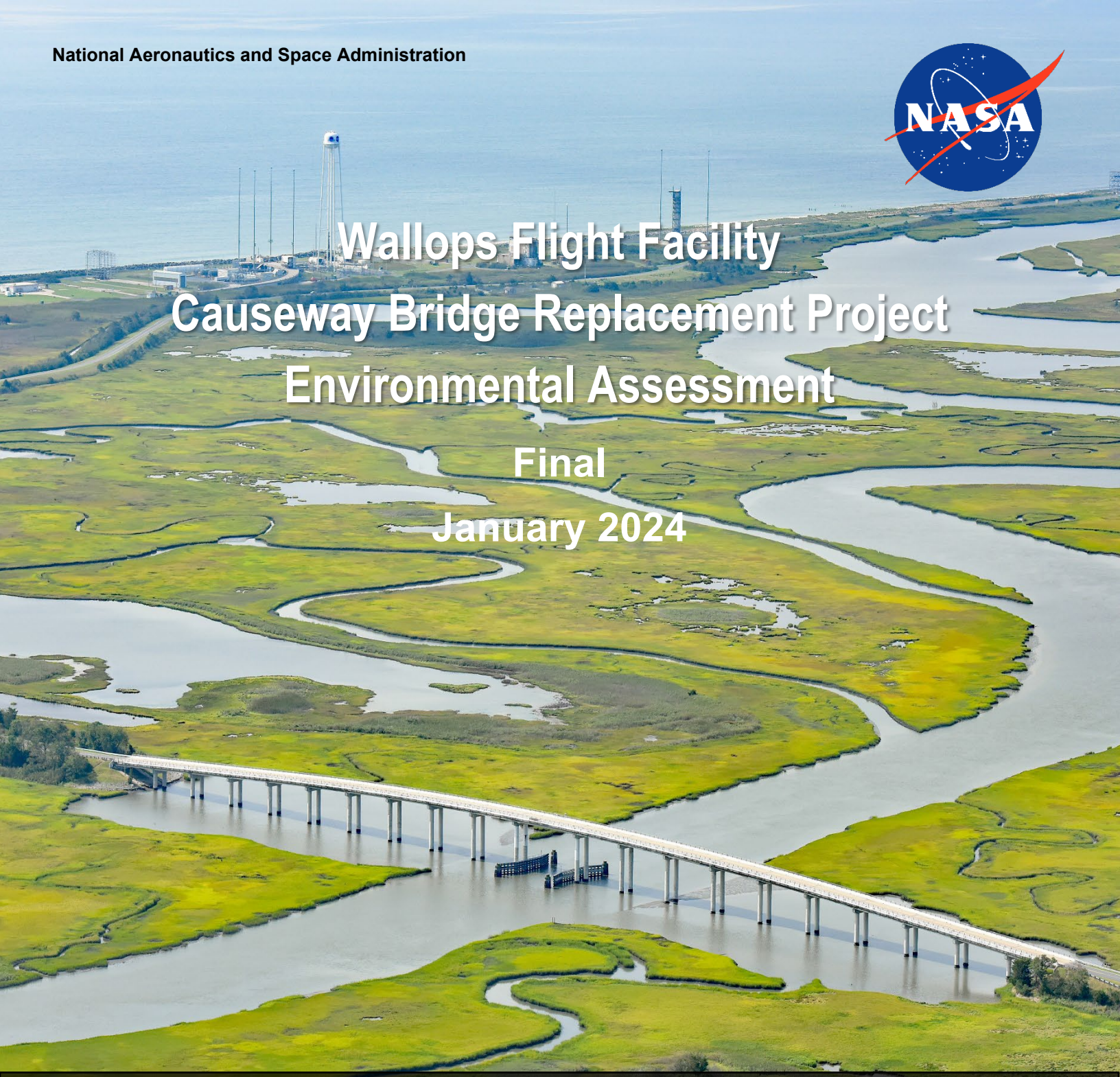
National Aeronautics and Space Administration



Wallops Flight Facility
Causeway Bridge Replacement Project
Environmental Assessment

Final

January 2024

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

In Cooperation With Federal Highway Administration, United States Coast Guard, and United States Army Corps of Engineers

Cover Image:

Patrick J. Hendrikson/Highcamera.com, June 2023–Photo Credit: NASA

FINAL ENVIRONMENTAL ASSESSMENT
CAUSEWAY BRIDGE REPLACEMENT PROJECT

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER
WALLOPS FLIGHT FACILITY
WALLOPS ISLAND, VIRGINIA 23337

Lead Agency: National Aeronautics and Space Administration

Participating Agencies: Federal Highway Administration

Cooperating Agencies: United States Coast Guard
United States Army Corps of Engineers

Proposed Action: Causeway Bridge Replacement Project

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Abstract

In accordance with the National Environmental Policy Act of 1969, NASA has prepared this Environmental Assessment (EA) to analyze the potential effects of replacing the existing Causeway Bridge that connects the Mainland to Wallops Island. This EA is tiered from the May 2019 *NASA WFF Site-Wide Programmatic Environmental Impact Statement*.

This EA analyzes the potential direct, indirect, and cumulative environmental effects of the Proposed Action and the No Action Alternative. Resources evaluated in detail include noise; air quality; toxic substances, hazardous and regulated materials, and waste; health and safety; land resources; water resources; vegetation; special status species; transportation; employment and income; recreational resources; and archaeological resources.

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ACRONYMS AND ABBREVIATIONS

ac	Acre(s)
ACM	Asbestos-Containing Materials
APE	Area of Potential Effect
ACWB	Accomack County Wetlands Board
AQCR	Air Quality Control Region
BGEPA	Bald and Golden Eagle Protection Act
BCC	Bird Species of Conservation Concern
BMP	Best Management Practice
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulation
cm	Centimeter(s)
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CRA	Cultural Resource Analysts, Inc.
cSEL	Cumulative Sound Exposure Level
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	Decibel(s)
dBA	A-weighted Decibel(s)
dB_{Peak}	Peak Sound Pressure Level
EA	Environmental Assessment
EFH	Essential Fish Habitat
ELMR	Estuarine Living Marine Resources
EO	Executive Order
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
FAR	Federal Acquisition Regulation
FCD	Federal Consistency Determination
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	FEMA Insurance Rate Map
FMC	Fishery Management Council
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
ft	Foot/Feet
FWCA	Fish and Wildlife Coordination Act
gal	Gallon(s)
GARFO	Greater Atlantic Regional Fisheries Office
GHG	Greenhouse Gas
ha	Hectare(s)
HAP	Hazardous Air Pollutant
HAPC	Habitat Areas of Particular Concern
HCD	Habitat Conservation Division

HDD	horizontal directional drilling
HWR	Hassan Water Resources, PLC
HUC	Hydrologic Unit Code
Hz	Hertz
IBA	Important Bird Area
ICP	Integrated Contingency Plan
in	Inch(es)
JDH	John D. Hynes & Associates, Inc.
JPA	Joint Permit Application
kHz	Kilohertz
km	Kilometer(s)
L	Liter(s)
LBP	Lead-based Paint
LOD	Limits of Disturbance
m	Meter(s)
MARS	Mid-Atlantic Regional Spaceport
MBTA	Migratory Bird Treaty Act
MD	Maryland
MEC	Munitions or Explosives of Concern
MEMD	Medical and Environmental Management Division
MHW	Mean high water
mi	Mile(s)
mg/l	Milligrams per liter
MLW	Mean low water
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management 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
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOTMARs	Notices-to-Mariners
NPR	NASA Procedural Requirement
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
OSHA	Occupational Safety and Health Administration
Pa	Pascal(s)
Pb	Lead
PDC	Project Design Criteria
PEIS	Programmatic Environmental Impact Statement
PFAS	Per- and polyfluoroalkyl substances

PJD	Preliminary Jurisdictional Determination
$PM_{2.5}$	Particulate Matter <2.5 microns
PM_{10}	Particulate Matter <10 microns
PRD	Protected Resources Division
PTS	Permanent Threshold Shift
RCRA	Resource Conservation and Recovery Act
RMS	Root-Mean-Square
SAV	Submerged Aquatic Vegetation
Sec	Second(s)
SEED	WFF's Stormwater, Erosion, and Environmental Development Program
SEL	Sound Exposure Level
SHPO	State Historic Preservation Office
SPCC	Spill Prevention, Control, and Countermeasure
SPL	Sound Pressure Level
SWPPP	Stormwater Pollution Prevention Plan
THPO	Tribal Historic Preservation Officer
TOYR	Time of Year Restriction
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
UAS	Unmanned Aircraft System
µPa	Micropascal(s)
U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
V-CRIS	Virginia Cultural Resource Information System
VCZMP	Virginia Coastal Zone Management Program
VDEQ	Virginia Department of Environmental Quality
VDCR	Virginia Department of Conservation and Recreation
VDH	Virginia Department of Health
VDHR	Virginia Department of Historic Resources
VDOT	Virginia Department of Transportation
VDWR	Virginia Department of Wildlife Resources
VIMS	Virginia Institute of Marine Science
VMRC	Virginia Marine Resources Commission
VSMP	Virginia Stormwater Management Program
VWP	Virginia Water Protection
WFF	Wallops Flight Facility
WOTUS	Waters of the United States

1 Purpose and Need for Action

1.1 Introduction

The National Aeronautics and Space Administration (NASA) has prepared this Tiered Environmental Assessment (EA) to analyze potential impacts to the environment resulting from the proposed replacement of the Wallops Island Causeway Bridge over Cat Creek (the Project). This EA has been prepared in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States [U.S.] Code [USC] 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).

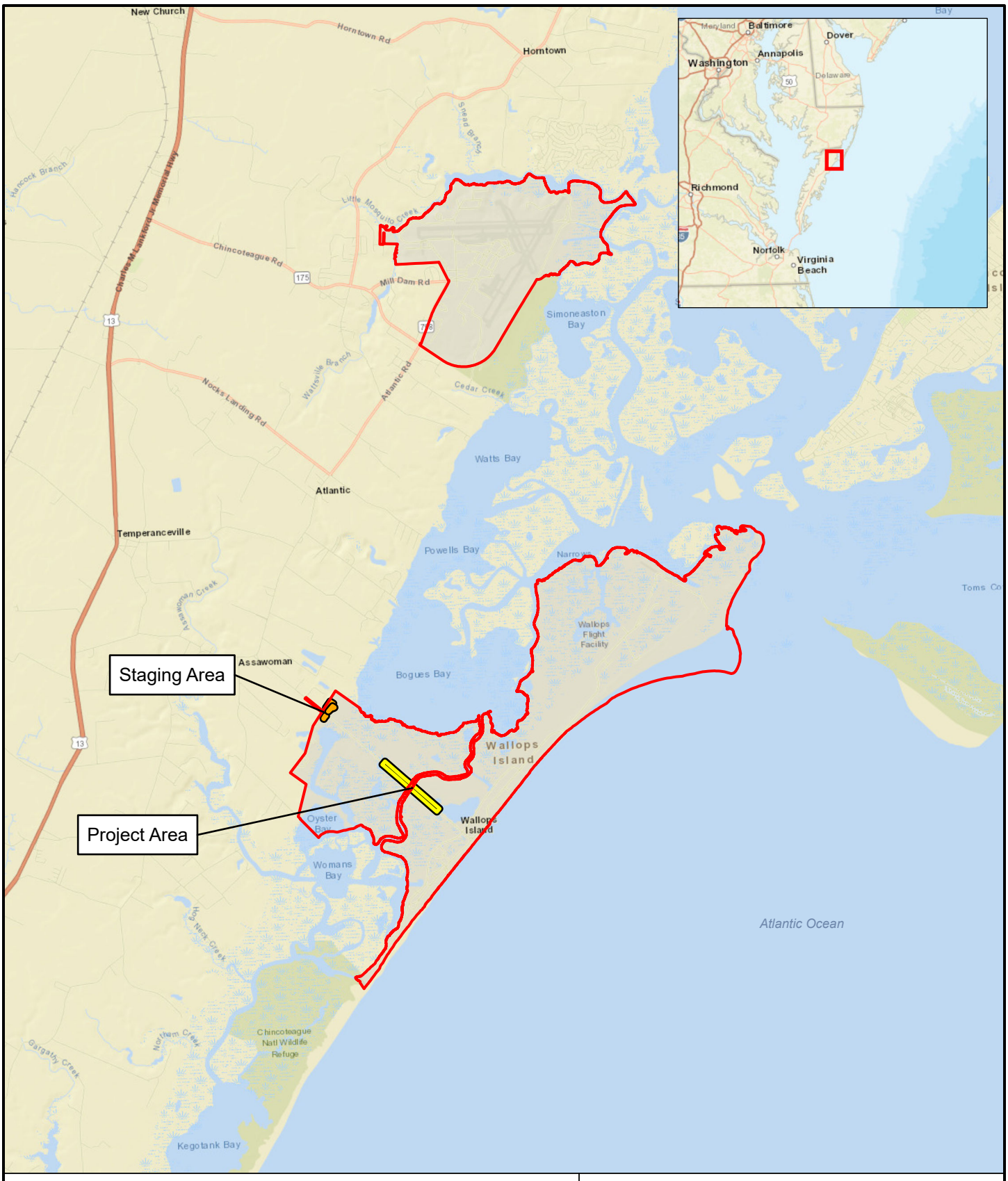
The Federal Highway Administration (FHWA), U.S. Army Corps of Engineers (USACE) Norfolk District, and U.S. Coast Guard (USCG) are Participating or Cooperating Agencies with NASA in preparation of this EA, with NASA serving as the lead agency.

