not applicable and colonization of the breakwaters would provide habitat for an essentially novel community of benthos. Potential direct benefits to native fishery species and EFH would be minimal.

3.9.3.4.2 Offshore

Offshore impacts to fishery species and EFH from Alternative 3 would be identical to either Alternative 1 or Alternative 2, depending on the sand source.

3.10 Marine Mammals

3.10.1 Regulatory Context

Marine mammals are protected under the Marine Mammal Protection Act (MMPA) of 1972. The MMPA protects all marine mammals and prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas. The MMPA also prohibits the importation of marine mammals and marine mammal products into the U.S. NMFS maintains jurisdiction of the majority of the marine mammal species found worldwide. The USFWS has jurisdiction for eight marine mammal species that are not regulated by NMFS (i.e., walrus, polar bear, two marine otter species, three manatee species, and the dugong) (USFWS 2018a).

Under the MMPA, NMFS has defined noise-related levels of harassment for marine mammals. The current Level A (injury) threshold is 190 and 180 dB_{RMS} for pinnipeds (e.g., seals) and cetaceans (e.g., whales and dolphins), respectively. The current Level B (disturbance) threshold for underwater impulse noise (e.g., pile driving) for both cetaceans and pinnipeds is 160 dB_{RMS} from a non-continuous noise source. The Level B (disturbance) threshold for continuous noise (e.g., dredging) is 120 dB_{RMS} for both cetaceans and pinnipeds.

3.10.2 Affected Environment

Section 3.2.9 of the *2010 Final SRIPP PEIS* describes in detail the marine mammals that may occur within the project area. This section provides a summary. Federally listed (i.e., ESA) species are discussed in **Section 3.11, Special Status Species** of this EA.

Of the approximately nineteen marine mammal species not listed by ESA that could occur within or adjacent to the project area, the bottlenose dolphin (*Tursiops truncatus*) is the most common, with the potential to occur at any time of year but most commonly encountered during non-winter months. During winter, the species is rarely observed north of the North Carolina-Virginia border. Those individuals encountered would be expected to be the coastal morphotype; the offshore morphotype are primarily found farther offshore.

3.10.3 Environmental Consequences

3.10.3.1 No Action Alternative

Under the No Action Alternative, there would be no project related impacts to marine mammals.

3.10.3.2 Alternative 1

Under Alternative 1, there would be no dredging or offshore construction activities. Therefore, there would be little to no impact to marine mammals, aside from the potential for increased turbidity in the very nearshore environment during the sand placement activities. These impacts would be minor, would occur in relatively shallow water, and would be temporary in nature. No long term impacts to marine mammals would occur under Alternative 1.

3.10.3.3 Alternative 2

Potential adverse impacts to marine mammals would be associated with physical disturbance to habitats during dredging and placement of material which would result in temporary increases in-water turbidity, a reduction in prey availability, vessel strike, and increased noise from vessel activities. However, given the relatively slow speed of the dredge, the limited extent of habitat affected, and with the implementation of mitigation measures described below, effects are expected to be minimal.

During the development of the *2013 Post-Hurricane Sandy EA*, NASA participated in a study (Reine *et al*. 2014) to better characterize dredge noise within its project site. Reine *et al.* (2014) found that in-water noise levels associated with dredging would not reach the 180 and 190 dB_{RMS} Level A thresholds (for cetaceans and pinnipeds, respectively); 160 dB_{RMS} non-continuous Level B would only be reached several yards from the dredge; and 120 dB_{RMS} continuous noise Level B would be reached at between 0.1 and 1.2 miles from the dredge, depending on the specific activity within the dredging cycle.

As with previous projects that involved dredging, NASA would ensure that an NMFS-approved bridge watch is stationed on each dredge at all times of year to scan the horizon for up to 1.2 miles for marine mammals. At this distance, marine mammals could be readily detected with the aid of binoculars. Should an individual be detected, the vessel would be required to turn off its pumps until the animal has left the immediate vicinity, upon which the dredging activity could resume.

In consideration of the above described mitigation measures, it would be highly unlikely that marine mammals within or adjacent to the project area would be subjected to noise levels in excess of those prescribed by the MMPA. Therefore, the Proposed Action would not result in the harassment of any non-listed marine mammals. In 2012, NMFS issued a revised Biological Opinion based on the best available information, and concluded that the effects of dredge noise on listed species of whales are discountable (see **Section 3.11, Special Status Species**).

3.10.3.4 Alternative 3

Under Alternative 3, impacts to marine mammals would be similar to those described under Alternatives 1 or 2, depending on the source of sand for renourishment, with the additional construction of breakwaters at two locations approximately 200 feet offshore, in shallow (4 to 8 feet deep) water. During breakwater construction, barge-mounted heavy equipment would place geotextile mattresses and large stones, per the breakwater design. Due to the shallow water, larger marine mammals would likely not be in the vicinity and therefore, would not be impacted. Bottlenose dolphins may be found at these water depths, but would likely avoid the area due to construction activity and noise. Disturbances to any potential foraging or movement of bottlenose dolphins would be temporary, and there would be no long term impacts to marine mammals under Alternative 3.

3.11 Special Status Species

Special status species include any species which is listed, or proposed for listing, as threatened or endangered by the USFWS or NMFS under the provisions of the ESA; species protected under other federal laws including the Bald and Golden Eagle Protection Act; species that are considered to be threatened or endangered under Virginia's ESA; or those species or habitats of conservation concern identified by the Commonwealth of Virginia. Marine mammals are also protected under federal regulations and are discussed in **Section 3.10, Marine Mammals**.

3.11.1 Regulatory Context

Section 7 of the ESA requires federal agencies to evaluate the effects of their actions on listed species and consult with either the USFWS or NMFS if the agency determines that its action "may affect" a listed species or designated critical habitat.

The Virginia ESA (29 VAC 1-563 – 29.1-570) is administered by Virginia Department of Game and Inland Fisheries and prohibits the taking, transportation, processing, sale, or offer for sale of any federally or state-listed threatened or endangered species. As a federal agency, NASA voluntarily complies with Virginia's ESA.

3.11.2 Affected Environment

Section 3.2.10 of the *2010 Final SRIPP PEIS* describes in detail the federally listed species that inhabit the project site. This section provides both a summary and updated information obtained since its publication.

3.11.2.1.1 Onshore

A review of the federal threatened and endangered species list for Accomack County indicates that the species potentially within the project area have not changed from those discussed in the *2010 Final SRIPP PEIS*, with the exception of the addition of the Northern long-eared bat (*Myotis septentrionalis*) (USFWS 2018b). In preparing the *2010 Final SRIPP PEIS,* NASA determined that project activities may affect the threatened seabeach amaranth (*Amaranthus pumilus*), threatened piping plover, threatened red knot, and several species of nesting sea turtles, including loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and Atlantic green (*Chelonia mydas*). Although there is suitable seabeach amaranth habitat present on the Wallops Island beach, recent biological surveys have not identified any of these listed plants (NASA 2016a). While habitat does exist on Wallops Island and within the boundaries of WFF for the Northern long-eared bat, no habitat exists within the project area. Therefore, seabeach amaranth and the Northern long-eared bat are not discussed further, and this section will focus on piping plovers, red knots, and sea turtles.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a listing of endangered, threatened, and species of greatest conservation need. Federal-level listings are mirrored in state-level listings. While no other state-listed plants, reptiles, or mammals have been documented in the project area, two state-listed birds Wilson's plover (*Charadrius wilsonia*) and gull-billed tern (*Sterna nilotica*) are present (VDGIF 2018).

In accordance with its Protected Species Monitoring Program, NASA continues to conduct regular monitoring of the Wallops Island beach between March and September to determine the level of federally-listed bird and sea turtle nesting activity within and adjacent to the project area. In general, the wildlife abundances measured under the monitoring program have stayed about the same since 2010, or have declined (NASA 2016, NASA 2017, NASA 2018).

Piping Plover: Since 2010, NASA has conducted annual piping plover surveys 3 to 4 times weekly between March and September. Six piping plover (*Charadrius melodus*) nests were observed in 2017 with four chicks surviving to fledge, and three nests were observed in 2018 with three chicks surviving to fledge (NASA 2017, NASA 2018).

Red Knot: NASA has observed and recorded red knot (*Caladris canutus rufa*) numbers since 2010. Red knot counts were 415 birds in 2017 and 393 in 2018. Since 2010 the high was over 3,000 birds in 2012 and the low was less than 100 birds in 2014 (NASA 2017, NASA 2018).

Sea Turtles: While NASA has observed loggerhead sea turtles and sea turtle nesting activity in the past, numbers are low and some years have no observations of sea turtle nesting. Between 2010 and 2013 NASA observed a total of 8 nests and 5 false crawls on Wallops Island beach. DNA analysis determined that all 4 nests in 2010 were dug by a single female loggerhead sea turtle (NASA 2010b; USFWS 2016). No sea turtle nesting activity was observed in 2014, 2015, 2016, 2017, and 2018 (NASA 2017, NASA 2018).

Gull-billed Terns and Wilson's Plovers: Since 2010, no nesting activity has been observed on Wallops Island for either gull-billed terns or Wilson's plovers.

3.11.2.1.2 Offshore

In preparing the *2010 Final SRIPP PEIS*, NASA determined that project activities have the potential to affect in-water sea turtles (species listed above under **Section 3.11.2.1.1 Onshore**) and several whale species, including right whale (*Eubalaena glacialis*), fin whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), sei whale (*Balaenoptera borealis*), and blue whale (*Balaenoptera musculus*). Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) was added into the Supplemental Biological Assessment (NASA 2011b), Biological Opinion (NMFS 2012), and the *2013 Post-Hurricane Sandy EA* (incorporated by reference into this section). The NMFS issued a revised 2012 Biological Opinion based on the best available information, and concluded that the effects of dredge noise on listed species of whales are discountable. Protected species monitoring conducted by observers onboard the three dredges during the post-Sandy beach fill cycle reported no in-water sightings of listed species.

The giant manta ray (*Manta birostris*) was listed as threatened in January of 2018. It is found worldwide in tropical, subtropical, and temperate oceanic waters and near productive coastlines. It is sometimes found in waters as cool at 66° F and one individual was recently observed just offshore of Assateague Island (Swann 2018). Though not observed inside Chincoteague Inlet, the giant manta ray has been observed in other estuarine waters near oceanic inlets (NOAA 2018).

The VDGIF maintains a listing of endangered, threatened, and species of greatest conservation need, including marine animals. Federal-level listings are mirrored in state-level listings, and there are no other state-level listed marine plants or animals known from the proposed project area (VDGIF 2018).

3.11.3 Environmental Consequences

3.11.3.1 No Action Alternative

Under the No Action Alternative, there would be no project related impacts to any special status species onshore or offshore at Wallops Island.

3.11.3.2 Alternative 1

The north Wallops Island beach borrow area under Alternative 1 is within the historical nesting areas utilized by piping plover and loggerhead sea turtles. In accordance with the 2016 USFWS Biological Opinion, no excavation would occur until nesting season and fledging and/or hatching has completed, thereby eliminating the potential for lethal take of piping plover and loggerhead sea turtles at the borrow area.

Avifauna: Impacts on piping plover and red knot would be generally the same as those discussed for non-listed avian species in **Section 3.8, Wildlife** of this EA. In summary, these effects would include the potential for startle or disruption of foraging, reduction in prey availability, and for plovers, the potential for disruption of courtship and nesting activities. The potential exists for plover nesting activity to occur within the proposed project site, and accordingly, NASA would employ a biological monitor to survey the project site on a daily basis should work occur between the months of April and September. In their 2016 Biological Opinion, the USFWS anticipates incidental take of 2 plover nests (2 x 1.33 = 2.66) (3 eggs or chicks) for each beach renourishment cycle, and take of 1 plover nest (1 x 1.33 = 1.33) (2 eggs or chicks) through adults failing to nest or nest failure for the year after the beach renourishment. The USFWS anticipates incidental take of 28 red knots each year over 2 years during each beach renourishment cycle resulting from borrowing sand from the north Wallops Island borrow area, as a result of disturbance from heavy equipment and decreased habitat suitability for foraging during spring migration.

Herpetofauna: Impacts to nesting sea turtles could include interference with nesting attempts during nighttime construction activity (particularly artificial lighting) on the beach, unintentional burial of a newly dug nest if it were to go undetected, disorientation of hatchlings (due to project related light sources), or obstruction to hatchlings during their emergence and subsequent trip to the ocean.

It is unlikely that that the replenished beach would prove unsuitable to nesting turtles because the beach fill material is not substantially different from nearby native beaches. Moreover, as evidenced by the sea turtle nesting that occurred on the Wallops Island beach during the initial beach fill cycle, it is possible that the additional elevated beach would provide suitable nesting habitat, a net benefit to the species. The USFWS anticipates incidental take of 1 adult loggerhead sea turtle and 1 loggerhead nest (1 nest equaling 128 hatchling turtles) every 5 years as a result of beach renourishment that may bury nests or place sand of a grain size that does not support loggerhead nesting attempts.

Atlantic Sturgeon and Giant Manta Ray: Under Alternative 1, no impacts to Atlantic sturgeon or giant manta ray are anticipated, as no in-water work would occur. Impacts would be limited to temporary increased turbidity in the nearshore environment as sand placement occurs.

Cetaceans: Under Alternative 1, no impacts to cetaceans are anticipated, as no in-water work would occur. Impacts would be limited to temporary increased turbidity in the nearshore environment as sand placement occurs.

3.11.3.3 Alternative 2

Avifauna: Impacts to avifauna from renourishment activities under Alternative 2 would be similar to those described under Alternative 1. No impacts are plausible to piping plover or red knot from the dredge operating at Unnamed Shoal A.

Herpetofauna: Impacts to sea turtles under Alternative 2 would be similar to those described for Alternative 1, with the addition of impacts from the dredge operating at Unnamed Shoal A. Impacts on in-water sea turtles could include entrainment in the dredge, interaction with the sediment plume, reduction in available forage, direct strike, and disturbance due to vessel created noise. However, the probability of interaction is very low because turtle numbers in the area are low. Nesting females number few to zero, and there were zero observations of sea turtles by protected species observers onboard each of the three dredges during the two prior fill cycles. Additionally, the probability of large-bodied animals being entrained through the dragheads is lower than during prior permitted actions because of turtle deflectors on the dragheads, implementation of NMFS BO Terms and Conditions (NMFS 2012 and **Section 3.11.3.5, Section 7 Consultations**), and screening to minimize potential uptake of UXO. The NMFS anticipates incidental take of 1 adult sea turtle for every 1.6 million cubic yards of offshore dredging as a result of entrainment – in addition to the USFWS anticipated incidental take on land.

Atlantic Sturgeon: Impacts to the Atlantic sturgeon would be similar to those of in-water sea turtles and could include entrainment in the dredge, interaction with the sediment plume, reduction in available forage, direct strike, and disturbance due to vessel created noise. However, given the limited number of sturgeon expected to use the borrow area as habitat and the limited portion of available habitat that would be affected, the potential for interaction is limited. Similar to in-water sea turtles, this conclusion is supported by the recently completed initial beach fill cycle. Endangered species observers stationed onboard each of the three dredges did not observe an Atlantic sturgeon. NMFS anticipates incidental take of 1 Atlantic sturgeon for every 9.4 million cubic yards of offshore dredging as a result of entrainment.

Giant Manta Ray: Impacts to the giant manta rays would be similar to those of Atlantic sturgeon with the exception of entrainment in the dredge. Considering the behavior and distribution of giant manta rays relative to the operating parameters of hopper dredges, it is not anticipated that dredging entrainment poses a risk. Additionally, the probability of large-bodied animals being entrained through the dragheads is lower than during prior permitted actions because of turtle deflectors on the dragheads and screening to minimize potential uptake of UXO. Giant manta rays were not federally listed during the previous dredging event so protected species observers did not search for them.

Cetaceans: Impacts to cetaceans under Alternative 2 may include reduction in available forage, direct strike, and disturbance due to vessel created noise. According to the July 22, 2010, NMFS Biological Opinion, the potential of marine mammal strikes would be mitigated by operating the dredges at low speeds. Dredge speeds are anticipated to be approximately 3 knots while dredging and 10 knots while transiting between the borrow site and the nearshore pump-out buoy. Therefore, there would be a low risk of vessel strike. NMFS issued a revised 2012 Biological Opinion based on the best available information, and concluded that the effects of dredge noise on listed species of whales are discountable because it is extremely unlikely for listed whales to be within 1 kilometer (km; 0.6 miles) of the dredge. In addition, NASA would ensure that the dredge contractor followed the updated mitigation measures summarized in the NMFS BO (summarized in **Section 3.11.3.5, Section 7 Consultations**) including protected species observers and all dredge pumps turned off upon a whale observation within 1 km of the dredge.

3.11.3.4 Alternative 3

Avifauna: Impacts to avifauna under Alternative 3 would be similar to those described under Alternative 1 or 2 depending upon the sand source, with the addition of disturbance caused by breakwater construction. The breakwaters are planned to be constructed well south of the historical areas used by piping plover and red knots, and would be constructed approximately 200 feet offshore of the renourished shoreline. It is unlikely that any long term impacts would occur from breakwater construction to listed bird species.

Herpetofauna: Impacts to sea turtles from Alternative 3 would be similar to those described under Alternative 1 or 2 depending upon the sand source, with the addition of disturbance caused by breakwater construction. The construction of breakwaters could potentially cause disturbance and area avoidance by sea turtles, depending on the time of year construction was initiated. Additionally, if work continued throughout the night, lighting could cause confusion for swimming sea turtle hatchlings. Although breakwaters have been shown to impact the ingress and egress of nesting sea turtles and hatchlings, it is unlikely that six breakwaters with a total length of 780 feet (4 percent of the 19,000 foot replenishment project) would provide a significant impediment to sea turtle ingress and egress of the beach.

Atlantic Sturgeon and Giant Manta Ray: Impacts to Atlantic Sturgeon and Giant Manta Ray would be similar to those described under Alternative 1 or 2 depending upon the sand source, with the addition of potential disturbance during breakwater construction. These species are highly mobile and would likely avoid the breakwater construction area during construction activities. Long term impacts due to breakwater construction would be unlikely.

Cetaceans: Impacts to cetaceans under Alternative 3 would be the same as those under Alternative 1 or 2 depending upon the sand source, with the addition of the disturbance during breakwater construction. During breakwater construction, barge-mounted heavy equipment would place large stone, per breakwater design in approximately 8 feet of water. It is extremely unlikely that larger marine mammals would be in water this shallow and potential for impact is discountable.

3.11.3.5 Section 7 Consultations

On March 20, 2013, USFWS responded that the impacts resulting from the beach renourishment proposed by the *2013 Post-Hurricane Sandy EA* would be within that already considered in its July 30, 2010 programmatic Biological Opinion (BO). USFWS also submitted a newer consolidated BO in June 2016 to replace and consolidate opinions and terms for ongoing operations at WFF that included a 2-7 year cycle for beach renourishment (USFWS 2016).

On March 21, 2013, NMFS determined that the action proposed in the *2013 Post-Hurricane Sandy EA* were not significantly differ from the actions considered in the 2012 NMFS Biological Opinion and did not warrant re-initiation. On September 26, 2014, following discovery of UXO in a hopper intake basket, NMFS concurred with NASA’s determination that installation of UXO screens would prevent onboard observers from monitoring intake baskets after each load, thereby focusing observer efforts on inspecting the dragheads versus the baskets for the presence of entrained or impinged protected species remains.

In developing the BOs, NMFS and USFWS provided mandatory terms and conditions that NASA must follow to reduce potential effects to listed species. As such, NASA and USACE would ensure that their contractors implemented these measures on their behalf. These measures include all specifications in Incidental Take Statements, Terms and Conditions, Reasonable and Prudent Measures, and other mitigation measures stipulated in each BO for dredging, backpassing, and renourishment.

NASA re-initiated informal consultation with NMFS and USFWS in 2018. On November 20, 2018, NMFS responded to NASA's submittal of additional effects analysis, that based on the effect analysis from the previous consultations, the information provided regarding changes to the project description, and the fact that no new listed species or designated critical habitat overlap with the action area, impacts from the proposed actions in this SERP EA do not warrant re-initiation of consultation. **[Results of the USFWS consultation will be updated once coordination is complete.]** Correspondence related to consultation for this EA are included as **Appendix F**.

3.12 CULTURAL RESOURCES

Cultural resources are defined as prehistoric or historic sites, buildings, structures, objects, or other physical evidence of human activity that are considered important to a culture or community for scientific, traditional, or religious reasons.

3.12.1 REGULATORY CONTEXT

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and as implemented by 36 CFR Part 800, requires federal agencies to consider the effects of their actions on historic properties before undertaking a project. A historic property is defined as any cultural resource that is included in, or eligible for inclusion in, the National Register of Historic Places (NRHP). The NRHP, administered by the National Park Service (NPS), is the official inventory of cultural resources that are significant in American history, prehistory, architecture, archaeology, engineering, and culture. The NRHP also includes National Historic Landmarks. In consideration of 36 CFR 800, federal agencies are required to initiate consultation with the State Historic Preservation Office (SHPO) informing them of the planned action and requesting their comments or concerns.

In accordance with Sections 106 and 110 of the NHPA, NASA developed a Programmatic Agreement with the Virginia SHPO and Advisory Council on Historic Preservation to outline how WFF manages its cultural resources as an integral part of its operations and missions (NASA 2014, 2016c). As part of this process, NASA identified a number of parties who have an interest in, or knowledge of, cultural resources at WFF and included them in the development of the terms of the Programmatic Agreement.

3.12.2 AFFECTED ENVIRONMENT

3.12.2.1 Aboveground Resources

Section 3.3.7 of the 2010 *Final SRIPP PEIS* describes in detail the effects on cultural resources that may occur within or adjacent to the project site. One NRHP-eligible resource has been identified at WFF: the Wallops Beach Life Saving Station (DHR ID #001-0027-0100; WFF #V-065) and the associated Coast Guard Observation Tower (DHR ID #001-0027-0101; WFF #V-070). The resources were surveyed in the 2004 *Historic Resources Survey and Eligibility Report* (NASA 2015). The survey determined the Wallops Beach Life Saving Station (DHR ID #001-0027-0100; WFF #V-065) to be eligible for listing in the NRHP under both Criterion A and Criterion C for its association with the Coast Guard and for architectural significance for exemplifying the Colonial Revival Style. The Coast Guard Observation Tower (DHR ID #001-0027-0101; WFF #V-070) was not considered eligible individually but as a contributing structure to the Life Saving Station.

WFF considered various options for the Wallops Beach Life Saving Station and Coast Guard Observation Tower disposition including their removal from WFF and transfer from Federal ownership or demolition or deconstruction. In accordance with the mitigation terms of the Programmatic Agreement, WFF prepared a Historic American Building Survey (HABS)/Historic American Engineer Record (HAER) recordation of the Station and Observation Tower and short documentary video of their history (VDHR 2016a). VDHR accepted the HABS/HAER recordation and documentary and concurred with the disposition proposals (VDHR 2016b). Currently, NASA and the General Services Administration are considering moving and transferring the building to a private buyer (Miller personal communication 2018).

NASA has prepared two architectural resource surveys at WFF since the *2010 Final SRIPP PEIS.* In 2011, a Section 110 architectural survey identified and evaluated buildings and structures built between 1956 and 1965. Out of the total 76 buildings and structures that were identified, 34 are located on Wallops Island. None were recommended eligible for listing in the NRHP. The VDHR concurred with these findings in 2011 (NASA 2015).

In 2018, a reconnaissance-level architectural survey of buildings and structures built between 1965 and 1981 and one resource constructed in 1963 was conducted. The survey identified and evaluated 52 resources, 16 of which are located on Wallops Island, and concluded that none of the resources were eligible for listing in the NRHP (NASA 2018b). The VDHR concurred with these findings in August 2018 (VDHR 2018).

3.12.2.2 Archaeological Resources

The Area of Potential Effects (APE) for archaeology is defined as the area where ground disturbing activities would take place. For the SERP EA, this includes areas of beach renourishment, sand dredging, and construction of offshore breakwaters.

Two archaeological surveys were completed to investigate the APE for the *2010 Final SRIPP PEIS.* In 2009, an investigation of the proposed groin, breakwater, and shoreline that would be impacted by the SRIPP project was completed. This investigation included pedestrian survey of the Wallops Island shoreline, archaeological monitoring of the installation of geotextile tubes along the shoreline, a diving survey of the proposed groin location, and a remote sensing survey of the proposed breakwater area. The investigation did not identify any archaeological resources in the areas and no additional work was recommended (Randolph et *al*. 2009).

The second investigation for the Final SRIPP EIS was conducted in 2010. This survey investigated the proposed offshore sand borrow areas using underwater remote sensing. No underwater archaeological resources were identified during the survey and no additional work was recommended for the borrow area (Randolph *et al.* 2010).

No previously identified archaeological sites are located in the APE for the project. Three previously identified archaeological sites are located on Wallops Island in the vicinity of the APE. The Military Earthworks site (44AC0089) is a Revolutionary War gun emplacement located at the northern end of Wallops Island. The site was subjected to additional investigations and recommended eligible for listing on the NRHP. Site 44AC0159 is an unnamed site located at the southern end of Wallops Island. The site is described as a shell pile or shell midden and has been determined not eligible for listing on the NRHP. Site 44AC0459 is a trash scatter associated with the Coast Guard Life Saving Station and Observation Tower. This site was also determined not eligible for the NRHP (NASA 2015).

3.12.3 Environmental Consequences

3.12.3.1 No Action Alternative

Under the No Action Alternative, the proposed renourishment of the beach and breakwater construction would not occur. Therefore, cultural resources would not be impacted.

3.12.3.2 Alternative 1

North Wallops Island has been previously surveyed for cultural resources. Only the Wallops Beach Life Saving Station (DHR ID #001-0027-0100; WFF #V-065) and the Coast Guard Observation Tower (DHR ID #001-0027-0101) are considered eligible for listing in the NRHP. Potential effects are likely to be minimal since the resources are located approximately 3,000 feet north of the APE. If sand from north Wallops Island beach were used for the renourishment of the shoreline, the potential effects are likely to be visual effects occurring during the harvesting phase. The visual effects would be short term and would not affect the integrity of the resource. Construction may create noise, but that would be minimal.

Previous surveys of the APE for archaeological resources did not identify any archaeological resources; therefore, the proposed project would have no effect on NRHP-eligible archaeological sites. The inadvertent discovery of any previously unidentified archaeological resources would result in immediate cessation of work and notification of the WFF Cultural Resources Manager, who would contact the VDHR and Native American Tribes as appropriate.

3.12.3.3 Alternative 2

Previous surveys of Unnamed Shoal A and the pumpout buoy area did not identify any archaeological resources; therefore, the proposed project would have no effect on NRHP-eligible archaeological sites.

3.12.3.4 Alternative 3

Potential impact to cultural resources from beach renourishment would be the same as those described for Alternative 1 and 2, depending on the sand source. Additionally, prior surveys were conducted of the pumpout buoy area utilized during offshore dredging. Breakwaters would be constructed within the pumpout buoy APE. As these surveys did not identify any archaeological resources, breakwater construction would have no effect on NRHP-eligible archaeological sites.

3.12.3.5 Section 106 Consultations

While preparing the *2010 Final SRIPP PEIS*, NASA consulted with the VDHR on the potential effects of the Proposed Action on historic properties. VDHR concurred with NASA's determination that the Proposed Action would have no adverse effect on historic properties. NASA requested comments from VDHR regarding potential impacts to historic resources by the proposed Shoreline Enhancement and Restoration Project prior to preparation of this EA. On August 14, 2018, the VDHR issued a finding of No Historic Properties Affected (VDHR 2018). Correspondence between NASA and the VDHR is included in **Appendix G** of this EA.

Three Native American Tribes were consulted during the scoping period for this EA, including the Pamunkey Indian Tribe, the Pocomoke Indian Nation, and the Catawba Indian Nation. The contact information for the tribes is listed in Chapter 6. The Pamunkey Indian Tribe became a federally recognized tribe in 2016. During scoping for this EA, the tribe requested to be notified in the event of the inadvertent discovery of archaeological resources (Gray 2018). The Thomasina E. Jordan Indian Tribes of Virginia Federal Recognition Act of 2017 (U.S. Public Law 115-121) federally recognized the

Chickahominy Indian Tribe, the Chickahominy Indian Tribe – Eastern Division, the Upper Mattaponi Tribe, the Rappahannock Tribe, Inc., the Monacan Indian Nation, and the Nansemond Indian Tribe as Native American tribes in January 2018. These tribes will be notified of the public draft of the EA.

3.13 Recreation Resources

Recreation resources include primarily outdoor recreational activities that occur away from a participant's residence. This includes natural resources and built facilities that are designated or available for public recreational use. The setting, activity, and other resources that influence recreation are also considered.

3.13.1 Affected Environment

There is one main area on Wallops Island designated for recreational use by permanently badged WFF employees, tenants, contractors, and their guests: a beach area north of the seawall and south of the beach cable barrier. In 2017, launch of non-motorized watercraft from U-070 and the North Island dock areas, and fishing and shell-fishing at the edge of these wetland areas was authorized. These areas are open after operational hours to permanently badged WFF employees and their guests unless temporarily restricted for mission/launch hazards. The northern portion of this recreational area is closed annually from March through August during piping plover and sea turtle nesting season. A second area designated for recreational use, the marsh under the Wallops Island Bridge that runs along the Virginia Inside Passage of the Intracoastal Waterway, is open year round; however, it may only be accessed via boat.

Virginia's Eastern Shore is a popular tourist destination. Many tourists and vacationers visit Accomack County throughout the late spring, summer, and early fall. Regional attractions include the Assateague Island National Seashore and CNWR. The Wallops Island National Wildlife Refuge is located south of the WFF Visitor Center and is under the jurisdiction of the USFWS. This refuge is not open to the general public. South of Wallops Island is Assawoman Island, a 1,420 acre parcel managed as part of the CNWR by the USFWS. The remainder of the CNWR lies mostly east and north of Wallops Island on Chincoteague Island. A string of undeveloped barrier islands, managed by The Nature Conservancy as part of the Virginia Coast Reserve, extends south down the coast to the mouth of the Chesapeake Bay. Winter hunting season draws people to hunt local game including dove, quail, deer, and many types of geese and ducks. The Wallops Island shoreline is also a popular location for local fishermen who surf fish or fish from boats in the nearshore environment. Recreational boaters and divers utilize the marine waters offshore. Annually, ongoing operations at the WFF, including rocket launches and testing, result in issuance of Notices to Mariners for approximately 128 events totaling 467 hours (Miller personal communication 2018).

3.13.2 Environmental Consequences

3.13.2.1 No Action Alternative

If the Proposed Action were not implemented, no change to existing recreational opportunities would occur. The north Wallops Island beach would continue to be used by employees for recreation, subject to seasonal restrictions.

3.13.2.2 Alternative 1

If sand from the north Wallops Island beach were used for the renourishment of the shoreline infrastructure protection area, sand would be excavated to the mean low water line. The area would be closed during the excavation and transport phases of the project and a portion of the beach used by employees for recreation would be removed, potentially limiting recreation opportunities in the short term. However, this area is expected to continue to accrete as a result of the littoral transport of sand from the renourished beach as well as from Assateague Island and to fully recover within 5 to 6 years.

3.13.2.3 Alternative 2

Using sand from Unnamed Shoal A to renourish the shoreline infrastructure protection area would not affect recreational opportunities on land, however recreational boating in the immediate area would be limited during the excavation of material from the shoal and transporting sediment from the borrow area to the discharge site would result in an increase in boat and barge traffic. However, as stated in the *2010 Final SRIPP PEIS*, a Notice to Mariners would be issued, when necessary, to notify boaters in advance so that they can select alternate routes without substantially affecting their activities or experience.

3.13.2.4 Alternative 3

Alternative 3 would involve renourishing the shoreline infrastructure protection area using sand from the north Wallops Island beach or Unnamed Shoal A and the resulting impacts would be the same as those described for Alternatives 1 and 2. Additionally, a series of offshore breakwaters would be constructed resulting in boat and barge traffic for the duration of construction. Impacts are expected to be similar to those described for Alternative 2 though the construction would occur nearshore in relatively shallow water, unlikely to affect recreational fishing or boating. Breakwater construction would be outside the Wallops Island beach and would not impact recreational users.

4.0 CUMULATIVE EFFECTS

The cumulative effects analysis (CEA) is important to understanding how multiple actions that occur in a particular time and area affect the environment. The CEQ regulations (40 CFR § 1508.7) define cumulative impacts as:

> *"…the impact on the environment, which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions."*

Whereas the individual impacts of one project in a particular area or region may not be considered significant, numerous projects in the same area or region may cumulatively result in significant impacts. Cumulative effects are most likely to arise when a relationship exists between a Proposed Action and other actions occurring in a similar location or during a similar time period. Actions overlapping with or in proximity to the Proposed Action would be expected to have more potential for a relationship than those more geographically separated. Similarly, actions that coincide in time, even partially, have the potential for cumulative effects.

4.1 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

Establishing an appropriate scope for cumulative effects analysis is vital to producing a meaningful analysis that appropriately informs agency decision-making. This involves properly delineating geographic and temporal boundaries within which to identify other activities that could contribute to cumulative impacts to resources; and providing an appropriate level of detail of those activities so their contribution to cumulative impacts is clear.

CEQ guidance advises that geographic boundaries for cumulative effects analysis should incorporate ecologically relevant boundaries, depending on the resource in question (CEQ 1997). EPA notes that geographic boundaries should not be extended to the point that the analysis "becomes unwieldy and useless for decision-making" and advises that the proper spatial scope of the analysis include the geographic areas that sustain the resources of concern (EPA 1999). On establishing an appropriate temporal scope, EPA advises estimating the length of time the effects of the Proposed Action would last (EPA 1999). Considering this, the focus of this CEA includes the projects and activities that affect Wallops Island (particularly the shoreline) that have occurred or are anticipated to occur in the next 5 years, at which time impacts are anticipated to have diminished to allow for a recovery state of analyzed resources.

CEQ (2005) provides guidance on the level of effort and detail that is appropriate in CEA:

> "*The scope of the cumulative impact analysis is related to the magnitude of the environmental impacts of the proposed action. Proposed actions of limited scope typically do not require as comprehensive an assessment of cumulative impacts as proposed actions that have significant environmental impacts over a large area. Proposed actions that are typically finalized with a Finding of No Significant Impact usually involve only a limited cumulative impact assessment to confirm that the effects of the proposed action do not reach a point of significant environmental impacts."*

Following this guidance, this CEA focuses only on those resources evaluated in Chapter 3 of this document that are expected to be measurably affected by the Proposed Action (see **Table 4.1-1**).

Table 4.1-1. Resources Considered in Cumulative Effects Analysis

Resource	Considered in Cumulative Effects Analysis?
Coastal Geology and Processes	No, negligible impacts identified in this EA
Water Quality	No, negligible impacts identified in this EA
Coastal Zone Management	No, negligible impacts identified in this EA
Air Quality	No, negligible impacts identified in this EA
Noise	No, negligible impacts identified in this EA
Benthos	Section 4.3.1
Wildlife	Section 4.3.2
Fisheries and Essential Fish Habitat	Section 4.3.3
Marine Mammals	No, negligible impacts identified in this EA
Special Status Species	Section 4.3.4
Cultural Resources	No, negligible impacts identified in this EA
Recreation Resources	No, negligible impacts identified in this EA

4.2 PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS

The sections below provide a summary of the actions considered in this CEA. Section 4.7 of the *2010 Final SRIPP PEIS* provides a detailed CEA for all potentially affected resource areas throughout the 50-year design life of the shoreline restoration program, including effects of past actions dating to federal settlement of Wallops Island in the early 1940s. Section 3.4 of the *2013 Final Post-Hurricane Sandy EA* documents activities that occurred or were planned to occur after the publication of the *2010 Final SRIPP PEIS*. Both of these documents are incorporated by reference here. NASA is currently preparing a twenty-year planning horizon “master plan” PEIS, and accordingly it considered the relevance of those actions to this CEA. The launch activities detailed in that PEIS may overlap in location and time with the Proposed Action.

4.2.1 ONGOING OPERATIONS

A number of past and ongoing activities are detailed in the *2010 Final SRIPP PEIS, 2013 Final Post-Hurricane Sandy EA* including launch range operations for launches of suborbital and orbital rocket missions as well as targets and projectiles; operations of Mid-Atlantic Regional Spaceport Unmanned Aerial Systems airstrip and Payload Processing Facility, both on the north end of Wallops Island; Protective Service Division security patrolling; and protected species monitoring. NASA’s *2018 Draft Site-wide PEIS* included these continuing actions and foreseeable future actions including replacement of the causeway bridge, maintenance dredging, and a north Wallops Island deep water port operations area.

4.2.2 WALLOPS ISLAND SHORELINE STABILIZATION ACTIVITIES

The *2010 Final SRIPP PEIS* evaluated extending the existing rock seawall on Wallops Island by up to 4,600 feet south of its southernmost point and renourishing 3.7 miles of shoreline with sand dredged from an OCS sand shoal. An initial seawall extension of approximately 1,430 feet was implemented between August 2011 and March 2012 and further seawall extension may be completed in the future as funding becomes available. In addition, between April and August 2012, approximately 3,200,000 cubic yards of fill was placed along the Wallops Island shoreline (from approximately 1,500 feet north of the Wallops Island-Assawoman Island property boundary and extending north to the terminus of the existing rock seawall), creating an approximately 100 foot wide beach and dune (NASA 2016b).

The *2013 Final Post-Hurricane Sandy EA* evaluated the impacts of repairing damage to the rock seawall and renourishing the recently filled beach. Between July and September 2014, approximately 667,000 cubic yards of material was dredged from the same location as the initial beach fill and placed along the southern 13,000 feet of Wallops Island (NASA 2016b). With the exception of a shortened period between initial fill and the first renourishment, the proposed project was essentially the same as that described in the *2010 Final SRIPP PEIS*, which estimated that up to 806,000 cubic yards of material would be needed every three to seven years.

The *2010 Final SRIPP PEIS* examines the potential impacts of the project's 50-year design life, which includes beach renourishment occurring every three to seven years. Accordingly, over the next 5 years, an additional beach renourishment may occur. Sand for this renourishment could be sourced from offshore shoals or from the north Wallops Island beach.

4.2.3 Federal Navigation Projects

On a periodic basis, the USACE dredges the Chincoteague Inlet, just north of Wallops Island to maintain channel depth, typically removing 80,000 to 100,000 cubic yards of material from the channel and placing it in the Atlantic Ocean east of Wallops Island. The Inlet has not required dredging in recent years and was most recently dredged in September – October 2018 (see **Table 3.2-1**). Additionally, USACE occasionally dredges the navigation channel in Bogues Bay, just west of Wallops Island.

4.2.4 Recreational and Motorized Vehicle Use of Wallops Island Beach

The WFF Protective Services Division performs daily vehicle patrols of the Wallops Island beach according to a defined protocol. Patrols use the same points of access and operate within the intertidal zone, except under emergency conditions. A portion of the north Wallops Island beach is open to WFF employees for recreational use, subject to seasonal restrictions protective of nesting piping plovers and sea turtles. All areas south of the northern terminus of the rock seawall are closed to recreation year round in accordance with launch range safety regulations.

4.2.5 Pest and Predator Management

The U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) Division of Wildlife Services personnel perform regular predator removal on Wallops Island to control the depredation of eggs or young of beach nesting turtles and shorebirds (NASA 2013). Efforts focus primarily on the management of raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), laughing gull (*Larus atricilla*), herring gull (*Larus argentatus*), great black-backed gull (*Larus marinas*), fish crow (*Corvus ossifragus*), American crow (*Corvus brachyrhynchos*), and common grackle (*Quiscalus quiscula*). Activities are conducted year round as needed but are concentrated in the winter, spring, and early summer months to coincide with predator dispersal and with breeding and nesting.

4.2.6 Protected Species Monitoring

In accordance with the USFWS 2016 Biological Opinion, WFF administers a Protected Species Monitoring Plan, which establishes procedures for monitoring a number of protected species that are likely to occur at Wallops Island including: seabeach amaranth, red knot, piping plover, Wilson's plover, gull-billed terns, American oystercatcher, and sea turtles (NASA 2016a). Annually between March and September, NASA regularly performs 3 to 4 surveys per week of Wallops Island beach for these species as a component of its Natural Resources Management Program. Any nests discovered are identified with signage and predator exclosures. Program staff provide outreach to beach users, including security staff and recreational users (NASA 2013).

4.2.7 Vessel Traffic

Commercial, recreational, and military maritime traffic all use the area off the coast of Virginia, one of the busiest areas in the world for maritime traffic. Traffic Separation Schemes (TSS), defined in 33 CFR Part 167 – *Offshore Traffic Separation Schemes,* are used to regulate ship traffic at busy confined areas by routing and separating opposing ship traffic. One-way ship traffic lanes that are marked by buoys. The nearest TSS lanes to WFF are the southernmost approaches to the Delaware Bay, which are approximately 50 nautical miles (nm) north of Wallops Island, and the northernmost lanes of the Chesapeake Bay approach, which are approximately 55 nm south of Wallops Island.