This EA is tiered from the May 2019 *NASA Wallops Flight Facility Site-wide Programmatic Environmental Impact Statement (PEIS) (Final Site-wide PEIS*; NASA 2019), in which NASA evaluated the environmental consequences of constructing and operating new facilities and infrastructure at Wallops Flight Facility (WFF). In accordance with the CEQ regulations - 40 CFR 1502.20 - actions associated with the Proposed Action in the *Final Site-wide PEIS* may be tiered from that document by incorporating the *Final Site-wide PEIS* by reference, thereby eliminating duplicate discussions.

The EA Project Area is located within the NASA Goddard Space Flight Center's WFF in Accomack County, Virginia, near the south end of Wallops Island (**Figure 1-1**). The existing Causeway Bridge was constructed in 1959-1960 and is beyond the end of its anticipated service life. The Proposed Action being evaluated by this EA consists of site preparation, construction and removal of construction access, construction of a new bridge parallel to the north side of the existing bridge on a new alignment, and demolition of the existing bridge after the new bridge opens.

1.2 Location and Setting

WFF is in northern Accomack County on the Eastern Shore of Virginia. Accomack County is bordered by Northampton County on the south, the state of Maryland on the north, the Atlantic Ocean on the east, and the Chesapeake Bay on the west. WFF consists of three separate land areas near each other: Main Base, Mainland, and Wallops Island (**Figure 1-1**). Collectively, WFF covers approximately 2,670 hectares (ha) (6,600 acres [ac]). The Proposed Action would be implemented on NASA-owned land on Wallops Island/Mainland, Commonwealth of Virginia (Virginia) submerged bottomlands, and a USACE maintained federal navigation channel.



Legend

- Project Area
- Wallops Flight Facility Boundary

Sources: NASA, ESRI World Street Basemap / Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

FIGURE 1-1
PROJECT LOCATION

0 1 2
Miles

WFF Causeway Bridge Replacement Project

Wallops Island is a barrier island located along Virginia's Atlantic coast. The 3-kilometer (km) (2-mile [mi]) long Wallops causeway and bridge, owned and maintained by NASA, connects Wallops Island to the Mainland. Encompassing approximately 1,375 ha (3,400 ac) and surrounded by water, Wallops Island is approximately 11 km (7 mi) long by 2.4 km (1.5 mi) wide. The Atlantic Ocean borders Wallops Island to the east, and Chincoteague Inlet delineates the northern coastline. Marshland, interlaced with small creeks, covers the entire western approach to Wallops Island. As shown on **Figure 1-2,** topography in the Project Area is generally flat.

1.3 NASA's Mission

For over 70 years, WFF has flown thousands of research vehicles in the quest for information on the flight characteristics of airplanes, launch vehicles, and spacecraft, as well as to increase knowledge of the Earth's upper atmosphere and the near space environment. WFF supports aeronautical research, science, technology, and education by providing NASA Centers and other U.S. government agencies access to resources such as special use (i.e., controlled/restricted) airspace, research runways, and launch pads. WFF regularly provides launch support for the commercial launch industry, either directly or through the Mid-Atlantic Regional Spaceport (MARS). WFF facilitates a wide array of U.S. Department of Defense research, development, and training missions, including target and missile launches, and aircraft development. The flight programs and projects supported by WFF range from small sounding rockets, unmanned scientific balloons and Unmanned Aircraft Systems (UAS), manned aircraft, and orbital tracking, to next generation launch vehicle development, launch vehicles, and small and medium classed orbital spacecraft. WFF conducts many of these programs from the Main Base research airport, the MARS UAS Airstrip, and the Wallops Island launch range.

NASA and its partners use the Mainland and Wallops Island sites for testing and launch activities, U.S. Navy training, and research facilities. The Mainland facilities include storage buildings, high speed cameras, radar antennas and transmitter systems, and associated buildings.

The southern end of Wallops Island primarily houses the launch complexes and associated structures. The central part of the island includes launch integration facilities and Navy facilities including the Advanced Enterprise Global Information Technology Solutions, the Wallops Island Engineering Test Center, and Ship Self Defense System. The northern part of Wallops Island includes the MARS UAS Airstrip, blockhouses, assembly shops, dynamic balancing facilities, tracking facilities, payload processing and fueling, and other related support structures. Restricted airspace managed by NASA overlies all of Wallops Island, the Mainland, and the Main Base (NASA 2019).

Legend

- Project Area
- Staging Area

Sources: NASA, USA Topo Maps/ Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia South FIPS 4502 Feet

FIGURE 1-2
USGS TOPOGRAPHY

0 1,000 2,000
Feet

WFF Causeway Bridge Replacement Project

1.4 Purpose and Need

1.4.1 Background for Purpose and Need

The Wallops Island Causeway Bridge is situated on an east-west alignment above Cat Creek. Information on the existing bridge is provided below. **Photos 1-1**, **1-2**, and **1-3** show the existing bridge.

- The bridge was constructed in 1959-1960 and is located on a 3-km (2-mi) long causeway road connecting the Mainland with Wallops Island.
- The bridge has two 3.1 meter (m) (10 foot [ft]) lanes, 0.3 m (1 ft) shoulders, and guardrails, and curbs for a total width of 8.2 m (27 ft) (see **Photo 1-3**). It is 391 m (1,284 ft) long, has a cast-in-place concrete deck with 21 spans, and is supported by prestressed concrete beams on 20 concrete piers.
- The center of the bridge is 13.7 m (45 ft) above the mean water elevation of Cat Creek with a vertical clearance of 12.2 m (40 ft) above mean high water (MHW) and a horizontal clearance of 18 m (60 ft) through the main navigation span.

Photo 1-1. Aerial View of the Exisitng Causeway Bridge from the North Looking South

Photo 1-2. Photo of the Existing Causeway Bridge from the Southwest End of the Bridge Looking East.

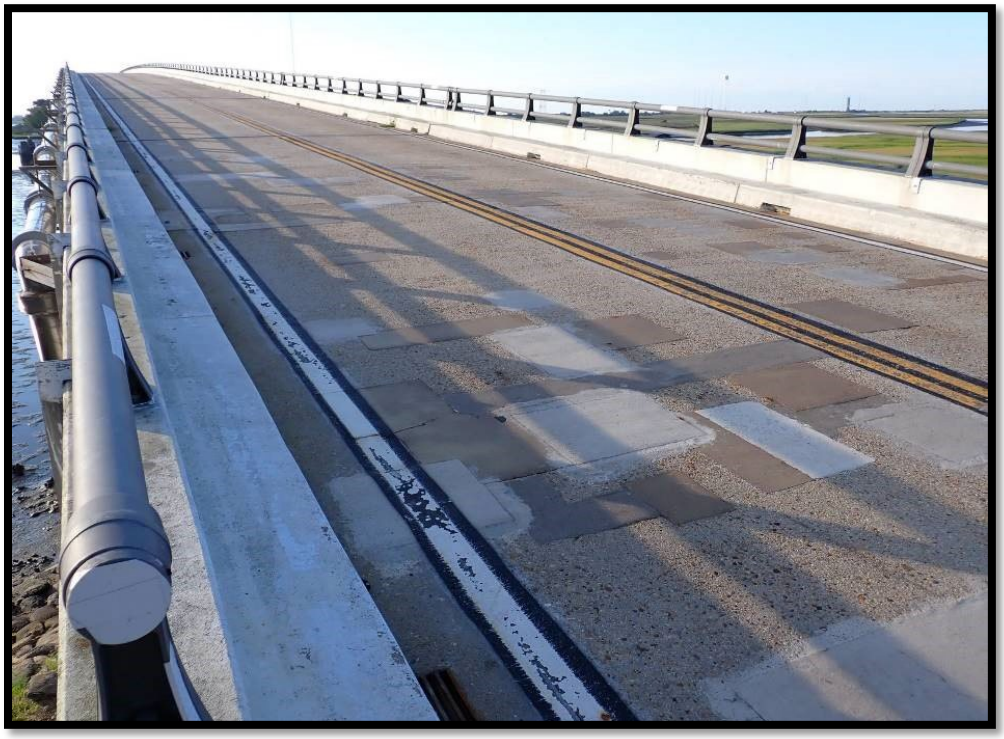


Photo 1-3. View of the Causeway Bridge Deck.

1.4.2 Purpose

The specific purpose of the Proposed Action is to allow NASA, its tenants, and customers to continue transporting personnel, mission hardware, and equipment via roadway and bridge to Wallops Island once the existing Causeway Bridge is decommissioned at the end of its service life.

The strategic purpose of the Proposed Action is to support NASA's mission by providing safe, efficient, and reliable transportation and improving the sustainability of operations by incorporating climate change resilience in the new bridge design. The new bridge, which is being designed for a longer service life than the existing bridge (the design service life will be at least 75 years), would provide cost-effective, environmentally responsible solutions for updating NASA's transportation infrastructure.

1.4.3 Need

The Causeway Bridge is approximately 65 years old and at the end of its service life. The structure was rehabilitated in 1986, including shotcrete repairs to the prestressed concrete beams. The structure was rehabilitated again in 2013 and 2021; both renovations primarily consisted of applying fiber reinforced polymer to the prestressed concrete beams, and performing major repair work on the pier caps, along with other improvements. All possible repairs on the bridge girders (the structures supporting the bridge deck) have been conducted; the next step would be full replacement of the girders, which would result in a long-term bridge closure.

The most recent bridge inspections were conducted in 2020 and 2022. The 2020 inspection report determined that bridge components are showing signs of accelerated structural deterioration (Clark Nexsen 2020). The report identified structural deficiencies and concluded that due to the current condition of the structure, the remaining design life of the 2013 repairs, and the functional obsolesce and mission critical nature of the structure, it is appropriate to prepare to replace this structure. The 2022 Clark Nexsen inspection report noted that recent repairs, completed in 2021 to address areas of immediate concern and extend the bridge life, were overall very successful. NASA would continue to conduct bridge deck repairs as needed based on routine inspections to keep the existing bridge in service until the new bridge is open.

The Causeway Bridge provides the only vehicular access to and from Wallops Island; therefore, the bridge is mission critical since NASA components, supplies, materials, staff, and visitors related to NASA and tenant operations on the island cross this structure. The amount of vehicular traffic, the size of transport trucks, and the frequency of "super-loads" crossing the bridge has increased significantly in the past decade. This level of use has exacerbated the deterioration of the bridge and is expected to continue to increase with the anticipated growth in mission activities. Therefore, additional load capacity is vital to support future flexibility.

Construction of the new bridge while the existing bridge remains open to traffic is critical; thus, a new bridge needs to be constructed such that traffic can be transferred from the existing bridge prior to the anticipated end of its service life. Not only would continual deterioration of the existing

bridge result in unsafe conditions for transport to and from Wallops Island, there is also the potential that people, vessels, and animal species under the bridge in Cat Creek could be struck by deteriorated parts from the structure. Even with ongoing maintenance and repairs to the bridge, there is a significant risk to NASA, Navy, and MARS missions if superstructure replacement or complete bridge replacement is not considered within the next few years.

To support NASA's and its tenants' missions at Wallops Island, and to protect travelers under the bridge, a new bridge is needed to provide a safe and reliable means for transportation from the Mainland to the island into the future.

Several utility lines providing electric, water, and sewer services to Wallops Island are currently attached to the existing Causeway Bridge. These utilities would need to be replaced or relocated to continue uninterrupted service to Wallops Island. Additionally, recent inspections of the water utility infrastructure showed catastrophic deterioration of the potable water supply to Wallops Island, which require imminent attention.

1.5 Participating and Cooperating Agencies

As stated in 23 CFR § 139, a federal Lead Agency shall identify any other federal and non-federal agencies that may have an interest in the project to become Participating Agencies in the environmental review process. A Participating Agency is responsible for providing comments, responses, studies, or methodologies on those areas within the special expertise or jurisdiction of the agency and shall use the process to address any environmental issues of concern to the agency.

As defined in 40 CFR § 1508.5, and further clarified in subsequent CEQ memoranda, a Cooperating Agency can be any federal, state, tribal, or local government which has jurisdiction by law or special expertise regarding any environmental impact involved in a proposal or a reasonable alternative.

NASA, as the property owner and project proponent, is the Lead Agency and is responsible for ensuring overall compliance with the applicable environmental statutes. FHWA is a Participating Agency because of its role in undertaking design and oversight of the construction of the new Causeway Bridge and approach road. USACE and USCG are Cooperating Agencies since USACE would authorize permits under Section 404 of the Clean Water Act (CWA), Section 10 of the Rivers and Harbors Act, and Section 14 of the Rivers and Harbors Act (commonly referred to as Section 408), and USCG would issue a Bridge Permit for the bridge reconstruction.

1.6 NEPA Guidance and Public Participation

This EA was prepared consistent with the CEQ regulations for implementing NEPA (40 CFR 1500-1508); and NPR 8580.1 *Implementing the National Environmental Policy Act* as promulgated in 14 CFR § 1216.3.

In preparing this environmental analysis, NASA used the following process:

1. ***Scoping and Consultation*** – FHWA and NASA jointly conducted public, agency, and stakeholder scoping in 2020. Scoping letters were sent to federal, state, and local government agencies in August 2020, requesting comments on the proposed project to reconstruct the Causeway Bridge. Coordination and consultation with regulators began in 2021. Scoping comments are included in **Appendix A**, Participating Agency Scoping and Coordination.
2. ***Draft EA*** – The Draft EA analyzed the environmental consequences of the Proposed Action and the No Action alternative. It included the Purpose of 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 implementing the alternatives. The Draft EA was supported by detailed technical studies.
3. ***Draft EA Notice of Availability and Notice of Public Meeting*** – NASA notified the public of the availability of the Draft EA for review and comment during a 30-day public comment period through advertisements placed in the *Shore Daily Post*, the *Eastern Shore News,* and the *Eastern Shore Post*.
4. ***Public Comment Period*** – Federal, state, and local agencies and members of the public were invited to provide written comments on the Draft EA during a comment period from September 12, 2023, through October 11, 2023. The Draft EA was available on the internet in Adobe® portable document format (pdf) at: https://code200-external.gsfc.nasa.gov/250-WFF/C-BREAs, and hard copies of the EA were available upon request. A public meeting was held on September 20, 2023, at the WFF Visitor Center. Comments were received from an individual, the U.S. Environmental Protection Agency (USEPA), USACE, and Virginia Spaceport Authority.
5. ***Final EA/Finding of No Significant Impact (FONSI)*** – NASA has determined that preparation of an Environmental Impact Statement is not required and has prepared a FONSI for the Proposed Action. The FONSI was signed by NASA on January 24, 2024. NASA prepared this Final EA based on comments received during the public comment period. Advertisement of the Final EA and signed FONSI will be published in the *Shore Daily News,* the *Eastern Shore News,* and the *Eastern Shore Post*. The Final EA will be made available at the following libraries: Chincoteague Island Library, Chincoteague, Virginia, and the Eastern Shore Public Library, Parksley, Virginia. The Final EA will also be made available online at https://code200-external.gsfc.nasa.gov/250-WFF/C-BREAs.

2 Description of the Proposed Action and Alternatives

2.1 Introduction

This chapter describes the Proposed Action to construct a new Causeway Bridge connecting NASA WFF's Mainland to Wallops Island. Section 2.2 describes the alternatives considered to implement the Proposed Action. Section 2.3 describes the Proposed Action and Section 2.4 describes the No Action Alternative. Section 2.5 discusses the environmental review process and use of the envelope concept in the EA analysis.

2.2 Alternatives

NASA considered several alternatives for the Proposed Action. This Section presents the following process that was used for the development and selection of alternatives:

1) Alternatives initially considered;
2) Alternatives screening criteria;
3) Alternatives considered but not carried forward for EA analysis; and
4) Alternatives carried forward for EA analysis.

2.2.1 Alternatives Initially Considered

NASA and FHWA began discussing conceptual alternatives prior to 2018, and in 2018, NASA and FHWA conducted a Value Analysis Study (Kirk and JMT 2018) in which several design options for construction of a new bridge were identified. The design options initially considered by NASA and FHWA represent differences in structure size, materials, alignment, and construction methods (see Section 2.3.4, *Construction of a New Bridge*).

The final design options would be chosen during the Design-Build process (see Section 2.5.1, *Design-Build Process*). Through the Value Analysis process and subsequent review of design options, NASA determined there are only two action alternatives carried forward for screening analysis in the EA: construction of a new bridge and construction of a causeway.

2.2.1.1 Alternative One: Construct a New Bridge

Construct a new bridge on a new alignment and demolish the existing bridge within 5 years of opening of the new bridge. The new bridge would be constructed adjacent to the existing bridge while the existing bridge remains open. There are various options for bridge types and methods of construction (see Section 2.3.4, *Construction of a New Bridge*).

2.2.1.2 Alternative Two: Construct a Causeway

Construction of a causeway would include extending the roadway with fill and stone across the entire width of Cat Creek. This alternative could also include a combination of extending the existing causeway on both sides of Cat Creek and constructing a shorter bridge to connect the Mainland with Wallops Island.

2.2.1.3 No Action Alternative

The No Action Alternative reflects the status quo, in which a new bridge would not be constructed, and NASA and its tenants would continue using the existing Causeway Bridge, conducting maintenance and rehabilitation of the existing bridge until structural deficiencies necessitate a full closure. A full closure would be determined based on future inspections and would be implemented to protect those using the bridge for travel and those using water-based transportation underneath the bridge.

2.2.2 Screening Criteria

NASA applied the following screening criteria to assess which alternatives met the purpose of and need for the Proposed Action. A feasible alternative must meet all screening criteria to be carried forward for analysis in the EA.

Criterion 1: Service Life of 75+ Years with Minimized Maintenance

The service life of the new bridge must exceed 75 years, and to minimize maintenance, the construction material would need to be appropriate for the marine water environment.

Criterion 2: Transport of Large Loads Cannot be Constrained

Transportation across the bridge cannot be constrained, i.e., there must be no overhead or wide-width clearance restrictions due to cables or other bridge infrastructure that are above the bridge deck.

Criterion 3: Cat Creek Must Remain a Navigable Waterway

Cat Creek must remain a viable waterway for public transportation, commercial vessels, and recreation. Cat Creek is considered a "navigable" waterway by USACE and must remain open to vessel traffic. Therefore, the new bridge must provide at least 3.9 m (12.8 ft) of vertical clearance above MHW and at least 18.3 m (60 ft) of horizontal clearance through the main navigation span of the bridge (USCG 2021).

Criterion 4: Minimizes Disturbance to Sensitive Environmental Resources

Potential impacts to Waters of the U.S. (WOTUS) and other environmental resources must be minimized.

Criterion 5: Incorporate Climate Change and Storm Surge Resiliency

To improve the efficiency, reliability, and sustainability of operations, climate change and storm surge resilience must be incorporated into the new bridge design.

2.2.3 Alternatives Considered but Not Carried Forward

NASA dismissed Alternative Two: Construct a full or additional Causeway (beyond existing abutments) from further consideration because it failed to meet Criterion 2, 3, and 5, and is not considered a practicable alternative. Construction of a Causeway would result in substantial impacts to WOTUS, would close Cat Creek to navigation, and would not incorporate climate change or storm surge resilience.

2.2.4 Alternatives Carried Forward for Analysis

NASA will carry the following alternatives forward in the EA for analysis:

- **Alternative One (the Proposed Action)**: Construct a new bridge on a new alignment and demolish the existing bridge within 5 years of the new bridge opening. While variations in the construction methods and bridge design would be determined during the Design-Build process, NASA has determined that this is the only action alternative that meets the Purpose and Need.
- **No Action Alternative**: The No Action Alternative reflects the status quo, in which a new bridge would not be constructed, and NASA and its tenants would continue using the existing Causeway Bridge indefinitely, conducting maintenance and rehabilitation of the existing bridge until structural deficiencies necessitate a full closure. NASA has conducted all repairs possible on the bridge girders (the structures supporting the bridge deck); the next step would be full replacement of the girders, which would result in a long-term bridge closure.

The Proposed Action (Alternative One: Construct a New Bridge), and the No Action Alternative are described in Sections 2.3, *Proposed Action*, and 2.4, *No Action Alternative*, respectively.

2.3 Proposed Action

Under the Proposed Action, NASA would construct a new Causeway Bridge on a new alignment between the WFF Mainland and Wallops Island. The new bridge would be constructed parallel to the existing bridge, using the same Wallops Island causeway road for ingress and egress.

The Proposed Action also includes demolition of the existing bridge within 5 years after the new bridge is opened. The Proposed Action consists of the following project elements, which are listed in approximate order of sequence. Each element is discussed in further detail below.

1. Site preparation and staging areas
2. Construction of temporary construction access(es)
3. Relocation of existing utilities from the Causeway Bridge to underneath Cat Creek by burial via horizontal directional drilling (HDD) or suspension from the new bridge
4. Construction of a new bridge including the installation of all superstructure and substructure elements such as abutments, piers, beams, and decks

5. Removal of temporary construction access
6. Construction of temporary access for demolition of existing bridge
7. Demolition of the existing bridge
8. Removal of temporary access used to demolish the bridge
9. Periodic maintenance and repairs over the 75+ year life of the bridge

Figure 2-1 shows the existing bridge, proposed new bridge alignment, proposed maximum limits of disturbance (LOD), and staging areas.

2.3.1 Site Preparation and Staging Areas

Site preparation would include establishing staging areas, clearing, grading, building embankments for approaches to the new bridge, installing cofferdams, excavating, and filling (as needed) to install temporary construction access(es). NASA has identified three staging areas, all near the security gate to the WFF Mainland, which are shown on **Figures 2-1** and **2-2**. The three staging areas combined encompass 1.44 ha (3.56 ac) (the individual areas are 0.95 ha [2.34 ac], 0.32 ha (0.79 ac), and 0.17 ha [0.43 ac]). They are currently open space covered with grass that is maintained by mowing. The Causeway Road shoulders may also be used for temporary parking and staging of materials and equipment in accordance with FHWA and NASA safety standards as the Causeway Road will remain open during the entirety of the project.

Permanent and temporary erosion and sediment control (ESC) measures would be implemented during site preparation and throughout construction. The type of measures would depend on final bridge design (see Section 2.5.1, *Design-Build Process*) and may include slope reinforcement, riprap for armoring, retaining walls, perimeter controls (such as silt fence), timber mats, slope stabilization (such as mulching and seeding), cofferdams, and turbidity curtains/controls.

2.3.2 Construction and Demolition Equipment

Construction and demolition are expected to occur primarily from land and from temporary construction access platforms. Equipment used may include excavators, backhoes, skid loaders, cranes, aerial lifts, pile driving equipment, HDD equipment, generators, and hydro platforms (hydro platforms are essentially scaffolding that hangs under the bridge).