4.2.8 U.S. Navy Atlantic Fleet Testing and Training Activities

The Navy conducts ongoing military readiness training and research, development, testing, and evaluation activities within the Atlantic Fleet Testing and Training (AFTT) area, which includes the Virginia Capes Operations Area located off Virginia and North Carolina (U.S. Navy 2017).

4.2.9 Climate Change and Resiliency

The Eastern Shore lies within one of the U.S's most vulnerable coastal regions. Coastal Virginia is especially susceptible to the impacts of climate change, primarily resulting from sea level rise and increased storm intensity. Sea levels are rising at three to four times the global average and storms are intensifying. Sea-level rise rates on Virginia's Eastern Shore show a MSL rise of between 4.5 to 7 feet by 2100. On the Eastern Shore, tens of millions of dollars have been spent on traditional "gray" infrastructure approaches, such as sea walls, groins, jetties, bulkheads and revetments, as defenses against mounting coastal hazards. Often, the gray infrastructure has only exacerbated the area's vulnerability and undermined the region's abundant natural resilience by interrupting critical environmental processes.

Currently, 12 % of Chincoteague Island, which is close proximity to Wallops Island, experiences chronic inundation, or tidal flooding. Under a low impact forecast scenario, the percentage of land in this locality experiencing chronic inundation will increase to 74% by 2100. Under the intermediate impact forecast scenario, 34% of the land area will reach this level of flooding by 2035, with 85% by 2100. In the high impact scenario, Chincoteague Island is virtually completely inundated by 2100 (UCS 2017).

The Main Base of Wallops Flight Facility sits at approximately 42 feet above sea level. As a result, chronic inundation is not likely to threaten all of the facility, though some low lying areas will experience the threat. Storm surge, however, could be very damaging, particularly if coupled with increased sea levels and rising tide cycles.

While the exact extent of inundation of the coastal, Atlantic-facing areas of the Eastern Shore are not currently known, the general long term impacts of chronic flooding and storm flooding potentials will be significant, altering the geography, and placing great strain on existing infrastructure. Long term coastal resilience master planning such as Governor Northam has called for in his recent Executive Order (EO 24 2018) are required to assess the best methods of coastal protection where practicable. The populated areas of the Eastern Shore and other areas of coastal Virginia will necessarily change as communities and citizens are ultimately relocated to reduced impact areas as a result of permanent flooding of low lying areas.

4.3 POTENTIAL CUMULATIVE EFFECTS

4.3.1 BENTHOS

Despite the minor increase in frequency of shoreline renourishment as compared to that which was assessed in the *2010 Final SRIPP PEIS*, the nature of potential cumulative impacts to benthos would be the same with or without this Proposed Action. Shoreline stabilization, replacement of the causeway bridge, maintenance dredging, a north Wallops Island deep water port operations area, Navy AFTT actions, and federal navigation projects would expose the benthos to infrequent but repeated impacts that are essentially identical to the Proposed Action. The consequences of each action results in delayed recovery, but does not cumulatively degrade the capacity for recovery.

4.3.2 WILDLIFE

The impacts to wildlife, particularly birds and sea turtles, resulting from the Proposed Action would add to those resulting from other past, present, and reasonably foreseeable projects. These include: disturbance from human presence, noise, and lighting associated with WFF infrastructure and its use; accidental injury or death resulting from vehicle use on beaches; and potential impacts to benthic prey base resulting from this and other shoreline stabilization projects. Additionally the creation of foraging and nesting habitat for birds and sea turtles could offset negative impacts from other activities occurring on or near the project area and add to the beneficial impacts of predator control projects.

4.3.3 ESSENTIAL FISH HABITAT

Despite the minor increase in frequency of shoreline renourishment as compared to that which was assessed in the *2010 Final SRIPP PEIS*, the nature of potential cumulative impacts to fisheries and EFH would be the same with or without the Proposed Action. Shoreline stabilization, replacement of the causeway bridge, maintenance dredging, a north Wallops Island deep water port operations area, Navy AFTT actions, and federal navigation projects will expose fisheries and EFH to infrequent but repeated impacts that are essentially identical to the Proposed Action. The consequences of each action results in delayed recovery, but does not cumulatively degrade the capacity for recovery of fisheries and EFH.

4.3.4 SPECIAL STATUS SPECIES

Impacts to special status species on land are similar to those described above for wildlife. A reduction in nesting habitat for piping plovers and loggerhead sea turtles and foraging habitat for red knot would result if sand from the north Wallops Island beach were used for renourishment. Disturbance from lighting, noise, and human presence could also occur. Additionally, inadvertent loss of individuals or eggs could occur if sand movement from this beach occurred during the breeding season and onsite monitors did not detect nests. These potential negative impacts to special status species on land could add to disturbance resulting from ongoing use of adjacent roads and infrastructure, beach patrols and species monitoring. The potential exists for nesting habitat to be created in the area renourished resulting in possible countervailing impacts when considered with past, present and reasonably foreseeable activities.

The proposed offshore work could result in the impacts to in-water sea turtles, protected fish, and whales including entrainment in the dredge, interaction with the sediment plume, reduction in available forage, and disturbance due to vessel created sounds. Though such impacts are considered unlikely, they could add to impacts resulting from federal navigation projects, launch events, replacement of the causeway bridge, maintenance dredging, a north Wallops Island deep water port operations area, Navy AFTT actions, and ongoing shoreline stabilization activities.

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Federal	
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Deborah Darden, Superintendent	Assateague Island National Seashore, National Park Service
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Brian Hopper, Section 7 Biologist	NOAA National Marine Fisheries Service
David O'Brien, Marine Habitat Resource Specialist	NOAA National Marine Fisheries Service
Nancy Finley, Refuge Manager	Chincoteague National Wildlife Refuge, U.S. Fish and Wildlife Service
Captain Jeffrey Lock, Commanding Officer	U.S. Navy, Surface Combat Systems Center
Al McMath, Operations Director	National Oceanic and Atmospheric Administration
Lt Commander Mark Merriman	U.S. Coast Guard, Sector Field Office Eastern Shore
Barbara Rudnick, NEPA Team Leader	U.S. Environmental Protection Agency
Chief Warrant Officer Brady Scheib	U.S. Coast Guard
Cindy Schulz, Field Supervisor	U.S. Fish and Wildlife Service, Virginia Field Office
Geoffrey Wikel, Chief	Bureau of Ocean Energy Management
Lt. Joshua Zirbes	U.S. Coast Guard
Tribal	
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Stephen Adkins, Chief	Chickahominy Indian Tribe
Gene Pathfollower Adkin, Chief	Chickahominy Indians Eastern Division
Dean Branham, Chief	Monacan Indian Nation
Dr. Robert Gray, Chief	Pamunkey Indian Tribe
Norris Howard, Sr., Paramount Chief	Pocomoke Indian Nation
Lee Lockamy, Chief	Nansemond Indian Tribal Association
Anne Richardson, Chief	Rappahannock Tribe
Caitlin Totherow, Tribal Historic Preservation Office	Catawba Indian Nation
State	
Hank Badger, Environmental Engineer	Virginia Marine Resources Commission, Habitat Management Division
Ray Fernald, Manager	Virginia Department of Game and Inland Fisheries Environmental Services Section
Rene Hypes, environmental Review Coordinator	Virginia Department of Conservation and Recreation, natural Heritage Program
Sheri Kattan, Team Leader	Virginia Department of Environmental Quality, Office of Wetlands and Water Protection
Laura Lavernia, Architectural Historian	Virginia Department of Historic Resources Office of Review and Compliance
Bettina Rayfield, Manager	Virginia Department of Environmental Quality Office of Environmental Impact Review
Local Government	
Michael Mason, Administrator	Accomack County
Grayson Chesser	Accomack County Board of Supervisors
J. Arthur Leonard, Mayor	Town of Chincoteague
Ronald Wolff	Accomack County Board of Supervisors
Rich Morrison, Director of Planning and Community Development	Accomack County Department of Building and Zoning
Curtis Smith, Director of Planning	Accomack-Northampton Planning District Commission
William Tarr	Accomack County Board of Supervisors
James West, Town Manager	Town of Chincoteague
Non-Government Organizations	
Jill Bieri, Director	The Nature Conservancy Virginia Coast Reserve
Donna Bozza, Executive Director	Citizens for a Better Eastern Shore
Alverne Chesterfield, Interim Executive Director	Marine Science Consortium
Karen Duhring, Marine Scientist Supervisor	Virginia Institute of Marine Sciences Center for Coastal Resources
Joseph Fehrer, Nassawango Land Manager	The Nature Conservancy, MD/DC Chapter

Name, Title	Agency
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Dr. Karen McGlathery, Site Director	Virginia Coast Reserve Long Term Ecological Research Project
Dale Nash, Executive Director	Virginia Commercial Space Flight Authority
Kathy Phillips, Executive Director	Assateague Coastal Trust
Frank Piorko, Executive Director	Maryland Coastal Bays Program

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NASA WFF		
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USACE		
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Wood, Megan |	Environmental Scientist	B.S. Biology Ph.D. Marine Biology Years of Experience: 9
BOEM		
Piatkowski, Doug	Marine Biologist	M.S. Marine Biology Years of Experience: 16
Cardno GS, Inc.		
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Burak, Elizabeth	Project Manager, Recreation, Cumulative Impacts	B.S. Biology M.S. Biology Years of Experience: 20
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Swain, Ken	Technical Review	B.S. Geology M.S. Geology, Coastal Processes Years of Experience: 23
Thursby, Lori	Cultural Resources	B.S. Environmental Design in Architecture M.S. Architectural History Years of Experience: 22
Wetland Design and Restoration		
Priest, Walter	Coastal Geology	B.S. in Biology M.S. in Biology Years of Experience: 44

APPENDIX A
SCOPING LETTERS

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COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

February 27, 2018

NASA Wallops Flight Facility
ATTN: SERP Project
34200 Fulton Street
Building F-160 I Room Cl 65
Wallops Island, Virginia 23337
email: wff-shoreline@mail.nasa.gov

RE: NASA's proposed Shoreline Enhancement and Restoration Project at Wallops Island, Virginia

Dear Ms. Miller:

This letter is in response to the scoping request for the above-referenced project.

As you may know, the Department of Environmental Quality, through its Office of Environmental Impact Review (DEQ-OEIR), is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. Similarly, DEQ-OEIR coordinates Virginia's review of federal consistency documents prepared pursuant to the Coastal Zone Management Act which applies to all federal activities which are reasonably likely to affect any land or water use or natural resources of Virginia's designated coastal resources management area must be consistent with the enforceable policies Virginia Coastal Zone Management (CZM) Program.

DOCUMENT SUBMISSIONS

In order to ensure an effective coordinated review of the NEPA document and federal consistency documentation, notification of the NEPA document and federal consistency documentation should be sent directly to OEIR. We request that you submit one electronic to eir@deq.virginia.gov (10 MB maximum) or make the documents available for download at a website, file transfer protocol (ftp) site or the VITA LFT file share system (Requires an "invitation" for access. An invitation request should be sent to eir@deq.virginia.gov.). We request that the review of these two documents be done concurrently, if possible.

The NEPA document and the federal consistency documentation (if applicable) should include U.S. Geological Survey topographic maps as part of their information. We strongly encourage you to issue shape files with the NEPA document. In addition, project details should be adequately described for the benefit of the reviewers.

ENVIRONMENTAL REVIEW UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT: PROJECT SCOPING AND AGENCY INVOLVEMENT

As you may know, NEPA (PL 91-190, 1969) and its implementing regulations (Title 40, *Code of Federal Regulations*, Parts 1500-1508) requires a draft and final Environmental Impact Statement (EIS) for federal activities or undertakings that are federally licensed or federally funded which will or may give rise to significant impacts upon the human environment. An EIS carries more stringent public participation requirements than an Environmental Assessment (EA) and provides more time and detail for comments and public decision-making. The possibility that an EIS may be required for the proposed project should not be overlooked in your planning for this project. Accordingly, we refer to "NEPA document" in the remainder of this letter.

While this Office does not participate in scoping efforts beyond the advice given herein, other agencies are free to provide scoping comments concerning the preparation of the NEPA document. Accordingly, we are providing notice of your scoping request to several state agencies and those localities and Planning District Commissions, including but not limited to:

Department of Environmental Quality:
- DEQ Regional Office*
- Air Division*
- Office of Wetlands and Stream Protection*
- Office of Local Government Programs*
- Division of Land Protection and Revitalization
- Office of Stormwater Management*

Department of Conservation and Recreation
Department of Health*
Department of Agriculture and Consumer Services
Department of Game and Inland Fisheries*
Virginia Marine Resources Commission*
Department of Historic Resources
Department of Mines, Minerals, and Energy
Department of Forestry
Department of Transportation

Note: The agencies noted with a star (*) administer one or more of the enforceable policies of the Virginia CZM Program.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the federal Coastal Zone Management Act of 1972, as amended, and its implementing regulations in Title 15, *Code of Federal Regulations*, Part 930, federal activities, including permits, licenses, and federally funded projects, located in Virginia's Coastal Management Zone or those that can have reasonably foreseeable effects on Virginia's coastal uses or coastal resources must be conducted in a manner which is consistent, to the maximum extent practicable, with the Virginia CZM Program.

Additional information on the Virginia's review for federal consistency documents can be found online at
http://www.deq.virginia.gov/Programs/EnvironmentalImpactReview/FederalConsistencyReviews.aspx

2

DATA BASE ASSISTANCE

Below is a list of databases that may assist you in the preparation of a NEPA document:

- DEQ Online Database: Virginia Environmental Geographic Information Systems

  Information on Permitted Solid Waste Management Facilities, Impaired Waters, Petroleum Releases, Registered Petroleum Facilities, Permitted Discharge (Virginia Pollution Discharge Elimination System Permits) Facilities, Resource Conservation and Recovery Act (RCRA) Sites, Water Monitoring Stations, National Wetlands Inventory:
    - www.deq.virginia.gov/ConnectWithDEQ/VEGIS.aspx

- DEQ Virginia Coastal Geospatial and Educational Mapping System (GEMS)

  Virginia's coastal resource data and maps; coastal laws and policies; facts on coastal resource values; and direct links to collaborating agencies responsible for current data:
    - http://128.172.160.131/gems2/

- MARCO Mid-Atlantic Ocean Data Portal

  The Mid-Atlantic Ocean Data Portal is a publicly available online toolkit and resource center that consolidates available data and enables users to visualize and analyze ocean resources and human use information such as fishing grounds, recreational areas, shipping lanes, habitat areas, and energy sites, among others.

  http://portal.midatlanticocean.org/visualize/#x=-73.24&y=38.93&z=7&logo=true&controls=true&basemap=Ocean&tab=data&legends=false&layers=true

- DHR Data Sharing System.

  Survey records in the DHR inventory:

    - www.dhr.virginia.gov/archives/data_sharing_sys.htm

- DCR Natural Heritage Search

  Produces lists of resources that occur in specific counties, watersheds or physiographic regions:
    - www.dcr.virginia.gov/natural_heritage/dbsearchtool.shtml

- DGIF Fish and Wildlife Information Service

  Information about Virginia's Wildlife resources:
    - http://vafwis.org/fwis/

- Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Database: Superfund Information Systems

3

Information on hazardous waste sites, potentially hazardous waste sites and remedial activities across the nation, including sites that are on the National Priorities List (NPL) or being considered for the NPL:

- www.epa.gov/superfund/sites/cursites/index.htm

- EPA RCRAInfo Search

  Information on hazardous waste facilities:
  - www.epa.gov/enviro/facts/rcrainfo/search.html

- EPA Envirofacts Database

  EPA Environmental Information, including EPA-Regulated Facilities and Toxics Release Inventory Reports:
  - www.epa.gov/enviro/index.html

- EPA NEPAssist Database

  Facilitates the environmental review process and project planning:
  http://nepaassisttool.epa.gov/nepaassist/entry.aspx

If you have questions about the environmental review process and/or the federal consistency review process, please feel free to contact me (telephone (804) 698-4204 or e-mail bettina.sullivan@deq.virginia.gov).

I hope this information is helpful to you.

Sincerely,

Bettina Rayfield, Program Manager
Environmental Impact Review and
Long-Range Priorities

4

From: Robert Gray
To: Miller, Shari A. (WFF-2500)
Subject: RE: Request for Comments on NASA Wallops Flight Facility Proposed Shoreline Project
Date: Wednesday, February 28, 2018 10:48:20 AM

The Pamunkey Indian Tribe is not aware of any site of cultural or religious significance that would be affected by the project. We ask to be notified in the event of inadvertent discovery.

<u>**MY E-MAIL HAS RECENTLY CHANGED AND YOU MAY NEED TO UPDATE YOUR CONTACT LIST. ALSO NOTE MY PHONE # AND MAIL ADDRESS.**</u>

Robert Gray
Chief / Tribal Administrator
Pamunkey Indian Tribe
Phone: (804) 572-1225
E-mail: robert.gray@pamunkey.org

Mail Address
Pamunkey Indian Tribe
1054 Pocahontas Trail
King William, VA 23086

From: Miller, Shari A. (WFF-2500) [mailto:shari.a.miller@nasa.gov]
Sent: Tuesday, February 27, 2018 8:51 AM
Subject: Request for Comments on NASA Wallops Flight Facility Proposed Shoreline Project

Dear Potential Stakeholder,

In accordance with the National Environmental Policy Act of 1969 (NEPA), as amended, the National Aeronautics and Space Administration (NASA) is preparing an Environmental Assessment (EA) for its proposed Shoreline Enhancement and Restoration Project (SERP) at Wallops Island, in Accomack County, Virginia. As the U.S. Bureau of Ocean Energy Management and U.S. Army Corps of Engineers are serving as cooperating agencies.

The attached letter contains further information on this proposed project. NASA respectfully requests that you provide comments or concerns by March 29, 2018. For updates on the project, as well as ways to submit comments on the SERP EA, please visit the following website address:
https://sites.wff.nasa.gov/code250/Tiered_Shoreline_Enhancement_and_Restoration_EA.html.

Please e-mail responses and inquiries to wff-shoreline@mail.nasa.gov or send responses via U.S. mail to the following address:

NASA Wallops Flight Facility
ATTN: SERP Project
34200 Fulton Street
Building F-160 / Room C165
Wallops Island, Virginia 23337

Sincerely,

Shari Miller

Shari A. Miller
Center NEPA Manager
Environmental Planning Lead
NASA Wallops Flight Facility
Wallops Island, VA 23337
(757) 824-2327
Shari.A.Miller@nasa.gov
http://sites.wff.nasa.gov/code250/

COUNTY OF ACCOMACK
OFFICE OF THE COUNTY ADMINISTRATOR
23296 COURTHOUSE AVE.
ROOM 203
P. O. BOX 388
ACCOMAC, VIRGINIA 23301
(757) 787-5700
(757) 824-5444
(757) 787-2468 FAX

Michael T. Mason, CPA
County Administrator

March 7, 2018

NASA Wallops Flight Facility
ATTN: SERP Project
34200 Fulton Street
Building F-160/Room C165
Wallops Island, Virginia 23337

RE: NASA's proposed Shoreline Enhancement and Restoration Project (SERP) at Wallops Islands

On behalf of the County of Accomack, Virginia Board of Supervisors, I write this letter in support of NASA's Shoreline Enhancement and Restoration Project (SERP) at Wallops Island, Virginia and the swift preparation of the Environmental Assessment (EA) associated with it.

It is of vital economic importance to Accomack County that continued steps are taken to protect the $1.2 billion in assets located on Wallops Island from storm-induced wave impacts thereby preserving the 1,700 jobs held by NASA servants, contractors and tenant personnel working on or in the general area of Wallops Island.

A great deal of investment has been made by Federal, State and local government to ensure NASA Wallops continues to meet ongoing and emerging needs in the science, defense, aerospace and commercial industries. It is only prudent that continued actions be pursued to protect these investments.

It is the County's hope that completion of the EA be achieved in an expeditious manner. Time is not on our side. Storms over the last few years have depleted defenses erected in 2014 to safeguard the island. While the shoreline has weathered these storms, they have taken their toll with shoreline sand volume at only 43% of the design levels.

It is with a sense of urgency that Accomack County supports this initiative and future actions to preserve Wallops Island. NASA is a valued partner of the County thus we hope this letter helps advance this project and our mutual goal of preserving the assets on Wallops Island.

Sincerely Yours,

Michael T. Mason, CPA
County Administrator

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 1111 East Main Street, Suite 1400, Richmond, VA 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

MEMORANDUM

TO: Shari A. Miller, Center NEPA Manager

FROM: Daniel Moore, Principal Environmental Planner

DATE: March 12, 2018

SUBJECT: Scoping Request – NASA Shoreline Enhancement and Restoration Project, Wallops Island, Virginia

We have reviewed the request for scoping comments for the proposed project and offer the following comments regarding consistency with the provisions of the *Chesapeake Bay Preservation Area Designation and Management Regulations* (Regulations):

Wallops Island is located along the shoreline of the Atlantic Ocean. As such it is outside of the Chesapeake Bay watershed and not subject to the Regulations and the *Chesapeake Bay Preservation Act*.

COMMONWEALTH of VIRGINIA

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

March 19, 2018

NASA Wallops Flight Facility
ATTN: SERP Project
34200 Fulton Street
Building F-160 / Room C165
Wallops Island, Virginia 23337

Re: Shoreline Enhancement and Restoration
Wallops Island (Scoping request)

Dear Sir or Madam:

You have inquired regarding the permitting requirements for Shoreline Enhancement and Restoration on Wallops Island. The Marine Resources Commission requires a permit for any activities that encroach upon or over, or take use of materials from the beds of the bays, ocean, rivers and streams, or creeks, which are the property of the Commonwealth.

In addition, since Accomack County has not yet adopted the model Coastal Primary Sand Dune Zoning Ordinance, the Commission is charged with reviewing the impacts associated with any projects that may fall within the Coastal Primary Sand Dunes/Beaches of Accomack County.

Based upon my review, it appears that all your proposed actions extending the seawall, beach nourishment, breakwaters and a southern end groin/jetty will require authorization from the Marine Resources Commission. The proposed dredged sits appear to be greater than 3 miles offshore therefore, that portion of the project will not require a permit from our agency.

We do have concerns that a southern end jetty may stop the existing longshore transport of sand to Assawoman Island. This would be especially so if funding could not be secured for the anticipated 3-7 year nourishment cycles. A series of offshore breakwaters would help alleviate some of our concerns with the nourishment cycles long term funding. If funding was not secured the existing longshore transport of sand to Assawoman Island would have less impact than a jetty. The impact to Assawoman Island from a jetty or breakwaters should be address.

An Agency of the Natural Resources Secretariat
www.mrc.virginia.gov
Telephone (757) 247-2200 (757) 247-2292 V/TDD Information and Emergency Hotline 1-800-541-4646 V/TDD

NASA Wallops Flight Facility
Page 2

If I may be of further assistance, please do not hesitate to contact me at (757) 414-0710

Sincerely,

George H. Badger, III
Environmental Engineer

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

March 29, 2018

Ms. Shari A. Miller
NASA Wallops Flight Facility
34200 Fulton Street
Building F-160/Room C165
Wallops Island, Virginia 23337

RE: Public scoping for NASA's proposed Shoreline Enhancement and Restoration Project at Wallops Island, Virginia

Dear Ms. Miller:

Thank you for your correspondence to the U.S. Environmental Protection Agency (EPA) dated February 27, 2018 informing us of NASA's decision to prepare an Environmental Assessment (EA) for its proposed Shoreline Enhancement and Restoration Project (SERP) at Wallops Island, in Accomack County, Virginia. We look forward to reviewing the project in compliance with the National Environmental Policy Act (NEPA), Clear Air Act Section 309 and authorities under the Clean Water Act. The SERP is the second document being tiered from the February 2010 Programmatic Environmental Impact Statement (PEIS) in which NASA evaluated the potential environmental effects from various alternatives including extending an existing seawall, recurring beach nourishment, constructing a parallel nearshore breakwater and constructing a southern-end perpendicular groin. The preferred action of the PEIS consisted of extending the seawall and beach nourishment. These actions proved effective in protecting Wallops' facilities during the 2012 Superstorm Sandy, however, the beach suffered significant loss of material.

In June 2013, NASA released the Wallops Island Post-Hurricane Sandy Shoreline Repair Final Environmental Assessment (Shoreline Repair EA) which was tiered from the PEIS and evaluated potential impacts associated with an adjusted renourishment cycle and repair of the Wallops Island seawall. Since completing these actions in 2014, the shoreline has withstood several storm events, including Winter Storm Jonas, however the sand volume has been reduced to 43% of design levels. The purpose of the SERP EA is to continue reducing the potential for damage of assets on Wallops Island from storm-induced wave impacts and evaluation of the potential impacts associated with dredging of offshore sand from two marine sand sources, placement of dredged sand on Wallops Island beach, and construction of a series of parallel, offshore breakwaters.

We have some general recommendations for the scope of analysis for the proposed study:

- The NEPA document should include a clear explanation of the underlying purpose and need for the proposed action. The purpose and need statement is important because it helps explain why the proposed action is being undertaken, the objectives the project intends to achieve, the measures to determine how well alternatives meet need. The purpose of the proposed action is typically the specific objective of the activity. The need should explain the underlying problem for why the project is necessary.
- The EA should provide context for the study area, other efforts being performed in the area, communication planning, etc.
- Alternatives analysis should include the suite of activities or solutions that were considered and the rationale for not carrying these alternatives forward for detailed study. Please feel free to reach out EPA to discuss Alternatives moved forward to detailed study.
- Please indicate in the EA what permits will be sought and required from the Commonwealth and Federal governments.
- The study should evaluate and discuss secondary and cumulative impacts, as defined by CEQ (40 CFR 1508.7 and 1508.8), of the proposed actions. Impacts may be positive or adverse (see CEQ 1997- "Considering Cumulative Effects Under the National Environmental Policy Act").
- We recommend the EA include an analysis of how shoal A may have diminished in volume since the 2013 Shoreline Repair EA, whether it can sustain additional dredging as a source of material for beach nourishment and, if so, what impacts additional dredging may have on the habitat it provides for birds and invertebrates such as annelids, mollusks and crustaceans.
- Please evaluate and discuss any impacts the proposed actions may have on herpetofauna; and any proposed avoidance and minimization measures.
- Please include discussion of any anticipated habitat creation for species such as the Piping Plover or Diamondback Terrapin and any monitoring of these species that will be conducted.
- In the Shoreline Repair EA, the presence of additional sand within the nearshore system was anticipated to lead to the formation of offshore sand bars which would dissipate wave energy (p.3-9). It would be helpful if the EA documented if these offshore sandbars formed since the additional sand was incorporated into the nearshore system. Please describe how any offshore sandbars formed since the Shoreline Repair EA may influence the construction of offshore breakwaters proposed in the SERP.

EPA appreciates the opportunity to engage in the scoping and development of the documentation to satisfy the requirements of NEPA and the Clean Water Act. For any questions or assistance EPA can provide, please contact Mr. Aaron Blair at (215) 814-2748, blairaaronm@epa.gov.

Sincerely,

Barbara Rudnick
NEPA Program Manager
Office of Environmental Programs

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APPENDIX B
JOINT PERMIT APPLICATION

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National Aeronautics and Space Administration
Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337-5099

Reply to Attn of 228

October 1, 2018

Hank Badger
Environmental Engineer, Habitat Management Division
Virginia Marine Resources Commission
2600 Washington Avenue,
Newport News, VA 23607

Re: NASA Wallops Flight Facility Shoreline Enhancement and Restoration Project Joint Permit Application

Dear Hank,

Attached please find the Joint Permit Application and supporting documentation for the above referenced project. We have included the following:

1. Joint Permit Application
2. Permit drawings
3. Attachment 1: Purpose and Need, Alternatives Considered and Description of Project
4. Department of Historic Resources Finding (DHR File No. 2018-3863)
5. Breakwater Design and Analysis Report
6. Periodic Surveying Evaluation Fall 2015
7. Periodic Surveying Evaluation Fall 2017
8. Plans Wallops Island 100% Submittal
9. Specifications Wallops Island 100% Submittal
10. September 24, 2018 Pre- Application Meeting Minutes

We are providing this by posting to the Cardno FTP site. Please see link in email. If there are problems downloading the information, please let us know and we will assist. We appreciate your time and attention to this project. Do not hesitate to contact us with questions or comments.

Sincerely,

Paul Bull, PE

Cc: Brian Denson, ACOE, with attachments
Shari Kattan, VDEQ, with attachments
Lyle Varnell, VIMS, with attachments
Dave O'Brien NOAA, with attachments
Chris Guvernator, Accomack County, with attachments
Shari Miller, NASA
John Saecker, NASA
John Lowenthal, Cardno
Elizabeth Burak, Cardno

FOR AGENCY USE ONLY	
	Notes:
JPA#	

APPLICANTS

PLEASE PRINT OR TYPE ALL ANSWERS. If a question does not apply to your project, please print N/A (not applicable) in the space provided. ***If additional space is needed, attach extra 8 ½ x 11 inch sheets of paper.***

Check all that apply			
Pre-Construction Notification (PCN) ☐ NWP # ____________ *(For Nationwide Permits ONLY - No DEQ-VWP permit writer will be assigned)*	SPGP ☐	DEQ Reapplication ☐ Existing permit number: ____________	Receiving federal funds ☐ Agency providing funding: ____________

PREVIOUS ACTIONS RELATED TO THE PROPOSED WORK (Include all federal, state, and local pre-application coordination, site visits, previous permits, or applications whether issued, withdrawn, or denied)

Historical information for past permit submittals can be found online with VMRC - https://webapps.mrc.virginia.gov/public/habitat/ - or VIMS - http://ccrm.vims.edu/perms/newpermits.html

Agency	Action / Activity	Permit/Project number, including any non-reporting Nationwide permits previously used (e.g., NWP 13)	Date of Action	If denied, give reason for denial
Corps/VMRC	Inter-agency Pre-Appl. Meeting	NAO-1992-1455	9/24/18	
VIMS/NOAA				

1. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR INFORMATION
The applicant(s) is/are the legal entity to which the permit may be issued (see How to Apply at beginning of form). The applicant(s) can either be the property owner(s) or the person/people/company(ies) that intend(s) to undertake the activity. The agent is the person or company that is representing the applicant(s). If a company, please also provide the company name that is registered with the State Corporation Commission (SCC), or indicate no registration with the SCC.

Applicant			Agent		
Legal Name(s) of Applicant(s) NASA Wallops Flight Facility			Agent (if applicable)		
Mailing address Wallops Island/Accomack County			Mailing address		
City Wallops Island	State VA	ZIP Code 23337	City	State	ZIP Code
Phone number w/area code	Fax		Phone number w/area code	Fax	
Mobile	E-mail		Mobile	E-mail	
State Corporation Commission Name and ID number (if applicable)			State Corporation Commission Name and ID number (if applicable)		

Certain permits or permit authorizations may be provided via electronic mail. If the applicant wishes to receive their permit via electronic mail, please provide an e-mail address here: ____________________________

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Application Revised: May 2017

1. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR INFORMATION (Continued)					
Property owner(s) legal name, if different from applicant Paul Bull, PE			Contractor, if known		
Mailing address NASA Wallops Flight Facility, Building N-161, Code 228			Mailing address		
City Wallops Island	State VA	ZIP code 23337	City	State	ZIP code
Phone number w/area code 757-824-1168	Fax 757-824-1831		Phone number w/area code	Fax	
Mobile	E-mail paul.c.bull@nasa.gov		Mobile	E-mail	
State Corporation Commission Name and ID number (if applicable)			State Corporation Commission Name ID number (if applicable)		

2. PROJECT LOCATION INFORMATION
(Attach a copy of a detailed map, such as a USGS topographic map or street map showing the site location and project boundary, so that it may be located for inspection. Include an arrow indicating the north direction. Include the drainage area if the SPGP box is checked on Page 7.)

Street Address (911 address if available) Wallops Island	City/County/ZIP Code Accomack County
Subdivision	Lot/Block/Parcel #

Name of water body(ies) within project boundaries and drainage area (acres or square miles).
Atlantic Ocean

Tributary(ies) to: NA
Basin: ______ Sub-basin: ______
(*Example: Basin: James River Sub-basin: Middle James River*)

Special Standards (based on DEQ Water Quality Standards 9VAC25-260 et seq.): NA

Project type (check one)
- ☐ Single user (private, non-commercial, residential)
- ☑ Multi-user (community, commercial, industrial, government)
- ☐ Surface water withdrawal

Latitude and longitude at center of project site (decimal degrees): 37-50-45 / -75-28-29
(Example: 37.33164/-77.68200)

USGS topographic map name: Wallops Island

8-digit USGS Hydrologic Unit Code (HUC) for your project site (See http://cfpub.epa.gov/surf/locate/index.cfm): 02040303
If known, indicate the 10-digit and 12-digit USGS HUCs (see *http://dswcapps.dcr.virginia.gov/htdocs/maps/HUExplorer.htm* :
______ ______

Name of your project (*Example: Water Creek driveway crossing*) Shoreline Enhancement Restoration Project

Is there an access road to the project? ☑ Yes ☐ No. If yes, check all that apply: ☐ public ☑ private ☐ improved ☐ unimproved

Total size of the project area (in acres): 405

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Application Revised: May 2017

2. PROJECT LOCATION INFORMATION (Continued)

Provide driving directions to your site, giving distances from the best and nearest visible landmarks or major intersections:

Access to project site will require NASA security badging. The NASA security office/badging facility directions are as follows: From Route 13 North, turn right on Chincoteague Road/Rt. 175. Travel east for 3.5 miles toward Town of Chincoteague. At Wallops Island stoplight, turn left (north) on Atlantic Road/Rt. 798. Travel north for one mile: veer off to the right (east) to parking area for NASA badging facility. NASA project personnel shall provide escort to the site.

Does your project site cross boundaries of two or more localities (i.e., cities/counties/towns)? ☐ Yes ☑ No
If so, name those localities:

3. DESCRIPTION OF THE PROJECT, PROJECT PRIMARY AND SECONDARY *PURPOSES*, PROJECT *NEED*, INTENDED USE(S), AND ALTERNATIVES CONSIDERED (Attach additional sheets if necessary)

- The purpose and need must include any new development or expansion of an existing land use and/or proposed future use of residual land.
- Describe the physical alteration of surface waters, including the use of pilings (#, materials), vibratory hammers, explosives, and hydraulic dredging, when applicable, and *whether or not tree clearing will occur* (include the area in square feet and time of year).
- Include a description of alternatives considered and measures taken to avoid or minimize impacts to surface waters, including wetlands, to the maximum extent practicable. Include factors such as, but not limited to, alternative construction technologies, alternative project layout and design, alternative locations, local land use regulations, and existing infrastructure
- For utility crossings, include both alternative routes and alternative construction methodologies considered
- For surface water withdrawals, public surface water supply withdrawals, or projects that will alter in-stream flows, include the water supply issues that form the basis of the proposed project.

See Attachment 1

Date of proposed commencement of work (MM/DD/YYYY) 3/1/19	Date of proposed completion of work (MM/DD/YYYY) 3/1/19
Are you submitting this application at the direction of any state, local, or federal agency? ☐ Yes ☑ No	Has any work commenced or has any portion of the project for which you are seeking a permit been completed? ☐ Yes ☑ No

If you answered "yes" to either question above, give details stating when the work was completed and/or when it commenced, who performed the work, and which agency (if any) directed you to submit this application. In addition, you will need to clearly differentiate between completed work and proposed work on your project drawings.

Are you aware of any unresolved violations of environmental law or litigation involving the property? ☐ Yes ☑ No
(If yes, please explain)

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Application Revised: May 2017

4. PROJECT COSTS

Approximate cost of the entire project, including materials and labor: $ 24,400,000
Approximate cost of only the portion of the project affecting state waters (channelward of mean low water in tidal areas and below ordinary high water mark in nontidal areas): $ 24,400,000

5. PUBLIC NOTIFICATION (Attach additional sheets if necessary)

Complete information for all property owners adjacent to the project site and across the waterway, if the waterway is less than 500 feet in width. If your project is located within a cove, you will need to provide names and mailing addresses for all property owners within the cove. If you own the adjacent lot, provide the requested information for the first adjacent parcel beyond your property line.

Failure to provide this information may result in a delay in the processing of your application by VMRC.

Property owner's name	Mailing address	City	State	ZIP code
USFWS Chincoteague NWR, (Robert Leffel, interim refuge manager)	PO Box 62, 8231 Beach Road	Chincoteague	VA	23336

Name of newspaper having general circulation in the area of the project: Eastern Shore News
Address and phone number (including area code) of newspaper PO Box 288 Tasley VA23441 757-787-1200

Have adjacent property owners been notified with forms in Appendix A? ☐ Yes ☑ No (attach copies of distributed forms)

6. THREATENED AND ENDANGERED SPECIES INFORMATION

Please provide any information concerning the potential for your project to impact state and/or federally threatened and endangered species (listed or proposed). Attach correspondence from agencies and/or reference materials that address potential impacts, such as database search results or confirmed waters and wetlands delineation/jurisdictional determination. Include information when applicable regarding the location of the project in Endangered Species Act-designated or -critical habitats. Contact information for the U.S. Fish and Wildlife Service, National Oceanic and Atmospheric Administration, Virginia Dept. of Game and Inland Fisheries, and the Virginia Dept. of Conservation and Recreation-Division of Natural Heritage can be found on page 4 of this package.

7. HISTORIC RESOURCES INFORMATION

Note: Historic properties include but are not limited to archeological sites, battlefields, Civil War earthworks, graveyards, buildings, bridges, canals, etc. Prospective permittees should be aware that section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the USACE from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the USACE, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant.

Are any historic properties located within or adjacent to the project site? ☑ Yes ☐ No ☐ Uncertain
If Yes, please provide a map showing the location of the historic property within or adjacent to the project site.

Are there any buildings or structures 50 years old or older located on the project site? ☐ Yes ☑ No ☐ Uncertain
If Yes, please provide a map showing the location of these buildings or structures on the project site.

Is your project located within a historic district? ☐ Yes ☑ No ☐ Uncertain

If Yes, please indicate which district: __________

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Application Revised: May 2017

7. HISTORIC RESOURCES INFORMATION (Continued)

Has a survey to locate archeological sites and/or historic structures been carried out on the property?
☑ Yes ☐ No ☐ Uncertain

If Yes, please provide the following information: Date of Survey: November 2003 and June/July 2010

Name of firm: URS Group and EG&G Technical Services

Is there a report on file with the Virginia Department of Historic Resources? ☑ Yes ☐ No ☐ Uncertain

Title of Cultural Resources Management (CRM) report: Cultural Resources Assessment of Wallops Flight Facility

Was any historic property located? ☑ Yes ☐ No ☐ Uncertain

8. WETLANDS, WATERS, AND DUNES/BEACHES IMPACT INFORMATION

Report each impact site in a separate column. If needed, attach additional sheets using a similar table format. Please ensure that the associated project drawings clearly depict the location and footprint of each numbered impact site. For dredging, mining, and excavating projects, use Section 17.

	Impact site number 1	Impact site number 2	Impact site number 3	Impact site number 4	Impact site number 5
Impact description (use all that apply): F=fill EX=excavation S=Structure T=tidal NT=non-tidal TE=temporary PE=permanent PR=perennial IN=intermittent SB=subaqueous bottom DB=dune/beach IS=hydrologically isolated V=vegetated NV=non-vegetated MC=Mechanized Clearing of PFO (*Example: F, NT, PE, V*)	F, T, PE, SB, DB, NV	S, T, PE, SB, NV			
Latitude / Longitude (in decimal degrees)	37-50-45/75-28-29	37-50-45/75-28-29			
Wetland/waters impact area (square feet / acres)	6,073,039/139.42	71,820/1.64			
Dune/beach impact area (square feet)	3,941.296/90.48	0			
Stream dimensions at impact site (length and average width in linear feet, and area in square feet)	NA	NA			
Volume of fill below Mean High Water or Ordinary High Water (cubic yards)	858,426	23,940			

8. WETLANDS/WATERS IMPACT INFORMATION (Continued)					
Cowardin classification of impacted wetland/water or geomorphological classification of stream *Example wetland: PFO; Example stream: 'C' channel and if tidal, whether vegetated or non-vegetated wetlands per Section 28.2-1300 of the Code of Virginia*	Marine, Intertidal/ Subtidal, Rock	Marine, Intertidal/ Subtidal, Rock			
Average stream flow at site (flow rate under normal rainfall conditions in cubic feet per second) and method of deriving it (gage, estimate, etc.)	NA	NA			
Contributing drainage area in acres or square miles (*VMRC cannot complete review without this information*)	NA	NA			
DEQ classification of impacted resource(s): Estuarine Class II; Non-tidal waters Class III; Mountainous zone waters Class IV; Stockable trout waters Class V; Natural trout waters Class VI; Wetlands Class VII; http://leg1.state.va.us/cgi-bin/legp504.exe?000+reg+9VAC25-260-50	Class I Open Ocean	Class I Open Ocean			

For DEQ permitting purposes, also submit as part of this section a wetland and waters boundary delineation map – see (3) in the Footnotes section in the form instructions.