Additionally, some of the work may be accomplished from vessels, including boats, tugboats, and small barges. Regardless of the construction methods selected, the use of vessels is anticipated to be minor. Cat Creek has not been dredged or maintained by USACE in recent years and the shallow depth limits the size of vessels that could access the Causeway Bridge. Although work could occur from floating barges that could be sunk into the mud, due to shallow water in the Project Area, NASA anticipates that most work would be done from land and temporary construction access. Dredging is not included in the methods of this Proposed Action.

Temporary lighting would be used to illuminate shadowed areas on the underside of the bridge(s) or if night work is needed.

Legend

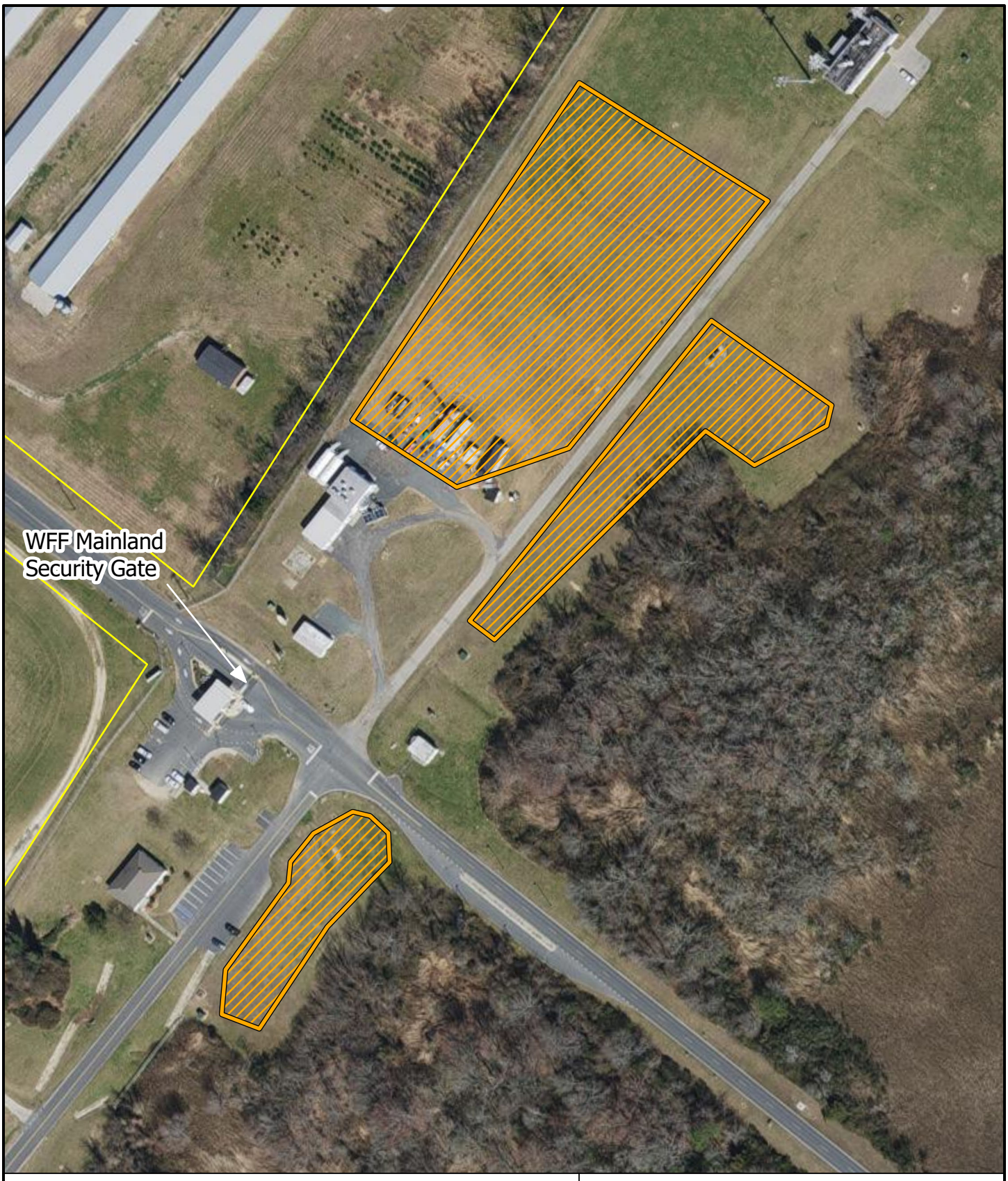
- Staging Area
- Proposed Causeway Bridge
- Bridge Envelope Limits of Disturbance
- Wallops Flight Facility Boundary

Sources: NASA, VGIN / Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

FIGURE 2-1
PROJECT OVERVIEW

0 500 1,000
Feet

WFF Causeway Bridge Replacement Project



Legend

- Staging Area
- Wallops Flight Facility Boundary

Sources: NASA, VGIN / Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

FIGURE 2-2
STAGING AREAS
LIMITS OF DISTURBANCE

0 100 200
Feet

WFF Causeway Bridge Replacement Project

2.3.3 Temporary Construction Access

To access the areas needed to construct the new bridge and demolish the existing bridge, the following methods could be used:

- "on-grade" access,
- construction of a temporary bridge, or
- a combination of on-grade access and construction of a temporary bridge.

2.3.3.1 On-Grade Access

Portions of the work would be done "on-grade," meaning equipment would operate from existing ground and bridge surfaces. Matting would be placed on the ground in areas that are soft or environmentally sensitive (such as tidal wetlands) from which heavy equipment could access construction areas and operate. Rock and fill could be used to extend the working land area, and barges could be sunk into mud to provide a stable surface from which to conduct construction and demolition activities.

2.3.3.2 Temporary Bridge

Typically, for this type of environment and bridge size, a temporary access may have vertical steel piles driven into the creek bed and intertidal mud flats to support the bridge beams and deck, on which the construction vehicles, workers, cranes, etc. would operate. The piles may be formed by using multiple steel liner plates or pipe piles, driven using vibratory or drop hammers, and braced using diagonal braces. On the top of steel-piles, cross beams and seating girders would likely be placed to support the load from main longitudinal beams. Usually, longitudinal beams/trusses are used to directly support the load of heavy construction equipment such as a crane, on the top of which a concrete deck slab or alternate decking would be placed.

FHWA's 30% design plans estimate that up to 144, 12-inch (in) steel piles would be installed for each temporary construction access (for a total of approximately 300 piles if two temporary bridges [one for new bridge construction and one for existing bridge demolition] are used), though other design solutions may not include piles or have a different number of piles for construction access.

Temporary accesses are often constructed using an "end-on" method, which means the crane and piling rig stand on the shoreline and drive the first row of piles in the water. When the first row of piles is driven, the crane places steel beams or trusses on the top of the pile and abutment, followed by the deck elements (concrete or wooden planks or steel plates, handrails, etc.). Once the first span is ready, the crane rig moves forward on the span to drive the second row of piles, and then to place the second span, following the same process as the first span. This process would be repeated until the temporary access is completed.

A temporary construction access, if used to construct the new bridge, would likely be removed soon after completion of the new bridge. If a separate temporary construction access is used to aid in demolishing the existing bridge, it would either be removed in parts along with the existing

bridge or after the bridge is fully demolished. The temporary construction access would be removed with construction vessels such as tugboats or barge-mounted cranes or from the temporary bridges themselves.

2.3.4 Relocation of Existing Utilities

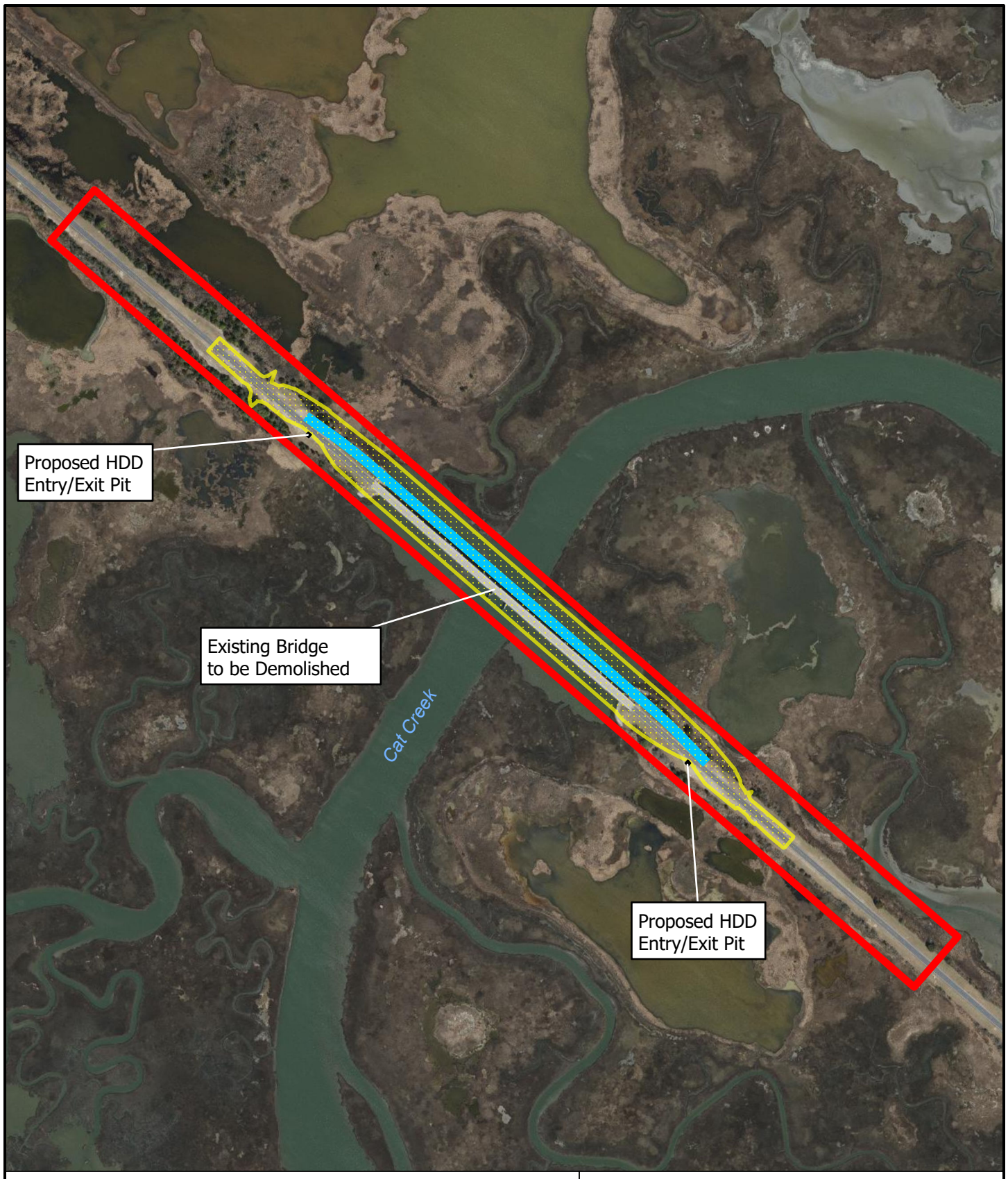
The existing Causeway Bridge has several utilities attached to it including water, sewer, electric, and communications. The existing utilities would be removed from the Causeway Bridge and would either be suspended from the new bridge or relocated underground via HDD under Cat Creek.

HDD is a method where a borehole is drilled along an engineered design path. The length of the boring would be approximately 275 m (1,900 ft) (measured between the entry and exit pits on the surface, not the arc of the borehole itself). Typical HDD borehole depths for this length of a bore are between 12 to 26 m (40 to 85 ft) below the subaqueous bottom of the waterbody above. Borehole entry/exit pits would be placed on both sides of Cat Creek (see **Figure 2-3**). Most HDD requires the use of a viscous fluid known as drilling fluid (also called "drilling mud") that is pumped through the drill pipe to the drill bit to facilitate the removal of cuttings (i.e., soil and rock particles), stabilize the borehole, cool the cutting head, and lubricate the passage of the pipe/conduit. The drilling mud consists mainly of a bentonite clay/water mixture (slurry) that is conditioned with various polymers and additives. A fluorescent, non-toxic dye is typically added to the drilling fluid during drilling beneath water bodies so that any "frac-outs" can be easily detected. A frac-out occurs when drilling mud is released through fractured rock or overburden into the surrounding rock/soil and travels toward the surface. NASA would conduct the HDD operation in a manner that avoids the discharge of water, drilling mud, and cuttings outside the HDD entry and exit work areas during the installation process.