For DEQ permitting purposes, also submit as part of this section a written disclosure of all wetlands, open water, or streams that are located within the proposed project or compensation areas that are also under a deed restriction, conservation easement, restrictive covenant, or other land-use protective instrument.

9. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR CERTIFICATIONS

READ ALL OF THE FOLLOWING CAREFULLY BEFORE SIGNING

PRIVACY ACT STATEMENT: The Department of the Army permit program is authorized by Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act, and Section 103 of the Marine Protection Research and Sanctuaries Act of 1972. These laws require that individuals obtain permits that authorize structures and work in or affecting navigable waters of the United States, the discharge of dredged or fill material into waters of the United States, and the transportation of dredged material for the purpose of dumping it into ocean waters prior to undertaking the activity. Information provided in the Joint Permit Application will be used in the permit review process and is a matter of public record once the application is filed. Disclosure of the requested information is voluntary, but it may not be possible to evaluate the permit application or to issue a permit if the information requested is not provided.

CERTIFICATION: I am hereby applying for permits typically issued by the DEQ, VMRC, USACE, and/or Local Wetlands Boards for the activities I have described herein. I agree to allow the duly authorized representatives of any regulatory or advisory agency to enter upon the premises of the project site at reasonable times to inspect and photograph site conditions, both in reviewing a proposal to issue a permit and after permit issuance to determine compliance with the permit.

In addition, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

9. APPLICANT, AGENT, PROPERTY OWNER, AND CONTRACTOR CERTIFICATIONS (Continued)

Is/Are the Applicant(s) and Owner(s) the same? ☑ *Yes* ☐ *No*

Legal name & title of Applicant Paul Bull, PE NASA Project Manager	Second applicant's legal name & title, if applicable
Applicant's signature	Second applicant's signature
Date 10/04/18	Date
Property owner's legal name, if different from Applicant	Second property owner's legal name, if applicable
Property owner's signature, if different from Applicant	Second property owner's signature
Date	Date

CERTIFICATION OF AUTHORIZATION TO ALLOW AGENT(S) TO ACT ON APPLICANT'S(S') BEHALF (IF APPLICABLE)

I (we), ________________________ (and) ________________________ ,
APPLICANT'S LEGAL NAME(S) – *complete the second blank if more than one Applicant*

hereby certify that I (we) have authorized ________________________ (and) ________________________
AGENT'S NAME(S) – *complete the second blank if more than one Agent*
to act on my (our) behalf and take all actions necessary to the processing, issuance, and acceptance of this permit and any and all standard and special conditions attached. I (we) hereby certify that the information submitted in this application is true and accurate to the best of my (our) knowledge.

Applicant's signature	Second applicant's signature, if applicable
Date	Date
Agent's signature and title	Second agent's signature and title, if applicable
Date	Date

CONTRACTOR ACKNOWLEDGEMENT (IF APPLICABLE)

I (we), ________________________ (and) ________________________ ,
APPLICANT'S LEGAL NAME(S) – *complete the second blank if more than one Applicant*

have contracted ________________________ (and) ________________________
CONTRACTOR'S NAME(S) – *complete the second blank if more than one Contractor*

to perform the work described in this Joint Permit Application, signed and dated ________________________

I (we) will read and abide by all conditions as set forth in all federal, state, and local permits as required for this project. I (we) understand that failure to follow the conditions of the permits may constitute a violation of applicable federal, state, and local statutes and that we will be liable for any civil and/or criminal penalties imposed by these statutes.
In addition, I (we) agree to make available a copy of any permit to any regulatory representative visiting the project site to ensure permit compliance. If I (we) fail to provide the applicable permit upon request, I (we) understand that the representative will have the option of stopping our operation until it has been determined that we have a properly signed and executed permit and are in full compliance with all of the terms and conditions.

Contractor's name or name of firm (printed/typed)	Contractor's or firm's mailing address	
Contractor's signature and title	Contractor's license number	Date
Applicant's signature	Second applicant's signature, if applicable	
Date	Date	

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Application Revised May 2017

13. FREE STANDING MOORING PILES, OSPREY NESTING POLES, MOORING BUOYS, AND DOLPHINS (not associated with piers)

Number of vessels to be moored: ___________

Type and number of mooring(s) proposed: ___________

In the spaces provided below, give the type (e.g., sail, power, skiff, etc.), size, and registration number of the vessel(s) to be moored

TYPE	LENGTH	WIDTH	DRAFT	REGISTRATION #

Give the name and complete mailing address(es) of the owner(s) of the vessel(s) if not owned by applicant (attach extra sheets if needed):

Do you plan to reach the mooring from your own upland property? ☐ Yes ☐ No
If "no," explain how you intend to access the mooring.

14. BOAT RAMPS

Will excavation be required to construct the boat ramp? ☐ Yes ☐ No. If "yes," will any of the excavation occur below the plane of the ordinary high water mark/mean high water line or in wetlands? ☐ Yes ☐ No. If "yes," you will need to fill out Section 17 for this excavation.
Where will you dispose of the excavated material?

____

What type of design and materials will be used to construct the ramp (open pile design with salt treated lumber, concrete slab on gravel bedding, etc.)?

Location of nearest public boat ramp

Driving distance to that public ramp ___________ miles

Will other structures be constructed concurrent with the boat ramp installation? ☐ Yes ☐ No
If "yes," please fill out the appropriate sections of this application associated with those other activities.

15. TIDAL/NONTIDAL SHORELINE STABILIZATION STRUCTURES (INCLUDING BULKHEADS AND ASSOCIATED BACKFILL, RIPRAP REVETMENTS AND ASSOCIATED BACKFILL, MARSH TOE STABILIZATION, GROINS, JETTIES, AND BREAKWATERS, ETC.) Information on non-structural, vegetative alternatives (i.e., Living Shoreline) for shoreline stabilization is available at [illegible].

Is any portion of the project maintenance or replacement of an existing and currently serviceable structure? ☐ Yes ☑ No
If yes, give length of existing structure: ___________ linear feet

If your maintenance project entails replacement of a bulkhead, is it possible to construct the replacement bulkhead within 2 feet channelward of the existing bulkhead? ☐ Yes ☑ No If not, please explain below:

Length of proposed structure, including returns: ___________ linear feet

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Application Revised: May 2017

15. TIDAL/NONTIDAL SHORELINE STABILIZATION STRUCTURES (Continued)

Average channelward encroachment of the structure from Mean high water/ordinary high water mark: 380 feet Mean low water: 334 feet	*Maximum* channelward encroachment of the structure from Mean high water/ordinary high water mark: 759 feet Mean low water: 668 feet
Maximum channelward encroachment form the back edge of the Dune NA feet	*Maximum* channelward encroachment from the back edge of the Beach 150 feet

Describe the type of construction including all materials to be used (including all fittings). Will filter cloth be used? ☐ Yes ☑ No

Cedar Mountain Stone

What is the source of the backfill material? Mitchells VA

What is the composition of the backfill material? rock

If rock is to be used, give the average volume of material to be used for every linear foot of construction: 21 cubic yards
What is the volume of material to be placed below the plane of ordinary high water mark/mean high water? 23,940 cubic yards

For projects involving stone:
Average weight of core material (bottom layers): 150-500 lbs pounds per stone (Class Type II)
Average weight of armor material (top layers): 1,500-4,000 lbs pounds per stone (Class Type I)

Are there similar shoreline stabilization structures in the vicinity of your project site? ☑ Yes ☐ No
If so, describe the type(s) and location(s) of the structure(s):
Existing seawalls onsite

If you are building a groin or jetty, will the channelward end of the structure be marked to show a hazard to navigation? ☐ Yes ☑ No	Has your project been reviewed by the Shoreline Erosion Advisory Service (SEAS)? ☐ Yes ☑ No If yes, please attach a copy of their comments.

16. BEACH NOURISHMENT

Source of material and composition (percentage sand, silt, clay): Wallops Island North End	Volume of material: 1.3 million cubic yards cubic yards

Area to be covered 4,845,675 square feet channelward of mean low water 5,187,130 square feet channelward of mean high water

4,824,482 square feet landward of mean low water 3,930,580 square feet ~~channelward~~ Landward of mean high water

Mode of transportation of material to the project site (truck, pipeline, etc.):
Truck

Describe the type(s) of vegetation proposed for stabilization and the proposed planting plan, including schedule, spacing, monitoring, etc. Attach additional sheets if necessary.
American Beach grass will be sprigged @ 18" on center each way(ocew) along the entire dune. The cultivar 'Cape' will be used. Plants will be installed between October 1 and March 31, during the appropriate time of year for dune planting. See permit drawings for a typical profile of the planing area.

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Application Revised: May 2017

17. DREDGING, MINING, AND EXCAVATING

FILL OUT THE FOLLOWING TABLE FOR DREDGING PROJECTS

	NEW dredging				MAINTENANCE dredging			
	Hydraulic		Mechanical (clamshell, dragline, etc.)		Hydraulic		Mechanical (clamshell, dragline, etc.)	
	Cubic yards	Square feet	Cubic yards	Square feet	Cubic yards	Square feet	Cubic yards	Square feet
Vegetated wetlands			0.0	0.0				
Non-vegetated wetlands			37,515	1,350,573				
Subaqueous land			0.0	0.0				
Totals			37,515	1,350,573				

Is this a one-time dredging event? [✓] Yes [ ] No If "no", how many dredging cycles are anticipated: ____________
(____ initial cycle in cu. yds.) (_____ subsequent cycles in cu. yds.)

Composition of material (percentage sand, silt, clay, rock):
Provide documentation (i.e., laboratory results or analytical reports) that *dredged* material from on-site areas is free of toxics. If not free of toxics, provide documentation of proper disposal (i.e., bill of lading from commercial supplier or disposal site).

sand

Please include a dredged material management plan that includes specifics on how the dredged material will be handled and retained to prevent its entry into surface waters or wetlands. If on-site dewatering is proposed, please include plan view and cross-sectional drawings of the dewatering area and associated outfall.

Will the dredged material be used for any commercial purpose or beneficial use? [✓] Yes [ ] No
If yes, please explain:
Beach renourishment

If this is a maintenance dredging project, what was the date that the dredging was last performed? ____________
Permit number of original permit: ____________ *(It is important that you attach a copy of the original permit.)*

For mining projects: On separate sheets of paper, explain the operation plans, including: 1) the frequency (e.g., every six weeks), duration (i.e., April through September), and volume (in cubic yards) to be removed per operation; 2) the temporary storage and handling methods of mined material, including the dimensions of the containment berm used for upland disposal of dredged material and the need (or no need) for a liner or impermeable material to prevent the leaching of any identified contaminants into ground water; 3) how equipment will access the mine site; and 4) verification that dredging: a) will not occur in water body segments that are currently on the effective Section 303(d) Total Maximum Daily Load (TMDL) priority list (available at http://www.deq.virginia.gov/Programs/Water/WaterQualityInformationTMDLs/TMDL/TMDLDevelopment/TMDLProgramPriorities.aspx) or that have an approved TMDL; b) will not exacerbate any impairment; and c) will be consistent with any waste load allocation/limit/conditions imposed by an approved TMDL (see, "What's in my backyard" or subsequent spatial files at http://www.deq.virginia.gov/ConnectWithDEQ/VEGIS.aspx to determine the extent of TMDL watersheds and impairment segments).

Have you applied for a permit from the Virginia Department of Mines, Minerals and Energy? [ ] Yes [✓] No If Yes:
Existing permit number: ____________ Date permit issued: ____________

Contributing drainage area: na ________ square miles

Average stream flow at site (flow rate under normal rainfall conditions): na ________ cfs

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Application Revised: May 2017

ATTACHMENT 1
PURPOSE AND NEED, ALTERNATIVES CONSIDERED AND DESCRIPTION OF PROJECT

The National Aeronautics and Space Administration (NASA) is proposing to enhance and restore the shoreline on Wallops Island. The Shoreline Enhancement and Restoration Project would reduce the potential for damage to, or loss of, NASA, United States (U.S.) Navy, and Virginia Commercial Spaceflight Authority's Mid-Atlantic Regional Spaceport (MARS) assets on Wallops Island from wave impacts associated with storm events.

Below is a summary of the purpose of and need for the project and the alternative considered for permitting in the project Environmental Assessment (EA). More detailed information is contained in the Final EA.

1.0 PURPOSE AND NEED FOR THE PROJECT

The purpose of the project is to restore the Wallops Island shoreline infrastructure protection area in order to reduce the potential for damage to, or loss of, NASA, U.S. Navy, and MARS assets on Wallops Island from wave impacts associated with storm events. The project is needed because the shoreline's beach berm and dune system, established to protect NASA's Wallops Island launch range infrastructure, has been eroded through storm wind and wave damage; therefore, the existing beach cannot provide the level of storm damage reduction for which it was originally designed. The constructed beach system has served its intended purpose of reducing damage to the range assets. However, a notable portion of subaerial (i.e., on land surface) sand has been relocated by storm winds and waves with a majority of this sand volume transported to the north end of Wallops Island. The effects of storms are most apparent within the southern half of Wallops Island, where many of the most critical launch assets are located. Within this area, referred to as the shoreline infrastructure protection area, the seaward half of the beach berm has been lowered by three feet or more. As such, the beach berm and dune system can no longer protect the area from storm damage reduction as it was originally intended and must be restored to regain full functionality.

2.0 BACKGROUND

Wallops Island has experienced shoreline changes throughout the six decades that NASA has occupied the site. Recent evaluations of the need to restore the Wallops shoreline and the possible impacts resulting therefrom include the Shoreline Restoration and Infrastructure Protection Program Programmatic Environmental Impact Statement (Shoreline Restoration and

Infrastructure Protection Program Programmatic Environmental Impact Statement, 2010) and the Post-Hurricane Sandy Shoreline Repair EA (Post-Hurricane Sandy Shoreline Repair EA, 2013). In 2012 and 2014, the infrastructure protection area was renourished using sand from offshore Unnamed Shoal A, located approximately seven miles east of Wallops Island.

Presently, the existing seawall in the shoreline infrastructure protection area is being undermined because there is little or no protective sand beach remaining and storm waves break directly on the rocks. Currently, the south end of the island is unprotected except for a low revetment around the MARS launch pad and temporary geotextile tubes that extend from the southern end of the existing seawall south to camera stand Z-100.

The potential risks to infrastructure from wave impacts (that will only be exacerbated by sea-level rise) are two-fold: first is the interruption of NASA, U.S. Navy, and MARS missions supported from Wallops Island facilities due to temporary loss of facility functions; and second is the potential for physical damage to or loss of these unique facilities. If no protective measures are taken, the assets on Wallops Island will be increasingly at risk from even moderate storm events.

The U.S. Army Corps of Engineers (USACE) prepared a breakwater analysis, design and modeling report for NASA to assess possible hardscape solutions to address the erosion problems along the shoreline infrastructure protection area of Wallops Island (USACE 2018-attached). The analysis included numerical modeling to determine the appropriate size and placement of a detached offshore breakwater or a series of detached breakwaters. Seven alternatives were evaluated and the recommendation was to construct two, series of three detached breakwaters to reduce the effects of erosion of the Wallops Island beach nourishment effort.

3.0 PROJECT DESCRIPTION

NASA has prepared an EA, which considers a range of alternatives that meet the purpose and need of restoring and enhancing the shoreline in the infrastructure protection area. The following alternatives are being proposed in this permit application and details are provided below.

1. Restoring the beach using sand from the north Wallops Island beach, where sand eroded from the south has accreted. This would involve removing sand using a pan excavator and trucking it to the shoreline infrastructure protection area where it would be spread using heavy equipment.
2. Building a series of six parallel offshore breakwaters.

3.1 Excavation

NASA would place an estimated 1.3 million cubic yards of sand along approximately 19,850 feet of shoreline in the infrastructure protection area. The beachfill material would come from the north Wallops Island beach, an area where sand is accreting due to longshore transport from the south.

A pan excavator would be used to remove sand from approximately 200 acres north Wallops Island beach to the mean low water line. The average excavation depth is 2.35 feet. Sand would be stockpiled and then loaded onto dump trucks for transport on existing roads to the southern end of the island. Bulldozers would be used to spread the fill material once it is placed on the beach. All heavy equipment would access the beach from existing roads and established access points. No new temporary or permanent roads would be constructed to access the beach or to transport the fill material to renourishment areas.

The beach fill would start approximately 1,500 feet north of the Wallops Island-Assawoman Island property boundary and extend north for approximately 3.7 miles. The initial fill would be placed so that there would be a 6-foot-high berm extending a minimum of 70 feet seaward of the existing seawall. The remainder of the fill would slope seaward; the amount of that distance would vary along the length of the beach fill.

3.2 Breakwaters

Six rubble mound breakwaters will be constructed in two sets of three each approximately 200 feet offshore from the mean high water line of the renourished beach in the shoreline infrastructure protection area. Each breakwater would be constructed of Virginia Department of Transportation Type I armor stone for the outer layer (which ranges from 0.75 to 2 tons) and Class II Stone for the core layer (which ranges from 150 to 499 pounds). All stone would be placed parallel to the shore and would measure approximately 130 feet long and 10 feet wide at top crest elevation. The breakwaters would be placed approximately 100 feet apart from each other. Water depths in these areas is approximately 4 to 8 feet. The southernmost set of three breakwaters will be constructed approximated 4000 feet north of the southern extent of beach nourishment. The second set of three breakwaters will be constructed approximately 10,000 feet north of the southern extent of beach nourishment. The rocks for constructing each breakwater would be transported to the Wallops Flight Facility area by rail, offloaded, and then trucked to the handling or placement site on Wallops Island. The stone would then be loaded onto barges and placed using heavy lifting equipment.

The tables below depict the areas impacted from various parts of the project. Table 3-1 provides a summary of impact types from placement of beachfill along the shoreline, Table 3-2 provides a summary of the impacts of the excavation of the sand north Wallops Island beach and Table 3-3 provides a summary of impact types from construction of the breakwaters.

Table 3-1. Areas affected by beach fill placement

Impact Location	Area (acres)	Volume (cubic yards)
Vegetated Wetland	0.0	0.0
Un-vegetated Wetland	0.0	0.0
MHW Seaward	139.4	858,426
MLW Seaward	111.2	742,815
MHW Landward	90.4	441,574
MLW Landward	118.6	557,185

Table 3-2. Areas affected by sand excavation on the north Wallops Island beach

Impact Location	Area (acres)	Volume (cubic yards)
Vegetated Wetland	0.0	0.0
Un-vegetated Wetland	0.0	0.0
MHW Seaward	31.0	37,515
MLW Seaward	0.0	0.0
MHW Landward	90.4	441,574
MLW Landward	405	1,300,000

Table 3-3. Areas affected by breakwater construction

Impact Location	Area (acres)	Volume (cubic yards)
Vegetated Wetland	0.0	0.0
Un-vegetated Wetland	0.0	0.0
MHW Seaward	1.64	23,940
MLW Seaward	1.64	23,940
MHW Landward	0.0	0.0
MLW Landward	0.0	0.0

4.0 SECTION 7 CONSULTATIONS

On March 20, 2013, U.S. Fish and Wildlife Service (USFWS) responded that the impacts resulting from the beach renourishment proposed by the *2013 Post-Hurricane Sandy EA* would be within that already considered in its July 30, 2010 Programmatic Biological Opinion (BO). USFWS also submitted a newer consolidated BO in June 2016 to replace and consolidate opinions and terms for ongoing operations at Wallops Flight Facility that included a 2-7 year cycle for beach renourishment.

In developing the BOs, National Marine Fisheries Service (NMFS) and USFWS provided mandatory terms and conditions that NASA must follow to reduce potential effects to listed species. As such, NASA and USACE would ensure that their contractors implemented these measures on their behalf. NASA re-initiated informal consultation with NMFS and USFWS in 2018. The results of this informal consultation will be provided, once complete.

5.0 MITIGATION AND MONITORING

Well before NASA's presence on Wallops Island in the mid-1940s, the project site has been in a state of constant change. Accordingly, much of the project site is now open ocean with the normal tidal range falling along the existing seawall. Construction of the project would restore the Wallops Island beach to pre-Hurricane Sandy condition.

NASA is adopting all mitigation and monitoring components identified in Chapter 5 of the Final EA, and additional detail can be found there. Consistent with the overall Shoreline Erosion Restoration Program, it is expected that the mitigation plan will be adjusted based on monitoring results and effectiveness of the measures.

5.1 Water Quality

Onshore, NASA will implement erosion and sediment control Best Management Practices (BMPs) to minimize adverse effects on adjacent water bodies. All BMPs will be designed and installed in accordance with the latest version of the Virginia Erosion and Sediment Control Handbook.

For both onshore and offshore operations, spill prevention BMPs will be implemented to reduce potential impacts on soils and sediments during seawall construction, and all work would be performed in accordance with the most current version of Wallops Flight Facility's Integrated Contingency Plan. Prior to starting work, the contractor will be required to submit an Environmental Protection Plan which will outline all measures that will be employed during onshore and offshore construction activities to minimize adverse environmental impacts.

5.2 Shoreline Change

As funding allows, NASA will initiate a shoreline monitoring program to evaluate the performance of performance of the breakwaters and beach fill and identify the need for future beach renourishment. The monitoring program will consist of subaerial beach cross-section surveys, subaqueous beach profile surveys, aerial photographs, and storm data summaries, beginning before construction. The program will compare the post-construction data with the pre-construction data and evaluate the performance of the project.

5.3 Revegetation

American beach grass (*Ammophila breviligulata*, cultivar "Cape") will be planted at 18 inches intervals over the re-established dune. Plants will be installed between October 1 and March 31. The planting area will be approximately 150 feet wide along the entire length of the newly created dune in the beach nourishment area. See permit drawings for a typical profile of the planting area (100% Design Plans and specifications, USACE 2018-attached).

5.4 Munitions and Explosives of Concern

NASA will provide all construction personnel a Munitions and Explosives of Concern (MEC) awareness briefing prior to beginning work. Additionally, informational signs would be posted conspicuously in areas of the jobsite most frequently visited by workers. If any MEC is identified along the Wallops shoreline, it would be reported to the Wallops Flight Facility Security Office and managed in accordance with Wallops Flight Facility's established program. Any MEC discovered offshore would be immediately reported to the U.S. Coast Guard and Wallops Flight Facility personnel.

To minimize the risk of adverse impacts from MEC in the north Wallops Island beach, MEC Awareness and Avoidance Plans that address the potential hazards will be prepared. Visual and geophysical surveys of the area to locate MEC will be completed, as appropriate, and potential hazards removed prior to excavation.

5.5 Protected Species

Onshore

NASA has initiated consultation with the USFWS regarding potential effects on Endangered Species Act-listed birds and sea turtles that could be affected by the project. NASA and USFWS developed a number of mitigation measures to reduce the probability and intensity of potential effects. These include:

1. No work will be conducted in the borrow area at the north end of the island during the plover or turtle nesting season April to September. NASA would employ a biological monitor to survey the project site on a daily basis should work occur between the months of April and September.

2. NASA will educate all personnel working in the construction area on recognizing protected species and their likely habitat so that appropriate avoidance and minimization measures can be incorporated into activities.
3. Wallops Flight Facility administers a Protected Species Monitoring Program for a number of protected species that are likely to occur at Wallops Island including: seabeach amaranth, red knot, piping plover, American oystercatcher, and sea turtles.
4. Annually between March and September, NASA regularly surveys the Wallops Island beach for piping plover, red knot, and sea turtle activity as a component of its Natural Resources Management Program. Any nests discovered are identified with signage. Program staff provide outreach to beach users, including security staff and recreational users.

Offshore

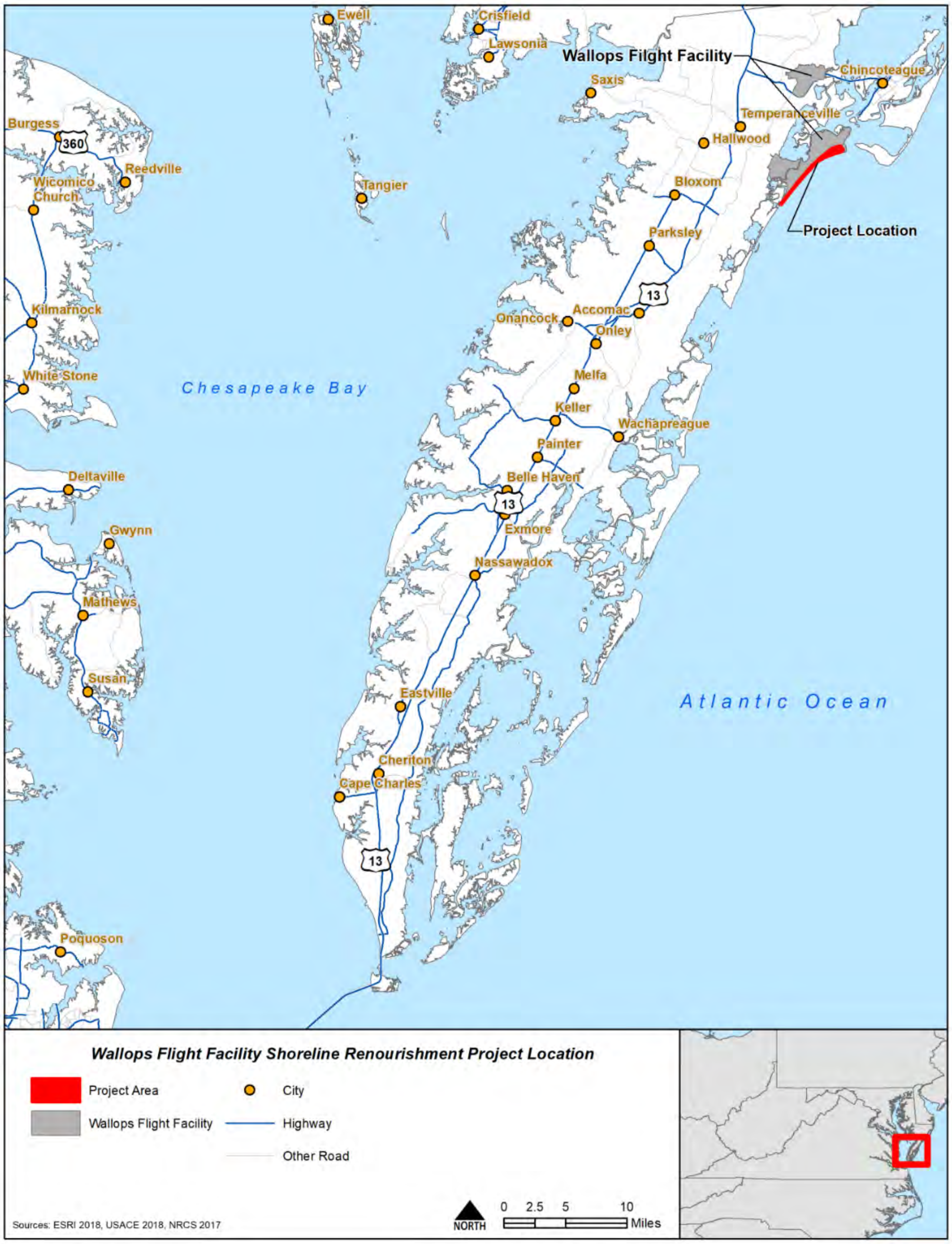
NASA has initiated consultation with NMFS regarding potential effects of the project on listed marine mammals, fish and in-water sea turtles. NASA will implement the any mitigation measures identified during the consultation to minimize impacts to protected species.

5.6 Essential Fish Habitat

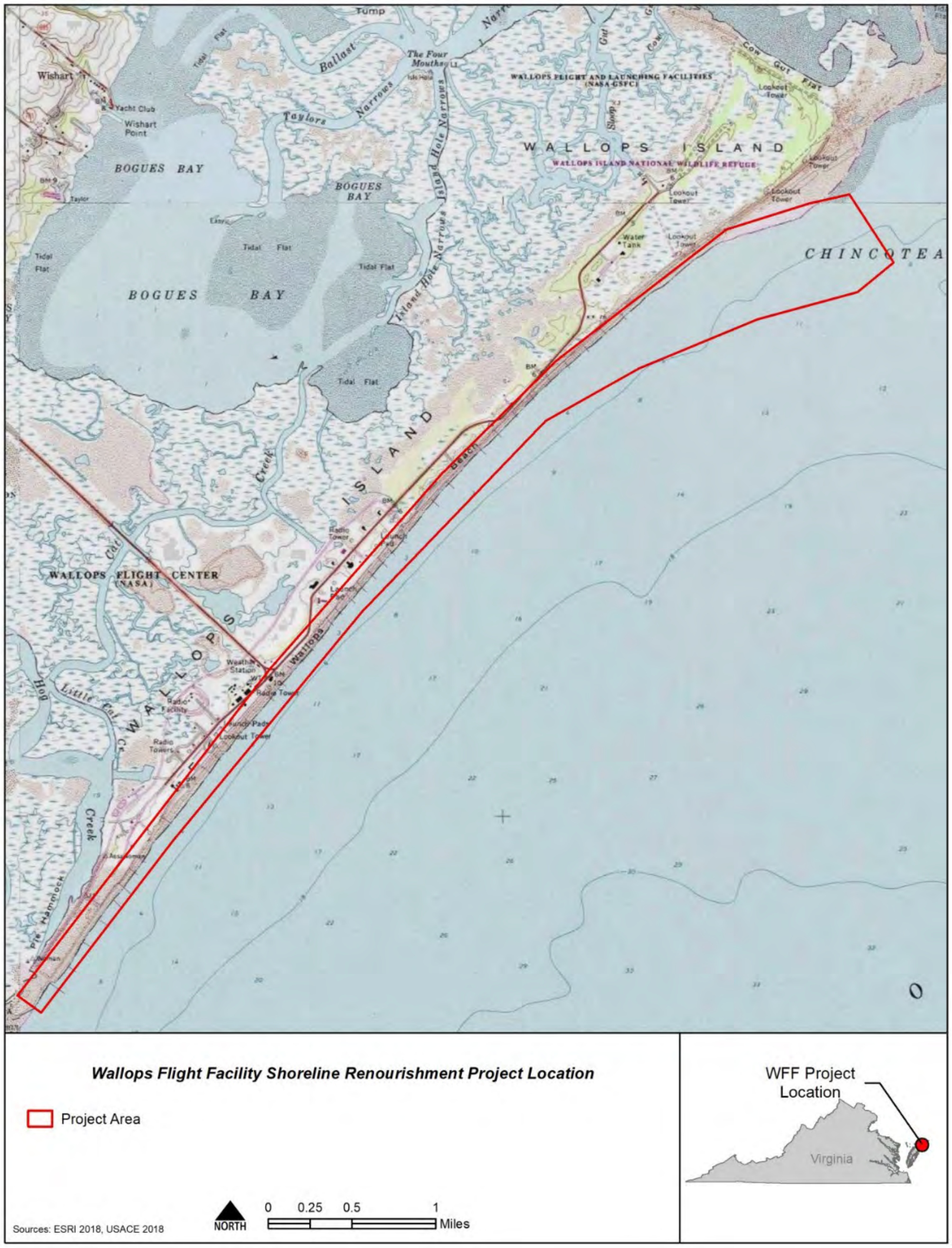
NASA has prepared an Essential Fish Habitat Assessment and is consulting with NMFS Habitat Conservation Division to identify any necessary mitigation measures. Any measures identified will be added as soon as the coordination with the agencies is concluded.

5.7 Cultural Resources

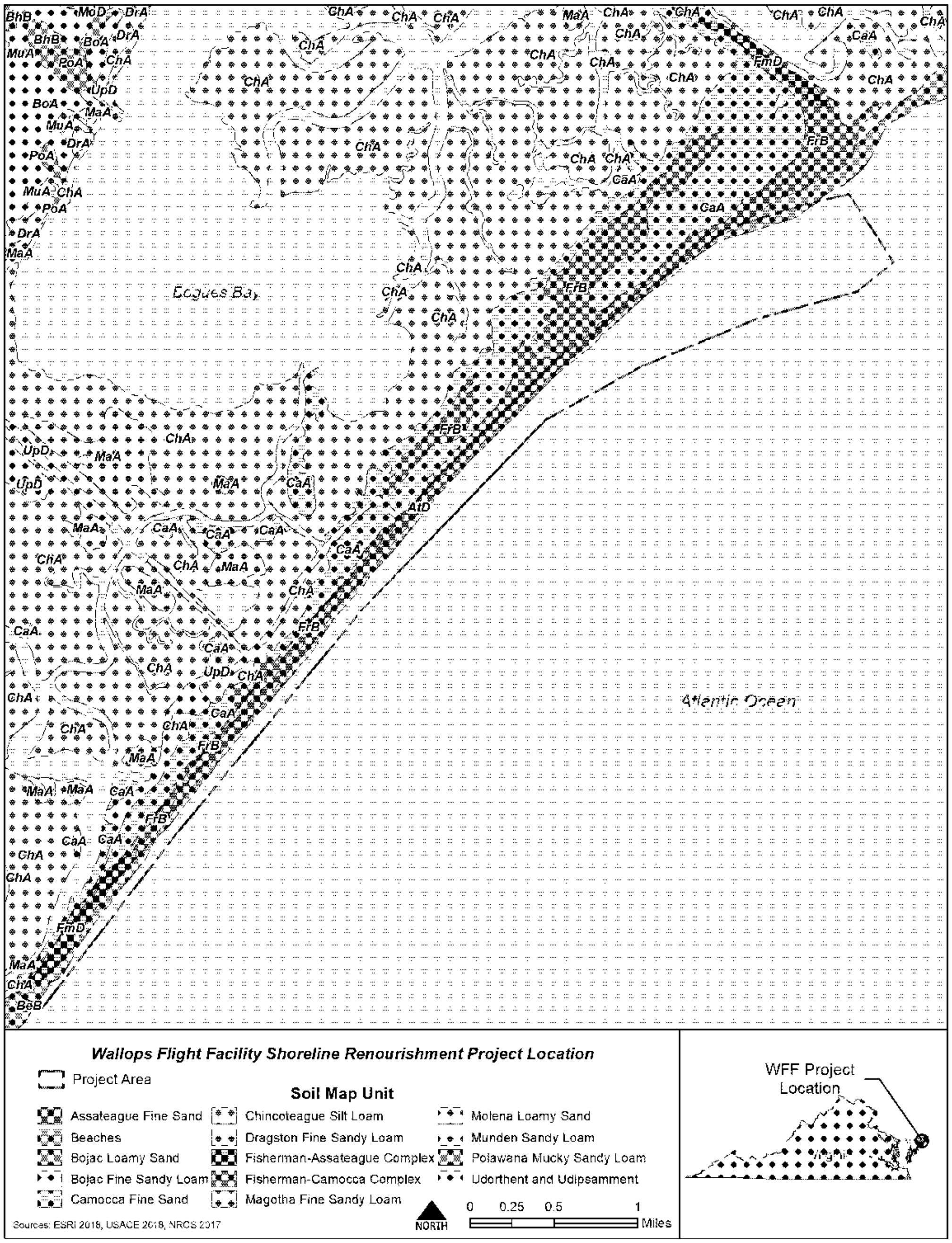
NASA has consulted with Virginia Department of Historic Resources (VDHR) regarding the beach nourishment and the breakwater construction and received a concurrence email dated August 14, 2018 (VDHR Concurrence 2018-attached). The inadvertent discovery of any previously unidentified archaeological resources would result in immediate cessation of work and notification of the Wallops Flight Facility Cultural Resources Manager.