To connect the utility lines to existing utility stubs, open trenching would occur along the south shoulder of Causeway Road on the east and west sides of Cat Creek. Soil excavated from the trench would be temporarily stored along the path of, and adjacent to, the open trench. The trench would be open for a few hours, and then it would be immediately backfilled.

2.3.5 Construction of a New Bridge

NASA would construct a new bridge in the approximate alignment shown on **Figure 2-3**. The information presented in this section is based on FHWA's 30% design plans for the bridge. Relevant plan sheets of the FHWA 30% design plans are provided in **Appendix B**. However, because the structure and type of the bridge, the alignment, and the bridge geometry may vary based on the proposal of the Design-Build contractor (see Section 2.5.1, *Design-Build Process*), the elements and details presented here are subject to change. NASA has established an "envelope" with a range of designs that meet the Purpose and Need (see Section 2.5.2, *Envelope Concept*).



Legend

- Proposed Causeway Bridge
- FHWA 30% Plan Limits of Disturbance
- Bridge Envelope Limits of Disturbance

N

Sources: NASA, VGIN / Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

FIGURE 2-3
FHWA 30% DESIGN PLAN
LIMITS OF DISTURBANCE

0 250 500
Feet

WFF Causeway Bridge Replacement Project

2.3.5.1 Design Standards

The Causeway Bridge replacement project would follow the guidelines of the FHWA's *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects* FP-14 manual (FHWA 2014). Both NASA and FHWA will review and approve of design plans from preliminary through final.

2.3.5.2 Material

The material used would most likely be concrete, which could include cast-in-place or precast deck and pier caps, precast prestressed beams and piles, or concrete box girder (girders are essentially large beams [FHWA 2023]). Prestressed concrete has tension or stress applied to the concrete beam before it is placed in position. Box girders may be comprised of concrete sections that are post-tensioned together after they are placed in position. While other material options are available, they are not likely to be used; for example, a steel bridge would require a high degree of maintenance given its expected corrosion over time in a marine environment.

2.3.5.3 Bridge Size

The length of the new bridge would depend on the design but is anticipated to be longer than the existing bridge (i.e., 391 m [1,284 ft]), up to approximately 600 m (1,950 ft) long. It would have multiple spans and may vary in the number of segments and length of each segment. The FHWA 30% design is for a bridge consisting of nine main spans totaling 411 m (1,350 ft) with 45 m (150-ft) spans and ten approach spans totaling approximately 180 m (600 ft) with 18-m (60-ft) spans.

The weight capacity of the proposed bridge does not need to be increased, but it may increase depending on final design.

The existing bridge has a 6% maximum slope, which is based on a previous USCG height requirement above MHW. With a 6% slope on the existing bridge, large materials and equipment travelling to Wallops Island, such as rocket components, require the aid of special transport equipment that has independently controlled axles.

NASA prefers a low-profile bridge with a lesser slope than 6% so that special transport equipment would no longer be required. **Exhibit 2-1** illustrates a potential design for a low-profile bridge for comparison alongside the existing bridge. A lower bridge height over a longer bridge length would decrease the slope of the new bridge.

Exhibit 2-1. Illustration of a Low-Profile Bridge Compared to the Existing Bridge.

USCG and USACE regulate the vertical and horizontal clearance of bridges and may impose conditions relating to the construction, maintenance, and operation of the bridge that would be in the interest of public navigation. In a Preliminary Navigation Clearance Determination dated May 11, 2021, USCG stated that the proposed new bridge should provide at least 3.9 m (12.8 ft) of vertical clearance above mean high water (the existing bridge has a higher vertical clearance of 12.2 m [40 ft] above mean high water) and at least 18 m (60 ft) of horizontal clearance through the main navigation span of the bridge (the existing bridge meets this requirement). The Preliminary Navigation Clearance Determination was valid for 3 years (USGS 2021). NASA and FHWA are in the process of renewing the Preliminary Navigation Clearance Determination with USCG to include the proposed construction timeline of the new bridge.

NASA anticipates a total bridge width of approximately 12 m (40 ft). To support larger materials and equipment, including "super-loads," NASA would require two 3.7 m (12 ft)-wide travel lanes. The width of the shoulders and curbs may vary depending on final design; using the example of a 12 m (40 ft)-wide bridge, the shoulders and railings would be 4.9 m (16 ft) combined.

2.3.5.4 Design Options

The bridge design would be determined during the Design-Build process. Some design options are listed below; however, the Design-Build contractor may propose other design solutions.

- Precast prestressed concrete bulb-tee bridge with varying span lengths such as 18.3 to 45.7 m (60 ft to 150 ft) long spans.
- Precast concrete segmental bridge with 60 m (200 ft) long spans.
- Precast prestressed concrete bridge with shorter spans (18 to 36 m [60 to 120 ft] long spans).
- Long span concrete segmental bridge. This design is possible but unlikely because it would create a deep superstructure that would result in an increase in bridge height compared to the existing bridge.

- Long span cable stay bridge. A cable bridge is unlikely because the cables and bridge structure above the bridge deck would inhibit movement of large loads.
- Precast tub girder superstructure. This bridge type is ideal for curved applications and not for straight design. Deck components would be cast in place.

2.3.5.5 Methods of Construction

While the method of bridge construction would be up to the Design-Build contractor (with NASA and FHWA approval), this section provides examples of two methods that could reasonably be used for this bridge replacement: the "Temporary Bridge Method" and "Top-Down Method."

- *Temporary Bridge Method.* This method follows the same initial approach for temporary staging clearing, subgrade work, and grading for the on-ramps, but a temporary bridge would be constructed from which cranes and other equipment would be placed to build the new bridge adjacent to the trestle. The temporary bridge would be supported by temporary piles driven into the ground to support the trestle network. Once the new Causeway Bridge was completed, the temporary bridge and supporting temporary piles would be removed. Restoration of wetlands that may have been temporarily impacted by the temporary bridge construction may be required. The construction design could call for a temporary earthen causeway into the marsh to begin construction of the temporary bridge. Cofferdams (i.e., a wall that is sealed into the creek bed around a designated workspace, which is then dewatered) could also be used with this method.
- *Top-Down Method.* The approach would be to install ESC measures before beginning construction. Clearing of brush for the temporary construction staging areas proximal to either end of the existing bridge would take place. The cleared vegetation would be transferred to an approved landfill for disposal. Subgrade excavation would be required to remove unsuitable soils, if they exist, and placement of subgrade foundation rock for footings and ramps on either side of the waterway would occur. New grades would be established leading to the on-ramp for each end of the Causeway Bridge. With the Top-Down Method, bridge segments would be built in stages. As each new section is completed, that section would then be used to extend out for construction of the next new section. This approach could be used starting at one end and building across the waterway to the other side, or construction could begin on both sides and meet in the middle. To conduct work in the water, such as installing bridge supports, cofferdams may be used.

2.3.5.6 Substructure Support (Piles or Drilled Shafts)

Different types of permanent deep foundations could be used in construction depending on the bridge design; however, NASA anticipates that the piles would be concrete, and that no other material (such as steel or timber) would be used. Drilled shafts can most likely be built without needing to install temporary cofferdams. However, the use of piles may require the installation of temporary cofferdams at some locations. The FHWA 30% design plans estimate that up to

196 concrete piles that are 91-centimeters (cm) (36-in) in diameter would be installed for the new bridge.

There would likely be several additional piles installed in the upland areas on both sides of the new bridge under the bridge approaches (Sheet B02 on the FHWA 30% plans in **Appendix B** illustrates upland piles in cross-section view).

2.3.6 Demolition

Once the new bridge is open, NASA would demolish the existing Causeway Bridge and remove all bridge debris. It is possible that cofferdams would be used to drive sheet walls around the base support structures, which would allow the area to be dewatered to enable work to occur on the creek bottom and intertidal mud flats. The existing support pilings would likely be left in place and cut off at least 2 feet below the "mud line" (the creek bottom).

Concrete piles or pieces of debris created during removal of the bridge and support piles would be removed, brought to shore, transferred to a dump truck, and hauled either to an onsite stockpile area or directly to a recycling facility. The debris may be removed partially by barge in the deeper waters, or by a "top down" method where debris is loaded onto trucks and carried off the bridge, or through use of a temporary platform placed south of the existing bridge. Materials determined not to be recyclable or reusable would be properly disposed of at an approved landfill, in accordance with local, state, and federal regulations. The amount of demolition debris generated is estimated to be approximately 18,000 metric tons (20,000 tons). The use of explosives would not be authorized for any demolition-related activities.

In scoping comments dated September 22, 2022, the Virginia Marine Resources Commission (VMRC) recommended coordination with the VMRC Artificial Reef Program to determine if bridge demolition debris could be used in the program. NASA initiated coordination with the VMRC Artificial Reef program on February 21, 2023; NASA, FHWA and VMRC discussed the project on March 9, 2023, and will continue to work together through the Design-Build process to identify how demolition debris could be used as artificial reefs.

2.3.7 Project Timeline

The Design-Build contract is planned to be awarded in the summer of 2024. Although the design award can be given prior to concluding the NEPA process, construction would not begin until the NEPA decision document is signed. NASA anticipates that project design would conclude approximately 1 year after award (2025) and that construction of the new bridge, including site preparation and temporary construction access(es), would be completed within 3 years after design (2028). Once the bridge is open to traffic, the existing bridge would be demolished. Dismantling and removal would take approximately 5 to 9 months and is anticipated to begin within 5 years of the new bridge opening, depending on funding. The new bridge would be designed to have a service life of at least 75 years.

2.4 No Action Alternative

CEQ regulations (40 CFR Part 1502.14(c)) for implementing NEPA require analysis of a No Action Alternative. "No Action" means that implementing the Proposed Action would not occur. The resulting environmental effects from taking No Action are compared to the anticipated effects of implementing the Proposed Action. Under the No Action Alternative, NASA would not construct a new Causeway Bridge and the existing bridge would remain in place. NASA would conduct maintenance and rehabilitation of the existing bridge until structural deficiencies necessitate a full closure.

2.5 Use of this Environmental Assessment

This EA evaluates the environmental effects of constructing a new bridge and demolishing the existing Causeway Bridge. As several different methods of design and construction could be used, the largest "footprint" was chosen as the demonstration, or "envelope," bridge design to provide a benchmark for assessing impacts to resources at WFF and the surrounding environment. The envelope concept is described below in more detail.

2.5.1 Design-Build Process

NASA is using the Design-Build process for design and construction of the Proposed Action. With Design-Build, the federal agency typically completes between 5 to 30 percent of the preliminary design before it is released to a Design-Build contractor for final design. This process is unlike traditional construction projects where 100 percent of the project is designed in advance of the construction contractor being selected.

Prior to the Design-Build process, NASA and FHWA conducted a Value Analysis Study, including a workshop with key members from NASA and FHWA, to identify risks (technical, environmental, financial, etc.) and project goals, and to determine if the project scope should be adjusted to adequately address identified risks. Although project alternatives were identified (and some dismissed) during the Value Analysis, as noted in Section 2.2.3, *Alternatives Considered but Not Carried Forward*, the Design-Build contractor would have the opportunity to propose their own structural design and construction and demolition methods. From here, all project team members (NASA, FHWA, and the Design-Build contractor) would work together to develop the best possible design for project success. A benefit of the Design-Build delivery method is that it provides an opportunity for the contractor to incorporate alternative technical concepts at the design and construction phases to deliver projects and provide cost savings more efficiently.

FHWA prepared preliminary design plans in 2020, and in January 2023, FHWA updated those plans to a 30% level of design (**Appendix B**). The FHWA preliminary and 30% designs provide an overview of the potential construction methods, bridge style, and LOD that convey enough information about the project to assess the potential environmental impacts. However, the FHWA design may be changed by the Design-Build contractor, and therefore is considered conceptual.