NASA WFF Shoreline Enhancement & Restoration Project 1 of 18



NASA WFF Shoreline Enhancement & Restoration Project 2 of 18



NASA WFF Shoreline Enhancement & Restoration Project 3 of 18

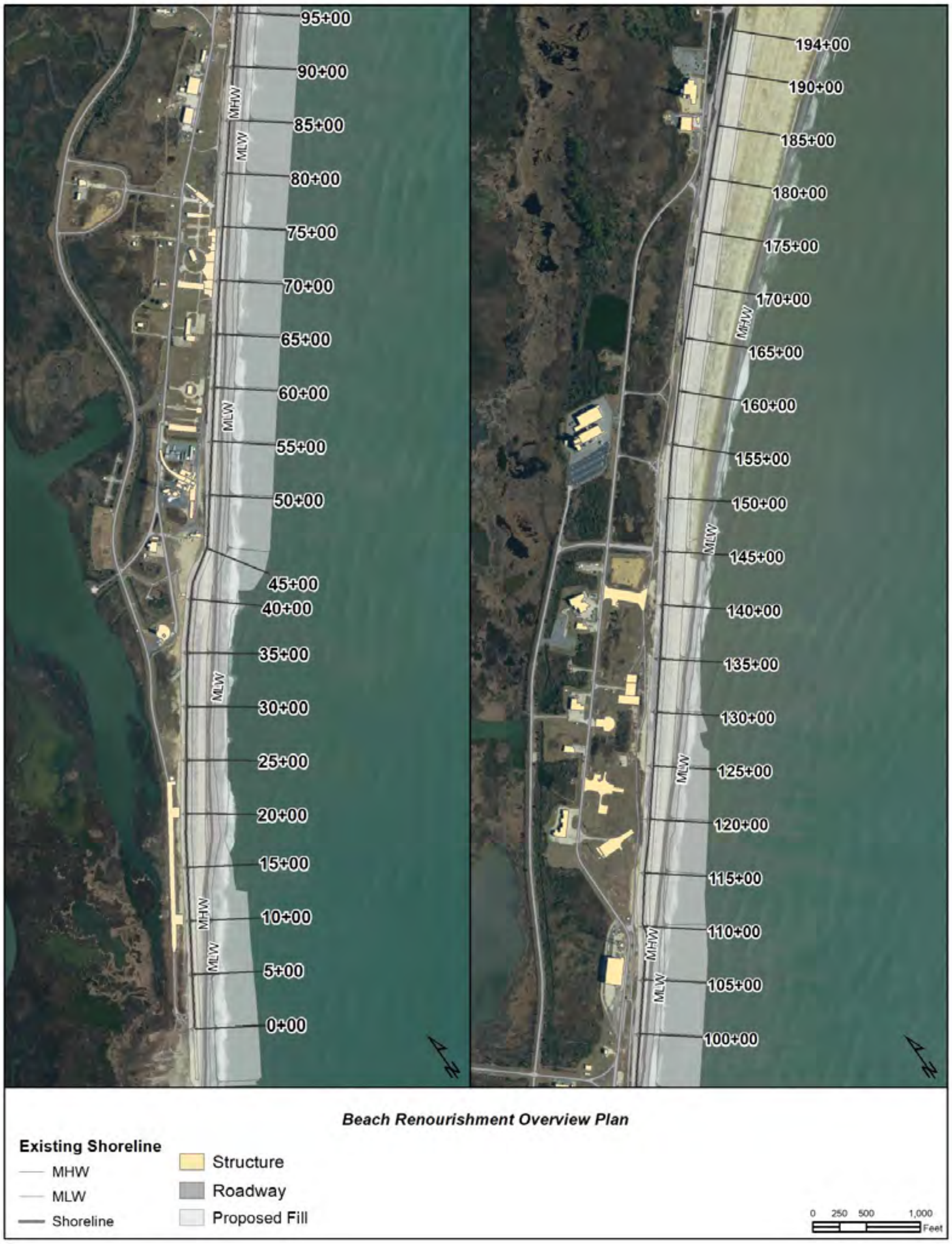
NASA WFF Shoreline Enhancement & Restoration Project 4 of 18

NASA WFF Shoreline Enhancement & Restoration Project 5 of 18

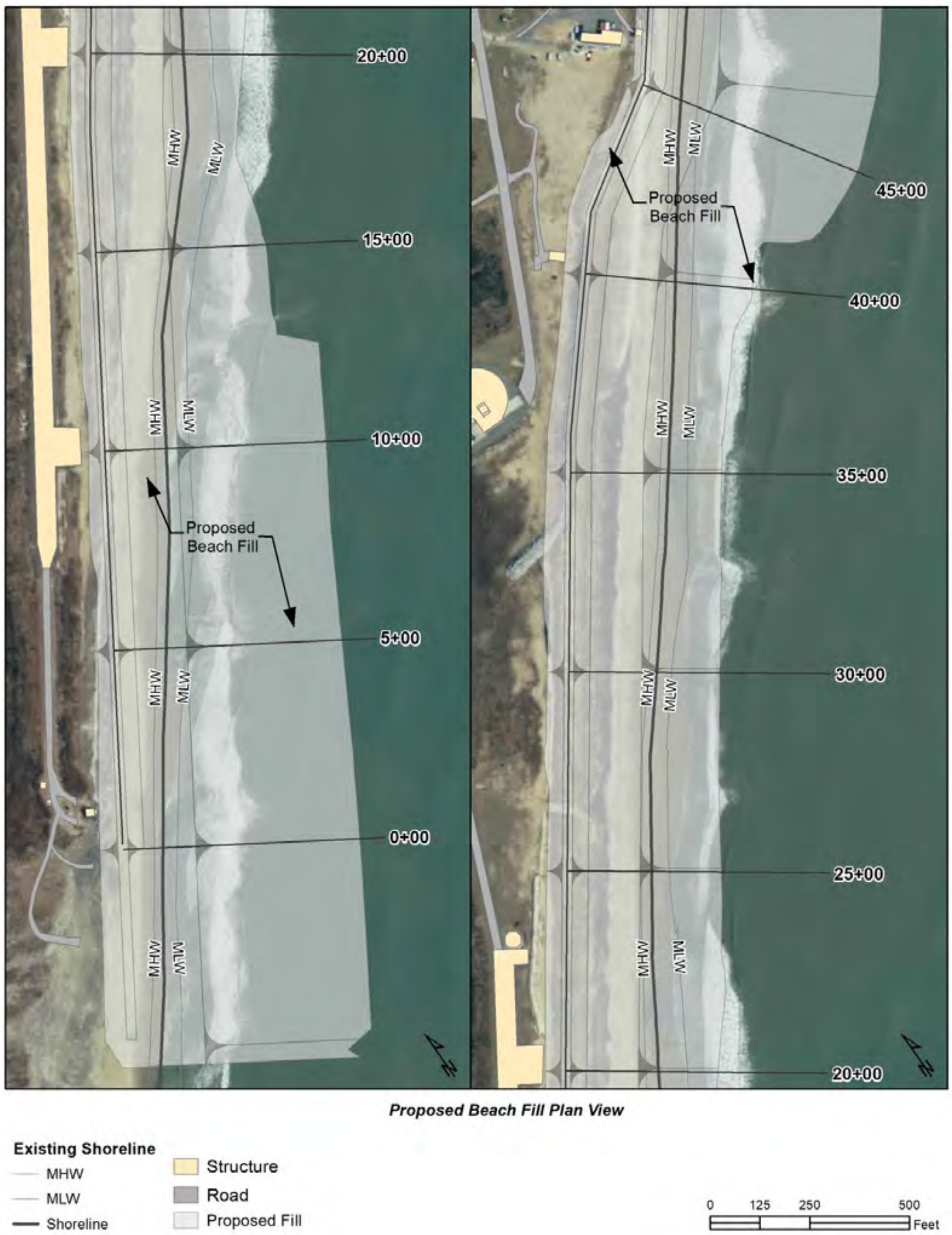
NASA WFF Shoreline Enhancement & Restoration Project 6 of 18

NASA WFF Shoreline Enhancement & Restoration Project 7 of 18

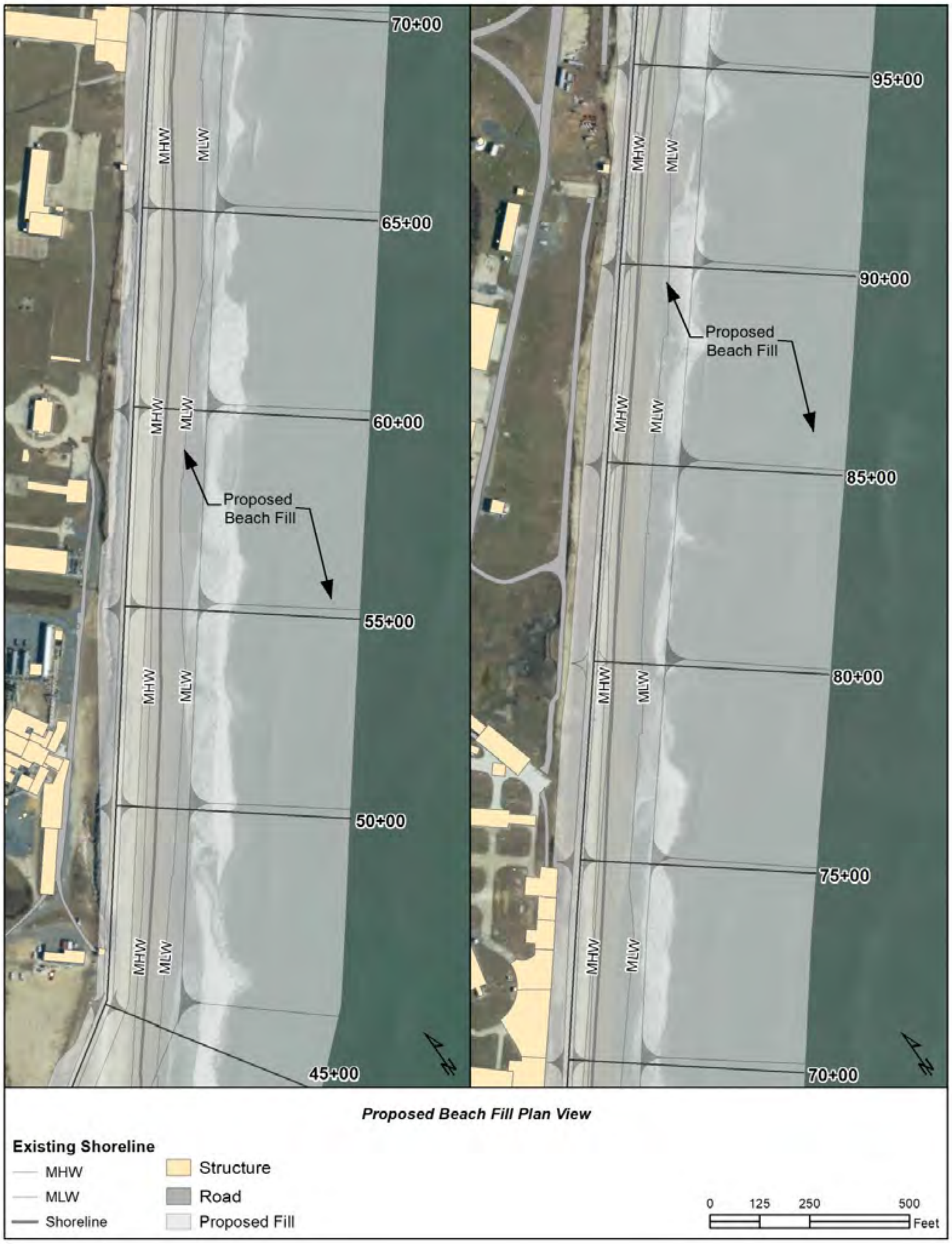
NASA WFF Shoreline Enhancement & Restoration Project 8 of 18



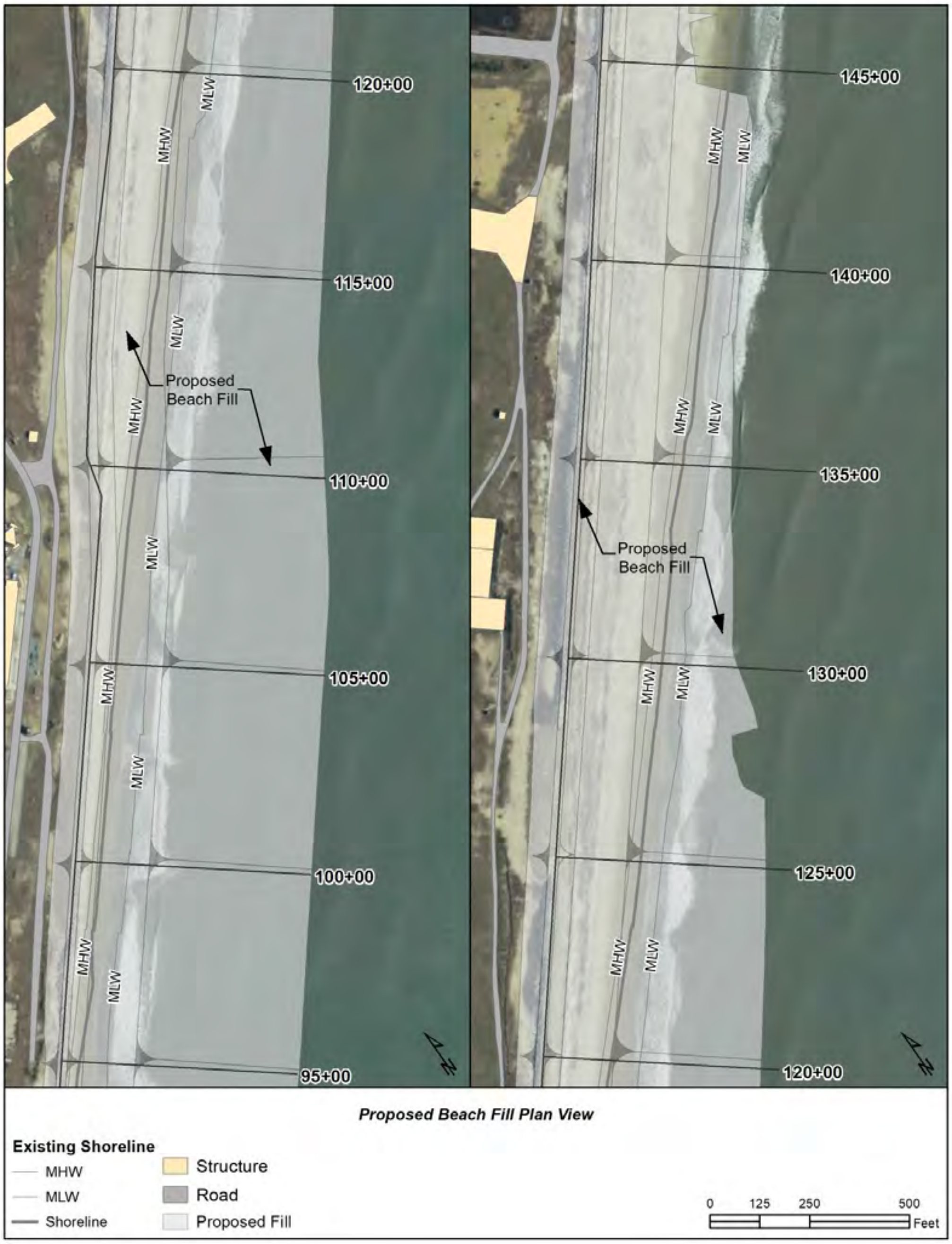
NASA WFF Shoreline Enhancement & Restoration Project 9 of 18



NASA WFF Shoreline Enhancement & Restoration Project 10 of 18

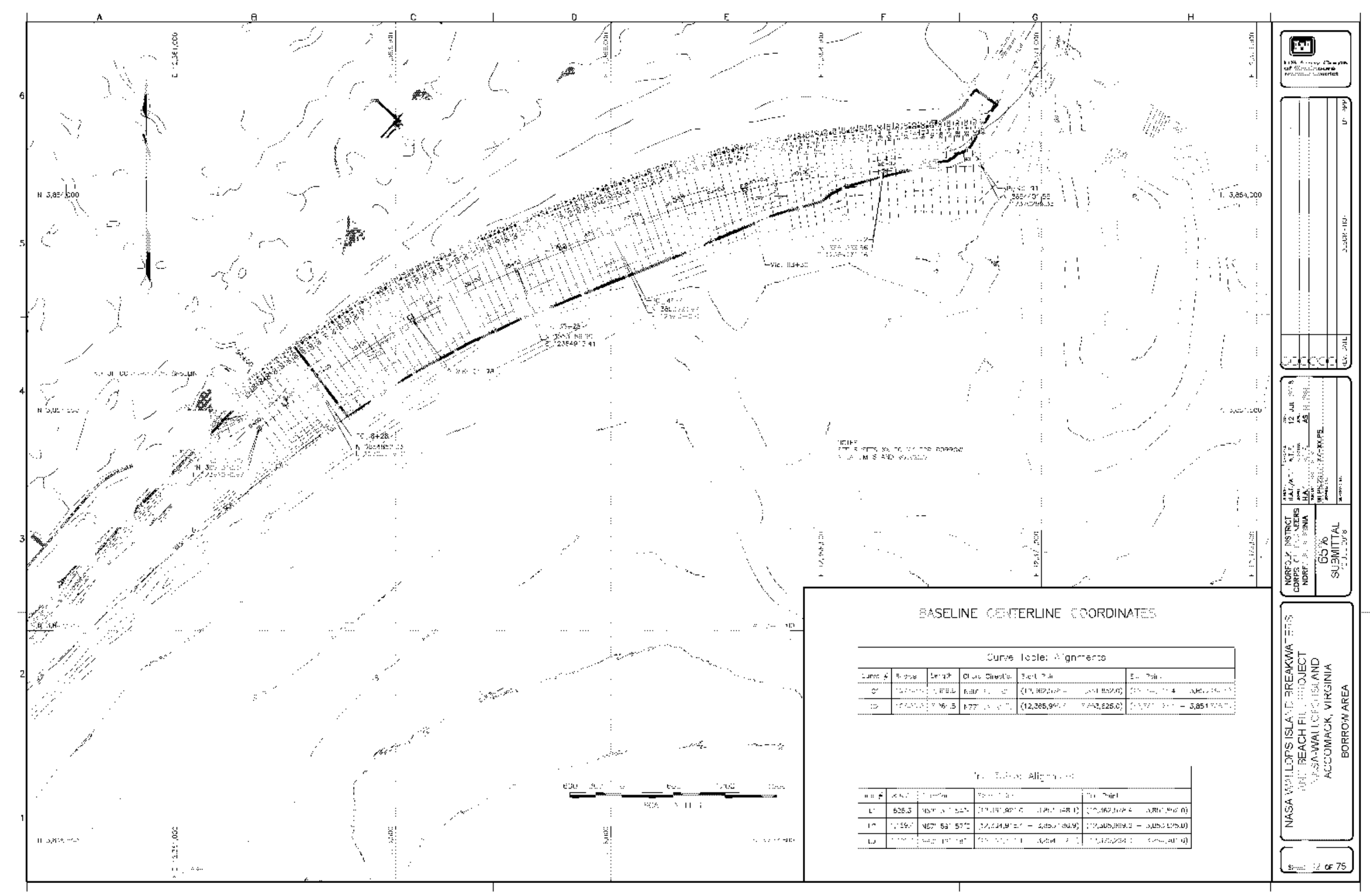


NASA WFF Shoreline Enhancement & Restoration Project 11 of 18



NASA WFF Shoreline Enhancement & Restoration Project 12 of 18

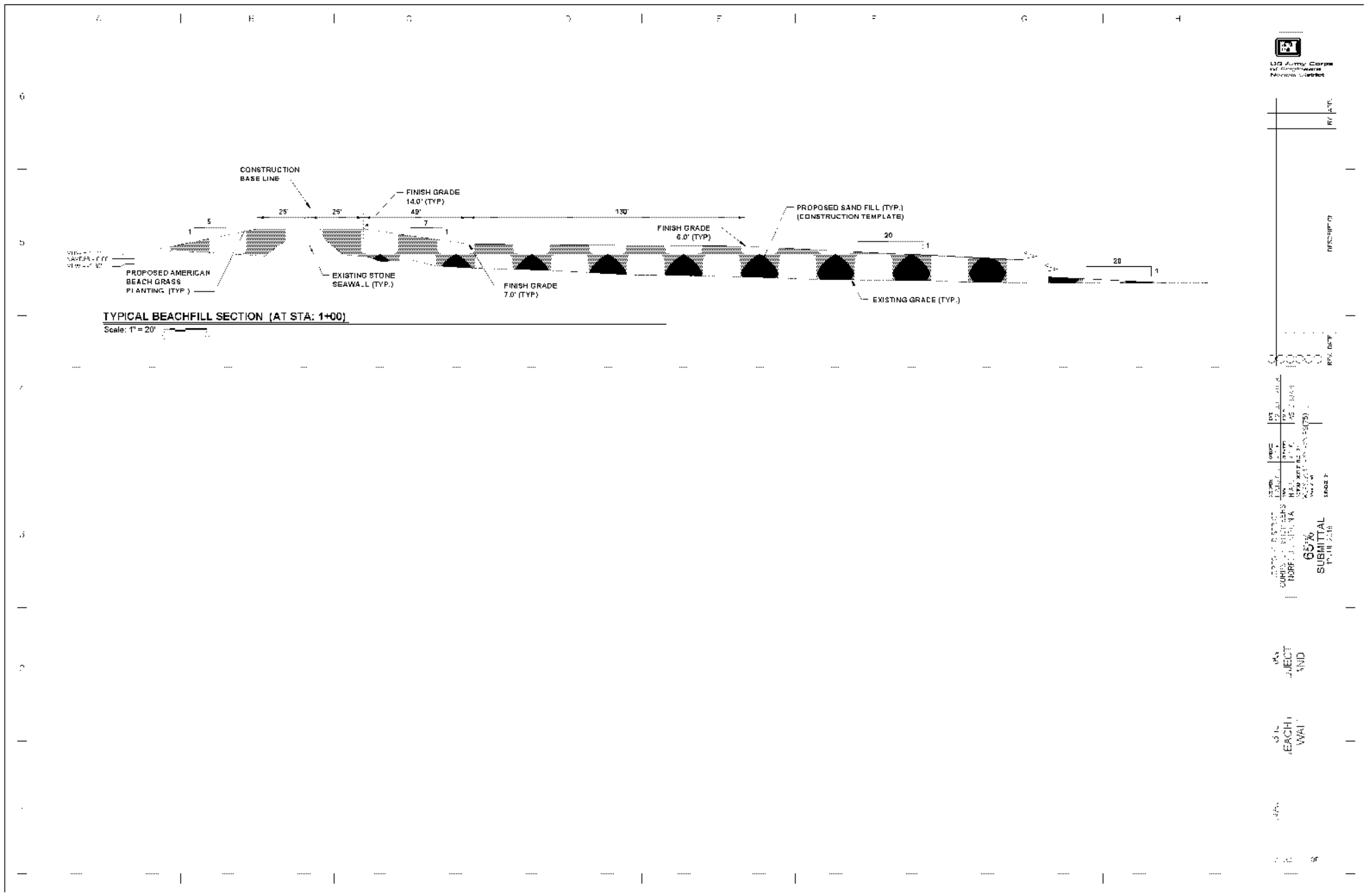
NASA WFF Shoreline Enhancement & Restoration Project 13 of 18



NASA WFF Shoreline Enhancement & Restoration Project 14 of 18

NASA WFF Shoreline Enhancement & Restoration Project 15 of 18

NASA WFF Shoreline Enhancement & Restoration Project 16 of 18



NASA WFF Shoreline Enhancement & Restoration Project 17 of 18

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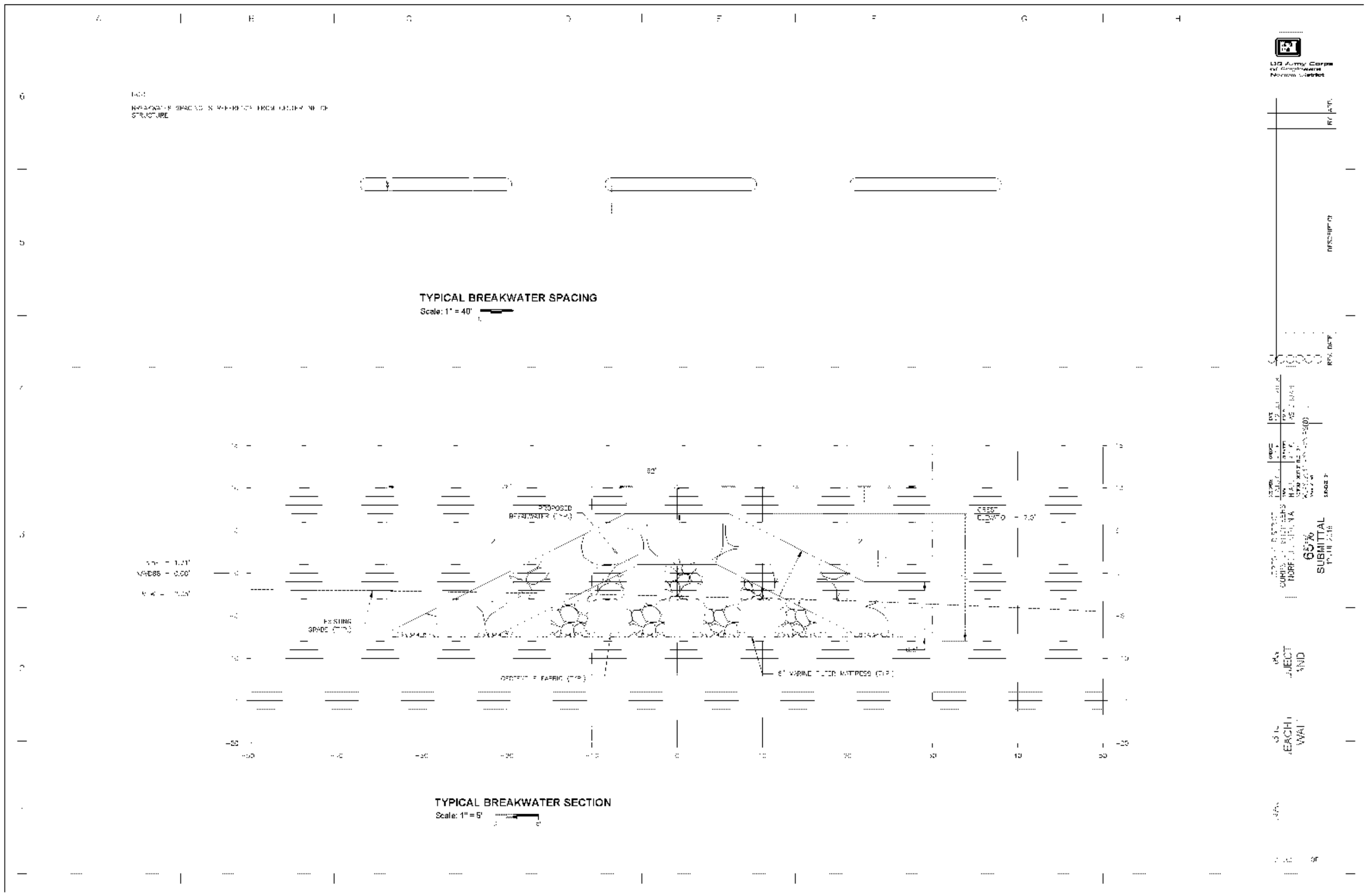

NASA WFF Shoreline Enhancement & Restoration Project 18 of 18

1

Cardno
Shaping the Future

NASA Wallops SERP Joint Permit Application Pre-Application Meeting Summary

1. Meeting Logistics and Materials

- Location: WFF Building F-160 Conference Room and via Telecon (1-844-467-6272; 109753#)
- Date: September 24, 2018
- Time: 10:00 am – 2:00 pm
- Materials: PDF slide presentation

2. Attendees

Shari Miller, NASA Wallops Flight Facility
Joe Mitchell, NASA WFF Environmental
John Saecker, NASA WFF
TJ Meyer, NASA WFF Medical and Environmental Division
Brian Denson, US Army Corps of Engineers, Regulatory (phone)
Alicia Farrow, USACE, Engineering (phone)
Megan Wood, USACE, NEPA (phone)
Doug Piatowski, BOEM (phone)
Hank Badger, VMRC
Dave O'Brien, NOAA
Lyle Varnell, VIMS
Chris Guvernater, Accomack County
John Lowenthal, Cardno
Liz Burak, Cardno

3. Meeting Discussion

USACE - Alicia and Brian had to leave the call at 10:30 so the presentation started with giving Brian some background providing input on permit type and processing schedule:Project exceeds the permit parameters (exceeding one acre of fill) for Regional Permit (RP19) and the project would require an individual permit.

- Noted that documentation of completed consultations with VDHR (SHPO), USFWS, NMFS would be required part of the package
- A public noitce would be issued 15 days after receipt of the JPA, and agree to issuing a final permit by February 2019.
- Dune grass planting as part of the project design, the project would be self-mitigating and that it's unlikely that additional mitigations would be required.
- Removal of sand below MHW would be considered dredging

VRMC - Hank then provided his comments and questions which included:

- Concerns/Questions: whether removal of the material at the north end would increase erosion at the north end; effect of removing sand from a functioning primary dune
- Project may be exempt from Coastal Zone permitting, depending on whetehr or not adjacent properties are affected. VIMS will provide advise VMRC.
- The next VMRC meeting where it is possible this project could be presented is in mid-December, next meeting is in January

Cardno Shaping the Future

NASA Wallops SERP Joint Permit Application
Pre-Application Meeting Summary

- If project is protested, it will have to go, to the commission, potentially as a "page 1" agenda item (requiring a presentation) or possibly as a "page 2" agenda item, which requires no formal presentation to the commission.

VIMS - Lyle provided comments and questions including:

- request any available data and reporting (NASA/Cardno provide Breakwater Modeling Report, Specifications/Plans, Spring and Fall Monitoring Reports and a summary of modeling on recover and erosion in/around borrow area.)
- Stated that he will not recommend not using breakwaters, his concern is the movement of sand

NOAA/NMFS - Dave asked for a copy of the EFH study and reiterated some of the concerns voiced by Hank and Lyle. Dave also asked for the planting plan to be included in the JPA.

4. Tour of Wallops Island

Shari Miller, John Saeker and Joe Mitchell provided the group a tour of the project area.

5. Action Items/After Action

1. Shari will provide Dave O'Brien the Essential Fish Habitat Assessment
2. Shari will request from Alicia: recovery time for the north Wallops Island beach, impacts downstream to Assawoman Island.
3. John Lowenthal - include planting information in the JPA
4. The JPA will include:
   - the application and narrative description,
   - agency coordination and consultation documentation (VDHR, USFWS, NMFS),
   - 100% plans/specifications,
   - first and last USACE seasonal monitoring reports,
   - USACE Breakwater Modeling Report rovide the design plans,
5. VDEQ and Accomack County will be includeded in JPA distribution so that they can issue waivers

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APPENDIX C
FEDERAL CONSISTENCY DETERMINATION

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FEDERAL CONSISTENCY DETERMINATION FOR THE SHORELINE ENHANCEMENT AND RESTORATION PROJECT ENVIRONMENTAL ASSESSMENT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION GODDARD SPACE FLIGHT CENTER

WALLOPS FLIGHT FACILITY WALLOPS ISLAND, VA 23337

INTRODUCTION

The National Aeronautics and Space Administration (NASA) has prepared an Environmental Assessment (EA) to evaluate the potential environmental impacts from proposed enhancement and restoration of the Wallops Island shoreline at NASA's Goddard Space Flight Center Wallops Flight Facility (WFF), Wallops Island, Virginia. The Shoreline Enhancement and Restoration Project EA evaluates the Proposed Action to renourish the beach along the Wallops Island shoreline infrastructure protection area. Before the renourishment, NASA may construct a series of parallel nearshore breakwater structures that would reduce the intensity of wave action and slow sediment transport. The Shoreline Enhancement and Restoration Project EA was prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 U.S. Code 4321-4347), the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), NASA's regulations for implementing NEPA (14 CFR Subpart 1216.3), and the NASA Procedural Requirements (NPR) for Implementing NEPA and Executive Order (EO) 12114 (NPR 8580.1).

This document provides the Commonwealth of Virginia with NASA's Consistency Determination under Coastal Zone Management Act Section 307(c)(1) and Title 15 CFR Part 930, Subpart C, for enhancing and restoring the Wallops Island shoreline analyzed in the NASA WFF Shoreline Enhancement and Restoration Project EA. The information in this Consistency Determination is provided pursuant to 15 CFR Section 930.39.

NASA requested the cooperation of Bureau of Ocean Energy Management (BOEM) and the United States Army Corps of Engineers (USACE), Norfolk District in preparing the Shoreline Enhancement and Restoration Project EA and this Consistency Determination, because they possess regulatory authority or specialized expertise pertaining to the Proposed Action. The EA is being developed to fulfill each Federal agency's obligations under NEPA and the Coastal Zone Management Act (CZMA). NASA, as the WFF property owner and project proponent, is the lead agency and responsible for ensuring overall compliance with applicable environmental statutes, including NEPA and the CZMA.

BACKGROUND

Some of NASA's and the Commonwealth of Virginia's most critical launch assets, including Mid-Atlantic Regional Spaceport Launch Complex 0 and multiple sounding rocket pads are located along the Wallops Island shoreline infrastructure protection area.

On December 13, 2010, NASA issued a Record of Decision (ROD) for its *Final Programmatic Environmental Impact Statement Wallops Flight Facility Shoreline Restoration and Infrastructure*

Protection Program[3]. In its ROD, NASA selected for implementation Alternative 1: Full Beach Fill, Seawall Extension and adopted a suite of mitigation and monitoring protocols to both reduce potential environmental impacts and track project performance. Implementing the initial phase of Alternative 1 entailed: 1) the placement along the Wallops Island shoreline of approximately 3.2 million cubic yards of sand dredged from Unnamed Shoal A, located on the Outer Continental Shelf (OCS) under BOEM jurisdiction, located in the Atlantic Ocean; and 2) an initial 1,430-foot southerly extension of the Wallops Island rock seawall with future extensions completed on a funds-available basis to a maximum length of 4,600 feet. The ROD stated that fill material for future renourishment cycles could be taken from either Unnamed Shoal A, Unnamed Shoal B, or north Wallops Island beach and left the specifics of how and when the fill material was obtained to be addressed in future action-specific NEPA documentation. After issuing its ROD and securing necessary permits, NASA and its technical partner, the U.S. Army Corps of Engineers (USACE), Norfolk District, oversaw the construction of the project between April and August 2012.

In October 2012, Hurricane Sandy made landfall. Monitoring surveys following the storm event identified the need to repair a section of the seawall and the southern two-thirds of the recently nourished beach. Public Law 113-2, *Disaster Relief Appropriations Act, 2013*, was signed into law on January 29, 2013. The bill included a provision for NASA to repair facilities that sustained damage during the Hurricane. NASA signed a Finding of No Significant Impact (FONSI) on June 6, 2013, for the *Wallops Island Post-Hurricane Sandy Shoreline Repair Final Environmental Assessment*[4]. Repairs to the seawall and beach renourishment were completed in September 2014. Subsequent storms including Hurricane Joaquin in 2015 and Winter Storm Jonas in 2016 reduced the sand volume in the southern portion of the project area by an average of 1,014,337 cubic yards as compared to volumes present after 2014 shoreline repair (USACE 2018a). Additional sand volume reduction occurred most recently in 2018 with Winter Storm Riley.

NASA and USACE have sponsored biannual (spring and fall) topographic and hydrographic monitoring surveys of the Wallops Island shoreline. The most recent survey was completed in fall of 2017. Data indicate that a notable portion of the land surface sand relocated by storm winds and waves has been transported to the north end of Wallops Island. The effects of storms are most apparent within the southern half of the Wallops Island beach, where many of the most critical launch assets are located. Within this area, the seaward half of the beach berm has been lowered by up to 3 feet or more. As such, the beach berm and dune system can no longer provide the level of storm damage reduction to which it was originally intended and must be restored to regain full functionality.

DESCRIPTION OF THE PROPOSED ACTION

Approximately 1.3 million cubic yards of sand would be needed to renourish the shoreline infrastructure protection area. Upon receipt of all necessary authorizations, NASA would contract for the placement of the sand material that would be taken from either 1) north Wallops Island beach (i.e., backpassed), an area that has been accreting due to transport of material from the south or 2) Unnamed Shoal A, an offshore sand ridge located in the OCS at the southern end of the Assateague ridge field which was used as a sand

[3] The *Final SRIPP PEIS* is available online at: https://code200-external.gsfc.nasa.gov/250-wff/programmatic-environmental-impact-statement-shoreline-restoration-and-infrastructure-protection
[4] The *Final Post-Sandy EA* is available online at: https://code200-external.gsfc.nasa.gov/250-wff/wallops-island-post-hurricane-sandy-shoreline-repair-final-environmental-assessment-fea-and-finding.

source for previous renourishment projects. Under either of the sand placement alternatives, a series of nearshore detached parallel breakwaters may be constructed prior to renourishment of the Wallops Island shoreline.

Sand Backpassed from North Wallops Island Beach

An estimated 1.7 million cubic yards of sand is available at the north Wallops Island beach, toward the 1.3 million cubic yards required. Based on vegetation and wildlife habitat constraints (such as avoiding areas of most dense vegetation and bird and sea turtle nesting season), the total potential area for sand removal is approximately 200 acres. Excavation depth would be to an average of -2.35 feet above mean sea level.

A pan excavator would likely be used to remove the sand from the north Wallops Island beach borrow area. The pan excavator would stockpile the sand, which would be loaded onto dump trucks that would transport the fill material up and down the beach. Bulldozers would then be used to spread the fill material once it is placed on the beach. Other onshore equipment may include all-terrain vehicles (ATV), an office trailer, mobile generators, construction site lighting, and mobile fuel tanks. All heavy equipment would access the beach from existing roads and established access points. No new temporary or permanent roads would be constructed to access the beach or to transport the fill material to renourishment areas. Prior to excavation, a pre-project topographic and hydrographic survey would be conducted. Multiple survey crews would employ ATVs and light trucks to conduct pre-project surveys of the project site.

It is expected that the sand backpassing and spreading work would take **3** months to complete. When completed, NASA would replant the dunes.

Sand Dredged from Unnamed Shoal A

In 2010, up to 515 acres of the shoal (sub-area A-1) were dredged for the initial beach fill cycle and an additional 800,000 cubic yards were dredged from the same area (sub-area A-1) for the post-Hurricane Sandy repairs.

Given the distance of the borrow area (Unnamed Shoal A) from Wallops Island, it is expected that the contractor would again use one or more trailing suction hopper dredges to obtain the sand material. Because of overflow from the hopper dredge at the offshore borrow area during dredging and losses during pump-out and placement, a larger volume of material would need to be dredged to meet the targeted fill volume. Based on information from other shoreline restoration projects, sediment losses during dredging and placement operations may be up to 25 percent. Assuming a conservative 25 percent loss of the 1.3 million cubic yards required, the dredged volume for the proposed renourishment would be approximately 1.625 million cubic yards.

Nearshore, it is expected that the contractor would require one or more anchored pumpout stations approximately 2 miles east of Wallops Island in 25 to 30 feet of water. Up to several miles of submerged steel pipeline would be temporarily placed on the seafloor and would be the conduit by which the sand/water slurry would be pumped from the dredge to the beach. Once discharged onto the beach, bulldozers would grade the material to the design template which is proposed to include an additional foot of berm elevation as compared to the initial beach fill. The time in the tidal cycle would factor into the location on the beach within which the equipment would work for a given dredge load. During low tide, the equipment would likely concentrate on the intertidal and subtidal zones, whereas during high tide, work would be focused on the upper beach berm and dune. After each section of beach is confirmed to meet design criteria, the process would continue in the longshore direction, with sections of discharge pipe added as it progresses.

It is expected that the dredging and beach fill work would take 3 months to complete. When completed, NASA would replant the dunes with vegetation.

Nearshore Detached Parallel Breakwaters

A series of rubble mound breakwaters would be constructed approximately 200 feet offshore from the renourished shoreline mean high water line. Each breakwater would be constructed of Virginia Department of Transportation (VDOT) Type I stone for the outer layer which ranges from 0.75 to 2 tons and VDOT Class II Stone for the core layer which range from 150 to 500 pounds. All stone would be placed parallel to the shore on top of approximately 130 feet long of prefabricated geotextile marine mattresses, placed approximately 100 feet apart from each other. The breakwaters would measure approximately 10 feet wide at top crest elevation. Water depths in these areas is approximately 4 to 8 feet. The breakwaters would be placed offshore of Launch Pad 0-B and continue north to the Horizontal Integration Facility (HIF); Building X-079. Depending upon economic, engineering, and environmental factors, the initial series may be broken into smaller series (e.g., three breakwaters offshore of Launch Pad 0-A and another three offshore of the HIF). The rocks for constructing each breakwater would be transported to the WFF area by rail, offloaded, and then trucked to the handling or placement site on Wallops Island. The breakwater construction would take place in the water using a barge and heavy lifting equipment.

It is expected that breakwater construction would take approximately 6 to 9 months to complete. Breakwater construction would be completed prior to renourishment of the shoreline infrastructure protection area.

Effects to Resources

NASA has determined that implementing the Shoreline Enhancement and Restoration Project EA would affect resources of Virginia in the following manner:

Coastal Geology and Processes

Nearshore - Renourishment of the beach at the southern end of the Wallops Island would result in a new shoreline extending several hundred feet offshore from the current shoreline. The new beach profile would provide increased wave dissipation and added protection for the onshore infrastructure from storm events. Over time, the new beach would be reshaped; the profile would shift with seasonal differences in wave action. Higher wave energy during the winter would likely steepen the beach profile with some of the sand moved offshore into a bar system. Lower wave energy during the summer months would tend to flatten out as sand from the offshore bar system is moved back onto the beach face. The onshore-offshore beach dynamics would also be influenced by the littoral transport of the sand both to the north and to the south depending upon the direction of incident wave action. Transport to the north should be recaptured at the north end as wave action is diminished in the lee of Assateague Island. Transport to the south would eventually provide additional sand resources to the barrier islands south of Wallops Island. Parallel breakwaters in conjunction with beach renourishment would help provide an increased level of shoreline protection with the minimum possible impact on shoreline processes.

Offshore - The removal of material from Unnamed Shoal A would be done in a uniform manner across the areal extent of sub-area A-1. As such, approximately two-thirds of the southern half of the shoal's elevation would be lowered by an additional 1.5 to 3 feet, with some areas approaching an additional 10 feet below the current profile. As proposed, the elevation of the northern portion of the shoal (sub-area A-2) would remain the same. The conservative model-based analysis performed for the *2010 Final SRIPP PEIS* indicated that even when a 2 square mile area of the shoal was "planed" to an elevation necessary to obtain up to 10 million cubic yards of material, the induced effects on the Assateague Island shoreline could not be distinguished from those changes occurring as a result of natural variation in sediment transport. Therefore, it is not expected that the additional lowering of the shoal would cause any measurable reduction in wave sheltering effects on properties to the west of the borrow area.

Water Quality

Nearshore - The beach fill material from the north Wallops Island beach has a grain size appropriate for use for renourishment. It is expected that the turbidity plume generated at the placement site would be comparable to those reported in similar projects: concentrated within the swash zone, dissipating between 1,000 to 2,000 feet alongshore; and short term, only lasting several hours. Offshore impacts to water quality could result from breakwater construction. Localized turbidity would be expected from placement of stone onto the sandy bottom during breakwater construction; the impact would be of short duration and not adverse.

Offshore - Dredging operations would cause sediment to be suspended in the water column. Studies of past projects indicate that the extent of the sediment plume is generally limited to between 1,640 to 4,000 feet from the dredge. The length and shape of the plume depends on the hydrodynamics of the water column and the sediment grain size. Given that the dominant substrate material at the borrow site is sand, it is expected to settle rapidly and cause less turbidity and oxygen demand than finer-grained sediments would cause. No appreciable effects on dissolved oxygen, pH, or temperature are anticipated because the dredged material has low levels of organics and low biological oxygen demand. Additionally, dredging activities would occur within the open ocean where the water column is subject to constant mixing and exchange with oxygen rich surface waters. Turbidity resulting from the dredging would be short term (i.e., present for approximately an hour) and would not be expected to extend more than several thousand feet from the dredging operation.

Air Quality

Emissions from earthmoving equipment used during sand excavation from north Wallops Island beach and placement along the shoreline infrastructure protection area, barge activities (dredging and transport), and equipment used in the transport and construction of nearshore breakwaters are not anticipated to cause significant impacts to air quality. GHG emissions generated alone would not be enough to cause global warming, in combination with past and future emissions from all other sources, they would contribute incrementally to the global warming that produces the adverse effects of climate change.

Noise

The operation of heavy equipment would be the primary source of project related noise. Wind and surf conditions would play a major role in dictating the distances at which the construction-related sounds could be heard by nearby receivers. Localized impacts would occur during sand excavation, movement and placement and construction of the breakwaters, but they would not be expected to be substantial.

Localized impacts on marine mammals from noise associated with vessel activities (dredging) and construction of breakwaters would be anticipated but any impacts would be temporary and not adverse.

Benthos

Benthos living in the sandy beach area of north Wallops Island beach would experience direct mortality from sand removal and relocation. The physical oceanographic conditions would be essentially unchanged, and after the renourishment reaches equilibrium, there would be no net change in the physical environment available for benthos. It is expected that organisms from adjacent areas would recolonize the new beach in 6 to 12 months after project completion. Minimal impacts to benthos during breakwater construction; minimal benefits post-construction as the breakwaters could provide attachment points as well as refuge and cover.

Bottom dwelling benthic organisms (most commonly the horseshoe crab, whelk, and blue crabs) would become entrained in the dredge. Because of the dynamic nature of nearshore benthic communities and their variability over time, the recovery of benthos at offshore borrow areas varies. Given that Unnamed Shoal A consists of fine to medium sand, benthos recovery would be approximately several months to two years.

Wildlife

Temporary noise and visual disturbances could adversely affect beach foraging and nesting birds and sea turtles during sand excavation and placement and breakwater construction. Due to the nesting cycle of potentially affected species, the possibility of adverse effects would be greatest should the work occur between the months of April and September. If work were to be conducted between the months of April and September, NASA would ensure that the work site and adjacent areas are surveyed for nesting birds and sea turtles by a biological monitor on a daily basis.

Topography of Unnamed Shoal A would not substantially change though the additional dredging would increase the water depths at the borrow area. Diving bird species could still effectively forage on the shoal; however, forage sources would be suppressed for several seasons post-dredging. Both adjacent undisturbed areas on Unnamed Shoal A and neighboring shoals would provide adequate forage should seabirds avoid the directly affected area. Impacts from disturbance would be limited to the anticipated 3-month active dredging phase.

Fisheries and Essential Fish Habitat

Turbidity and water quality stressors imposed on intertidal and subtidal fishery species and EFH would be moderate and episodic for the duration of the project. Construction equipment and materials would displace water column EFH, fish species, and their prey. The adverse impact would be concentrated within the swash zone, projected to dissipate approximately 1,000 to 2,000 feet alongshore, and projected to last only several hours after cessation of work. Physical strike and disturbance stressors would be limited to vehicles operating in the surf zone.

Approximately 206 acres of offshore shoal habitat would be affected. Absolute mortality of sessile species (organisms attached to substrate) in the project area; potential mortality to motile species from entrainment into the sand excavation equipment. Most motile fishery species would be displaced. Displacement would range from temporary to long term, and most consequences would be temporary or short term.

Marine Mammals

Potential adverse impacts to marine mammals would be associated with physical disturbance to habitats during dredging and fill, temporary increases in-water turbidity, a reduction in prey availability, vessel strike, and increased noise from vessel activities. However, given the relatively slow speed of the dredge, the limited extent of habitat affected, and with the implementation of mitigation measures described below, effects are expected to be minimal. Adverse impacts to marine mammals during breakwater construction would not be anticipated as large marine mammals would likely not be found in the shallow waters and bottlenose dolphins would avoid the noise and construction activity.

During the development of the *2013 Post-Hurricane Sandy EA*, NASA participated in a study that found in-water sounds levels associated with dredging would not reach the 190 and 180 dB root mean square (RMS) thresholds; 160 dB_{RMS} would only be reached several meters from the dredge; and 120 dB_{RMS} would be reached at between 0.1 and 1.2 miles from the dredge, depending on the specific activity within the dredging cycle. As with previous projects that involved dredging, NASA would ensure that an NMFS-approved bridge watch is stationed on each dredge at all times of year to scan the horizon for up to 1.2 miles for marine mammals. At this distance, marine mammals could be readily detected with the aid of binoculars. Should an individual be detected, the vessel would be required to turn off its pumps until the animal has left the immediate vicinity, upon which the dredging activity could resume.

Special Status Species

Potential impacts on piping plovers and red knots would include the potential for startle or disruption of foraging, reduction in prey availability, and, for piping plovers, the potential for disruption of courtship and nesting activities. Nesting sea turtles could potentially be impacted during nighttime construction activity (particularly artificial lighting) on the beach, unintentional burial of a newly dug nest if it were to go undetected, disorientation of hatchlings (due to project related light sources), or obstruction to hatchlings during their emergence and subsequent trip to the ocean. NASA would employ a biological monitor to survey the project site on a daily basis should renourishment work occur between the months of April and September to ensure and would not harvest (i.e., backpass) sand from north Wallops Island during those months, to ensure the species are not directly impacted during construction activities. Potential impacts on in-water sea turtles, Atlantic sturgeon, and the giant manta ray, and cetaceans could include entrainment in the dredge, interaction with the sediment plume, reduction in available forage, and elevate sounds levels. NASA would implement a number of measures to minimize impacts to listed species including approved observers that would be present on the dredging vessels.

Cultural Resources

All dredging, sand placement, and breakwater construction would be conducted within areas previously surveyed for cultural resources. Only the Wallops Beach Life Saving Station (DHR ID #001-0027-0100; WFF #V-065) and the Coast Guard Observation Tower (DHR ID #001-0027-0101) are considered eligible for listing in the National Register of Historic Places. Potential effects are likely to be minimal since the resources are located approximately 3,000 feet north of the area of potential effect. Previous surveys did not identify any archaeological resources. The inadvertent discovery of any previously unidentified archaeological resources would result in immediate stoppage of work and notification of the WFF Cultural Resources Manager, who would contact the Virginia Department of Historic Resources and Native American Tribes as appropriate.

Recreation Resources

Closure of the north Wallops Island beach during sand excavation would temporarily reduce recreational opportunities. Increased boat and barge traffic during excavation of material from Unnamed Shoal A and breakwater construction could limit recreational boating. A Notice to Mariners would be issued when necessary to notify boaters in advance so that they can select alternate destinations without substantially affecting their activities or experience.

Consistency Determination

The Virginia Coastal Resources Management Program contains the following applicable enforceable policies:

- **Fisheries Management**. Administered by Virginia Marine Resources Commission (VMRC) and the Virginia Department of Game and Inland Fisheries (VDGIF), this program stresses the conservation and enhancement of shellfish and finfish resources and the promotion of commercial and recreational fisheries. The State Tributyltin (TBT) Regulatory Program is also part of the Fisheries Management program. The TBT program monitors boating activities and boat painting activities to ensure compliance with TBT regulations promulgated pursuant to the amendment. The VMRC, VDGIF, and Virginia Department of Agriculture and Consumer Services share enforcement responsibilities.
- **Subaqueous Lands Management.** Administered by VMRC, this program establishes conditions for granting permits to use state-owned bottomlands.
- **Wetlands Management.** Administered by VMRC, Virginia Department of Environmental Quality (VDEQ), and the Accomack County Wetland Board, the wetlands management program preserves and protects both tidal and non-tidal wetlands.
- **Dunes and Beaches Management.** Administered by VMRC and the Accomack County Wetland Board, the purpose of this program is to prevent the destruction and/or alteration of primary dunes.
- **Non-point Source Water Pollution Control.** Administered by the Virginia Department of Environmental Quality, the Virginia Erosion and Sediment Control Law is intended to minimize soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth.
- **Point Source Water Pollution Control.** Administered by the State Water Control Board, the Virginia Pollution Discharge Elimination System and Virginia Pollution Abatement permit programs regulate point source discharges to Virginia's waterways.
- **Shoreline Sanitation.** Administered by the Virginia Department of Health, this program regulates the installation of septic tanks to protect public health and the environment.
- **Point Source Air Pollution Control.** Administered by the State Air Pollution Control Board, this program implements the Federal Clean Air Act through a legally enforceable State Implementation Plan.
- **Coastal Lands Management.** Administered by VDEQ's Office of Ecology and the Chesapeake Bay Local Assistance Department, the Chesapeake Bay Preservation Act guides land development in coastal areas to protect the Chesapeake Bay and its tributaries.

Based upon the following information, data, and analysis, NASA finds that the project activities proposed and evaluated under the Shoreline Enhancement and Restoration Project EA are consistent to the maximum extent practicable with the enforceable policies of the Virginia Coastal Resources Management Program. The following table below summarizes NASA's analysis supporting this determination.

Virginia Policy	Consistent?	Analysis
Fisheries Management	Yes	There would be short term site specific adverse effects on fish habitat within the fill placement backpassing, and breakwater construction areas due to temporary burial of existing benthic habitat and increased levels of turbidity during and immediately after sand placement. Benthic habitats would recover post-project.
Subaqueous Lands Management	Yes	The proposed renourishment would affect existing subaqueous areas in the nearshore ocean environment. Elevated turbidity in marine waters would occur during and immediately after beach fill, backpassing, and breakwater construction. Recent correspondence with VMRC indicated they would issue new permits for beach renourishment.
Wetlands Management	Yes	Project activities would not impact vegetated wetlands.
Dunes and Beaches Management	Yes	The project would restore the previously constructed dune system. As discussed above under Subaqueous Lands Management, VMRC indicated they would issue new permits for beach renourishment.
Non-point Source Water Pollution Control	Yes	Project activities have the potential to increase non-point source runoff to the Atlantic Ocean. NASA would implement appropriate best management practices to avoid these impacts.
Point Source Water Pollution Control	Yes	The project would not involve a new point source discharge to Virginia waters.
Shoreline Sanitation	Yes	The project would not involve the construction of septic tanks.
Point Source Air Pollution Control	Yes	Use of fossil fuel-burning equipment for construction of the nearshore breakwaters and the movement of sand would generate emissions of both criteria pollutants and greenhouse gases. However, the project activities would not violate Federal or Virginia air quality standards.
Coastal Lands Management	Yes	The project would not include land development activities that would impact the Chesapeake Bay or its tributaries. Moreover, although Accomack County has adopted the Chesapeake Bay Preservation Act restrictions for its seaside riparian areas, NASA's Wallops Island is specifically excluded from this overlay area.

Pursuant to 15 CFR section 930.41, the Virginia Coastal Resources Management Program has 60 days from the receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under 15 CFR Section 930.41(b). Virginia's concurrence will be presumed if its response is not received by NASA on the 60th day from receipt of this determination. The Commonwealth's response should be sent to:

Shari A. Miller
Environmental Planning Lead
NASA Wallops Flight Facility
Wallops Island, VA 23337
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APPENDIX D
AIR QAULITY EMISSIONS CALCULATIONS

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Emissions Summary

	VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2e
Alternative 1	11.15	33.74	174.72	0.20	5.73	5.56	20,175
Alternative 2	5.02	56.47	234.13	0.18	10.03	8.65	18,843
Alternative 1 & 3	13.52	49.18	190.48	0.27	21.63	5.90	31,011
Alternative 2 & 3	7.38	71.91	249.89	0.25	25.93	8.99	29,679

Emission Calculations for Alternative 1

Dump trucks
Bulldozers
Mobile generators
tractor scraper
loader

1,300,000 CY of sand truck cap 12 CY

Material	Source Location	One way distance (mi)	Total Round Trip Time (hrs)	CY19 Total # of trips	Computed Total time (hrs)	Total mi traveled
Sand transport by dump trucks	stockpile	3.25	0.75	108,333	81,250	704,167

	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump Trucks	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
	VOCs Ton	**CO** Ton	**NOx** Ton	**SO_2** Ton	**PM_{10}** Ton	**$PM_{2.5}$** Ton	**N2O** Ton	**CH4** Ton	**CO2** Ton
CY 2019 Dump Trucks	0.56	2.93	13.33	0.01	0.56	0.55	0.00	0.00	1,481.64
								CO2e in metric tons/year	**1,344**

Truck emission factors from MOVES

Equipment Usage	CY 19 Hours
Bulldozer	81,250
Wheel Tractor	54,167
Scraper	54,167
Loader	18,056
Gen Set	22,750

24 CY capacity
6 CY bucket capacity

CY 19 Equipment Emissions

Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**N2O** g/gal	**CH4** g/gal	**CO2** g/hp-hr	**BSFC** lb/hp-hr
Bulldozer	81,250	215	0.59	0.31	0.75	4.00	0.005	0.13	0.13	0.22	0.58	530	0.367
Wheel Tractor	54,167	407	0.59	0.17	0.84	4.34	0.005	0.13	0.13	0.22	0.58	531	0.367
Scraper	54,167	290	0.59	0.31	0.75	4.00	0.005	0.13	0.13	0.22	0.58	530	0.367
Loader	18,056	262	0.59	0.31	0.75	4.00	0.005	0.13	0.13	0.22	0.58	530	0.367
Generator	22,750	13	0.43	0.44	2.16	4.44	0.005	0.27	0.27	0.22	0.58	589	0.408

	VOC	CO	NOx	SO2	PM10	PM2.5	N2O	CH4	CO2
	lb	lb	lb	lb	lb	lb	lb	lb	lb
Bulldozer	7,381	16,985	90,889	111	2,990	2,901	260	686	12,044,107
Wheel Tractor	5,040	24,159	124,312	140	3,774	3,661	328	865	15,212,802
Scraper	6,637	15,273	81,729	100	2,689	2,608	234	616	10,830,359
Loader	1,999	4,600	24,613	30	810	785	70	186	3,261,557
Generators	129	606	1,245	2	75	75	4	9	165,129
Tons/year:	**10.6**	**30.8**	**161.4**	**0.2**	**5.2**	**5.0**	**0.4**	**1.2**	**20,757**
								CO2e in metric tons/year	**18,830**

Emission factors and BFSC from Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition, USEPA 2010; Tier 2

Except for N2O and CH4 which are from Federal Greenhouse Gas Accounting and Reporting Guidance Technical Support Document, Revision 1, Page D-7. USEPA 2012.

Load factors from Median Life, Annual Activity and Load Factor Values for Nonroad Engine Emissions Modeling, USEPA 2010

VOC correction from Conversion Factors for Hydrocarbon Emission Components, USEPA 2010

Wheel Tractor Scraper Engine and Capacity Ratings from Caterpillar 627H

BSFC = brake specific fuel consumption

Total Emissions

	VOC	CO	NOx	SO2	PM10	PM2.5	CO2e
Tons per Year	11.15	33.74	174.72	0.20	5.73	5.56	20,175

Emission Calculations for Alternative 2 1,300,000 CY of sand + 25% for loss 325000 1,625,000 Total CY

110 days

Material	Source Location	One way distance (mi)	Total Round Trip Time (hrs)	CY19 Total # of trips	Computed Total time (hrs)	Total mi traveled
Mobilization - supplies	Newport News	114	2.5	90	228	20,520
Tug & barge - mob supplies	Norfolk	100	40	10	400	2,000

	VOC lb/mile	CO lb/mile	NOx lb/mile	SO2 lb/mile	PM10 lb/mile	PM2.5 lb/mile	N2O lb/mile	CH4 lb/mile	CO2 lb/mile
Dump/Supply Trucks	1.59E-03	8.31E-03	3.78E-02	1.79E-05	1.60E-03	1.6E-03	1.06E-05	1.12E-05	4.21
	VOCs Ton	**CO** Ton	**NOx** Ton	**SO_2** Ton	**PM_{10}** Ton	**$PM_{2.5}$** Ton	**N2O** Ton	**CH4** Ton	**CO2** Ton
CY 2019 Dump/Supply Trucks	0.02	0.09	0.39	0.00	0.02	0.02	0.00	0.00	43.18
								CO2e in metric tons/year	**39**

Deliveries	**Engine HP**	**# Engines**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**N2O** g/gal	**CH4** g/gal	**CO2** g/hp-hr	**BSFC** lb/hp-hr
Tugboat - propulsion	2000	2	0.85	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367
				VOC Ton	**CO** Ton	**NOx** Ton	**SO2** Ton	**PM10** Ton	**PM2.5** Ton	**N2O** Ton	**CH4** Ton	**CO2** Ton	
	Tugboat Annual Emissions (CY 19)			0.16	0.95	0.49	0.01	1.11	0.00	0.00	0.00	103.43	
											CO2e in metric tons/year	**94**	

Equipment Usage	CY 19 Hours
Derrick barge	240
Work barge	240
Work Tug	5,040
Bulldozer	9,600
Trailing Suction Dredge-propulsion	9,600
Trailing Suction Dredge - pumps	6,720

CY 19 Equipment Emissions

Off-road Equipment	**Hours of Operation**	**Engine HP**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**N2O** g/gal	**CH4** g/gal	**CO2** g/hp-hr	**BSFC** lb/hp-hr
Derrick barge	240	2,500	0.85	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367
Work barge	240	1,000	0.85	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367
Work Tug	5,040	500	0.85	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367
Bulldozer	9,600	215	0.59	0.31	0.75	4.00	0.005	0.13	0.13	0.22	0.58	530	0.367
Trailing Suction Dredge-propulsion	9,600	4,000	0.4	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367
Trailing Suction Dredge - pumps	6,720	2,500	0.85	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367

1.053 VOC corr f

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
Derrick barge	125	1,677	6,984	5	268	260	15	43	596,708
Work barge	50	671	2,794	2	107	104	6	17	238,683
Work Tug	523	7,043	29,334	21	1,127	1,093	64	182	2,506,174
Bulldozer	872	2,007	10,739	13	353	343	31	81	1,423,058
Trailing Suction Dredge-propulsion	3,752	50,504	210,348	152	8,081	7,838	458	1,304	17,971,443
Trailing Suction Dredge - pumps	3,488	46,953	195,558	141	7,512	7,287	426	1,212	16,707,826
Tons/year:	**4.4**	**54.4**	**227.9**	**0.2**	**8.7**	**8.5**	**0.5**	**1.4**	**19,721.9**
								CO2e in metric tons/year	**18,059**

Vessel emission factors from page 3-22 of Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder, USEPA 2008.

All vessels are presumed to use 2 propulsion engines, table lists total HP.

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/gal	CH4 g/gal	CO2 g/hp-hr	BSFC lb/hp-hr
Bulldozer	9,600	215	0.59	0.31	0.75	4.00	0.005	0.13	0.13	0.26	0.58	530	0.367
				VOC lb	**CO** lb	**NOx** lb	**SO2** lb	**PM10** lb	**PM2.5** lb	**N2O** lb	**CH4** lb	**CO2** lb	
			Bulldozer	872	2,007	10,739	13	353	343	36	81	1,423,058	
			Tons/year:	**0.4**	**1.0**	**5.4**	**0.0**	**0.2**	**0.2**	**0.02**	**0.04**	**711.5**	
											CO2e in metric tons/year	**651**	

Total Emissions

	VOC	CO	NOx	SO2	PM10	PM2.5	CO2e
Tons per Year	5.02	56.47	234.13	0.18	10.03	8.65	18,843

Emission Calculations for Alternative 3

130	ft long
10	ft wide at top
8	ft depth
50	ft width at base assumed based on std breakwater design
21.5	ft width of long sides
31,200	CY volume of one breakwater - ends
2,000	CY volume of one breakwater end
33,200	CY Total volume of one breakwater
6	total
1	month construction period
rocks brought by water from Norfolk	
1,500	tons ave barge capacity
15,000	Type 2 stone capacity for 1 barge
3,000	Type 3 stone capacity for 1 barge
Deposited using barge excavator	
31,318	CY of Type 2 stone required for breakwater
325,061	Total Type 2 stones for 1 breakwater
22	barges to bring this number of Type 2 stone

Type 2 stone	150 - 299	
Type 3 stone	500-1500	
200 lb stone	2.3	ft long
	0.78	ft wide
	1.45	ft thickness type 2
	0.10	CY volume of 1 Type 2 200 lb stone
1000 lb stone	3.7	ft long
	1.25	ft wide
	2.2	ft thickness
	0.377	CY volume of 1 Type 3 1000 lb stone

35	stones for one 130 ft length
17	stones for one 21.5 ft width course
8	stones for 10 ft top width
40	stones for 50 ft base width
562	Total Type 3 stones for double row on top
1,209	Total Type 3 stones for double row on long sides
2,811	Total Type 3 stones for double row on bottom
413	Total Type 3 stones for ends
4,994	Total Type 3 stones for 1 breakwater
2	barges to bring this number of Type 3 stone
1,882	CY volume of Type 3 stone in 1 breakwater

Material	Source Location	One way distance (mi)	Total Round Trip Time (hrs)	CY19 Total # of trips	Computed Total time (hrs)	Total mi traveled
Tug & barge - riprap	Norfolk	100	40	140	5,601	28,003

Deliveries	**Engine HP**	**# Engines**	**Load Factor**	**VOC** g/hp-hr	**CO** g/hp-hr	**NOx** g/hp-hr	**SO2** g/hp-hr	**PM10** g/hp-hr	**PM2.5** g/hp-hr	**N2O** g/gal	**CH4** g/gal	**CO2** g/hp-hr	**BSFC** lb/hp-hr
Tugboat - propulsion	2000	2	0.85	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367
				VOC Ton	**CO** Ton	**NOx** Ton	**SO2** Ton	**PM10** Ton	**PM2.5** Ton	**N2O** Ton	**CH4** Ton	**CO2** Ton	
	Tugboat Annual Emissions (CY 19)			2.21	13.30	6.86	0.07	15.56	0.01	0.10	0.29	11,139.61	
											CO2e in metric tons/year	**10,140**	

Equipment Usage	CY 19 Hours
Work Tug	960
Excavator	960

CY 19 Equipment Emissions

Off-road Equipment	Hours of Operation	Engine HP	Load Factor	VOC g/hp-hr	CO g/hp-hr	NOx g/hp-hr	SO2 g/hp-hr	PM10 g/hp-hr	PM2.5 g/hp-hr	N2O g/gal	CH4 g/gal	CO2 g/hp-hr	BSFC lb/hp-hr
Work Tug	960	2000	0.5	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367
Excavator	960	417	0.85	0.11	1.49	6.21	0.004	0.24	0.23	0.26	0.74	531	0.367

	VOC lb	CO lb	NOx lb	SO2 lb	PM10 lb	PM2.5 lb	N2O lb	CH4 lb	CO2 lb
Work Tug	234	3,156	13,147	9	505	490	29	81	1,123,215
Excavator	83	1,119	4,660	3	179	174	10	29	398,124
Tons/year:	**0.2**	**2.1**	**8.9**	**0.0**	**0.3**	**0.3**	**0.0**	**0.1**	**760.7**
CO2e in metric tons/year									**697**

Vessel emission factors from page 3-22 of Regulatory Impact Analysis: Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression Ignition Engines Less than 30 Liters Per Cylinder, USEPA 2008.

All vessels are presumed to use 2 propulsion engines, table lists total HP.

Total Emissions

	VOC	CO	NOx	SO2	PM10	PM2.5	CO2e
Tons per Year	2.37	15.44	15.76	0.08	15.90	0.34	10,836

average passenger vehicle

404			grams of CO_2 per mile		
0.89			lb of CO_2 per mile		
CO_2e					
Tons/yr		45,333,824		miles	
Alt 1	20,175		3,942		cars driving 11,500 miles per year
40,578,601			miles		
Alt 2	18,059		3,529		cars driving 11,500 miles per year
69,682,638			miles		
Alt 3 - north wallops	31,011		6,059		cars driving 11,500 miles per year
66,689,595			miles		
Alt 3 - unnamed shoal	29,679		5,799		cars driving 11,500 miles per year

CY 2019

North Wallops Beach -	sand coming from (Alternative 1)		200 acres							
Offshore Shoal A -	sand coming from (Alternative 2)									
Nearshore Breakwaters	Add to Alt 1 or Alt 2 and becomes Alt 3									
Remove, store, replace sand fencing										
Estimated distance from southern edge of borrow										
area to northern edge of renourishment area		0.5 mi								
Total distance from north to south of both areas		9 mi								

Alternative 1		1,300,000 cubic yards of sand								
Excavate sand to 2.35 feet		2 mi approx length of borrow area								
tractor scraper with low pressure tires		remove sand from beach								
stockpile sand	assume	0.25 mi from fill area								
dump trucks would transport to fill area		6.5 mi approx length of renourishment area			3.25 mi is avg distance					
bulldozers spread the sand		4	215 HP each	24 hr/day						
ATVs										
mobile generators for lighting										
mobile fuel tanks										

Alternative 2		1,625,000 cubic yards of sand								
Equipment mobilization		30-45 days		Dodge Island	4350 HP propulsion					
discharge pipe (several miles)					3000 HP dredge pump power					
productivity =	18,513 CY/day	based on 2010 EIS								
pump out buoys										
multiple barges										
tugboats	4000 HP X 2									
derrick barge										
crew transport vehicles										
Onshore discharge lines trucked in and placed using loader or crane										
onshore equipment										
bulldozers										
ATVs										
mobile generators										
mobile fuel tanks										
suction hopper dredges	self propelled		8000 HP			assume 2 dredges	3 RT/day			
pumping/jetting engines	5000 HP			centrifugal pumps						
mooring buoy placement using derrick barge			5000 HP	2 work barges		2000 HP	2 tender tu	1000 HP	Placement and remov: 12 hrs	
12-14 hr dredging days										
Dredge over a large area		from unnamed Shoal A to mooring buoy			17 mi					
length of pipeline to placement		2 mi								
7-10 ft depth										
hopper capacity 4000 CY	actual capacity		3000 CY							
booster pumps for moving sand from offload point to placement area										

Alternative 3	combined with either 1 or 2
Type 1 stone =	0.75 to 2 tons
Type 2 stone =	150 to 500 pounds
130	ft long
10	ft high at crest
100	ft apart
water depth	4 to 8 ft
6	total
rock transport by rail	
offloaded than moved by truck to staging location	

APPENDIX E
ESSENTIAL FISH HABITAT ASSESSMENT

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Final

NASA WFF Shoreline Enhancement and Restoration Project
Essential Fish Habitat Assessment

Prepared for

National Aeronautics and Space Administration

Goddard Space Flight Center

Wallops Flight Facility

Wallops Island, VA

September 2018

In Cooperation with:
Bureau of Ocean Energy Management
U.S. Army Corps of Engineers

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Abbreviations and Acronyms

°F	degrees Fahrenheit
ac	acre(s)
ASTM	American Society for Testing and Materials
BOEM	Bureau of Ocean Energy Management
CFR	Code of Federal Regulation
CWA	Clean Water Act
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFHA	Essential Fish Habitat Assessment
ELMR	Estuarine Living Marine Resources
EPA	Environmental Protection Act
FMC	Fishery Management Council
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
ft	foot/feet
HAPC	Habitat Area of Particular Concern
HCD	Habitat Conservation Division
HIF	Horizontal Integration Facility
in	inch(es)
MAB	Mid-Atlantic Bright
MSA	Magnuson-Stevens Fishery Conservation And Management Act of 1976
mi	mile(s)
mm	millimeter(s)
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
PEIS	Programmatic Environmental Impact Statement
ppt	parts per thousand
SERP	Shoreline Enhancement and Restoration Project
SRIPP	Shoreline Restoration and Infrastructure Protection Program
ROD	Record of Decision
U.S.	United States
USACE	U.S. Army Corps of Engineers
VDOT	Virginia Department of Transportation
WFF	Wallops Flight Facility
y^3	cubic yard(s)

1.0 BACKGROUND AND INITIAL CONSIDERATIONS

1.1 INTRODUCTION

The National Aeronautics and Space Administration (NASA) has prepared this Essential Fish Habitat Assessment (EFHA) as an attachment to the Environmental Assessment (EA) to evaluate the potential environmental impacts of both enhancing and restoring the shoreline on Wallops Island. The vicinity of the Wallops Flight Facility (WFF) Shoreline Enhancement and Restoration Project (SERP) Area includes Essential Fish Habitat (EFH) for 21 managed species of all life stages ([variously] eggs, larvae, juveniles, adults, and spawning adults), and an additional nine species under Alternative 2. The WFF project area coincides with no Habitat Area of Particular Concern (HAPCs).

In accordance with the Magnuson-Stevens Fishery Conservation and Management Act of 1976, Public Law 94-265 (MSA), Federal agencies must consult with the National Marine Fisheries Service (NMFS) for activities that may adversely influence EFH that is designated in a Federal Fisheries Management Plan. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."

This EFHA is part of the tiered consultations from the *2010 Final Shoreline Restoration and Infrastructure Protection Program (SRIPP) Final Programmatic Environmental Impact Statement* (*PEIS)* with information and project components as presented in the *2013 Final Post-Hurricane Sandy EA*. The *2010 Final SRIPP PEIS* presented a complete description of all project-related resource areas with relevant, updated descriptions and information presented in the Post-Hurricane Sandy EA. Similarly, the SERP EA and EFHA focuses on those resources that have meaningfully changed, and the previous conclusions and regulatory findings are carried forward with new information and analysis provided as appropriate.

1.2 BACKGROUND

On December 13, 2010, NASA issued a Record of Decision (ROD) for WFF SRIPP PEIS, hereafter referred to as the *2010 Final SRIPP PEIS*. The United States (U.S.) Department of the Interior's Bureau of Ocean Energy Management (BOEM) and the U.S. Army Corps of Engineers (USACE), Norfolk District were Cooperating Agencies. The primary goal of the SRIPP is to reduce direct damage to Wallops Island's infrastructure; however, its true benefit is the continued use of the island to support the aerospace programs that are at the core of WFF's mission (NASA, 2010). The *2010 Final SRIPP PEIS* analyzed three action alternatives including structural and non-structural options, varying beach berm widths, and multiple sources of fill material. In its ROD, NASA selected *Alternative 1: Full Beach Fill, Seawall Extension* and adopted a suite of mitigation and monitoring protocols to both reduce potential environmental impacts and track project performance. Implementing the initial phase of Alternative 1 entailed: 1) the placement along the Wallops Island shoreline of approximately 3.2 million cubic yards (yd^3) of sand dredged from Unnamed Shoal A, located on the Outer Continental Shelf (OCS) under BOEM jurisdiction, located in the Atlantic Ocean; and 2) an initial 1,430-foot (ft) southerly extension of the Wallops Island rock seawall with future extensions completed on a funds-available basis to a maximum length of 4,600 ft. An estimated nine beach renourishment cycles at approximately five-year intervals would be implemented (NASA, 2010). The ROD stated that fill material for future renourishment cycles could be taken from either Unnamed Shoal A, Unnamed Shoal B, or north Wallops

Island beach and left the specifics of how and when the fill material was obtained to be addressed in future action-specific National Environmental Policy Act (NEPA) documentation.

In October 2012, Hurricane Sandy made landfall. Monitoring surveys following the storm event identified the need to repair a section of the seawall and the southern two-thirds of the recently nourished beach. Public Law 113-2, *Disaster Relief Appropriations Act, 2013*, was signed into law on January 29, 2013. The bill included a provision for NASA to repair facilities that sustained damage during the Hurricane. NASA signed a Finding of No Significant Impact (FONSI) on June 6, 2013, for the *Wallops Island Post-Hurricane Sandy Shoreline Repair Final Environmental Assessment* (NASA, 2013) hereafter referred to as the *2013 Final Post-Hurricane Sandy EA*. Repairs to the seawall and beach renourishment were completed in September 2014. Subsequent storms in 2015 (Hurricane Joaquin) and in 2016 (Winter Storm Jonas) have reduced the sand volume to approximately 43 percent of the design levels (NASA, 2018). Additional sand volume reduction occurred most recently in 2018 with Winter Storm Riley.

The USACE Norfolk District is involved in project design, construction, and monitoring of SRIPP on NASA's behalf. Since issuing its 2010 ROD and 2013 FONSI, NASA and USACE oversaw the initial seawall extension between August 2011 and March 2012 and have nourished the beach twice, once during initial construction in 2012 and again in 2014. Beginning prior to the initial beach fill, both agencies have sponsored bi-annual (spring and fall) topographic and hydrographic monitoring surveys of the Wallops Island shoreline, which have demonstrated a trend in sediment transport from the southern portion of the project area to the north. Additionally, the USACE Norfolk District has evaluated utilizing breakwaters along the Wallops Island shoreline to reduce the rate of erosion and sediment transport.

1.3 REGULATORY CONTEXT

The MSA and the 1996 Sustainable Fisheries Act defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." *Waters* consist of aquatic areas and their associated physical, chemical, and biological properties that are currently utilized by fishes and may include areas historically used by fishes. *Substrate* is defined as sediment, hardbottom, structures beneath the waters, and any associated biological communities. *Necessary* means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. *Spawning, breeding, feeding*, or *growth to maturity* includes all habitat types used by a species throughout its life cycle. Only species managed under a Federal Fishery Management Plan (FMP) are protected under (50 Code of Federal Regulations [CFR] 600). The act requires federal agencies to consult on activities that may adversely influence EFH designated in the FMPs.

The purpose of this assessment is to describe and evaluate activities that may have direct (e.g., physical disruption) or indirect (e.g., loss of prey species) effects on EFH and may be site-specific or habitat-wide. Potential adverse impacts are evaluated individually and cumulatively.

1.4 ESSENTIAL FISH HABITAT CONSULTATION HISTORY

The vicinity of the WFF Shoreline Enhancement and Restoration Project Area includes EFH for 21 managed species of all life stages ([variously] eggs, larvae, juveniles, adults, and spawning adults), and an additional nine species under Alternative 2. The WFF project area coincides with no HAPCs. The most recent SRIPP EFH consultations on April 24, 2013, concurred that beach restoration actions would affect EFH for 27 Federally managed species. NMFS Habitat Conservation Division (HCD) provided three straightforward conservation recommendations and concurred that the beach restoration actions would not substantially adversely affect EFH.

Note that Alternative 1 and Alternative 3 includes a smaller spatial footprint and less intense stressors. NASA anticipates that the intensity of stressors and magnitude of potential consequences under Alternative 1 and Alternative 3 would be smaller than prior actions under SRIPP and Post-Sandy (NASA, 2010, 2013).

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2.0 DESCRIPTION OF PROPOSED ACTION AND NO ACTION ALTERNATIVE

Consistent with the renourishment component of Alternative One described in detail in the EFH consultation associated with the *2010 Final SRIPP PEIS* (NASA, 2010) and reiterated in the EFH consultation associated with the *2013 Final Post-Hurricane Sandy EA* (NASA, 2013), NASA's Proposed Action is to renourish the beach along the Wallops Island shoreline infrastructure protection area. Before the renourishment, NASA may construct a series of parallel nearshore breakwater structures that would reduce the intensity of wave action and slow sediment transport. The proposed action and alternatives are extensively described in the *2018 NASA WFF Shoreline Enhancement and Restoration Project Environmental Assessment* (*2018 SERP EA*; NASA, 2018). Elements of Alternative 1 and Alternative 3 that would be relevant to EFH and managed species are summarized in the following abridged sections. Full details are in the *2018 SERP EA*, incorporated by reference.

2.1 ELEMENTS OF THE ALTERNATIVES RELEVANT TO ESSENTIAL FISH HABITAT

2.1.1 BEACH RENOURISHMENT

Beach renourishment-related stressors imposed on EFH and managed species common to both Alternative 1 and Alternative 2 include nearshore turbidity and water quality, and physical strike and disturbance. All other stressors imposed by Alternative 1 or Alternative 2 are not relevant because their nature and intensity is discountable, stressor and receptor are not co-located, and EFH and managed species have little-to-no meaningful susceptibilities in this context (i.e., artificial lighting, noise, ingestion, entanglement, electromagnetic, and chemical stressors). These other stressors were discounted in previous SRIPP and Post-Sandy EFHAs, and were discounted or determined to be negligible in similar recent EFH consultations in the region.

The beach renourishment fill template requires approximately 1.3 million yd^3 of sand material to restore the shoreline areas that have sustained berm and dune system reductions. Either the sand for renourishment would come from north Wallops Island beach (Alternative 1), or would come from unnamed shoal A (Alternative 2). The less efficient methods of Alternative 2 would require collection of 1.625 million yd^3 to meet the 1.3 million yd^3 fill template.

The most relevant aspect of Alternative 1 to EFH is that none of the source sand is EFH, and none of the collection and transport methods intersect with EFH. North Wallops Island beach (**Figure 2.1-1**) has been accreting due to transport of material from the south; shifting sand from north back to the south renourishment area is called "backpassing" (Alternative 1). Sand collected from north Wallops Island beach would be transported by truck to the renourishment area (**Figure 2.1-2**). Truck haul under Alternative 1 does not require large volumes of water needed to transport sand in a slurry through a pipeline, and imposes none of the associated turbidity and water quality stressors associated with Alternative 2. The highly efficient methods of Alternative 1 would require collection of approximately 1.3 million yd^3 of sand to meet the 1.3 million yd^3 fill template. Taken together, the impacts and stressors imposed on EFH and managed species under Alternative 1 would be substantially less than in previous consultations.

Elements relevant to EFH of Alternative 2 renourishment with sand from unnamed shoal A were extensively documented in the SRIPP and Post-Sandy actions and included entrainment in the dredge, turbidity at both dredge and pump-out sites, and removal of benthic food sources at the dredge site.

Figure 2.1-1. Approximate Sand Source Area

Figure 2.1-2. Approximate Sand Placement Area

Approximately 515 acres (ac) of unnamed shoal A were used in the SRIPP and Post-Sandy actions to source 3.2 million and 800,000 yd^3 of sand, respectively. The proposed action (Alternative 2) would use approximately 206 additional acres of the shoal's 1,800 ac borrow area to source 1.625 million yd^3 of sand from unnamed shoal A.

2.1.2 CONSTRUCTION OF NEARSHORE DETACHED PARALLEL BREAKWATERS

Nearshore breakwaters reduce the amount of storm related wave energy reaching protected upland areas as well as slow the rate of longshore sediment transport, thereby, increasing the longevity of a beach fill project. Under Alternative 3 of the Proposed Action, a series of rubble mound breakwaters would be constructed approximately 200 ft offshore from the mean high water line of the renourished shoreline (**Figure 2.1-3**). Each breakwater would be constructed of Virginia Department of Transportation (VDOT) Type I stone for the outer layer which ranges from 0.75 to 2 tons and VDOT Class II Stone for the core layer which range from 150 to 500 pounds upon a 6 inch (in) marine mattress. All stone would be placed parallel to the shore and the constructed breakwaters would measure approximately 130 ft long and 10 ft wide at top crest elevation. The breakwaters would be placed approximately 100 ft apart from each other. Water depths in these areas is approximately 4 to 8 ft. The breakwaters would be placed offshore of Launch Pad 0-A and continue north to the Horizontal Integration Facility (HIF) (Building X-079). Depending upon economic, engineering, and environmental factors, the initial series may be broken into smaller series (e.g., three breakwaters offshore of Launch Pad 0-A and another three offshore of the HIF). Note that the area highlighted in **Figure 2.1-3** is broadly indicative of potential breakwater location and dramatically overstates the actual affected area under Alternative 3.

The rocks for constructing each breakwater would be transported to the WFF area by rail, offloaded, and then trucked to the handling or placement site on Wallops Island. Construction, estimated to last approximately 6 to 9 months, would take place in the water using a barge and heavy lifting equipment. These breakwaters would be permanent structures as removal would be impractical and cost prohibitive (NASA, 2010). Construction of the offshore breakwaters would be completed prior to starting beach renourishment.

Construction-related stressors imposed on EFH and managed species by include nearshore turbidity and under Alternative 3 are not relevant because their nature and intensity is discountable, stressor and receptor are not co-located, and EFH and managed species have little-to-no meaningful susceptibilities in this context (i.e., artificial lighting, noise, ingestion, entanglement, electromagnetic, and chemical stressors). The rationale for this write-off is that these stressors were not identified in the Description of Proposed Action and Alternatives, were not imposed by similar construction efforts, and were absent from EFHAs of similar construction actions.

2.1.3 POST-RENOURISHMENT ACTIVITIES

Additional activities would include installation of sand fencing and planting dune grasses. None of these additional activities impose stressors on EFH or managed species, and additional activities will not be carried forward in the EFHA.

Figure 2.1-3. Proposed Breakwater Locations

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3.0 DESIGNATED EFH AND MANAGED SPECIES

The proposed action area under Alternative 1 and Alternative 3 is geographically coincident with eight EFH designations (**Table 3.1-1**), no HAPC designations, 21 managed species. The proposed action area under Alternative 2 is geographically coincident with an additional three EFH designations (**Table 3.1-1**), no HAPC designations, and an additional nine managed species.

3.1 DESIGNATED ESSENTIAL FISH HABITAT

The proposed action area is geographically coincident with eight EFH designations (**Table 3.1-1**), an additional three under Alternative 2, and no HAPC designations. Only two habitat types occur within the proposed action area, water column and unconsolidated sand. Completion of the proposed offshore breakwaters under Alternative 3 would convert approximately 0.34 ac of unconsolidated sand into hardbottom seafloor EFH. However, because the regional coastline has very little hardbottom habitat in the surf zone the potential direct benefits to designated EFH or managed species would be minimal.

Table 3.1-1. Essential Fish Habitat Designations for the Proposed Action Area

Essential Fish Habitat Designation	Management	Inshore(1)	Water Column	Seafloor
Northeast Multispecies	New England FMC	X	X	X
Northeast Skate Complex	New England FMC		X	X
Summer Flounder, Scup, and Black Sea Bass	Mid-Atlantic FMC	X	X	X
Atlantic Herring	New England FMC	X	X	X
Atlantic Bluefish	Mid-Atlantic FMC	X	X	X
Atlantic Mackerel, Squid, and Butterfish	Mid-Atlantic FMC		X	X
Coastal Migratory Pelagics	South Atlantic FMC	X	X	X
Atlantic Highly Migratory Species	Secretarial		X	X

Note: (1) Inshore waters of Chincoteague Bay could conceivably be affected by turbidity associated with the proposed action, but no other direct or indirect stressors would be imposed by the proposed action.
Legend: FMC = Fishery Management Council

3.2 MANAGED SPECIES

Approximately 21 managed species have designated EFH in the vicinity of the proposed action area (**Table 3.2-1**). EFH designations are assigned as 10 x 10 minute blocks, and the proposed action area is an essentially linear feature that diagonally crosses the blocks. Lists of managed species were queried from EFH blocks within approximately one mile to the north, south, and offshore of the areas under the alternatives. Species and habitat management are continuously refined and improved by FMCs, and may change during the course of the consultation. For example, four of the 21 managed species under Alternative 1 and Alternative 3 did not fall into the prior WFF EFHAs (see * in **Table 3.2-1**). Other managed species affected only under Alternative 2 were extensively discussed under NASA 2010 and NASA 2013 (e.g., scup, surfclam, witch flounder, etc.).