For Design-Build projects, FHWA, as the design lead would ensure that the requirements set by 23 CFR Part 636, which include those imposed to protect the objectivity and integrity of the NEPA process during the environmental review and Design-Build process, would be met. The Design-Build process provides flexibility by allowing projects to be advertised and selected while the NEPA process is being concluded. The process recognizes the requirement for obtaining NEPA approval (e.g., issuance of a FONSI) before ground disturbance can commence.

2.5.2 Envelope Concept

The nature of the Design-Build process in which NASA would obtain a contractor to design the new bridge could result in the final design differing from the January 2023 FHWA 30% design plans provided in this EA. Therefore, to adequately understand the potential footprint and to evaluate the environmental impacts of the Proposed Action, NASA is applying the envelope concept to the EA analysis.

The envelope concept facilitates the environmental analysis and documentation process by providing a threshold below which, if not exceeded, further in-depth NEPA analysis would not be needed. For this EA, an "envelope" for the LOD has been identified and is presented in **Figures 2-1 and 2-3** as a scenario with the greatest potential for environmental impacts.

The total area of the envelope is 9.96 ha (24.6 ac). The envelope extends:

- 45.7 m (150 ft) to the north of the existing roadway centerline
- 30.5 m (100 ft) south of the existing roadway centerline
- 1,306 m (4,284 ft) east to west (along the long edge of the envelope rectangle)

Although FHWA has prepared 30% design plans, they represent a reference design that can be used to identify potential footprints of disturbance (both temporary and permanent) on which the EA analysis can be based. Once a Design-Build contractor provides bridge construction and demolition designs, NASA would review the plans to determine if the designs fall within the envelope identified in **Figures 2-1 and 2-3**. The LOD at the bridge associated with FHWA's 30% design plans encompasses 3.5 ha (8.7 ac).

Note that the LOD at the staging areas (1.44 ha [3.56 ac] total for all three staging areas) are not part of the envelope; the envelope only applies to the work area around the Causeway Bridge.

Any proposed bridge design (including construction and demolition) that presents lesser or equal disturbance than presented in **Figures 2-1 and 2-3** may be considered within the purview of this EA. If the new plans do not exceed the envelope, then the NEPA review trigger is not met, and NASA would rely on the findings of this EA. If the new design exceeds the thresholds in this EA, additional NEPA review would be required. Supplemental NEPA analysis would document what changes, if any, have occurred with the project including changes in the design, project limits, scope, new or modified laws and regulations, circumstances, or other new information affecting the project, and provide an analysis of potential impacts to resources.

3 Affected Environment and Environmental Consequences

NEPA requires focused analysis of the areas and resources potentially affected by an action or alternative. The results of the analysis should be presented in a comparative fashion that allows decision makers and the public to differentiate among the alternatives.

CEQ regulations for implementing NEPA (40 CFR Parts 1500-1508) also require the discussion of impacts in proportion to their significance, with only enough discussion of non-significant issues to show why more study is not warranted. The analysis in this EA considers the current conditions of the affected environment and compares those to conditions that might occur should WFF implement either of the Alternatives.

The geographic area for this EA includes any area that would be disturbed by construction and demolition activities and by the staging activities, including uplands, wetlands, and water. **Figures 2-1 and 2-3** show the "envelope" for the LOD for construction and demolition activities. The proposed staging areas are shown on **Figures 2-1 and 2-2**.

Resources Considered but Eliminated from Detailed Analysis

Numerous resources were considered in the *Final Site-wide PEIS* but warrant no further examination in this EA because the resource is not present within the affected environment. **Table 3-1** presents resources that were analyzed in the *Final Site-wide PEIS* and indicates which resources are not discussed in this EA because they are not present within the affected environment, have not measurably changed since the *Final Site-wide PEIS* was completed, or would not be notably affected by the Causeway Bridge Replacement project.

Table 3-1. Resources Considered in this EA			
Resource		**Analyzed in Detail in this EA?**	**If *Yes*, EA Section** **If *No*, Rationale for Elimination**
Physical Environment	Noise	Yes	Section 3.1
	Air Quality	Yes	Section 3.2
	Toxic Substances, Hazardous and Regulated Materials, and Waste	Yes	Section 3.3
	Environmental Compliance and Restoration Program, Storage Tank Management	No	No buildings, storage tanks, or historic Areas of Concern in the Project Area
	Munitions and Explosives of Concern (MEC)	No	No MEC within or near the Project Area
	Health and Safety	Yes	Section 3.4
	Land Use	No	Land use would not change
	Land Resources	Yes	Section 3.5
	Surface Waters	Yes	Section 3.6.1
	Stormwater Management (combined with Surface Waters for this EA)	Yes	Section 3.6.1
	Groundwater	Yes	Section 3.6.2
	Wetlands	Yes	Section 3.6.3
	Marine Waters	No	Marine waters are defined as the Atlantic Ocean in *Final Site-wide PEIS* and would not be directly affected by the proposed project.
	Floodplains	Yes	Section 3.6.4
	Coastal Zone	Yes	Section 3.6.5
	Sea-Level Rise	Yes	Section 3.6.6
Biological Environment	Vegetation	Yes	Section 3.7
	Submerged Aquatic Vegetation (SAV)	No	No SAV in the Project Area (VMRC 2022)
	Wildlife (Terrestrial, Aquatic)	Yes	Section 3.8
	Special Status Species	Yes	Section 3.9
Social and Economic	Airspace Management	No	Project would not affect airspace
	Roads	Yes	Section 3.10
	Rails	No	Project would not affect or use rails

Table 3-1. Resources Considered in this EA			
Resource		**Analyzed in Detail in this EA?**	**If *Yes*, EA Section** **If *No*, Rationale for Elimination**
	Water	Yes	Section 3.10
	Potable Water	Yes	Section 3.6.2 (Groundwater)
	Wastewater Treatment	No	Project would not involve wastewater treatment
	Electric Power	No	Project would not involve electrical power infrastructure
	Communication	No	Project would not affect communication
	Waste Collection and Disposal Services	No	Project waste collection and disposal services are outlined in the *Final Site-wide PEIS.* Additionally, demolition debris disposal is addressed in Section 3.3.
	Population	No	Project has no potential to result in changes to population
	Employment and Income	Yes	Section 3.11
	Housing	No	Project has no potential to result in loss or addition of housing
	Environmental Justice (Including Protection of Children)	No	Project has no potential to affect communities outside of WFF
	Visual Resources	No	Project would not result in changes to the viewshed
	Recreation	Yes	Section 3.12
Cultural Resources	Archaeological Resources	Yes	Section 3.13
	Architectural Resources	No	Project has no potential to affect architectural resources

3.1 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. Noise may be intermittent or continuous, steady or impulsive, and may be generated by stationary or mobile sources. The individual response to similar noise events can vary widely and is influenced by the type and characteristics of the noise source, distance between source and receptor, receptor sensitivity, and time of day.

Noise regulations applicable to the Proposed Action include the Noise Control Act, the Accomack County Code, and those required by the U.S. Occupational Safety and Health Administration (OSHA). Although noted in the *Final Site-wide PEIS* as potentially applicable to the Causeway Bridge Replacement project, FHWA's highway noise regulations *Procedures for Abatement of Highway Traffic Noise and Construction Noise* would not apply since the project would not significantly change the horizontal or vertical alignment of the highway or increase the number of traffic lanes. Details outlining noise metrics, thresholds, and ordinances are available in the *Final Site-wide PEIS*.

Sound is expressed in decibels (dB). A-weighting (dBA) 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. A sound level of 0 dBA is the approximate threshold of human hearing and is barely audible under extremely quiet conditions. By contrast, normal speech has a sound level of approximately 60 dBA. Sound levels above 100 dBA begin to be felt as discomfort inside the human ear. Sound levels between 110 and 130 dBA are felt as pain. Levels exceeding 140 dBA could involve tissue damage to the ear (Berglund and Lindvall 1995).

Noise levels continuously vary with location and time. Sound disperses as it travels from the source, and the Sound Pressure Level (SPL) diminishes, or "attenuates," with distance. In addition to distance attenuation, air absorbs sound energy. Atmospheric effects (wind, temperature, precipitation) and terrain/vegetation effects also influence sound propagation and attenuation over distance from the source. An individual's sound exposure is determined by measurement of the noise that the individual experiences over a specified time interval.

Airborne Noise

Human hearing is more sensitive to medium and high frequencies than to low and very high frequencies, so it is common to use maximum dBA metrics (also shown as dB L_{Amax}) representing the maximum A-weighted sound level during an event, such as an aircraft overflight. According to OSHA, an employee should not be subjected to continuous noise exceeding 90 dBA for durations lasting more than 8 hours per day, with a maximum limit of 115 dBA for durations of 15 minutes or less.

Underwater Acoustics

Sound waves can travel much farther in water than in air. Unlike airborne noise, underwater noise is not weighted to match frequencies that can be heard by the human ear. Instead, two common descriptors of underwater noise are instantaneous Peak SPL (dB_{Peak}) and the Root-Mean-Square (RMS) (dB_{RMS}) pressure level during the impulse. The (dB_{Peak}) is the instantaneous maximum overpressure or under pressure observed during each sound pulse and can be presented in Pascals (Pa) or SPL in dB, referenced to a pressure of 1 micropascal (µPa) at 1 m (dB re1µPa-m). The dB_{RMS} is the square root of the energy divided by the duration of the sound pulse and is often used for continuous sounds. The National Oceanic and Atmospheric Administration (NOAA) Fisheries, also known as, National Marine Fisheries Service (NMFS), typically utilizes dB_{Peak} thresholds for physiological injury and dB_{RMS} thresholds for behavioral effects to fish, sea turtles, and marine mammals.

3.1.1 Affected Environment

This section describes the existing airborne and underwater noise environments and major noise sources in the Project Area. There are no noise-sensitive receptors near the site.

Airborne Noise

Generally, the noise environment at the Causeway Bridge is relatively quiet, with the dominant noise sources being naturally occurring wind and wave action. Intermittent airborne noise occurs from commercial fishing, recreational boating, personal watercraft, vehicular traffic, and ongoing operations at Wallops Island such as UAS flights, target launches, and rocket launches. According to the *Final Site-wide PEIS*, ambient noise at WFF is below 52 dB Day-Night Average Sound Level. Noise generated by rocket launches is short-term in duration lasting less than 10 minutes with the peak noise levels occurring within the first one to two minutes.

Underwater Acoustics

Generally, the waters surrounding the Project Area are relatively quiet, with the major human-generated noise sources coming from commercial fishing vessels, recreational boats, and personal watercraft. The main natural sound source that may be found near the Causeway Bridge is thunderstorms.

3.1.2 Environmental Consequences

Noise-related impacts would be considered significant if the Proposed Action generated noise levels that were incompatible with surrounding land uses, resulted in long-term adverse impacts at noise-sensitive receptors, or created a situation that endangered human health and safety. Potential noise impacts to ecological receptors in terrestrial and aquatic habitats, as well as special status species are discussed in Sections 3.8, *Wildlife* and 3.9, *Special Status Species,* respectively.

3.1.2.1 No Action Alternative

Under the No Action Alternative, current baseline sound conditions would continue. Periodic bridge maintenance and repairs would occur as needed, until bridge closure is required. It is likely that noise from maintenance and repairs would not be heard beyond Wallops Island and workers would adhere to noise standards and guidelines, as outlined below. Therefore, noise impacts would be minor and short-term.

3.1.2.2 Proposed Action

Construction and Demolition

Construction and demolition noise is generally temporary and intermittent in nature, as it typically occurs only on weekdays and during daylight hours. Noise produced from roadway construction, especially bridge construction, can cause adverse, but short-term impacts to the surrounding environment. The use of explosives is not authorized at WFF and therefore explosives would not be used for demolition of the existing Causeway Bridge.

Construction Vehicle/Equipment Noise: In the *Final Site-wide PEIS*, NASA noted that the U.S. Department of Transportation's FHWA Road Construction Noise Model showed that airborne construction noise from typical bridge construction equipment (e.g., impact pile driver, crane, excavator, dump truck, etc.) would attenuate to less than 60 dBA in approximately 2,135 m (1.3 mi) (FHWA 2006). Therefore, while some noise could be heard at the closest residence to the Causeway Bridge, which is approximately 1.6 km (1 mi) west of the bridge, no adverse impacts would occur to the surrounding communities. If HDD is used to install the utility lines, noise levels from these operations in the Project Area are anticipated to be between 90 to 120 dBA range (eNoiseControl 2023). In general, noise levels at the HDD entry site would be typical of standard construction activities.