No designated HAPCs occur in or near the proposed action area. The nearest HAPCs are approximately 60 miles (mi) north and south, at Delaware Bay and Chesapeake Bay.

Table 3.2-1. Essential Fish Habitat and Managed Species for the Proposed Action Area under Alternative 1 and Alternative 3

Species	Scientific Name	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Northeast Multispecies Fishery Management Plan – Amendment 14 (New England FMC)						
Red hake	*Urophycis chuss*	X	X	X		
Windowpane flounder	*Scopthalmus aquosus*	X	X	X	X	X
Northeast Skate Complex Fishery Management Plan – Amendment 2 (New England FMC)						
Clearnose skate	*Raja eglanteria*			X	X	
Winter skate	*Leucoraja ocellata*			X	X	
Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan – Amendment 12 (Mid-Atlantic FMC)						
Black sea bass	*Centropristis striata*	X	X	X	X	
Summer flounder	*Paralichthys dentatus*	X(1)	X	X	X	
Atlantic Herring Fishery Management Plan – Amendment 3 (New England FMC)						
Atlantic sea herring	*Clupea harengus*	X(2)	X	X	X	X(2)
Atlantic Bluefish Fishery Management Plan – Amendment 1 (Mid-Atlantic FMC)						
Bluefish	*Pomatomus saltatrix*	X	X	X	X	
Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan – Amendment 11 (Mid-Atlantic FMC)						
Atlantic butterfish	*Peprilus triacanthus*	X(3)	X(3)	X(3)	X(3)	X(3)
Coastal Migratory Pelagics(4) – Amendment 26 (South Atlantic FMC)						
Cobia	*Rachycentron canadum*	X(4)	X(4)	X(4)	X(4)	
King mackerel	*Scomberomorus cavalla*	X(4)	X(4)	X(4)	X(4)	
Spanish mackerel	*Scomberomorus maculatus*	X(4)	X(4)	X(4)	X(4)	
Atlantic Highly Migratory Species Fishery Management Plan – Amendment 10 (Secretarial)						
Albacore tuna*	*Thunnus alalunga*			X(4)		
Skipjack tuna*	*Katsuwonus pelamis*			X(4)(5)	X(4)	
Atlantic angel shark	*Squatina dumeril*	X				
Blacktip shark* (Atlantic stock)	*Carcharhinus limbatus*	X		X	X	
Common thresher shark	*Alopias vulpinus*	X				
Dusky shark	*Carcharhinus obscurus*	X		X(5)	X(5)	
Sand tiger shark	*Carcharias taurus*	X		X	X	(6)
Sandbar shark	*Carcharhinus plumbeus*	X		X	X	(6)
Smoothhound shark complex* (Atlantic stock)	*Mustelus canis*	X				

Notes: (*) Not covered under previous EFH consultations for the Proposed Action Area. Managed species affected only under Alternative 2 were extensively discussed under NASA 2010 and NASA 2013.

(1) Less likely in affected area under Alternative 1 and Alternative 3. Eggs are most likely from 30 to 360 ft.

(2) Less likely in affected area under Alternative 1 and Alternative 3. Eggs and spawning adults are most likely from 15 to 300 ft.

(3) Less likely in affected area under Alternative 1 and Alternative 3. All life stages are most likely deeper than 30 ft.

(4) Coastal migratory pelagics and some highly migratory species are not year-round residents of the Proposed Action Area and are generally absent in winter. These species are much less likely in the affected area under Alternative 1 and Alternative 3.

(5) Less likely in affected area under Alternative 1 and Alternative 3. Juveniles and adults are most likely deeper than 60 ft.

(6) No HAPC near the proposed action area, but HAPC is approximately 60 mi north and south, at Delaware Bay and Chesapeake Bay.

Legend: FMC = Fishery Management Council

3.2.1 ALBACORE TUNA* (*THUNNUS ALALUNGA*)

(*=Not covered under previous EFH consultations for the Proposed Action Area)

This highly migratory species has negligible probability of occurrence within the area potentially affected under Alternative 1 and Alternative 3.

3.2.2 ATLANTIC ANGEL SHARK (*SQUATINA DUMERILI*)

3.2.2.1 Essential Fish Habitat for Atlantic Angel Shark

EFH for larvae (known as neonates), juveniles, and adult Atlantic angel shark (*Squatina dumerili*) is off the coast of southern New Jersey, Delaware, and Maryland in shallow coastal waters out to the 82-ft isobath, including the mouth of Delaware Bay.

3.2.2.2 Background

The Atlantic angel shark is a bottom dwelling species found in coastal waters of the Atlantic, generally at depths between 131 and 820 ft. The flattened body and sandy-brown or gray color cause the shark to be frequently mistaken for a ray. The angel shark preys on demersal fish like flounder and skate, mollusks, crustaceans, and stingrays, such as the southern stingray (*Dasyatis americana*). The shark is ovoviviparous, meaning that the female produces eggs, but they remain inside her body until they hatch, so that “live” birth occurs. The litter generally consists of approximately 16 pups, which are born in the spring and summer. The angel shark is highly migratory, moving north during the summer and wintering in warmer southern waters (Florida Museum of Natural History, 2018).

3.2.3 ATLANTIC BUTTERFISH (*PEPRILUS TRIACANTHUS*)

3.2.3.1 Essential Fish Habitat for Atlantic Butterfish

For juvenile and adult Atlantic butterfish (*Peprilus triacanthus*), offshore EFH is the pelagic waters found over the continental shelf (from the coast out to the limits of the Exclusive Economic Zone [EEZ]), from the Gulf of Maine through Cape Hatteras, North Carolina. Inshore, EFH is the "mixing" and/or "seawater" portions of all the estuaries where juvenile butterfish are "common," "abundant," or "highly abundant" on the Atlantic coast, from Passamaquoddy Bay, Maine to James River, Virginia. Generally, juvenile butterfish are present in depths between 33 ft and 1,200 ft and temperatures between approximately 37 degrees Fahrenheit (°F) and 82°F (New England FMC, 2017).

3.2.3.2 Background

Both juveniles and adults are found over the shelf during the winter months, and spend the spring and fall in the estuaries. Schools of adults and larger juveniles form over sandy, sandy-silt, and muddy substrates. During summer, butterfish move toward the north and inshore to feed and spawn. Spawning occurs from June to August, and peaks progressively later at higher latitudes. During winter, butterfish move southward and offshore to avoid cool waters. Butterfish are primarily pelagic, and form loose schools that feed upon small fish, squid, and crustaceans. Smaller juveniles evade predation by associating with floating objects and organisms such as jellyfish. Inshore and in the surf zone, butterfish prey on plankton, thaliaceans, squid, and copepods (Overholtz, 2006).

3.2.4 ATLANTIC SEA HERRING (*CLUPEA HARENGUS*)

3.2.4.1 Essential Fish Habitat for Atlantic Sea Herring

Only larvae and juvenile life stages have EFH within the estuarine seawater zone of the proposed action area. The adult life stage has EFH designations within the 10-minute block encompassing the coastal waters, but not for the estuarine seawater zone within the proposed action area.

Larvae. Larval EFH includes inshore and offshore pelagic habitats in the Gulf of Maine, on Georges Bank, and in the upper Mid-Atlantic Bight, and in the bays and estuaries listed in New England FMC (2017). Atlantic herring have a very long larval stage, lasting 4 to 8 months, and are transported long distances to inshore and estuarine waters where they metamorphose into early stage juveniles (“brit”) in the spring (New England FMC, 2017).

Juvenile. Juvenile EFH includes intertidal and subtidal pelagic habitats to 984 ft throughout the region, including the bays and estuaries listed in New England FMC (2017). One and two-year old juveniles form large schools and make limited seasonal inshore-offshore migrations. Older juveniles are usually found in water temperatures of 37°F to 59°F in the northern part of their range and as high as 71°F in the Mid-Atlantic. Young-of-the-year juveniles can tolerate low salinities, but older juveniles avoid brackish water (New England FMC, 2017).

Adult. Adult EFH area is subtidal pelagic habitats with maximum depths of 984 ft throughout the region, including the bays and estuaries listed in New England FMC (2017). Adults make extensive seasonal migrations between summer and fall spawning grounds on Georges Bank and the Gulf of Maine and overwintering areas in southern New England and the Mid-Atlantic region. They seldom migrate beyond a depth of about 328 ft and, unless they are preparing to spawn, usually remain near the surface. They generally avoid water temperatures above 50°F and low salinities. Spawning takes place on the bottom, generally in depths of 16 to 295 ft on a variety of substrates (New England FMC, 2017).

3.2.4.2 Background

The Atlantic sea herring (*Clupea harengus*) is a pelagic, schooling, plankton feeding species inhabiting both sides of the Atlantic. In the western North Atlantic it ranges from Labrador to Cape Hatteras, North Carolina. Adult herring spawn during the summer and fall in the Gulf of Maine and Georges Bank region, producing demersal eggs. Larvae overwinter offshore as well as in coastal waters and become juveniles in the spring. Both juveniles and adults are heavily preyed upon by marine fishes, marine mammals, and seabirds. Adults undergo north-south migrations for feeding, spawning, and overwintering (Stevenson & Scott, 2005). According to NMFS, the Atlantic sea herring is not currently overfished, and overfishing is not occurring (NMFS, 2018).

3.2.5 BLACK SEA BASS (*CENTROPRISTUS STRIATA*)

3.2.5.1 Essential Fish Habitat for Black Sea Bass

Larvae. Larval EFH consists of: 1) north of Cape Hatteras, the pelagic waters found over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina; and 2) estuaries where black sea bass were identified as common, abundant, or highly abundant in the Estuarine Living Marine Resources (ELMR) database, NMFS’s program to develop a consistent database of economically important fishes in the Nation’s estuaries, for the "mixing" and "seawater" salinity zones. Generally, the habitats for the transforming (to juveniles) larvae are near the coastal areas and into marine parts of estuaries between Virginia and New York. When larvae become demersal, they are generally found on structured inshore habitat such as sponge beds (New England FMC, 2017; Shepherd & Packer, 2006). For juveniles, EFH consists of: 1) offshore, the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina; and 2) inshore, the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones.

Juvenile. Juvenile EFH includes the estuaries in the summer and spring. Generally, juvenile black sea bass are found in waters warmer than 43°F with salinities greater than 18 parts per thousand (ppt) and coastal areas between Virginia and Massachusetts. In winter, they are present offshore from New Jersey and south. Juvenile black sea bass are usually found in association with rough bottom, such as shellfish and eelgrass beds, and man-made structures in sandy-shelly areas; offshore clam beds and shell patches may also be used during the wintering.

Adult. Adult EFH consists of: 1) offshore, the demersal waters over the Continental Shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina; and 2) inshore, the estuaries where adult black sea bass were identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones. Black sea bass are generally found in estuaries from May through October. Wintering adults (November through April) are generally offshore, south of New York to North Carolina. Temperatures above 43°F seem to be the minimum requirements. Structured habitats (natural and man-made), and sand and shell substrate are preferred.

3.2.5.2 Background

Black sea bass is a demersal species found in temperate and subtropical waters all along the Atlantic coast, from the Gulf of Maine to the Gulf of Mexico. In the Mid-Atlantic, black sea bass migrate to inshore coastal areas and bays in the springtime and offshore areas in the fall as the temperatures change. The species is strongly associated with structured habitats including jetties, piers, shipwrecks, submerged aquatic vegetation, and shell bottoms.

3.2.6 BLACKTIP SHARK* (*CARCHARHINUS LIMBATUS*)

(*=Not covered under previous EFH consultations for the Proposed Action Area)

Apart from potential transit to nursery habitat, this highly migratory species has negligible probability of occurrence within the area potentially affected under Alternative 1 and Alternative 3.

3.2.7 BLUEFISH (POMATOMUS SALTATRIX)

3.2.7.1 Essential Fish Habitat for Bluefish

Larvae. Larval EFH for bluefish (*Pomatomus saltatrix*), EFH consists of: 1) North of Cape Hatteras, pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) most commonly above 49 ft, from Montauk Point, New York, south to Cape Hatteras; 2) south of Cape Hatteras, 100% of the pelagic waters greater than 45 ft over the continental shelf (from the coast out to the eastern edge of the Gulf Stream) through Key West, Florida; and 3) the "slope sea" and Gulf Stream between latitudes 29° 00' N and 40° 00' N. Bluefish larvae are not generally found inshore so there is no EFH designation inshore for larvae. Generally, bluefish larvae are present April through September in temperatures greater than 64°F in shelf salinities greater than 30 ppt (Shepherd & Packer, 2006).

Juvenile. Juvenile EFH consists of: 1) north of Cape Hatteras, pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ) from Nantucket Island, Massachusetts south to Cape

Hatteras; 2) south of Cape Hatteras, 100% of the pelagic waters over the continental shelf (from the coast out to the eastern edge of the Gulf Stream) through Key West, Florida; 3) the "slope sea" and Gulf Stream; and 4) inshore, EFH is all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Generally juvenile bluefish occur in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from May through October, and South Atlantic estuaries March through December, within the "mixing" and "seawater" zones (Jury, Field, Stone, Nelson, & Monaco, 1994; Nelson, Monaco, Coston-Clements, Settle, & Irlandi, 1991; Stone et al., 1994). Distribution of juveniles by temperature, salinity, and depth over the continental shelf is undescribed (Lough, 2004).

Adult. Adult EFH consists of: 1) north of Cape Hatteras, the pelagic waters found over the continental shelf (from the coast out to the limits of the EEZ), from Cape Cod Bay, Massachusetts south to Cape Hatteras; 2) south of Cape Hatteras, 100% of the pelagic waters over the continental shelf (from the coast out to the eastern edge of the Gulf Stream) through Key West, Florida; and 3) inshore, all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida. Adult bluefish are present in Mid-Atlantic estuaries from April through October in the "mixing" and "seawater" zones (Jury, et al., 1994; Nelson, et al., 1991; Stone, et al., 1994). Bluefish adults are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the schools. Bluefish are generally found in shelf salinities greater than 25 ppt.

3.2.7.2 Background

EFH is defined within the project area for larval, juvenile, and adult bluefish. Eggs of this species are pelagic and highly buoyant; with hatching and early larval development occurring in oceanic waters in the Mid-Atlantic Bight (MAB), a coastal region running from Massachusetts to North Carolina. The young move inshore to estuaries, which serve as chief habitat for juveniles. Adults travel northward in spring and summer and to the south in fall and winter. Southerly migration may be closer to shore than northerly movement, although movement in both directions is characterized by inshore-offshore movement. It is believed that estuarine and nearshore waters are important habitats for juveniles and adults from Maine to Florida (Shepherd & Packer, 2006). Adult bluefish prey on squid and other fish such as menidia.

3.2.8 CLEARNOSE SKATE (*RAJA EGLANTERIA*)

3.2.8.1 Essential Fish Habitat for Clearnose Skate

For juvenile and adult clearnose skate (*Raja eglanteria*), EFH consists of bottom habitats with a substrate of soft bottom along the continental shelf and rocky or gravelly bottom, ranging from the Gulf of Maine south along the continental shelf to Cape Hatteras, North Carolina (the southern boundary of the New England FMC management unit). Generally, their full range is from the shore to 1,640 ft, but they are most abundant at depths less than 364 ft. The juvenile and adult skate prefers temperatures in the range of 48°F to 86°F, but are most abundant from 48°F to 70°F in the northern part of its range and 66°F to 86°F around North Carolina.

3.2.8.2 Background

This skate species occurs along the eastern coast from the Nova Scotian Shelf to northeastern Florida, as well as in the northern Gulf of Mexico from northwestern Florida to Texas. North of Cape Hatteras, skate move inshore and northward along the OCS during the spring and early summer, and offshore and southward during the autumn and early winter. In winter and spring, the juveniles are most densely concentrated on the continental shelf from the Delmarva Peninsula to Cape Hatteras out to the 66 ft contour. In winter, adults are concentrated inshore out to 656 ft from near the Hudson Canyon to Cape Hatteras. In spring, small numbers of adults are found inshore out to 656 ft from Delaware to south of Cape Hatteras. In summer, small concentrations of adults are found from Cape May to Cape Hatteras, and during the fall, they are located from Long Island to Cape Hatteras. The species is most abundant from the sublittoral zone out to about 180 ft (Packer, Zetlin, & Vitaliano, 2003). The clearnose skate is found on soft bottoms along the continental shelf but may also occur on rocky or gravelly bottoms.

3.2.9 Dusky Shark (*Charcharinus obscurus*)

3.2.9.1 Essential Fish Habitat for Dusky Shark

For neonate/early juveniles, EFH consists of shallow coastal waters, inlets, and estuaries to the 86-ft isobath from the eastern end of Long Island, New York, to Cape Lookout, North Carolina; from Cape Lookout south to West Palm Beach, Florida, in shallow coastal waters, inlets, and estuaries and offshore areas to the 328-ft isobath. For late juveniles/subadults, EFH includes coastal and pelagic waters between the 82-ft and 656-ft isobaths off the coast of southern New England; and shallow coastal waters, inlets and estuaries to the 656-ft isobath from Assateague Island at the Virginia/Maryland border to Jacksonville, Florida (NMFS, 2017).

3.2.9.2 Background

Dusky shark habitat ranges from shallow inshore waters to beyond the continental shelf. Although the shark feeds near the bottom, it can also be found anywhere in the water column to a depth of 1,240 ft. Mating occurs in the spring, followed by a gestational period of either 8 or 16 months, depending on the number of birth seasons in a given year. While juveniles inhabit estuaries and shallow coastal waters, adults are not found in estuaries or waters with lower salinities. The dusky shark preys on a variety of fish and invertebrates, such as herring, grouper, sharks, skates, rays, crabs, squid, and starfish. The species is highly migratory, moving north during the summer and wintering in warmer southern waters. Males and females make the seasonal migrations separately (Florida Museum of Natural History, 2009).

3.2.10 Red Hake (*Urophycis chuss*)

3.2.10.1 Essential Fish Habitat for Red Hake

Eggs. EFH for eggs includes the surface waters of the Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, hake eggs are found in areas where sea surface temperatures are below 50°F along the inner continental shelf with salinity less than 25 ppt. Eggs are most often present during the months from May through November, with peaks in June and July.

Larvae. EFH for larvae includes surface waters of Gulf of Maine, Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, red hake larvae are found where sea surface temperatures are below 66°F, water depths are less than 656 ft, and salinity is greater than 0.5 ppt. Red hake larvae are most often observed from May through December, with peaks in September and October.

Juvenile. EFH for juveniles consists of bottom habitats with a substrate of shell fragments, including areas with an abundance of live scallops, in the Gulf of Maine, on Georges Bank, the continental shelf off southern New England, and the middle Atlantic south to Cape Hatteras. Generally, red hake juveniles are found where water temperatures are below 61°F, depths are less than 328 ft, and salinity ranges from 31 to 33 ppt.

3.2.10.2 Background

Red hake migrate seasonally, coming from as far north as Maine to the warmer southern waters of Virginia and North Carolina. Spawning for red hake populations throughout the eastern Atlantic occurs in the MAB. Not much is known about the eggs, other than that they float near the surface and hatching occurs about a week after spawning. Larvae can be found in the upper water column from May through December. Juveniles are pelagic and stay close to floating debris and patches of Sargassum until they are approximately 2 months old, at which time they become demersal. Juveniles prefer silty, fine sand sediments while adults favor muddy substrates (Steimle, Morse, Berrien, & Johnson, 1999).

3.2.11 Sand Tiger Shark (*Odontaspis taurus*)

3.2.11.1 Essential Fish Habitat for Sand Tiger Shark

EFH is defined within the project area for larvae and adult sand tiger sharks. The sand tiger shark may be found in the western Atlantic from the Gulf of Maine to Argentina, the Atlantic coast of Europe and North Africa, and the Mediterranean Sea. Sand tiger sharks may occur singly or in small schools and are active primarily at night. They are generally coastal and usually found from the surf zone to depths of around 82 ft; however, they may also be found in shallow bays and to depths of 656 ft.

3.2.11.2 Background

The sand tiger shark is found inshore in areas including the surf zone, shallow bays, reefs, and wrecks. It can also be found in deeper areas like the OCS. The sand tiger shark usually gives birth to only one or two pups at a time. Although the shark can be found throughout the water column, it prefers to drift along the bottom. To become buoyant in the water column, the shark comes to the surface to gulp air, as it lacks the swim bladder that bony fish possess. The species is seasonally migratory, moving north during the summer and wintering in warmer southern waters. Common prey includes herring, bluefishes, flatfishes, eels, mullets, snappers, rays, squid, crabs, and other sharks (Florida Museum of Natural History, 2018).

3.2.12 Sandbar Shark (*Charcharinus plumbeus*)

3.2.12.1 Essential Fish Habitat for Sandbar Shark

Neonates/Early Juvenile. For neonates/early juveniles, EFH consists of shallow coastal areas to the 82-ft isobath from Montauk, Long Island, New York, south to Cape Canaveral, Florida (all year); nursery areas in shallow coastal waters from Great Bay, New Jersey, to Cape Canaveral, Florida, especially Delaware and Chesapeake Bays (seasonal-summer); shallow coastal waters to depths of 164 ft on the west coast of Florida and the Florida Keys from Key Largo to south of Cape San Blas, Florida. Typical parameters include salinity greater than 22 ppt and temperatures greater than 70°F.

Late Juvenile/Subadult. For late juveniles/subadults, EFH includes offshore southern New England and Long Island, both coastal and pelagic waters; also, south of Barnegat Inlet, New Jersey, to Cape Canaveral, Florida, shallow coastal areas to the 82-ft isobath; also, in the winter, in the MAB, at the shelf break, benthic areas between the 328-ft and 656-ft isobaths; also, on the west coast of Florida, from shallow coastal waters to the 164-ft isobath, from Florida Bay and the Keys at Key Largo north to Cape San Blas, Florida.

Adult. For adults, EFH is on the east coast of the United States, shallow coastal areas from the coast to the 164-ft isobath from Nantucket, Massachusetts, south to Miami, Florida; also, shallow coastal areas from the coast to the 328-ft isobath around peninsular Florida to the Florida panhandle near Cape San Blas, Florida, including the Keys and saline portions of Florida Bay.

3.2.12.2 Background

The sandbar shark is the most common gray shark along the Mid-Atlantic Coast (Chesapeake Bay Program, 2009). From late May to early June, females head to the inlets and coastal bays of Virginia to give birth to litters of between 6 and 13 pups. The pups remain in the area until September or October, when they school and migrate south, along with the adults, to the warmer waters of North Carolina and Florida. The sharks begin to return to the coastal waters of Virginia around April. Pups and juveniles feed primarily on crustaceans, graduating to a more diverse diet of fish from higher in the water column, as well as rays, skates, mollusks, and crustaceans near or in the benthic layer. The sharks are bottom-dwellers found in relatively shallow coastal waters 60 ft to 200 ft deep on oceanic banks and sand bars with smooth, sandy substrates. The adults can also occasionally be found in estuaries in turbid waters with higher salinity (Florida Museum of Natural History 2009).

3.2.13 Skipjack tuna* (*Katsuwonus pelamis*)

(*=Not covered under previous EFH consultations for the Proposed Action Area)

This highly migratory species has negligible probability of occurrence within the area potentially affected under Alternative 1 and Alternative 3.

3.2.14 Smooth Dogfish (Mustelus canis)

(*=Not covered under previous EFH consultations for the Proposed Action Area)

3.2.14.1 Essential Fish Habitat for Smooth Dogfish

EFH includes the waters of the Continental shelf from inshore to 656 ft along the Atlantic coast from Massachusetts to South Carolina.

3.2.14.2 Background

Dogfish are located both inshore and offshore to the OCS. Although dogfish can be found at the surface and in the water column, they are demersal and spend most of their time on the bottom. They can also be found inshore and in estuaries. Smooth dogfish primarily prey on invertebrates, but seasonally also prey on a variety of small fish. Generally, adult smooth dogfish are found in water temperatures greater than 45°F. During the winter they migrate south to waters outside of the Proposed Action Area.

3.2.15 Summer Flounder (*Paralicthys dentatus*)

3.2.15.1 Essential Fish Habitat for Summer Flounder

EFH is defined within the project area for juvenile and adult summer flounder and consists of: 1) north of Cape Hatteras, the demersal waters over the continental shelf (from the coast out to the limits of the EEZ), from the Gulf of Maine to Cape Hatteras, North Carolina; 2) south of Cape Hatteras, the waters over the continental shelf (from the coast out to the limits of the EEZ) to depths of 500 ft from Cape Hatteras, North Carolina, to Cape Canaveral, Florida; and 3) inshore, all of the estuaries where summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the "mixing" and "seawater" salinity zones. In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures greater than 37°F and salinities from 10 to 30 ppt. .

3.2.15.2 Background

The geographical range of the summer flounder encompasses the shallow estuarine waters and OCS from Nova Scotia to Florida. The center of the species abundance lies within the MAB from Cape Cod to Cape Hatteras, North Carolina. Adult and juvenile summer flounder normally inhabit shallow coastal and estuarine water during the warmer months of the year and move offshore on the OCS at depths of 500 ft in colder months. In Virginia, adult flounder use the Eastern Shore seaside lagoons and lower Chesapeake Bay as summer feeding areas. The fish concentrate in shallow warm water at the upper reaches of the channels and larger tidal creeks on the Eastern Shore in April and then move toward the inlets as spring and summer progress. Juveniles apparently utilize a range of substrate types including mud, silt, and submerged aquatic vegetation. Adults seem to prefer sandy habitat in order to avoid predation and conceal themselves from prey. Seasonal temperature shifts appear to drive juveniles and adults in and out of estuary habitats (Packer et al., 1999). Juveniles prey on crustaceans, small pelagic fish, and shrimp while adults feed opportunistically on a variety of fish, crustaceans, squid, and polychaetes.

3.2.16 Common Thresher Shark (*Alopias vulpinus*)

This highly migratory species has negligible probability of occurrence within the area potentially affected under Alternative 1 and Alternative 3.

3.2.17 Windowpane Flounder (*Scopthalmus aquosus*)

3.2.17.1 EFH for Windowpane Flounder

Eggs/Larvae. For eggs and larvae, EFH consists of pelagic waters around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, windowpane flounder larvae are found at sea surface temperatures less than 68°F and water depths less than 250 ft. Larvae are often present from February to November with peaks in May and October in the middle Atlantic and July through August on Georges Bank.

Juvenile. EFH for juveniles is bottom habitat with a substrate of mud or fine-grained sand, around the perimeter of the Gulf of Maine, on Georges Bank, southern New England, and the middle Atlantic south to Cape Hatteras. Generally, windowpane flounder juveniles are found at water temperatures below 77°F, at depths from 3ft to 328 ft, and salinities between 5.5 to 36 ppt.

Adult. EFH for adults is comprised of bottom habitats with a substrate of mud or fine-grained sand around the perimeter of the Gulf of Maine, on Georges Bank, southern New England and the middle Atlantic south to the Virginia-North Carolina border. Generally, windowpane flounder adults are found in water temperatures below 26.8° C, depths from 3ft to 246 ft, and salinities between 5.5 to 36 ppt. EFH for spawning adults is bottom habitats comprised of mud or fine-grained sand in the Gulf of Maine, Georges Bank, southern New England and the middle Atlantic south to the Virginia- North Carolina border. Spawning windowpane flounder are found in water temperatures below 70°F, depths from 3 ft to 246 ft, and salinities between 5.5 to 36 ppt.

3.2.17.2 Background

Windowpane flounder inhabit estuaries, nearshore waters, and the continental shelf of the middle Atlantic. The species is demersal and prefers substrates of sand or mud. Windowpane flounder are most often observed spawning during the months February to December with a peak in May in the middle Atlantic. Juveniles that settle in shallow inshore waters move to deeper waters as they grow, migrating to nearshore or estuarine habitats in the southern MAB in the autumn. Juvenile and adult windowpane feed on small crustaceans and various fish larvae.

3.2.18 Winter Skate (*Leucoraja ocellata*)

3.2.18.1 Essential Fish Habitat for Winter Skate

Juvenile. For juveniles, EFH consists of bottom substrates of sand and gravel or mud in Cape Cod Bay, on Georges Bank, the southern New England shelf, and through the MAB to North Carolina. Winter skate juveniles are generally found at a depth range from shoreline to about 1,312 ft and are most abundant at depths less than 364 ft. Preferred temperatures range from 30°F to 70°F, with most juveniles found in water with temperatures ranging from 39°F to 61°F, depending on the season.

Adult. For adults, EFH includes bottom substrates of sand and gravel or mud in Cape Cod Bay, on Georges Bank, the southern New England shelf, and through the MAB to North Carolina. Winter skate adults are generally found at a depth range from shoreline to 1,217 ft and are most abundant at depths of 364 ft. Preferred temperatures are from 30°F to 70°F, with most found in water with temperatures ranging from 41°F to 59°F, depending on the season.

3.2.18.2 Background

The winter skate is found all along the western Atlantic, from Newfoundland to North Carolina. In the cooler winter months, the winter skate comes closer to shore. Winter skates prefer sandy and gravelly bottoms but may also be found in mud substrates. The skate lies on the ocean floor covered by a layer of sand during the day, and at night preys upon crabs, worms, squid, shrimp, clams, and occasionally small fish. Winter skates are oviparous. Although there is no defined reproductive season, skate reproduction peaks during the summer months. Each female produces approximately 40 egg cases per year, each containing one embryo. The egg cases are released by the female in offshore waters on rock bottom habitats.

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4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

4.1 ANALYSIS APPROACH

Alternative 1 and Alternative 3 would impose nearshore turbidity and water quality stressors during construction and beach nourishment. The construction phase of Alternative 3 would also impose physical strike and disturbance stressors. The analysis considers the nature and intensity of stressors, the susceptibility of managed species and habitat elements, and the spatial/temporal co-location of stressors and susceptible organisms.

The nature and intensity of turbidity and water quality stressors imposed under Alternative 1 and Alternative 3 would be minimal, and would be substantially less than in previous consultations at WFF. Sand sourced from an active beach is coarser and often substantially cleaner than sand from offshore shoals. Truck haul under Alternative 1 does not require large volumes of water needed to transport sand in a slurry through a pipeline, and imposes none of the associated turbidity and water quality stressors associated with Alternative 2. The highly efficient methods of Alternative 1 would require collection of approximately 1.3 million yd^3 of sand to meet the 1.3 million yd^3 fill template. Taken together, the intensity of turbidity and water quality stressors imposed on EFH and managed species under Alternative 1 would be substantially less than in previous consultations and substantially less than under Alternative 2.

The nature and intensity of physical strike and disturbance stressors imposed by the construction phase of Alternative 3 would be minimal. Physical strike stressors would be imposed by vessels (i.e., barge, tugboat, and crewboat) operating from the Chincoteague channel to the proposed breakwater construction area, nearly into the surf zone. The barge may be anchored by spuds. Construction materials (e.g., rocks and geotextile mattresses) would be placed on the seafloor individually. All of the physical strike stressors under Alternative 3 would be slow-moving and mortality to individual managed species is possible but not probable. The intensity of physical disturbance stressors would be minimal. Although the entire seafloor footprint of the proposed breakwaters would be physically contacted by construction equipment and materials, the contact is both incremental and slow. Physical disturbance stressors under Alternative 3 would, therefore, be minimal intensity but relatively long-term duration. All other stressors imposed by breakwater construction under Alternative 3 are not relevant because their nature and intensity is discountable, stressor and receptor are not co-located, and EFH and managed species have little-to-no meaningful susceptibilities in this context (i.e., artificial lighting, noise, ingestion, entanglement, electromagnetic, and chemical stressors). The rationale for this write-off is that these stressors were not identified in the Description of Proposed Action and Alternatives, were not imposed by similar construction efforts, and were absent from EFHAs of similar construction actions. These stressors will not be carried forward in the EFHA.

Stressors under Alternative 2 would be identical to prior permitted actions, extensively documented in the SRIPP and Post-Sandy (NASA, 2010, 2013).

4.2 WATER COLUMN ESSENTIAL FISH HABITAT

Nearshore and surf zone water column EFH would be exposed to stressors under Alternative 1 and Alternative 3.

4.2.1 Affected Environment

Water column EFH in the vicinity of Wallops Island is saline to brackish and are influenced by the tides. Marine waters in the project area maintain a fairly uniform salinity range (32 to 36 ppt) throughout the year, with pockets of high salinity water (38 ppt) found near the Gulf Stream in the fall (NASA, 2016). In the winter, the water column is vertically well mixed, with water temperatures averaging 57°F at the surface and 52°F at depths greater than 660 ft. In summer (August), the water column is vertically stratified with 77°F water near the surface and 50°F water at depths greater than 660 ft (NASA, 2016).

4.2.2 Environmental Consequences

The nature and intensity of turbidity and water quality stressors imposed under Alternative 1 and Alternative 3 would be minimal, and would be substantially less than in previous consultations at WFF that include Alternative 2. Sand sourced from an active beach is often substantially cleaner than sand from offshore shoals. Truck haul sand does not require the large volumes of water associated with dredging methods required for transporting sand from offshore shoals, and consequently cannot produce a similarly intense turbidity plume. Taken together, turbidity and water quality stressors imposed on EFH and managed species would be substantially less than in previous consultations that projected elevated turbidity would be concentrated within the swash zone, dissipating between 1,000-2,000 ft alongshore; and lasting several hours. Under Alternative 1 and Alternative 3 all of the nearshore intertidal and subtidal water column EFH would be exposed to moderate and episodic turbidity stressors for the duration of the project.

Construction equipment and materials would displace water column EFH, managed species, and their prey. Under Alternative 1 and Alternative 3 there would be no dredging of sand from the offshore environment and no offshore impact to water quality.

The nature and intensity of stressors affecting water column EFH under Alternative 2 would be identical to prior permitted actions.

4.3 Benthic Essential Fish Habitat

The only sedimentary habitat type within the proposed action area is unconsolidated sand. Under Alternative 1 and Alternative 3 the exposed habitat is restricted to the mixing zone of an active beach coastline. Bottom dwelling invertebrates provide a critical link in the productivity of the marine waters off of Wallops Island. The benthos includes organisms that live on the sediment surface (epifauna) such as sea stars and sand dollars, as well as organisms that live within the sediment (infauna) such as clams and worms. The majority of the benthos live in the upper 6 in of sediment. Benthic organisms are an important food resource for fish, including those caught by recreational and commercial fishermen. Beach renourishment substantially impacts the native infauna and epifauna, and the consequences range from short term within backpassing and renourishment areas to permanent underneath the breakwaters.

4.3.1 Affected Environment

4.3.1.1 Geology and Coastal Processes

4.3.1.1.1 Onshore and Nearshore Geology and Coastal Processes

The interaction of wave, wind, and tidal energies determine how erosional and depositional processes shape coastlines. Wallops Island is one of the twelve Virginia barrier islands fronting the Atlantic Ocean. Though it displays generally similar morphologic features as neighboring islands shaped by mixed energy conditions (i.e., sedimentary processes driven by the interplay of waves and tide), localized processes occurring over both the short- and long-term have led to Wallops Island being distinct from others in the Virginia barrier island chain. In general, the net sediment transport along the Virginia barrier islands is from north to south. However, along much of Wallops Island, the direction of net longshore sediment transport is toward the north, due in most part to the growth (and resulting wave sheltering effects) of Fishing Point at the south end of Assateaugue Island (King, Ward, Williams, & Hudgins, 2010). In addition to the northerly sediment transport, the westward drift of Chincoteague Inlet ebb shoals in the cross shore direction is contributing to the rapid growth of north Wallops Island beach. This sediment accumulation is changing the existing north-south shoreline orientation to one that is much more east-west.

Of the Virginia barrier islands, Wallops Island is the only one that has been nourished. With the exception of federally sponsored recreational beach parking area repairs on south Assateague Island, the others are managed for conservation purposes and are driven by natural forces. Sediment samples collected on Wallops Island in 2007 and 2009 indicated native median grain sizes ranging from approximately 0.18 to 0.27 millimeter (mm), corresponding to fine sand per the American Society for Testing and Materials (ASTM) unified classification system. Samples collected during the initial beach fill indicate that the sediment within the nourished portion of the beach is coarser, with median grain sizes between approximately 0.28 and 0.54 mm, corresponding to fine to medium sand per ASTM (NASA, 2013).

4.3.1.2 Benthos

Air-breathing crustaceans such as ghost crabs dominate the uppermost zone of the Wallops Island beach, while the swash zone is dominated by isopods, amphipods, polychaetes, and mole crabs (*Emerita talpoida*). Below the mid-tide line is the surf zone where coquina clams (*Donax variabilis*), other shellfish, and a variety of amphipods are prevalent. All such organisms are important prey species for a variety of waterbirds and fish. Consequences to onshore and intertidal infauna and epifauna range from short term to permanent and studies reviewed in preparing the *Final SRIPP PEIS* indicated that filled beaches can be devoid of living benthos for up to a year following project completion.

Because the proposed action area was renourished in the past, the biological community of onshore and intertidal infauna and epifauna was previously impacted during those past actions. The immediate baseline condition is, therefore, currently degraded relative to adjacent non-renourished beaches, or relative to the pre-intervention conditions at Wallops Beach.

4.3.2 Environmental Consequences

Under Alternative 1 and Alternative 3 the intertidal and supratidal sand habitat would be impacted by breakwater construction, sand removal, or sand placement. The footprint of the breakwaters would be permanently converted to approximately 0.34 ac of new hardbottom habitat. However, because the regional coastline has very little hardbottom habitat in the surf zone the potential direct benefits to designated EFH or managed species would be minimal. In terms of geological resources, there would be no net change in the beach habitat and nearshore surf zone EFH.

The nature and intensity of physical disturbance and turbidity stressors imposed by the proposed action would be essentially identical to previous consultations and renourishment actions at WFF. Alternative 1 and Alternative 3 would only affect surf zone habitat, while Alternative 2 would also affect approximately 206 ac of offshore shoal habitat. Consequences to onshore and intertidal infauna and epifauna range from short term to permanent. At minimum, a conservative estimate is that it could take several seasons for impacts to onshore and intertidal infauna and epifauna in the excavated backpassing area to recover. In particular, *Donax spp*., could be suppressed in the intertidal zone due to the removal of source material and heavy equipment compaction of the borrow area. By the time renourishment action would likely occur, the affected areas would likely have regained habitat value. However, the proposed project would again disturb the same area and prolong the recovery cycle for up to several seasons, though the spatial extent of the impacted area would not expand (as compared to backpassing within the previously undisturbed area) (USFWS, 2016).

4.4 OTHER ELEMENTS OF ESSENTIAL FISH HABITAT

There is no submerged aquatic vegetation, salt marshes, mudflats, or hardbottom in or adjacent to the proposed action area. Habitat in the inshore waters of the Atlantic Ocean could conceivably be affected by turbidity and vessel traffic but no other direct or indirect stressors would be imposed by the proposed action. Impact is possible but not probable. The footprint of the breakwaters would be permanently converted from sand to approximately 0.34 ac of new hardbottom habitat. However, because the regional coastline has very little hardbottom habitat in the surf zone the potential direct benefits to designated EFH or managed species would be minimal.

5.0 CONSEQUENCES TO EFH FUNCTIONS AND VALUES

Water column and benthic unconsolidated sediment EFH may be adversely affected by turbidity and water quality stressors and by physical strike and disturbance stressors.

5.1 DIFFERENTIAL CONSEQUENCES TO ESSENTIAL FISH HABITAT FUNCTIONS AND VALUES

Alternative 1 and Alternative 3 expose stressors to water column EFH relatively evenly, and any differential consequences would be small. Breakwater construction under Alternative 3 exposes seafloor EFH to intense and highly localized stressors. Except for this aspect of Alternative 1 and Alternative 3, seafloor EFH would be exposed to stressors relatively evenly. EFH at the offshore unnamed shoal A would be exposed to stressors under Alternative 2 that are essentially identical to prior permitted actions.

5.1.1 SPAWNING

No differential consequences to spawning functions would be expected under any alternative.

5.1.2 NURSERY

No more than minimal impacts to nursery functions would be expected under any alternative. The main exposure to project-related stress would temporary as organisms transit the project area through the Chincoteague Inlet.

5.1.3 FORAGE

Differential consequences to forage value could impact sight-reliant feeders. However, adverse impacts are expected to be no more than minimal, temporary, and highly localized under any alternative.

5.1.4 SHELTER

No differential consequences to shelter functions would be expected under any alternative. Alternative 3 would create some new shelter within the approximately 0.34 ac (0.14 ha) breakwater. However, because the regional coastline has very little hardbottom shelter habitat in the surf zone the potential direct benefits of enhanced shelter would likely be minimal.

5.2 DIFFERENTIAL CONSEQUENCES TO MANAGED SPECIES

Relatively few differential consequences to managed species would be expected under Alternative 1 and Alternative 3. Most managed species are highly mobile, and should be able to quickly avoid or exit affected areas. In many other aspects, the area affected under Alternative 1 and Alternative 3 is not differentially valuable to managed species (e.g., the area is shallower than preferred, or offers unsuitable shelter).

Neonate/early juvenile sandbar sharks, and juvenile/adult summer flounder tend to congregate in estuaries, therefore, temporary differential impacts would be possible under all alternatives as the fish transit the project area through the inlet. Sand tiger sharks feed on crabs; differential impacts to forage habitat quality would be possible under all alternatives, but adverse impacts to either species are expected to be temporary and highly localized.

Dredging at the offshore unnamed shoal A under Alternative 2 would have differential consequences to all demersal managed species (e.g., flatfish, dogfish, angel shark). The overall direct and indirect consequences would be essentially identical to prior permitted actions.

5.3 Overall Consequences to Essential Fish Habitat

Water column and benthic unconsolidated sediment EFH may be adversely affected by turbidity and water quality stressors and by physical strike and disturbance stressors. The main temporary impact of turbidity stressors is to water column EFH functions and values for sight-reliant organisms (e.g., feeders and predator escape). However, adverse impacts are expected to be temporary and highly localized and substantially less than in previous consultations because the methods of Alternative 1 and Alternative 3 would not produce a similarly intense turbidity plume. Consequences under Alternative 2 would be identical to prior permitted actions.

Overall, adverse impacts to EFH would be no more than minimal because the consequences of turbidity and water quality stressors would be minimal and temporary to short term. Adverse impacts of benthic habitat disturbance would be long-term or permanent, but no more than minimal because the consequences affect a negligible portion of EFH in the region and because most of the affected area would remain available to the same suite of organisms.

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APPENDIX F
THREATENED AND ENDANGERED SPECIES CONSULTATION

[Appendix currently contains correspondence from NASA to regulators, responses will be added to this appendix once consultation is complete]

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337

Reply to Attn of: 250.W

September 27, 2018

Ms. Kimberly Damon-Randall
Deputy Regional Administrator
Northeast Region
Protected Resources Division
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, Massachusetts 01930-2276

Dear Ms. Damon-Randall:

Per our recent conversation with Mr. Brian Hopper of your staff, this correspondence serves as the National Aeronautics and Space Administration's (NASA) notification to the National Marine Fisheries Service (NMFS) Protected Resources Division of its proposed Shoreline Enhancement and Restoration Project at Wallops Flight Facility (WFF), Wallops Island, Virginia.

As you are aware, on August 3, 2012, NMFS issued NASA a *Biological Opinion on the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (SRIPP BO)* and issued an amendment to the SRIPP BO on September 26, 2014. Due to storm- and wave-induced erosion of the beach berm and dune system, renourishment of the Wallops Island beach is needed again, as was analyzed in the *SRIPP BO*. Therefore, the purpose of this correspondence is to request NMFS concurrence regarding the level of Endangered Species Act (ESA) consultation required to conduct the work, especially in consideration of the 2010 *Biological Assessment Shoreline Restoration and Infrastructure Protection Program,* August 2011 *Supplemental Biological Assessment Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program,* (collectively, *SRIPP BAs*), the *SRIPP BO*, and consultation letters dated March 7, 2013, and August 15, 2014.

Similar to the last two beach fill events, NASA had considered multiple borrow area alternatives, including obtaining the necessary sand from offshore shoals in Federal waters, which would require authorizations from both the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) and the U.S. Army Corps of Engineers (USACE). Therefore, both BOEM and USACE are serving as cooperating agencies on this project. The BOEM has jurisdiction over mineral resources on the Federal Outer Continental Shelf (OCS) and would enter into a negotiated agreement with NASA and USACE pursuant to section 8(k)(2)(d) of the OCS Lands Act. Under Section 404 of the Clean Water Act (CWA), the USACE Regulatory Program has jurisdiction over the disposal of dredged and fill material in Waters of the U.S. Similarly, under Section 10 of the Rivers and Harbors of Act of 1899, the USACE has jurisdiction over the placement of structures and work conducted in navigable waters of the U.S. and would issue a permit to enable the proposed project. Finally, in addition to its regulatory role in the project, the USACE Norfolk District is overseeing project design, construction, and monitoring on NASA's behalf.

To this end, NASA has assumed the role of Lead Federal Agency for ESA compliance and both BOEM and USACE are participating in NASA's ESA consultation. The effects of their actions are considered in all project documents, including this correspondence.

Background

On December 13, 2010, NASA issued a Record of Decision (ROD) for the *Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program Programmatic Environmental Impact Statement*, hereafter referred to as the *2010 Final SRIPP PEIS*. The primary goal of the SRIPP is to reduce direct damage to Wallops Island's infrastructure; however, its true benefit is the continued use of the island to support the aerospace programs that are at the core of WFF's mission (**NASA, 2010**). In its ROD, NASA selected *Alternative One: Full Beach Fill, Seawall Extension* and adopted a suite of mitigation and monitoring protocols to both reduce potential environmental impacts and track project performance. Implementing the initial phase of Alternative One entailed: 1) the placement along the Wallops Island shoreline of approximately 3.2 million cubic yards (yd^3) of sand dredged from Unnamed Shoal A located in the Atlantic Ocean; and 2) an initial 1,430-foot (ft) southerly extension of the Wallops Island rock seawall with future extensions completed on a funds-available basis to a maximum length of 4,600 ft. An estimated nine beach renourishment cycles at approximately five-year intervals would be implemented (**NASA, 2010**). The ROD stated that fill material for future renourishment cycles could be taken from either Unnamed Shoal A, Unnamed Shoal B, or north Wallops Island beach and left the specifics of how and when the fill material was obtained to be addressed in future action-specific NEPA documentation.

Hurricane Sandy made landfall in October 2012. Monitoring surveys following the storm event identified the need to repair a section of the seawall and the southern two-thirds of the recently nourished beach. Public Law 113-2, *Disaster Relief Appropriations Act, 2013*, was signed into law on January 29, 2013. The bill included a provision for NASA to repair facilities that sustained damage during the Hurricane. NASA signed a Finding of No Significant Impact (FONSI) on June 6, 2013 for the *Wallops Island Post-Hurricane Sandy Shoreline Repair Final Environmental Assessment* (**NASA, 2013**), hereafter referred to as the *2013 Final Post-Hurricane Sandy EA*. Repairs to the seawall and beach renourishment were completed in September 2014. Subsequent storms in 2015 (Hurricane Joaquin) and in 2016 (Winter Storm Jonas) have reduced the sand volume to approximately 43 percent of the design levels (**NASA, 2018**). Additional sand volume reduction occurred most recently in 2018 with Winter Storm Riley.

Description of Proposed Action

The beach system constructed under the SRIPP has served its intended purpose of reducing damage to the range assets. However, a notable portion of sub-aerial (i.e., on land surface) sand has been relocated by storm winds and waves with a majority of this sand volume transported to the north end of Wallops Island as was expected and analyzed in the 2010 PEIS/ROD. The effects of storms are most apparent within the southern half of the Wallops Island beach, where many of the most critical launch assets are located. Within this area, the seaward half of the beach berm has been lowered by up to 3 ft. or more. As such, the beach berm and dune system can no longer provide the level of storm damage reduction for which it was originally intended and must be repaired to regain full functionality.

NASA is currently proposing to renourish the beach along the Wallops Island shoreline infrastructure protection area with sand recycled, or "backpassed", from the north end of Wallops Island. Before the renourishment, NASA would construct a series of parallel nearshore breakwater structures that would reduce the intensity of wave action and slow sediment transport. Though obtaining fill material from the north end of Wallops Island is the preferred alternative for this nourishment event, the use of offshore sand resources are still considered as alternatives for this and future nourishment events.

The proposed action and alternatives are described in the 2018 *NASA WFF Shoreline Enhancement and Restoration Project Environmental Assessment*, hereafter referred to as the *2018 SERP EA*. Elements of *2018 SERP EA* Alternative 1 (backpassing sand) and Alternative 3 (construction of breakwaters) that would be relevant to ESA analysis are summarized in the following abridged sections. Full details are in the *2018 SERP EA* are hereby incorporated by reference.

Construction of Nearshore Detached Parallel Breakwaters

Nearshore breakwaters reduce both the amount of storm related wave energy reaching protected beach areas and the rate of longshore sediment transport, thereby increasing the longevity of a beach fill project. NASA is proposing to construct a series of rubble mound breakwaters approximately 200 ft. offshore from the renourished shoreline mean high water (MHW) line (**Figure 1**). Each breakwater would be constructed of Virginia Department of Transportation (VDOT) Type I stone for the outer layer which ranges from 0.75 to 2 tons and VDOT Class II Stone for the core layer which range from 150 to 500 pounds. All stone would be placed parallel to the shore and would measure approximately 130 ft long and 10 ft wide at top crest elevation. The breakwaters would be placed approximately 100 ft apart from each other. Water depths in these areas is approximately 4 to 8 ft. The initial breakwaters would be placed offshore of Launch Pad 0B and continue north to the Horizontal Integration Facility (HIF) (Building X-079). Depending upon economic, engineering, and environmental factors, additional series may be added (Error! Reference source not found.). Note that the area highlighted in Error! Reference source not found. is broadly indicative of potential breakwater location and dramatically overstates the actual affected area.

The rocks for constructing each breakwater would be transported to the WFF area by rail, offloaded, and then trucked to the handling or placement site on Wallops Island. Construction, estimated to last approximately 1 month, would take place in the water using a barge and heavy lifting equipment. These breakwaters would be permanent structures as removal would be impractical and cost prohibitive (**NASA, 2010**). Construction of the offshore breakwaters would be completed prior to starting beach renourishment.

Construction-related stressors imposed on ESA species include nearshore turbidity and water quality. Artificial lighting, noise, ingestion, entanglement, and chemical stressors are not imposed by construction – or are not meaningfully increased above background, and these stressors would not be carried forward in this analysis.

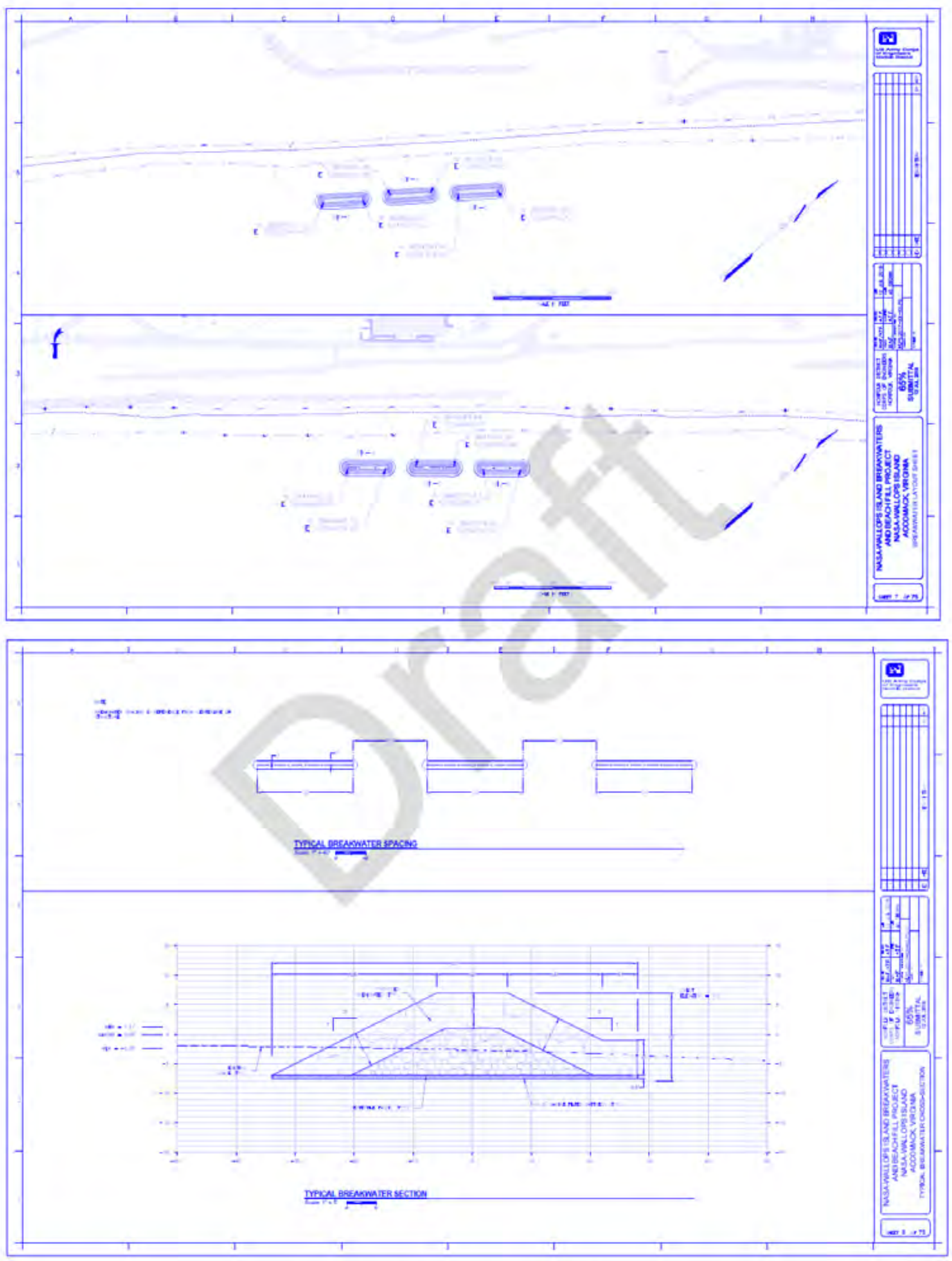

Figure 1: Breakwater Layout and Typical Cross Section

Figure 2: Full Possible Extent of Breakwater Locations

Beach Renourishment

The beach renourishment fill template (**Figure 3**) requires approximately 1.3 million yd^3 of sand material to restore the shoreline areas that have sustained berm and dune system reductions. Either the sand for renourishment would come from north Wallops Island beach (Alternative 1), or would come from unnamed shoal A (Alternative 2). The less efficient methods of offshore dredging would require collection of 1.625 million yd^3 to meet the 1.3 million yd^3 fill template.

North Wallops Island beach (**Figure 4**) has been accreting due to wind and wave transport of material from the south; mechanically moving sand from the north end of the island back south to the restoration area is called "backpassing" (Alternative 1). Sand collected from north Wallops Island beach would be transported by truck to the renourishment area (**Figure 3**). Truck haul under backpassing does not require large volumes of water needed to transport sand in a slurry through a pipeline, and, therefore, does not impose the associated turbidity and water quality stressors associated with offshore dredging. The highly efficient method of backpassing would require collection of approximately 1.3 million yd^3 of sand to meet the 1.3 million yd^3 fill template. The most relevant aspect of backpassing to ESA is that none of the source sand would be essential fish habitat, and none of the collection and transport methods intersect with ESA. Taken together, the impacts and stressors imposed on ESA and managed species through backpassing sand would be substantially less than offshore sources, as described in previous consultations

Figure 3: Approximate Sand Placement Area

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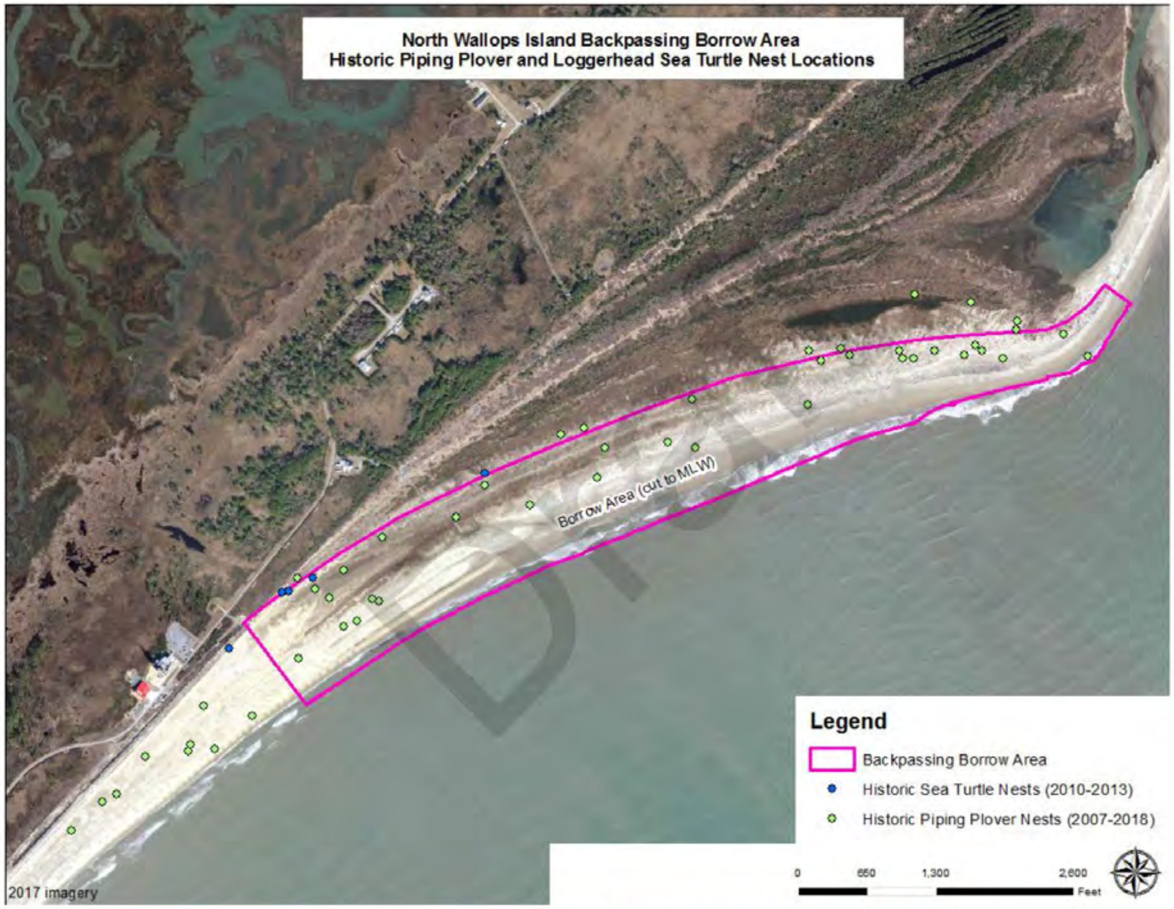


Figure 4: Backpassing Area with Historic Piping Plover and Loggerhead Sea Turtle Nest Sites

Elements relevant to ESA of renourishment with sand from unnamed shoal A were extensively documented in the SRIPP and Post-Sandy actions. Approximately 515 acres of unnamed shoal A were used in the SRIPP and Post-Sandy actions to source 3.2 million and 800,000 yd^3 of sand, respectively. The current backpassing proposal would avoid the use of approximately 206 additional acres of the shoal's 1,800 acre borrow area to source 1.625 million yd^3 of sand from unnamed shoal A.

Fill placement-related stressors imposed on ESA and managed species related to backpassing sand include nearshore turbidity and water quality. Other stressors imposed by fill placement (i.e., artificial lighting, noise, and chemical stressors) are not relevant because their nature and magnitude would be discountable, stressor and receptor are not co-located, and ESA and managed species have little-to-no meaningful susceptibilities in this context.

Post-Renourishment Activities

Additional activities would include post-renourishment installation of sand fencing and planting dune grasses. It would be NASA's intent to re-use as much of the existing sand fencing as possible. Therefore, the proposed project would include removing the existing sand fencing, stockpiling it until the beach fill is complete, and then re-installing it as needed. It is expected that a majority of the existing dune grass within the work site would be covered with sand, therefore requiring re-planting.

Description of the Action Area

The action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR §402.02). For this project, the action area includes the portion of Atlantic Ocean from the edge of Wallops Island shoreline and adjacent to the outboard side of the proposed breakwater structures (see Error! Reference source not found.), all areas in the immediate vicinity of the shoreline renourishment project to account for suspended sediment, and the surrounding area where any increase in vessel traffic may occur. Previous studies have reported that elevated total suspended sediment (TSS) concentrations associated with the type of shoreline restoration proposed for the breakwater construction are limited to areas within the swash zone (defined as the area of the nearshore that is intermittently covered and uncovered by waves) and close to where renourishment sand is being placed (**Wilber et al., 2006; Burlas et al., 2001**). Thus, elevated suspended sediment levels are expected to occur only in the swash zone and in bottom waters in the immediate vicinity of shoreline restoration and would be contained within the study area indicated in **Figure 3**. This area is expected to encompass all of the effects of the proposed project. No aquatic resources will be exposed to the effects of land-based activities and, thus, will not be considered further.

Status of Species within the Action Area

In preparing the *SRIPP BAs*, NASA determined that project activities may affect the following species under NMFS's jurisdiction:

Table 1. Listed Species Which May Exist within the Action Area

Common Name	Scientific Name	ESA Status
Atlantic sturgeon	*Acipenser oxyrhinchus oxyrhinchus*	Endangered
Green sea turtle (North Atlantic DPS)	*Chelonia mydas*	Threatened
Hawskbill sea turtle	*Eretmochelys imbricata*	Endangered
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	*Caretta caretta*	Threatened
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
North Atlantic right whale	*Eubalaena glacialis*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Sperm whale	*Physeter macrocephelus*	Endangered

Key: DPS = distinct population segment

The SRIPP BO considered the effects of offshore dredging and beach renourishment on these listed species, and based on these effects, also includes an Incidental Take Statement (ITS) for those species that may be adversely affected, but not jeopardized, by the SRIPP. More specifically, the ITS exempts the take of 9 sea turtles and 2 Atlantic sturgeon during these operations over the 50 year life of the SRIPP. A separate, 2010 USFWS SRIPP BO addressed ITS associated with onshore renourishment activities.

Two sea turtle nests were discovered in each year 2010, 2012, and 2013. **Figure 5** displays historic sea turtle nesting sites in relation to the backpassing area and proposed breakwaters. No sea turtle activity has been found on Wallops Island since 2013, indicating that the individuals which previously utilized Wallops Island for nesting may be deceased or have begun nesting elsewhere.

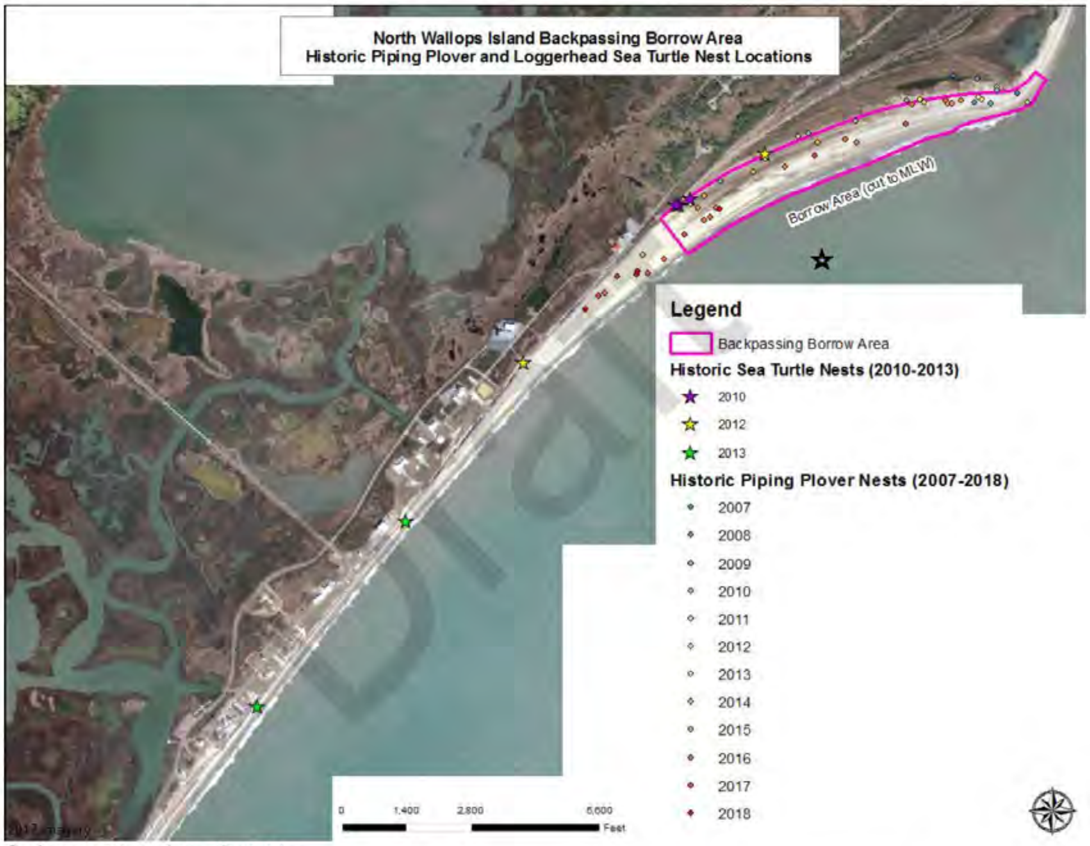
The giant manta ray (*Manta birostris*) was recently listed as threatened in January of 2018. According to **NOAA (2018)**, the giant manta ray is the world's largest ray with a wingspan of up to 29 ft and can weigh up to 5,300 pounds. Giant manta rays are slow-growing, migratory animals with small, highly fragmented populations that are sparsely distributed across the world. It has the potential to be within the offshore borrow area during the summer months. It is found worldwide in tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and near productive coastlines. It has been found in waters as cool at 66° F and has been observed in estuarine waters near oceanic inlets (**NOAA, 2018**).

Manta rays primarily feed on planktonic organisms such as euphausiids, copepods, mysids, decapod larvae, and shrimp, but some studies have noted their consumption of small and moderately sized fishes as well. During feeding, giant manta rays may be found aggregating in shallow waters at depths less than 33 ft; however, tagging studies have also shown that the species conducts dives of up to 650 to 1,500 ft and is capable of diving to depths exceeding 3,200 ft. This diving behavior may be influenced by season and shifts in prey location associated with the thermocline (**NOAA, 2018**).

Effects of the Action on Listed Species

Impacts on listed species from renourishment would be the same as those discussed in the *SRIPP BAs* and *SRIPP BO* NMFS issued to NASA; therefore, this analysis focuses only on potential impacts from backpassing sand and the construction of the breakwaters as described below.

Figure 5: Historic Loggerhead Sea Turtle Nesting Locations on Wallops Island



Sediment Disturbing Activities

Construction of the breakwaters would have the potential to result in sediment suspension during placement of the materials (e.g., marine mattresses, armor stone) and the movement of construction barges and vessels. Increases in suspended sediment would be temporary, localized, and would dissipate upon cessation of sediment disturbing activities. To construct the breakwater segments, each prefabricated geotextile marine mattresses would be floated out to its final location, and then lowered to the bottom by the weight of large rocks to minimize sediment resuspension. Rocks would be placed inside the geotextile mattress in a manner that limits sediment resuspension. Rocks used for armoring and to construct the breakwaters would be made of "clean" material, further minimizing the potential for release of suspended material into the water column. Crane barges would be continually moved during construction, and vessels carrying construction materials. Construction vessels would maintain at least 2 ft of clearance from the bottom of the ocean, or work only at tide levels sufficient to keep the barges off the ocean bottom to further minimize sediment disturbance. Expected increases to suspended sediment concentrations related to vessel activity during construction would likely be minimal relative to background levels.

Temporary increases in suspended sediment would occur during the sand harvesting backpassing and during the shoreline renourishment components. However, these components would be conducted from land using bulldozers, frontend loaders, and excavators rather than from a discharge pipe. As such, the shoreline restoration would use sand and not a slurry mixture. Any increase in turbidity would be expected to be limited to the swash zone and bottom waters in the immediate vicinity of the placement site and would be temporary and localized. Sediment suspended during the sand harvesting and placement activities would dissipate quickly upon completion of those actions. The majority of the sand harvesting and shoreline restoration areas would be above mean low water (MLW), and the sand harvesting and placement and subsequent grading would be conducted from land. To minimize potential impacts to aquatic resources, the equipment would likely concentrate on the intertidal and subtidal zones during low tide, whereas during high tide, work would be focused on the upper beach berm and dune. After each section of beach is confirmed to meet design criteria, the process would continue in the longshore direction.

TSS would most likely affect sea turtles, subadult and adult Atlantic sturgeon, or giant manta rays if a plume causes a barrier to normal behaviors or if sediment settles on the bottom affecting prey of these species. While the increase in suspended sediments may cause Atlantic sturgeon, giant manta rays, and sea turtles to alter their normal movements, any change in behavior would not able to be measured or detected, as it would only involve minor movements that alter their course out of the sediment plume which would not disrupt any essential life behaviors. As sturgeon, rays, and sea turtles are highly mobile, they are likely able to avoid any sediment plume. Temporary increases in suspended sediment during construction of the breakwaters would be below thresholds shown to have an adverse effect on fish (580.0 milligrams per liter [mg/L] for the most sensitive species, with 1,000.0 mg/L more typical; see summary of scientific literature in **Burton, 1993**) and benthic communities (390.0 mg/L [**USEPA, 1986**]). Thus, any potential effects of sediment disturbance to sea turtles, giant manta rays, or sturgeon would be too small to be meaningfully measured or detected and are insignificant.

Project Vessels

In this analysis, three elements were considered: (1) the existing baseline conditions, (2) the action and what it adds to existing baseline conditions, and (3) new baseline conditions (the existing baseline conditions and the action together). NASA has determined that vessel traffic added to baseline conditions as a result of the proposed project would not be likely to adversely affect ESA-listed species for the following reasons.

Adding project vessels (e.g., barges during breakwater construction) to the existing baseline would not increase the risk that any vessel in the area would strike an individual, or would increase it to such a small extent that the effect of the action (i.e., any increase in risk of a strike caused by the project) cannot be meaningfully measured or detected. During the project activities, a minimal number of project vessels would be added to the baseline. Therefore, the increase in traffic associated the proposed project would be extremely small. The addition of project vessels would also be intermittent, temporary, and restricted to a small portion of the overall action area on any given day. Additionally, **Pace and Silber (2005)** found that the probability of death or serious injury to large whales increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 percent to 75 percent as vessel speed increased from 10 to 14 knots, and exceeded 90 percent at 17 knots. Since, all barges would steam to construction locations at slow rates of speed or would remain almost stationary during construction activities, any increased risk of a vessel strike caused by the project would be too small to be meaningfully measured or detected. As a result, the effect of the action on the risk of a vessel strike in the action area would be insignificant.

In-water/Over-water Structures and Material Placed on Bottom/Shoreline

Breakwaters

Breakwaters would extend approximately 7 ft above MHW. Two sets of three breakwaters are initially proposed along the mid (HIF) and southern portions (Launch Pad 0B) of Wallops Island (**Figure 2**). As funding allows, more breakwaters may be installed in the approximately 40-acre area. Unlike the sand backpassing portion of the project, breakwater construction will not subject to time-of-year restrictions.

Each breakwater would be approximately 130 ft long and would displace approximately 7,580 yd^3 with approximately 4,700 yd^3 below MWH. Each breakwater in a set of three would be separated by 100 ft from the next, with the total set occupying an approximately 35,400-square foot (0.8-acre) footprint. Together the initial six segments would be approximately 780 ft long, permanently converting approximately 0.34 acres from sand to new hardbottom habitat and resulting in the placement of approximately 45,500 yd^3 of stone in the ocean, of which 28,200 yd^3 would be below MHW. The two initial sets of three breakwaters (i.e., oceanward of Launch Pad 0B and the HIF) would be separated from each other by approximately 12,000 ft.

It is important to note that breakwaters have been shown to impact the ingress and egress of nesting sea turtles and the egress of hatchlings. Aside from the physical obstruction of the breakwater blocking access to the beach for the mother and the open ocean for both the mother and emergent hatchlings, the structures can redirect the direction of the turtles and possibly point them towards a light source. Hoggard **(1991**), describes sea turtle hatchlings which emerged from their nest who apparently swam the length of a 300 meter breakwater off Biloxi, Mississippi only to be misdirected by the bright lights of a marina just off the terminus of the breakwater. Three live hatchlings were recovered inside the marina. In the long term, longshore transport will be altered by the breakwaters and may enhance or denigrate nesting habitat for sea turtles on Wallops Island. However, modeling by the Corps of Engineer suggests that the borrow area would recover in 5 to 6 years from continued northerly sediment transport even with the breakwaters in place. (**A. Farrow, personal communication 2018**).In the short term, it is unlikely that six breakwaters with a total length of 780 ft (4 percent of the 19000 foot replenishment project) will provide a significant impediment to sea turtle ingress and egress to and from the beach.

Backpassing and Beach Renourishment

The proposed project would restore approximately 19,000 ft of shoreline. Of the approximately 230 acres of renourished area, approximately 140 acres would be below MHW. About 1.3 million yd^3 of sand would be harvested from across 200 acres on the north end of Wallops Island and mechanically moved to the renourishment area to establish a wider beach in what is currently a narrow and erosion-prone section of the island.

Benthic organisms living in the sandy beach area of Wallops Island would experience direct mortality from the sand removal on the north end and relocation to the renourishment area. This would be due to disturbance and crushing from excavators removing sand and burial in the renourishment area. The physical oceanographic conditions would be essentially unchanged, and after the renourishment reaches equilibrium, there would be no net change in the physical environment available for benthos.

Recovery time of benthos within the surf zone would likely be short given the dynamic conditions within the nearshore and surf zones. **Burlas *et al.* (2001)** estimated that the recovery time for benthos in a New Jersey study ranged from approximately 2 to 6 months when there is a good match between the fill material and the natural beach sediment. **Dalfsen and Essink (2001)** noted that recolonization is generally defined by two patterns: the rapid development of "opportunistic" species, and the subsequent recovery of community composition and structure. It is expected that organisms from adjacent areas would recolonize the new beach. Additionally, backpassed material would not be substantially different than native material, and some benthic organisms may survive in the transition to the renourished area; therefore, it is expected that recovery would occur over a relatively short time (i.e., on the order of 6 to 12 months post-project).

Effects Determination

Sea Turtles: Effects on in-water sea turtles could include interaction with the sediment plume, reduction in available forage, disturbance due to vessel created sounds, and ingress and egress for adult females and hatchlings around breakwater.. The construction of breakwaters could potentially cause disturbance and area avoidance by sea turtles, depending on the time of year construction was initiated. Additionally, if work continued throughout the night, lighting would cause confusion for sea turtle hatchlings traveling to the water. The area offshore of Wallops Island would be considered to be marginal as sea turtle habitat, and observations of sea turtles in these waters are infrequent.

Table 2. Recorded Sea Turtle Nesting on Wallops Island Beaches

Year	Species	Number of Nests
1979	Loggerhead (*Caretta caretta*)	1
1982	Loggerhead (*Caretta caretta*)	1
1989	Loggerhead (*Caretta caretta*)	1
2002	Loggerhead (*Caretta caretta*)	1
2008	Loggerhead (*Caretta caretta*)	1
2010	Loggerhead (*Caretta caretta*)	4
2012	Loggerhead (*Caretta caretta*)	2
2013	Loggerhead (*Caretta caretta*)	2

Nesting on Wallops Island beaches is infrequent as well. From 1979 to 2008, a total of five loggerhead sea turtle nests occurred on Wallops Island. A flurry (for Wallops Island) of nesting occurred from 2010 to 2013. The USFWS performed genetic testing on eggs taken from nests from this period. The same individual dug the six nests in 2010 and 2012, while a different female(s) was responsible for the 2013 nests. (**K. Holcomb, personal communication 2018)** No loggerhead sea turtle nesting activity has occurred on Wallops Island since 2013, suggesting that the individuals which previously utilized Wallops Island for nesting may be deceased or have begun nesting elsewhere. Sea turtles species are considered to occur within the study area, although only loggerhead sea turtles have nested on Wallops Island.

Impacts to nesting sea turtles could include avoided nesting attempts due to nighttime construction activity (particularly artificial lighting) on the beach, disorientation of hatchlings (due to project-related light sources), obstruction to hatchlings during their emergence and subsequent trip to the ocean, or loss of beach habitat. Given that the beach fill material from backpassing would be from sourced from Wallops Island, it is not expected that fill material would affect sea turtle nesting success. In fact, sea turtle nesting occurred on the new Wallops Island dune during the initial beach fill, indicating that it is very possible that the additional elevated beach provides suitable nesting habitat, a net benefit to the species.

Consistent with the monitoring proposed for piping plovers and red knots, NASA's biological monitor would also survey the work site for signs of sea turtle nesting activity. Should a nest be detected within the work site, the daily surveys would continue throughout the hatch window until the last hatchlings emerge. Additionally, situation-specific mitigation measures, which could include shading nests from artificial light or establishing defined emergence corridors, would be developed in consultation with USFWS should a nest be identified within an active work site.

Atlantic Sturgeon: Effects on sturgeon would be similar to those of in-water sea turtles and could include interaction with the sediment plume, reduction in available forage, and disturbance due to vessel created sounds. However, given the limited number of sturgeon expected to use the breakwater area as habitat and the limited portion of available habitat that would be affected, the potential for interaction would be limited.

Direct mortality of all benthos within the footprint of breakwater construction would be likely. The footprint of the breakwaters would be permanently converted from sand to approximately 0.34 acres of new hardbottom habitat. However, because the regional coastline has very little hardbottom habitat in the surf zone the concept of recovery is not applicable and colonization of the breakwaters would provide habitat for an essentially novel community of benthos. Potential direct benefits to native benthos would be minimal, but the breakwaters would provide attachment points for sessile creatures, refuge and cover for mobile macrobenthos, such as polychaete worms or amphipods, and could offer some minor beneficial impacts in the long term.

Existing benthic habitat displaced by the initial breakwater construction would lessen forage available for Atlantic sturgeon. However, there is no indication that the study area could provide unique ecological opportunities; the loss of this specific bottom forage habitat would happen sequentially over the 6 to 9 month construction period. Shading may reduce photosynthesis in these areas, which forms the basis of benthic food chains, and may reduce the forage base in the area shaded by the breakwaters.

In addition, subadult and adult Atlantic sturgeons consume a greater proportion of fish in their diets compared to younger life stages and would be expected to forage on and in the vicinity of the breakwater segments. Those sturgeon that do choose to opportunistically forage in the action area would be physically able to shift to other nearby areas in the estuary where the preferred benthic community is more readily accessible. Thus, any potential effects of habitat modification to sturgeon would be too small to be meaningfully measured or detected and are insignificant.

Giant Manta Ray: Impacts to giant manta ray would be similar to those described for in water sea turtles and Atlantic sturgeon and could include interaction with the sediment plume and disturbance due to vessel created sounds. As rays do not forage on benthic organisms, construction of breakwaters would not present a direct impact to food sources. These species are highly mobile and would likely avoid the breakwater construction area during construction activities. Those rays that do choose to opportunistically forage in the action area would be physically able to shift to other nearby areas where zooplankton is more readily accessible. Thus, any potential effects of habitat modification to giant manta rays would be too small to be meaningfully measured or detected and are insignificant.

Should the offshore dredging option be employed, impacts to giant manta rays could expected to be similar or less than impacts to Atlantic sturgeons and sea turtles described in previous SRIPP BO's. While Atlantic sturgeons are bottom feeders and sea turtles often rest on the sea bottom, giant manta rays feed on planktonic and nektonic species throughout the water column and are less likely to be trapped or crushed by the drag head or entrained in the dredge.

Conclusion

In consideration of the scope of the proposed project, listed species known to inhabit the project area, and the potential effects on those species, NASA has determined that the project *may affect, but is not likely to adversely affect* loggerhead sea turtles, Atlantic sturgeon, and giant manta rays. As the proposed action is substantially similar to that considered within the *SRIPP BAs* and subsequent *SRIPP BO*, NASA concludes that reinitiating formal ESA consultation is not necessary. NASA requests NMFS concurrence with this determination.

If you have any questions or require additional information, please contact Ms. Shari Miller of my staff at (757) 824-2327.