Pile Driving: Generally, the greatest noise impacts during bridge construction are from pile driving, which is impulsive but occurs over weeks to months for installing all necessary piles. Pile driving would impact noise conditions in the airborne and underwater environments. A number of parameters are considered when estimating pile driving noise impacts, such as the size and type of piles, the number of piles, and the average number of strikes per day from the impact pile driving equipment. Under the Proposed Action, temporary construction access may require the installation of approximately 144 piles over a period of several weeks during construction. According to the *Final Site-wide PEIS,* underwater noise from pile driving is unlikely to create any noise impacts to humans; however, the potential for impacts to special status species, marine mammals, and fish exists. These impacts are discussed in Section 3.9, *Special-Status Species*.

Worker Protection: OSHA 8-hour thresholds (90 dBA) would be exceeded within 53 m (175 ft) of bridge construction and demolition activity. Construction and demolition equipment often produce noise in excess of 90 dBA (e.g., jackhammers, bulldozers, or other heavy equipment); however, the maximum noise levels would likely be caused by pile driving (120 dB). Although construction and demolition noise are not likely to be heard at most facilities on Wallops Island, on days with

little to no wind, there may be minor annoyance to personnel who are outside on the central portion of Wallops Island or the Mainland. Noise levels would be far below OSHA noise guidelines and would not result in adverse impacts to human health. NASA would comply with local noise ordinances and state and federal standards and guidelines for potential impacts to humans caused by construction and demolition activities (e.g., hearing protection) to minimize potential impacts to NASA and construction contractor personnel.

Vehicle Traffic Noise: Traffic-related construction and demolition noise would result from the movement of construction equipment as well as the movement of related vehicles (i.e., worker trips, and material and equipment trips) on the bridge and surrounding roadways. The level of noise from construction-related traffic would vary depending on the phase of construction. Noise levels associated with construction traffic would increase ambient noise levels adjacent to the construction site and along roadways used by construction-related vehicles. However, the noise levels generated by construction-related traffic would be minor and short-term.

Following completion of construction and demolition activities, the ambient sound environment would return to existing levels and there would be no long-term impacts to the noise environment.

Operation

The new Causeway Bridge would not increase the amount of traffic using the bridge; as such, long-term traffic noise on the Causeway Bridge is not anticipated to increase due to the Proposed Action. There would be noise associated with ongoing maintenance and repairs of the utility lines and the bridge during its 75-year lifespan; however, maintenance- and repair-related noise is not anticipated to exceed thresholds described for construction and demolition. Workers would adhere to all noise-related standards and guidelines as described for construction and demolition. Depending on the magnitude of repairs, impacts would be minor, likely last for short periods of time, and occur infrequently. There would be no long-term adverse noise impacts.

3.2 Air Quality

Air quality 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 Clean Air Act (CAA), and its subsequent amendments, established the National Ambient Air Quality Standards (NAAQS) for "criteria" pollutants: ozone, carbon monoxide (CO), nitrogen dioxide, sulfur dioxide, 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. Air quality at WFF is regulated by the USEPA, Virginia Department of Environmental Quality (VDEQ), and the State Air Pollution Control Board (Code of Virginia § 10-1.1300).

Hazardous Air Pollutants

In addition to the ambient air quality standards for criteria pollutants, national standards exist for hazardous air pollutants (HAPs) for both stationary and mobile source emissions. The National

Emission Standards for Hazardous Air Pollutants regulate 187 HAPs based on available control technologies (VDEQ 2023). Examples of HAPs regulated by VDEQ include toxins such as benzene, methylene chloride, dioxin, toluene, and metals such as cadmium, mercury, chromium, and Pb compounds. The majority of HAPs are volatile and semi-volatile organic compounds. Unlike the criteria pollutants, toxics do not have NAAQS. HAP impacts are based on exposure concentration and duration.

Greenhouse Gases

Greenhouse gases (GHGs) include carbon dioxide (CO_2), methane, nitrous oxide, ozone, and several hydro- and chloro-fluorocarbons. For simplification, total GHG emissions are often expressed as a CO_2 equivalent. As GHGs are relatively stable in the atmosphere and are essentially uniformly mixed throughout the troposphere and stratosphere, the climatic impact of GHG emissions does not depend upon the source location. Therefore, regional GHG impacts are likely a function of global emissions.

On January 9, 2023, CEQ issued interim guidance, *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*, that directs federal agencies to include analyses of GHG emissions and climate change in NEPA reviews. In addition, Executive Orders (Eos) 14057 *Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability,* 14008 *Tackling the Climate Crisis at Home and Abroad, and* EO 13990 *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis* direct federal agencies to consider climate change, including GHG emissions, in their operations.

3.2.1 Affected Environment

The region of influence for air quality for this EA is defined as the Northeastern Virginia Intrastate Air Quality Control Region (AQCR) (defined in 40 CFR Part 81.144), which includes Accomack County. This AQCR is designated as "in attainment/unclassifiable" for all criteria pollutants. Because the Proposed Action is in an attainment area for all criteria pollutants, a General Conformity Review (under Section 176(c) of the CAA) does not apply to this project.

3.2.2 Environmental Consequences

Air quality impacts would be significant if emissions associated with the Proposed Action would: 1) increase ambient air pollution concentrations above the NAAQS, 2) contribute to an existing violation of the NAAQS, or 3) interfere with, or delay timely attainment of the NAAQS. The Northeastern Virginia Intrastate AQCR is designated as "in attainment/unclassifiable" for all criteria pollutants; therefore, significant impacts to air quality would result only if the Proposed Action were to increase ambient air pollution concentrations above the NAAQS.

3.2.2.1 No Action Alternative

The No Action Alternative would have no impacts to air quality because the proposed Causeway Bridge would not be replaced; therefore, none of the associated construction or demolition activities with potential to affect air quality would occur. There would be emissions associated

with ongoing maintenance and repairs of the bridge, and depending on the extent of activities, may occur for months at a time, until bridge closure. However, emissions from maintenance and repair activities would not increase ambient air pollution concentrations above the NAAQS.

3.2.2.2 Proposed Action

Construction and Demolition

Air quality effects would occur from combustion emissions of mobile sources due to the use of fossil fuel-powered equipment during construction and demolition activities and from the commute of construction workers to and from the site. The equipment used during construction would likely vary in age and have a range of pollution reduction effectiveness. However, construction equipment would be operated intermittently over a large area and would produce negligible ambient HAPs in a localized area. Construction equipment and worker vehicles would be operated in compliance with applicable USEPA regulations for emissions from vehicles and engines and would be used intermittently over the construction period. Any fuel-burning equipment (e.g., generators, pumps, cranes) that are anticipated to remain on-site for 12 months or longer and thereby qualify as stationary sources would be evaluated by the equipment owner(s) for permitting through VDEQ.

Equipment and vehicle use would produce minimal pollutant emissions in a localized area. Additionally, ground disturbance would create fugitive dust emissions (PM_{10} and $PM_{2.5}$). The Design-Build construction contractor would be required to adhere to VDEQ's Open Burning Restrictions and Fugitive Dust Precautions (e.g., water may be sprayed to lessen impacts from activities that generate dust). Architectural coatings and sealants used in construction activities would be required to comply with VDEQ's volatile organic compound limits. Regional adverse impacts to air quality would be localized, short-term, and negligible.

Operation

Periodic maintenance and repair of the utility lines and during the 75-year lifespan of the bridge would result in similar types of emissions, including GHGs, as described for construction and demolition activities. Emissions would be periodic and could last for several days to months depending on the work required to conduct the maintenance and/or repairs. The amounts of air pollutants associated with these emissions would likely be similar to those from construction and demolition and are expected to have negligible short-term adverse effects on regional air quality or climate change.

3.3 Toxic Substances, Hazardous and Regulated Materials, and Waste

Hazardous materials are generally defined as any substance that, due to quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health, welfare, or the environment. Hazardous and toxic materials and wastes are regulated at the federal level by the USEPA in accordance with the CWA; Toxic Substances Control Act; Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response,

Compensation, and Liability Act; CAA; and at the state level by VDEQ under applicable state authorization to the federal regulations. The federal government is required to comply with these acts and all applicable state regulations under EO 12088 *Federal Compliance with Pollution Control Standards*. Additionally, EO 12088, under the authority of USEPA, ensures that necessary actions are taken for the prevention, management, and abatement of environmental pollution from hazardous materials.

The WFF *Integrated Contingency Plan* (ICP) serves as WFF's primary guidance document for the prevention and management of oil, hazardous material, and hazardous waste releases (NASA 2023a).

3.3.1 Affected Environment

The affected environment for hazardous materials consists of all areas associated with construction of the proposed new Causeway Bridge and demolition of the existing bridge, the proposed staging areas, and the road between the staging areas and the bridge on which construction equipment would regularly travel. Based on the information provided in Section 3.3.1.4, *Environmental Compliance and Restoration Program* of the *Final Site-wide PEIS*, there are no existing hazardous materials Areas of Concern that may pose a risk to human health or the environment in or near the proposed Project Area. There are also no areas containing MECs in the Project Area.

Due to the age of the structure, the existing Causeway Bridge may have Asbestos-Containing Materials (ACM), as well as lead-based paint (LBP). Since this paint has historically been used to inhibit the rusting and corrosion of iron and steel in marine environments, NASA anticipates that LBP is likely present on the existing bridge.

3.3.2 Environmental Consequences

The magnitude of potential impacts associated with hazardous materials, toxic substances, and hazardous waste depends on the toxicity, transportation, storage, and disposal of these substances. The threshold of significance would be met if hazardous materials, hazardous waste, or interaction with restoration sites substantially increase the human health risk or environmental exposure through storage, use, transportation, or disposal of these substances.

3.3.2.1 No Action Alternative

Under the No Action Alternative, further maintenance and repairs of the bridge would result in the use and disposal of regulated wastes; the type and magnitude of impacts would be similar to those from the Proposed Action, described below.

3.3.2.2 Proposed Action

Construction and Demolition

The primary sources of regulated waste generated during the Proposed Action would be demolition debris from the existing bridge and the use of petroleum products in machinery and equipment.

Construction and demolition activities would include the use of regulated hazardous materials and could generate the following types of hazardous and non-hazardous waste:

- LBP contaminated demolition waste,
- Solvents, anticorrosives, hydraulic fluid, oil, and antifreeze used in construction equipment,
- On-site storage of materials such as petroleum products (fuels), oils, lubricants, anticorrosives, and solvents, and
- General refuse generated during construction (i.e., non-hazardous solid waste).

Mobile equipment (e.g., trucks, boats, barges, excavators) would be powered by diesel and gasoline engines, with on-board fuel tank capacities expected to range from 10 to 1,900 liters (L) (2 to 500 gallons [gal]). Some of the equipment would have on-board hydraulic oil systems with capacities estimated to range between 60 to 120 L (15 to 30 gal).

Demolition debris may contain ACM. The Design-Build contractor would be responsible for surveying for ACM prior to demolition. If ACM is found, in addition to the federal waste-related regulations mentioned in Section 3.3, state regulations for ACM must be followed. ACM would be properly removed and disposed of prior to or during demolition in accordance with 40 CFR 61.40 through 157 and Goddard Procedural Requirements 8500.3 (Waste Management).

Demolition debris may also contain LBP (including older paint that may be sealed under newer layers of paint), and the Design-Build contractor would be responsible for sampling the debris to determine whether it contains LBP prior to demolition. If LBP is found, demolition of the bridge and removal of LBP would be conducted in accordance with OSHA's Lead Standard for the Construction Industry.

NASA would require the Design-Build contractor to evaluate the debris for potential use in VMRC's Artificial Reef Program. NASA discussed the project on March 9, 2023, with VMRC Artificial Reef Program staff, and would continue to work with VMRC through the Design-Build process. NASA would follow all requirements for cleaning and/or use of demolition debris that is considered for use as a reef in accordance with VMRC's Artificial Reef Program.