Sincerely,

Theodore J. Meyer
Associate Chief, Medical and Environmental Management Division

cc:
228/Mr. J. Saecker
250/Ms. K. Finch
250/Ms. S. Miller
BOEM/Mr. D. Piatowski
USACE/Mr. J. Altuna

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National Aeronautics and
Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, VA 23337

Reply to Attn of: 250.W

September 27, 2018

Ms. Cindy Schulz
Virginia Field Office
U.S. Fish and Wildlife Service
6669 Short Lane
Gloucester, Virginia 23061

Dear Ms. Schulz:

The purpose of this correspondence is to request United States Fish and Wildlife Service (USFWS) concurrence regarding Endangered Species Act (ESA) consultation required to continue and expand beach renourishment activities at the NASA Goddard Space Flight Center's Wallops Flight Facility (WFF) on Wallops Island, Virginia. In consideration of the *2010 Biological Assessment Shoreline Restoration and Infrastructure Protection Program* (**SRIPP BA**; **NASA, 2010a**), the subsequent July 30, 2010 *Programmatic Biological Opinion on the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program* (**2010 PBO**; **USFWS, 2010**), and the subsequent June 22, 2016 *Consolidated Biological Opinion for Wallops Flight Facility Proposed and Ongoing Operations and Shoreline Restoration/ Infrastructure Protection Program* (**2016 BO**; **USFWS, 2016**), NASA requests that this letter serves as informal ESA consultation.
NASA is preparing the *Shoreline Enhancement and Restoration Project Environmental Assessment* (**SERP EA; NASA, 2018**) as a tiered document off of the *2010 SRIPP Programmatic Environmental Impact Statement* (**2010 SRIPP PEIS**; **NASA, 2010b**). The alternatives for beach nourishment considered in the SERP EA include Alternative 1, removal of sand from a north Wallops Island borrow site for shoreline renourishment purposes ("backpassing") and Alternative 2, offshore dredging. As described in the SRIPP BA, the 2010 PBO, and 2016 BO, NASA has considered backpassing as an alternative since its initial consultation under the ESA for the SRIPP PEIS. While offshore dredging has been NASA's preferred alternative for the SRIPP PEIS and subsequent *Final Environmental Assessment: Wallops Island Post-Hurricane Sandy Shoreline Repair* (**Post-Sandy EA**; **NASA, 2013**), the SERP EA would consider backpassing as an equally viable alternative for acquisition of sand for beach nourishment. In addition, consistent with the 2010 SRIPP PEIS, the SERP EA considers the use of offshore breakwaters to reduce erosion and longshore transport. As such, the SERP

EA considers beach nourishment (accomplished either through backpassing or dredging) with and without construction of breakwaters.

Similar to the last two beach fill events, NASA had considered multiple borrow area alternatives, including obtaining the necessary sand from offshore shoals in Federal waters which would require authorizations from both the U.S. Department of the Interior's Bureau of Ocean Energy Management (BOEM) and the U.S. Army Corps of Engineers (USACE). Therefore, both BOEM and USACE are serving as cooperating agencies on this project. The BOEM has jurisdiction over mineral resources on the Federal Outer Continental Shelf (OCS) and would enter into a negotiated agreement with NASA and USACE pursuant to section 8(k)(2)(d) of the OCS Lands Act. Under Section 404 of the Clean Water Act (CWA), the USACE Regulatory Program has jurisdiction over the disposal of dredged and fill material in Waters of the U.S. Similarly, under Section 10 of the Rivers and Harbors of Act of 1899, the USACE has jurisdiction over the placement of structures and work, conducted in navigable waters of the U.S., and would issue a permit to enable the proposed project. Finally; in addition to its regulatory role in the project, the USACE Norfolk District is overseeing project design, construction, and monitoring on NASA's behalf. To this end, NASA has assumed the role of Lead Federal Agency for ESA compliance and both BOEM and USACE are participating in NASA's ESA consultation. The effects of their actions are considered in all project documents, including this correspondence.

The Virginia Department of Game and Inland Fisheries would also be consulted to ensure compliance with all Commonwealth of Virginia requirements.

Background

On December 13, 2010, NASA issued a Record of Decision (ROD) for the 2010 Final SRIPP PEIS. The primary goal of the SRIPP are to reduce direct damage to Wallops Island's infrastructure; however, its true benefit is the continued use of the island to support the aerospace programs that are at the core of WFF's mission (**NASA, 2010b**). In its ROD, NASA selected *Alternative One: Full Beach Fill, Seawall Extension* and adopted a suite of mitigation and monitoring protocols to both reduce potential environmental impacts and track project performance. Implementing the initial phase of Alternative One entailed: 1) the placement along the Wallops Island shoreline of approximately 3.2 million cubic yards (yd^3) of sand dredged from Unnamed Shoal A located in the Atlantic Ocean; and 2) an initial 1,430-foot (ft) southerly extension of the Wallops Island rock seawall with future extensions completed on a funds-available basis to a maximum length of 4,600 ft. An estimated nine beach renourishment cycles at approximately five-year intervals would be implemented (**NASA, 2010b**). The ROD stated that fill material for future renourishment cycles could be taken from either Unnamed Shoal A, Unnamed Shoal B, or north Wallops Island beach and left the specifics of how and when the fill material was obtained to be addressed in future action-specific NEPA documentation.

Hurricane Sandy made landfall in October 2012. Monitoring surveys following the storm event identified the need to repair a section of the seawall and the southern two-thirds of the recently nourished beach. Public Law 113-2, *Disaster Relief Appropriations Act, 2013*, was signed into law on January 29, 2013. The bill included a provision for NASA to repair facilities that sustained damage during the Hurricane. NASA signed a Finding of No Significant Impact (FONSI) on June 6, 2013 for the *Wallops Island Post-Hurricane Sandy Shoreline Repair Final Environmental Assessment* (**NASA, 2013**), hereafter referred to as the *2013 Final Post-Hurricane Sandy EA*. Repairs to the seawall and beach renourishment were completed in September 2014. Subsequent storms in 2015 (Hurricane Joaquin) and in 2016 (Winter Storm Jonas) have reduced the sand volume to approximately 43 percent of the design levels (**NASA, 2018**). Additional sand volume reduction occurred most recently in 2018 with Winter Storm Riley.

Description of the Action

The beach system constructed under the SRIPP has served its intended purpose of reducing damage to the range assets. However, a notable portion of sub-aerial (i.e., on land surface) sand has been relocated by storm winds and waves with a majority of this sand volume transported to the north end of Wallops Island. The effects of storms are most apparent within the southern half of the Wallops Island beach, where many of the most critical launch assets are located. Within this area, the seaward half of the beach berm has been lowered by up to 3 ft. or more. As such, the beach berm and dune system can no longer provide the level of storm damage reduction for which it was originally intended and must be repaired to regain full functionality.

NASA is currently proposing to renourish the beach along the Wallops Island shoreline infrastructure protection area with sand recycled, or “backpassed”, from the north end of Wallops Island. Before the renourishment, NASA would construct a series of parallel nearshore breakwater structures that would reduce the intensity of wave action and slow sediment transport.

The proposed action and alternatives are described in the 2018 *NASA WFF Shoreline Enhancement and Restoration Project Environmental Assessment*, hereafter referred to as the *2018 SERP EA*. Elements of *2018 SERP EA* Alternative 1 (backpassing sand) and Alternative 3 (construction of breakwaters) that would be relevant to ESA analysis are summarized in the following abridged sections. Full details are in the *2018 SERP EA* are hereby incorporated by reference.

Construction of Nearshore Detached Parallel Breakwaters

Nearshore breakwaters reduce both the amount of storm related wave energy reaching protected beach areas and the rate of longshore sediment transport thereby increasing the longevity of a beach fill project. NASA is proposing to construct a series of rubble mound breakwaters approximately 200 ft. offshore from the renourished shoreline mean high water (MHW) line). Each breakwater would be constructed of Virginia Department of Transportation (VDOT) Type I stone for the outer layer which ranges from 0.75 to 2 tons and VDOT Class II Stone for the core layer which range from 150 to 500 pounds. All stone would be placed parallel

4

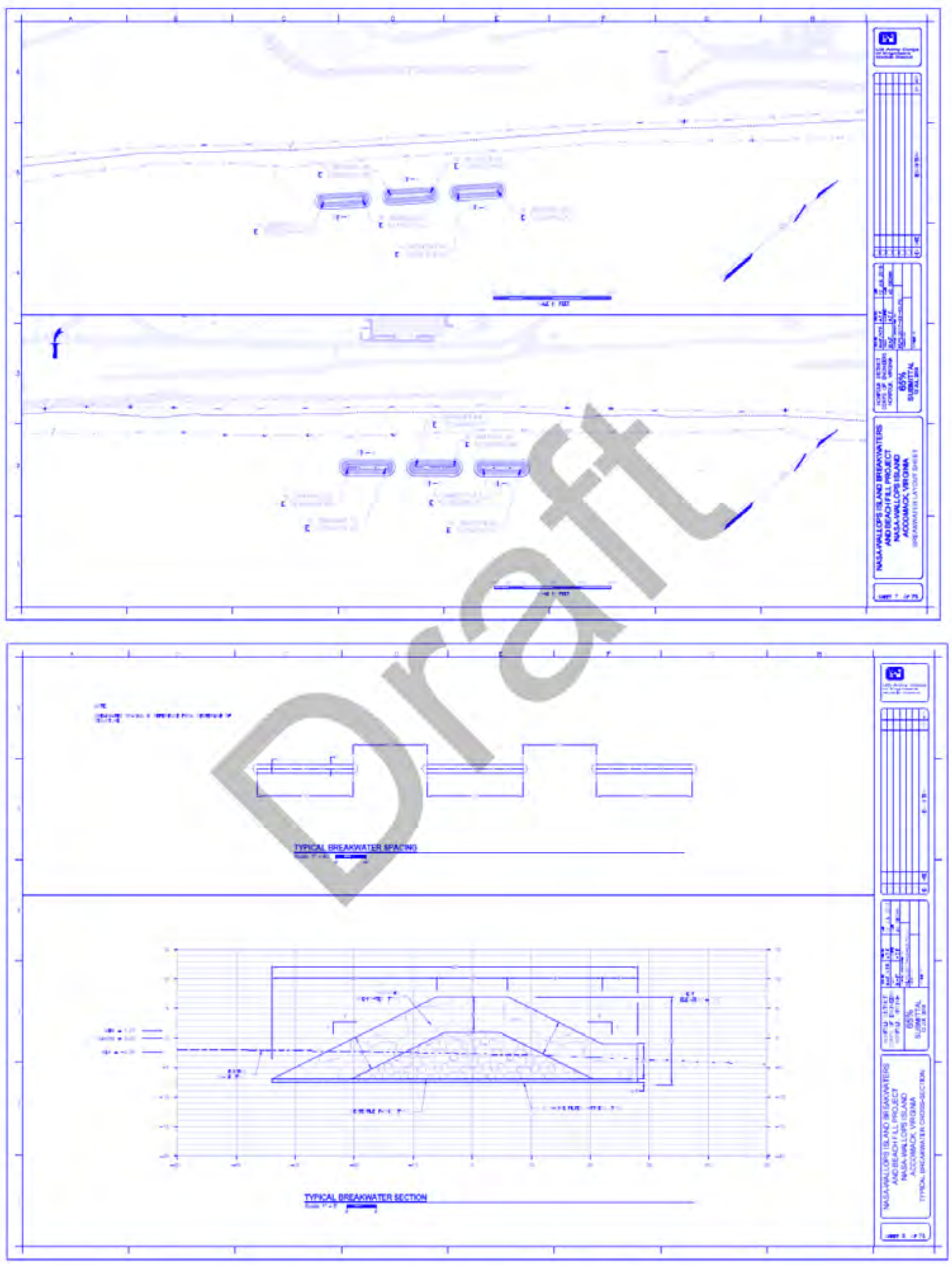

Figure 1: Breakwater Layout and Typical Cross Section

to the shore and would measure approximately 130 ft long and 10 ft wide at top crest elevation. The breakwaters would be placed approximately 100 ft apart from each other. Water depths in these areas is approximately 4 to 8 ft. The initial breakwaters would be placed offshore of Launch Pad 0B and continue north to the Horizontal Integration Facility (HIF) (Building X-079). Depending upon economic, engineering, and environmental factors, additional series may be added (

Figure 2). Note that the area highlighted in

Figure 2 is broadly indicative of potential breakwater location and dramatically overstates the actual affected area.

The rocks for constructing each breakwater would be transported to the WFF area by rail, offloaded, and then trucked to the handling or placement site on Wallops Island. Construction, estimated to last approximately 1 month, would take place in the water using a barge and heavy lifting equipment. These breakwaters would be permanent structures as removal would be impractical and cost prohibitive (**NASA, 2010b**). Construction of the offshore breakwaters would be completed prior to starting beach renourishment.

Figure 2: Full Possible Extent of Breakwater Locations

Beach Renourishment

The beach renourishment fill template (**Figure 3**) requires approximately 1.3 million yd^3 of sand material to restore the shoreline areas that have sustained berm and dune system reductions. Either the sand for renourishment would come from north Wallops Island beach (Alternative 1), or would come from unnamed shoal A (Alternative 2). The less efficient methods of offshore dredging would require collection of 1.625 million yd^3 to meet the 1.3 million yd^3 fill template.

One potential source of sand for renourishment is the existing beach on the northern end of Wallops Island, an area where sediment accumulates by longshore transport from the south. USACE modeling showed that prior to initial shoreline restoration, on average, approximately 40,000 yd^3 of sediment per year was accumulating at the northern end of Wallops Island by longshore transport from the south (**NASA, 2010b**). A requirement of the SRIPP PEIS was the establishment of semi-annual (fall and spring) beach monitoring. A trend in sediment transport was identified from the fall 2016 survey assessment (**USACE, 2017**) suggesting that while the

Figure 3: Approximate Sand Placement Area

USACE modeling of sediment transport is occurring, the material transport volume may be much greater. This was supported by the Fall 2017 Monitoring Report (**USACE, 2018**), which observed high erosion rates and substantial losses of sediment in the southern portion of the project area (sub-reaches 1 and 2) and significant accretion resulting from longshore transport in the northern portion of the project area (sub-reach 3).

It is estimated that 1.7 million yd^3 of sand is available at the north Wallops Island beach site, more than enough to provide volumes required for the proposed renourishment. Excavation depth is expected to be limited to mean low water (MLW; 2.35 feet below mean tide level), based on USACE calculations (**A. Farrow, personal communication 2018**). Based on target depth of sediment removal, the area to be excavated would be approximately 176 acres (ac) to provide the required volume for the proposed renourishment (**Figure 3**).

Using sand from the northern end of Wallops Island (**Figure 4**) would offer a material without the mobilization and operational costs associated with offshore dredging. Sediment transported alongshore to the north from a previous fill cycle would be of the proper grain size and could be effectively recycled (backpassed) by excavating it and placing it in eroding areas in the southern project area.

A pan excavator would likely be used to remove sand from north Wallops Island beach. Because it runs on several rubber tires with a low tire pressure, it can work in areas of the beach where typical equipment may be bogged down in unstable sand. The pan excavator would stockpile the sand, which would be loaded onto dump trucks that would transport the fill material up and down the beach. Bulldozers would then be used to spread the fill material once it is placed on the beach. Other onshore equipment may include all-terrain vehicles (ATVs), an office trailer, mobile generators, construction site lighting, and mobile fuel tanks. All heavy equipment would access the beach from existing roads and established access points. No new temporary or permanent roads would be constructed to access the beach or to transport the fill material to renourishment areas.

Prior to excavation, a pre-project topographic and hydrographic survey would be conducted. Multiple survey crews would employ ATVs and light trucks to conduct pre-project surveys of the project site.

Elements relevant to ESA of renourishment with sand from unnamed shoal A were extensively documented in the SRIPP and Post-Sandy actions. Approximately 515 acres of unnamed shoal A were used in the SRIPP and Post-Sandy actions to source 3.2 million and 800,000 yd^3 of sand, respectively. The current backpassing proposal for this nourishment event would avoid the use of approximately 206 additional acres of the shoal's 1,800 acre borrow area to source 1.625 million yd^3 of sand from unnamed shoal A.

Figure 4: Backpassing Borrow Area

Post-Renourishment Activities

Additional activities would include post-renourishment installation of sand fencing and planting dune grasses. It would be NASA's intent to re-use as much of the existing sand fencing as possible. Therefore, the proposed project would include removing the existing sand fencing, stockpiling it until the beach fill is complete, and then re- installing it as needed. It is expected that a majority of the existing dune grass within the work site would be covered with sand, therefore requiring re-planting.

Action Area

In the 2010 PBO and 2016 BO, USFWS considered the action area for beach nourishment to include the entire land area of Wallops Island, the shoreline and beaches of Assawoman Island, the aquatic environment adjacent to these lands, three borrow sites including Unnamed Shoals A and B and north Wallops Island, and the waters through which dredges would transit from borrow sites to pumpout areas. The action area also included the hook and overwash segments of Assateague Island.

In consideration of the scope of the proposed action, all expected effects on listed species would be within the action area considered in the 2010 PBO and 2016 BO.

Changes to Environmental Context Since SRIPP BA, 2010 PBO, and 2016 BO

As in previous fill cycles, storm conditions encountered between the Post-Sandy fill and today relocated much of the sub-aerial dune and berm east in the cross-shore direction, with large amounts of fill material on south Wallops Island migrating north or offshore. The extent of accretion and erosion experienced between 2014 and 2017 is indicated in **Figure 5**.

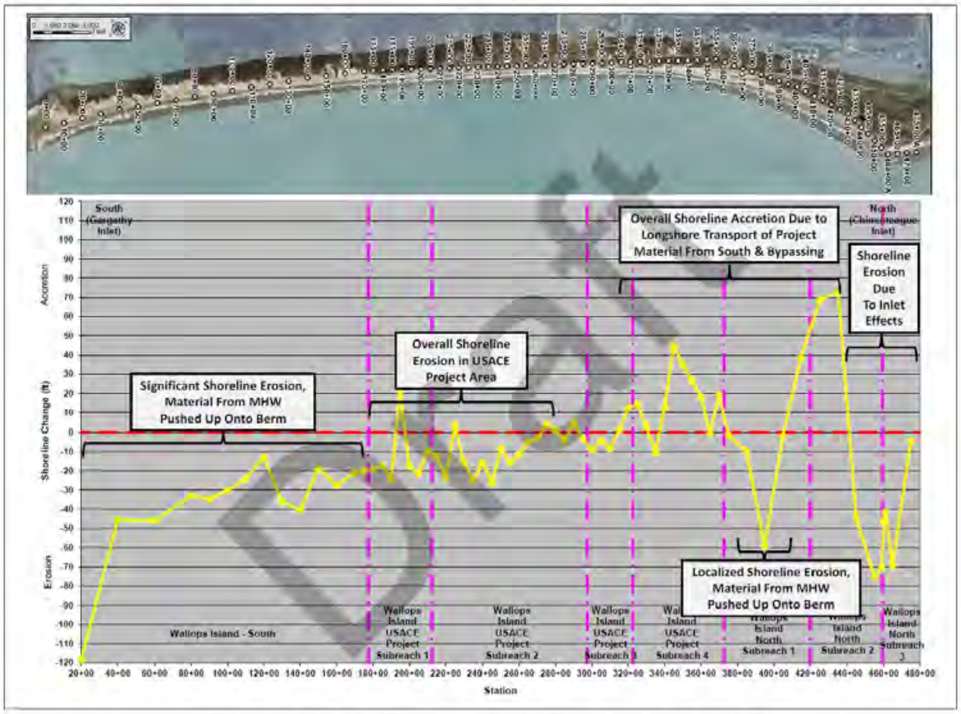

Figure 5: Beach Profile Changes at Wallops Island (2014-2017)
Red line indicates design build shoreline; yellow line indicates accretion (up) or erosion (down); purple lines indicate extent of project reaches

Status of Species within the Action Area

A review of the Accomack County species list indicates that the species have not changed from those considered in the SRIPP BA, 2010 PBO, and 2016 BO. In preparing the SRIPP BA, NASA determined that project activities may affect the threatened piping plover (*Charadrius melodus*), candidate red knot (*Calidris canutus rufa*), and several species of nesting sea turtles, including loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidechelys kempii*), and Atlantic green (*Chelonia mydas*). The USFWS concurred with NASA in the 2016 BO that the proposed and ongoing actions discussed in the document, including beach nourishment, may affect, but are not likely to adversely affect, the federally listed roseate tern (*Sterna dougallii dougallii*), leatherback, Kemp's ridley, and Atlantic green sea turtles, and federally listed threatened seabeach amaranth (*Amaranthus pumilius*). No new information indicates that effects to additional species would be anticipated; therefore, this section focuses only on updated information regarding piping plovers, red knots, and sea turtles.

Piping Plover: In accordance with the SRIPP BA, 2010 PBO, and 2016 BO, NASA monitors for piping plover nests between March 15 and September 15 each year. NASA has conducted piping plover surveys 3 to 4 times weekly since 2010, during which 44 nests were found. Records of historic nesting dates between 2010 and 2018 indicate that nesting on Wallops Island may occur between May 1 and June 29. As shown in **Table 1**, the earliest recorded piping plover nesting date on Wallops Island is May 1.

Table 1: Piping Plover Nest Date Analysis

Year	Earliest Nest	Latest Nest Date	Number of Nests
2010	May 3	May 21	3
2011	May 16	June 7	3
2012	May 24	June 29	5
2013	May 15	June 9	4
2014	May 20	June 18	5
2015	May 13	May 22	6
2016	May 31	June 14	9
2017	May 1	June 20	6
2018	May 21	May 24	3

Red Knot: Between 2012 and 2018 monitoring seasons, red knots have not been observed earlier than May 1st. During the month of May, NASA has observed flocks of red knots ranging in size from just under 10 individuals to more than 650. All red knots were on the recreational beach and north end of Wallops Island.

Sea Turtles

Sea Turtles Recorded Sea Turtle Nesting on Wallops Island Beaches

Year	Species	Number of Nests
1979	Loggerhead (*Caretta caretta*)	1
1982	Loggerhead (*Caretta caretta*)	1
1989	Loggerhead (*Caretta caretta*)	1
2002	Loggerhead (*Caretta caretta*)	1
2008	Loggerhead (*Caretta caretta*)	1

2010	Loggerhead (*Caretta caretta*)	4
2012	Loggerhead (*Caretta caretta*)	2
2013	Loggerhead (*Caretta caretta*)	2

Nesting on Wallops Island beaches is infrequent.From 1979 to 2008, a total of five loggerhead sea turtle nests occurred on Wallops Island. A flurry (for Wallops Island) of nesting occurred from 2010 to 2013. The USFWS performed genetic testing on eggs taken from nests from this period. The same individual dug the six nests in 2010 and 2012, while a different female(s) was responsible for the 2013 nests. (**K. Holcomb, personal communication 2018)** No loggerhead sea turtle nesting activity has occurred on Wallops Island since 2013, suggesting that the individuals which previously utilized Wallops Island for nesting may be deceased or have begun nesting elsewhere. Sea turtles species are considered to occur within the study area, although only loggerhead sea turtles have nested on Wallops Island.

Effects of the Action on Listed Species

Impacts on listed species from renourishment would be the same as those discussed in the SRIPP BA, 2010 PBO, and 2016 BO. Although installation of breakwaters may impact in-water sea turtles (NASA is undergoing consultation with the National Marine Fisheries Service regarding potential in-water impacts to ESA species), it would not impact terrestrial species. Therefore, this analysis focuses only on potential impacts from backpassing sand as described below.

The proposed project would restore approximately 19,000 ft of shoreline. Of the approximately 230 acres of renourished area, approximately 140 acres would be below MHW. About 1.3 million yd^3 of sand would be harvested from across 200 acres on the north end of Wallops Island and mechanically moved to the renourishment area to establish a wider beach in what is currently a narrow and erosion-prone section of the island.

Benthic organisms living in the sandy beach area of Wallops Island would experience direct mortality from the sand removal on the north end and relocation to the renourishment area. This would be due to disturbance and crushing from excavators removing sand and burial in the renourishment area. The physical oceanographic conditions would be essentially unchanged, and, after the renourishment reaches equilibrium, there would be no net change in the physical environment available for benthos.

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Figure 6: Historic Loggerhead Sea Turtle Nesting Locations on Wallops Island

Recovery time of benthos within the surf zone would likely be short given the dynamic conditions within the nearshore and surf zones. **Burlas *et al.* (2001)** estimated that the recovery time for benthos in a New Jersey study ranged from approximately 2 to 6 months when there is a good match between the fill material and the natural beach sediment. **Dalfsen and Essink (2001)** noted that recolonization is generally occurs in two stages: (1) the rapid development of "opportunistic" species, and (2) the subsequent recovery of community composition and structure. It is expected that organisms from adjacent areas would recolonize the new beach. Additionally, backpassed material would not be substantially different than native material, and some benthic organisms may survive in the transition to the renourished area; therefore, it is expected that recovery would occur over a relatively short time (i.e., on the order of 6 to 12 months post-project).

Backpassing was discussed in the 2016 BO as a means of acquiring up to half of the sand volume required for renourishment. The document discussed a borrow area of 150 acres excavated to a depth of about 3.5 feet (**USFWS, 2016**). For the proposed backpassing activities, the USACE identified an area of approximately 175 acres excavated to MLW (-2.35 ft, referencing NAVD88; **Moffat & Nichols, 2018**). A comparison of these areas is shown in **Table 3**.

Table 2: Borrow Area Volume Comparisons

Reference	Area (acres)	Depth (ft)	Volume (yd^3)	Difference (%)
2016 BO	150	3.5	847,000	-
USACE 2018	175	Various to MLW	1,700,000	200

As expected, the volume of sand proposed for removal from the USACE borrow area is almost exactly double the size of the borrow area identified in the 2016 BO. The main difference between the two borrow areas is the depth of excavation. In the case of the 2016 BO borrow area, sand would be removed to a specific depth, leaving a beach of a profile similar, albeit more landward, to its current configuration. In contrast, under the current proposal, sand would be excavated throughout the borrow area to a constant depth identified as MLW, resulting in removal of sub-aerial beach habitat (**Figure 4**). Generally both bird and sea turtle species generally do not nest deep into the primary/secondary dune; therefore, such alterations to the beach would result in a short-term loss of habitat for piping plovers, red knots, and sea turtles. However, removal of sediment will have short term impacts, as the primary dune would quickly equilibrate and create a new non-vegetated berm with foraging and nesting area for birds and sea turtles. Moreover, the borrow area would recover in 5 to 6 years from continued northerly sediment transport (**A. Farrow, personal communication 2018**). Additionally, as indicated in the 2016 BO, effects to these species would be minimal, provided that backpassing activities occur outside of foraging and nesting periods and assuming that these species adapt by nesting and/or foraging in nearby beach habitats, either on Wallops Island or on neighboring barrier islands.

Avifauna: Effects would include the potential for startle or disruption of foraging, reduction in benthic prey availability, and, for plovers, the potential for disruption of courtship and nesting activities. As both plover and red knot activity on Wallops Island has historically occurred on the north end of the island, potential impacts could be associated specifically with backpassing. The potential exists for plover nesting activity to occur within the proposed project site. The borrow area identified by USACE (2018; **Figure 4**) includes areas used preferentially by piping plovers and red knots. Geospatial density analysis of piping plover nest locations from 2007 to 2018 indicates that the proposed backpassing activities would remove up to 57% of areas preferred by piping plovers for nesting (**Table 2**). This analysis, shown graphically in **Figure 7**, did not consider success of the nests reported during this time period.

Table 3: Historic Nest Location Density Analysis

Historic Nest Location Density (nests per acre)	Category	Historic Nesting Sites (elements within bin)	Borrow Area (elements within bin)	Percent
<0.05	Negligible Use	213283	3255	1.52
0.06-0.10	Limited Use	113353	40518	35.74
0.11-0.15	Moderate Use	46680	23461	50.26
0.16-0.20	Preferred	13521	7759	57.38

As red knots only exist in the region as migrant species, the proposed backpassing activities would require members of this species to use other portions of Wallops Island or neighboring barrier island beaches for foraging.

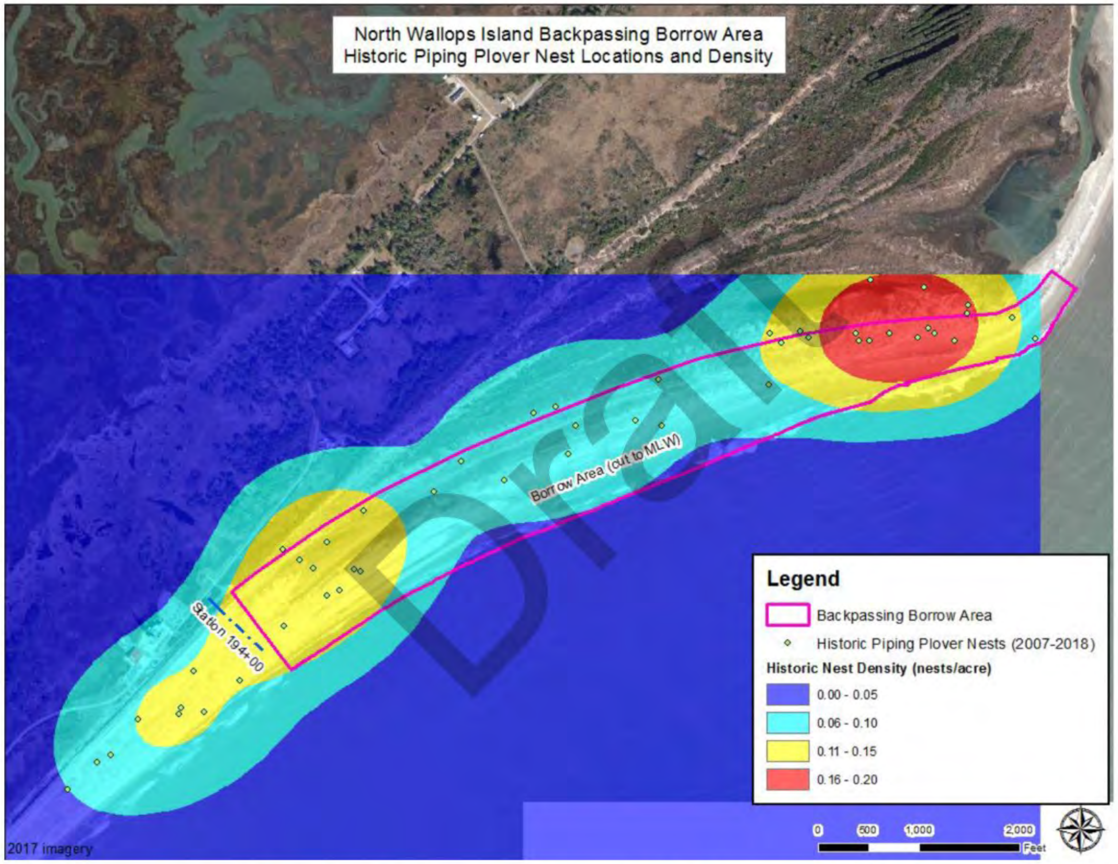

Figure 7: Backpassing Borrow Area Historic Piping Plover Nest Locations

Herpetofauna: Impacts to nesting sea turtles could include avoided nesting attempts due to nighttime construction activity (particularly artificial lighting) on the beach, unintentional excavation or burial of a newly dug nest if it were to go undetected, disorientation of hatchlings (due to project-related light sources), obstruction to hatchlings during their emergence and subsequent trip to the ocean, or loss of beach habitat. However, as indicated in the 2016 BO, effects to these species would be minimal, provided that backpassing activities occur outside of sea turtle nesting periods and assuming that these species adapt by nesting in nearby beach habitats, either on Wallops Island or on neighboring barrier islands.

Given that the beach fill material from offshore dredging or backpassing is similar to that on Wallops Island, it is not expected that fill material would have a long-term effect on sea turtle nesting success. In fact, sea turtle nesting occurred on the new Wallops Island dune during the initial beach fill, indicating that it is very possible that the additional elevated beach provides suitable nesting habitat, a net benefit to the species.

Mitigation Measures

To minimize potential impacts to federally listed species, NASA proposes to comply with the time-of-year mitigation measures established in the 2016 BO for backpassing sand from north Wallops Island, with the following changes based on the above analysis of piping plover and sea turtle nesting data and red knot foraging data:

> Excavate sand from the north Wallops Island borrow area for beach renourishment outside of plover and sea turtle nesting season (**May 1** through November 30 **or fledging of all known piping plover and the last sea turtle hatchling emergence**). Stockpile sand outside the north Wallops Island borrow area, and outside potential nesting habitat for plovers and sea turtles prior to placement for renourishment.

Conclusion

In consideration of the scope of the proposed project, listed species known to inhabit the project area, and the potential effects on those species, NASA concludes that impacts associated with the project are substantially the same as those considered within the SRIPP BA, 2010 PBO, and 2016 BO; that is these action *may affect but are not likely to adversely affect* piping plovers, red knots, or loggerhead sea turtles. Furthermore, NASA proposes to observe the above-mentioned and existing restrictions on backpassing and beach nourishment activities to further minimize impacts to listed species. NASA hereby requests USFWS concurrence with this determination.

If you have any questions or require additional information please contact Ms. Shari Miller of my staff at (757) 824-2327.

Signature page follows.

Sincerely,

T.J. Meyer
Associate Chief, Medical and Environmental Management Division

Enclosure

cc:
228/Mr. P. Bull
228/Mr. J. Saecker
250/Ms. K. Finch
250/Ms. S. Miller
BOEM/Ms. L. Brandt
BOEM/Mr. D. Piatowski
USACE /Mr. J. Altuna
USACE/Dr. M. Wood

References

Burlas, M., G. L Ray, & D. Clarke. 2001. The New York District's biological monitoring program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach erosion control project. U.S. Army Engineer District, New York and U.S. Army Engineer Research and Development Center, Waterways Experiment Station.

Dalfsen, J.A. van and K. Essink. 2001. Benthic Community Response to Sand Dredging and Shoreface Renourishment in Dutch Coastal Waters. *Senckenbergiana Marit.* 31 (2): 329-332.

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NASA. 2010b. Final Programmatic Environmental Impact Statement for Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Programs. October.

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NASA. 2018. Preliminary Draft WFF Shoreline Enhancement and Restoration Project Environmental Assessment. September.

U.S. Fish and Wildlife Service (USFWS). 2010. Programmatic Biological Opinion on the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program. Gloucester, Virginia Field Office. July

USFWS. 2016. Revised Biological Opinion Wallops Flight Facility Proposed and Ongoing Operations and Shoreline Restoration. June.

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APPENDIX G
CULTURAL RESOURCES CONSULTATION

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Miller, Shari A. (WFF-2500)

From:	Laura Lavernia <Laura.Lavernia@dhr.virginia.gov>
Sent:	Tuesday, August 14, 2018 11:43 AM
To:	Miller, Shari A. (WFF-2500)
Subject:	Shoreline Enhancement and Restoration Project (DHR File No. 2018-3863) | e-Mail # 03512

Dear Ms. Shari Miller,

Thank you for requesting comments from the Department of Historic Resources on the referenced project. Based upon the documentation provided, it is our opinion that no historic properties will be affected by the proposed undertaking.

Implementation of the undertaking in accordance with the finding of No Historic Properties Affected as documented fulfills the Federal agency's responsibilities under Section 106 of the National Historic Preservation Act. If for any reason the undertaking is not or cannot be conducted as proposed in the finding, consultation under Section 106 must be reopened.

If you have any questions or if we may provide any further assistance at this time, please do not hesitate to contact me.

Sincerely,

Laura Lavernia, Architectural Historian
Division of Review and Compliance
Phone: (804) 482-8097
Laura.Lavernia@dhr.virginia.gov

1

From: Brian D Hopper - NOAA Federal
To: Miller, Shari A. (WFF-2500)
Cc: David O"Brien - NOAA Federal; Christine Vaccaro - NOAA Federal
Subject: Re: FW: Request for Concurrence
Date: Tuesday, November 20, 2018 12:54:50 PM

Hi Shari,

Thank you for providing us with the documentation describing the proposed shoreline enhancement and restoration project at Wallops Island, Virginia. I've reviewed the information attached to your email requesting a determination from us regarding re-initiation of consultation and, based on the effect analysis from the previous consultation on the project, the information that you have provided regarding changes to the project description, and the fact that no new listed species or designated critical habitat overlap with the action area, it is not necessary to re-initiate the consultation on the August 3, 2012 Biological Opinion on the Wallops Flight Facility Shoreline Restoration and Infrastructure Protection Program (as amended, September 26, 2014). Please let me know if you have any questions.

Regards,
-Brian

On Tue, Nov 13, 2018 at 3:41 PM NMFS.GAR ESA.Section7 - NOAA Service Account <nmfs.gar.esa.section7@noaa.gov> wrote:

> ---------- Forwarded message ---------
> From: **Miller, Shari A. (WFF-2500)** <shari.a.miller@nasa.gov>
> Date: Tue, Nov 13, 2018 at 2:11 PM
> Subject: FW: Request for Concurrence
> To: nmfs.gar.esa.section7@noaa.gov <nmfs.gar.esa.section7@noaa.gov>, Brian D Hopper - NOAA Federal <brian.d.hopper@noaa.gov>
> Cc: Piatkowski, Douglas <douglas.piatkowski@boem.gov>
>
> Good afternoon, Brian,
>
> Could you please tell me if NMFS had any comments or questions regarding our consultation letter for NASA's proposed shoreline restoration project?
>
> Thank you.
>
> ________________

Shari A. Miller

Center NEPA Manager

Environmental Planning Lead
NASA GSFC Wallops Flight Facility
Wallops Island, VA 23337
(757) 824-2327
Shari.A.Miller@nasa.gov

SIPRnet: Shari.Miller@nss.sgov.gov

https://code200-external.gsfc.nasa.gov/250-wff/

"When I was a boy and I would see scary things in the news, my mother would say to me, 'Look for the helpers. You will always find people who are helping.' " – Fred Rogers

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From: Mitchell, Joel T. (WFF-2500)
Sent: Thursday, September 27, 2018 2:15 PM
To: Kim.Damon-Randall@noaa.gov
Cc: brian.d.hopper@noaa.gov; Meyer, T J (WFF-2500) <theodore.j.meyer@nasa.gov>; Finch, Kimberly (GSFC-2500) <kimberly.s.finch@nasa.gov>; Saecker, John R. (WFF-2280) <john.r.saecker@nasa.gov>; Megan.A.Wood@usace.army.mil; douglas.piatkowski@boem.gov; mailto:leighann.brandt@boem.gov <leighann.brandt@boem.gov>; mailto:Julio.F.Altuna@usace.army.mil <Julio.F.Altuna@usace.army.mil>; Bull, Paul C. (WFF-2200) <paul.c.bull@nasa.gov>; mailto:Elizabeth.Burak@cardno-gs.com <Elizabeth.Burak@cardno-gs.com>; Miller, Shari A. (WFF-2500) <shari.a.miller@nasa.gov>
Subject: Request for Concurrence

Dear Ms. Damon-Randall,

NASA is proposing to continue the Shoreline Restoration and Infrastructure Protection Program initiated in 2010. The current proposal includes renourishing the beach along the Wallops Island shoreline infrastructure protection area with sand recycled, or "backpassed", from the north end of Wallops Island. Before the renourishment, NASA would construct a series of parallel nearshore breakwater structures that would reduce the intensity of wave action and slow sediment transport. Though obtaining fill material from the north end of Wallops Island is the preferred alternative for this nourishment event, the use of offshore sand resources are still considered as alternatives for this and future nourishment events.

The attached letter is to request concurrence from your office under Section 7 of the Endangered Species Act (ESA) for the Shoreline Enhancement and Restoration Project. Based on the analysis that all effects of the proposed action will be insignificant and/or discountable, we have made the determination that the proposed activity may affect, but is not likely to adversely affect, any species listed as threatened or endangered by the National Marine Fisheries Service under the ESA of 1973, as amended. Our supporting analysis is provided in the attached Biological Evaluation.

We certify that we have used the best scientific and commercial data available to complete this analysis. We request your concurrence with this determination.

If you have any questions, please contact me at (757) 824-2327 or Shari.A.Miller@nasa.gov.

____

Shari A. Miller

Environmental Planning Lead
NASA Wallops Flight Facility
Wallops Island, VA 23337
(757) 824-2327
Shari.A.Miller@nasa.gov

SIPRnet: Shari.Miller@nss.sgov.gov

https://code200-external.gsfc.nasa.gov/250-wff/

---------- Forwarded message ----------
From: "Mitchell, Joel T. (WFF-8200)" <joel.t.mitchell@nasa.gov>
To: "Miller, Shari A. (WFF-2500)" <shari.a.miller@nasa.gov>

Cc:
Bcc:
Date: Fri, 28 Sep 2018 12:34:33 +0000
Subject: FW: Ms. Damon-Randall's email address

OK, Fish and Wildlife letter out. Sent a new email to Jennifer Andersen at the address Brian supplied.

From: Brian D Hopper - NOAA Federal [mailto:brian.d.hopper@noaa.gov]
Sent: Friday, September 28, 2018 7:59 AM
To: Mitchell, Joel T. (WFF-2500) <joel.t.mitchell@nasa.gov>
Subject: Re: Ms. Damon-Randall's email address

Hi Joel,

Thanks for contacting us with your request for consultation. Kim is on a detail and our current division chief is Jennifer Anderson. We have an email address specifically set up to receive consultation requests. Here it is: nmfs.gar.esa.section7@noaa.gov

Please let me know if you have any questions.

Regards,

-Brian

On Fri, Sep 28, 2018 at 7:51 AM Mitchell, Joel T. (WFF-2500) <joel.t.mitchell@nasa.gov> wrote:

> Dear Mr. Hopper,
>
> I was trying to the email to Kim.Damon-Randall regarding consultation concerning the Wallops Island Beach Renourishment and Breakwater project for Shari Miller. However it keeps getting reflected back to me as undeliverable. Would you happen to have her email address?
>
> Thank you,
>
> Joel Mitchell
>
> Natural Resources Manager

Wallops Flight Facility

757-824-1127

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Brian D. Hopper
Protected Resources Division
NOAA Fisheries
Greater Atlantic Regional Fisheries Office

177 Admiral Cochrane Dr.

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