Debris not used as artificial reef would be recycled to the extent practicable and would otherwise be disposed of in accordance with local, state, and federal regulations. Debris would either be temporarily stockpiled onsite, including at one of the staging areas, or immediately hauled off site. Concrete piles removed from open water areas under the bridge, or pieces of concrete debris created during the pile removal, could be removed from the project site, brought to shore, and then hauled either to an onsite stockpile area or directly to a recycling or waste facility.

Under the Proposed Action, NASA would require the Design-Build contractor to prepare a project-specific Spill Prevention, Control, and Countermeasure (SPCC) if the contractor plans to store more than 5,000 L (1,320 gal) of petroleum products on site. The SPCC plan would include an equipment maintenance and fueling plan. Protective control measures (e.g., oil-absorbent socks,

temporary containment areas) would be installed around the fuel transfer equipment prior to fueling operations. The SPCC plan would include provisions for controls and countermeasures during land-based and marine-based activities. USEPA/OSHA Safety Data Sheets for all regulated materials would be kept on-site at each project work area. In accordance with Virginia Stormwater Management Program (VSMP) requirements, the Design-Build contractor would also be required to prepare and submit for approval a Stormwater Pollution Prevention Plan (SWPPP).

WFF is currently in the planning stages for an investigation of per- and polyfluoroalkyl substances (PFAS) concentrations in groundwater on the Mainland and Wallops Island. If PFAS is detected above USEPA Regional Screening Levels, any dewatering of PFAS contaminated groundwater must be containerized and be handled in accordance with the NASA PFAS Investigation Derived Waste Policy and applicable federal and state guidance or regulations. If the Design-Build process determines that dewatering would be treated and discharged on site, a dewatering plan must first be approved by the WFF Medical and Environmental Management Division (MEMD). The plan should include pumping rate, dewatering depth, estimated duration of dewatering (hours/days), estimated amount to be dewatered (gallons), dewatering sequence (if applicable), proposed discharge location, and controls to be used to prevent direct or indirect discharge to surface water.

If HDD is utilized, the operation would employ equipment and procedures to maximize the recirculation and reuse of drilling mud to minimize waste disposal. The drilling mud recovery and reclamation process separates excess solids from the drilling mud and reconditions the drilling mud for reuse. The drill cuttings generated from the HDD drilling operations would be temporarily stored on site in roll-off containers to prevent their release into any surface waters or wetlands. Bentonite slurry may be used but would be contained within the drilling pits and borehole such that no recycling system or on-site storage tanks for solids would be needed. Excess drilling fluid and cuttings would be recovered and transported to an approved off-site upland disposal site.

Bentonite, used in the drilling mud, is not characterized or regulated as a hazardous substance under federal regulations (such as the Emergency Planning and Community Right-to-Know Act under Title III of the Superfund Amendments and Reauthorization Act, or RCRA) or the NASA ICP, or under state regulations. Potential impacts from bentonite slurry and applicable mitigation measures are addressed in Section 3.6 *Water Resources*.

NASA would require the contractor to manage all hazardous wastes and regulated materials in accordance with the WFF ICP (NASA 2023a); NASA requirements; and applicable federal, state, and local regulations. The contractor would be responsible for coordinating with WFF MEMD for the disposal of any hazardous or solid waste generated. NASA anticipates that use of hazardous materials would have negligible potential to adversely impact human health and the environment and would not exceed the capabilities of NASA and its contractors to manage in accordance with current procedures.

Materials used for the new bridge would require approval from NASA and FHWA and would need to meet federal standards including those of NASA, FHWA, and USEPA/OSHA. Because the handling of hazardous and solid wastes, and the removal of toxic substances as part of construction

and demolition activities would be conducted in accordance with all applicable regulations, impacts to human health or the environment resulting from an accidental release or spill, are anticipated to be short-term and minor.

Operation

The Causeway Bridge would be used for transport of fuels and hazardous substances associated with operations on Wallops Island, including launches; therefore, an accidental release during transportation could occur. The quantities and types of products transported over the bridge would be the same as existing conditions. If a spill were to occur, the vehicle operator would notify NASA (and USCG if the spill entered Cat Creek) and implement the appropriate response plans. The types, duration, and intensity of impacts for maintenance and repairs would be like those during construction and demolition. NASA and its contractors would implement plans and best management practices (BMPs) similar to those described for construction and demolition. With proper control, prevention, and clean-up, any adverse impacts are expected to be short-term and minor.

3.4 Health and Safety

The health and safety analyses for this EA consider occupational hazards and risks to the public, NASA personnel, contractors, and civilians from potentially hazardous activities during construction and demolition and ongoing maintenance and operation of the Causeway Bridge.

3.4.1 Affected Environment

Institutional construction and demolition activities conducted at WFF are performed in accordance with applicable NASA institutional safety programs and controls. The WFF Safety Office plans, develops, and implements facility programs and controls for the safety of personnel, protection of property, and operations of facilities, including occupational health and safety and emergency (i.e., fire, crash, and rescue) planning and operations. The WFF Safety Office manages the WFF Fire Department with fire stations on the Main Base and on Wallops Island. The WFF Safety Office also reviews contractor-prepared safety plans for construction, modification, or demolition of facilities and infrastructure. Safety controls are established to minimize the potential hazards associated with institutional and workplace activities.

NASA requires that all activities occurring at WFF be conducted in accordance with federal and state OSHA regulations. Additionally, federal contractors are required to follow regulations defined in Federal Acquisition Regulation (FAR) 52.236-13, Accident Prevention. Proposed activities are initially reviewed through Goddard Space Flight Center's online Environmental and Safety Review portal. The WFF Safety Office then determines which health and safety plans contractors would be required to submit for approval prior to working onsite.

A single gate at the entrance to the WFF Mainland provides a monitoring and control point for access to Wallops Island by road. Wallops Island is patrolled 24 hours a day to prevent

unauthorized access via boat. Badges are provided to all WFF personnel, contractors, range users, tenants, and visitors.

3.4.2 Environmental Consequences

The threshold of significance would be met if construction and demolition activities and/or ongoing maintenance and operation would substantially increase the potential for occupational hazards or risks to the public, NASA personnel, contractors, and civilians.

3.4.2.1 No Action Alternative

The No Action Alternative would result in the potential for long-term adverse impacts to health and safety because the Causeway Bridge would not be replaced, and there would be an increasing risk for the bridge to fail a safety inspection. In the event the existing bridge failed an inspection, NASA would close the bridge temporarily, or permanently, as needed, and there would be no access for vehicles (including emergency vehicles) to or from the Mainland and Wallops Island.

There would be potential impacts associated with maintenance and repairs of the bridge until closure; these would be similar to those described from the Proposed Action. Any bridge maintenance and repairs would be conducted following all applicable local, state, and federal regulations for worker health and safety. NASA would work with the WFF Safety and Communications offices and USCG to notify mariners of any maintenance operations in Cat Creek or if the bridge was not safe to travel under (and thus closed).

Under the No Action Alternative, the utility lines would be repaired as needed until replacement would be necessary. Wallops Island would continue to have issues with potable water and utility line leaks would become more frequent. If the existing utilities are not replaced, Wallops Island would not receive potable water due to the deterioration of the utility lines. This would pose a major safety concern as potable water is used not only for drinking but also for building fire suppression systems and heat and acoustic vibration deluge during rocket launches.

It is also possible that people, vessels, and species under the bridge in Cat Creek could be struck by deteriorated parts from the structure, which could cause major adverse short- and long-term health and safety impacts.

3.4.2.2 Proposed Action

Construction and Demolition

Proposed construction and demolition activities could present safety risks to construction personnel, anyone traveling along Causeway Road between the staging areas and Causeway Bridge, and boaters that could access the Project Area via Cat Creek. These risks would be from the presence and movement of large vehicles, boats, and equipment; workers operating or near construction equipment such as cranes and large sections of concrete; and the handling, use, and transport of hazardous materials.

The Design-Build contractor would be required to designate Safety Officers who would perform regular inspections and document compliance. Safety briefings for workers would occur during construction and demolition. Emergency plans, procedures, and contacts would be documented along with locations of first aid stations, emergency transport, and local emergency facilities.

In addition to the standard safety practices, bridge construction would also follow the procedures presented in Standard Specifications for the Construction of Roads and Bridges on Federal Highway Projects administered by FHWA, and the new bridge would be designed to current FHWA specifications, including safety. For example, the new rail design would meet current crash-worthiness standards. Wider shoulders (likely a 1.8 m (6 ft) shoulder) would be added on each side of the bridge to provide enough space for two-way traffic to continue if a vehicle is stopped on the shoulder as well as increased safety for maintenance workers and bridge inspectors who occasionally require foot access to the bridge.

Use of bentonite (a component of the drilling mud used in HDD operations), which is classified as crystalline silica by OSHA, is regulated by OSHA under 29 CFR 1926.1153. If HDD is used to install the utilities, NASA and its contractors would conduct all project activities in accordance with federal OSHA regulations and Virginia OSHA regulations, with oversight by the WFF Safety Office. Federal contractors would follow regulations defined in FAR 52.236-13, Accident Prevention, and NASA's contractor would be required to submit a project-specific health and safety plan for approval by the WFF Safety Office prior to starting work.

Prior to construction, the Design-Build contractor would obtain a Bridge Permit from USCG and follow any safety measures outlined by USCG, such as lighting requirements. In the May 2021 Preliminary Navigation Clearance Determination, USCG stated that the proposed new bridge should provide at least 3.9 m (12.8 ft) of vertical clearance above mean high water and at least 18 m (60 ft) of horizontal clearance through the main navigation span of the bridge.

WFF would coordinate all in-water activities that have a potential to affect watercraft with USCG and other organizations to clear potential hazard areas. Notices-to-Mariners (NOTMARs) depicting the hazard areas would be published at least 24 hours prior to in-water operations. Additionally, the WFF Office of Communications would distribute both electronic and faxed notices of the construction-related hazard area to a group of more than 100 recipients that includes local watermen, marinas, and marine transportation companies. Public signage, as appropriate, would be placed on Cat Creek to alert boaters of project activities at the Causeway Bridge.

With the implementation of the safety measures described in this section, adverse health and safety impacts would be minimized to the greatest extent practicable and are expected to be short-term and minor. Safety concerns related to construction and demolition would be temporary and would cease when these activities are complete.

Operation

A new Causeway Bridge would provide long-term, major beneficial impacts to Wallops Island by providing a reliable mode of transport between the Mainland and Wallops Island, during its

75-year lifespan. Relocation of the existing utility lines from the Causeway Bridge to be underground would also provide a long-term, major beneficial impact by providing a more protected utility line and thus reliable source of potable water to Wallops Island.

The new bridge would provide safer conditions when carrying super-loads across the bridge since special equipment, and thus traffic control, would no longer be needed to transport these large loads. All personnel involved with operations at WFF, including those conducting maintenance and repairs to the bridge, would follow appropriate safety protocols, including OSHA regulations and training requirements.

The handling, processing, storage, and disposal of hazardous materials or hazardous wastes from operations and routine maintenance activities would be accomplished in accordance with all applicable federal and state requirements. A new Causeway Bridge would ensure the continued safety not only of users, but also of boaters beneath the bridge.

3.5 Land Resources

Land resources for this EA describe the physical surface characteristics such as topography, geology, and soils in the affected land areas.

3.5.1 Affected Environment

3.5.1.1 Topography

The topography of the Causeway Bridge Project Area varies, with the Causeway Road elevated by artificial fill (to create the causeway) to approximately 2.7 m (9 ft) above the natural topography of the tidal marsh (see **Photo 1-2**), which lies at approximately 0.3 to 0.6 m (1 to 2 ft) above sea level. The approaches to the existing bridge deck are further built up with fill, slightly higher than the rest of the Causeway Road, to the east and west of the approaches. Topography at the staging areas is relatively flat, between 0 to 5 percent slope.

3.5.1.2 Geology

In June 2021 and March 2022, John D. Hynes & Associates, Inc. (JDH), conducted a geotechnical survey for the Project Area. The survey limits included the envelope maximum LOD as described in Section 2.5.2 and shown on **Figure 2-3**. The study included a total of 27 drilled test borings. All boring were taken from the north side of the Causeway Bridge, with ten taken on the west side of Cat Creek, eight taken in Cat Creek, and nine on the east side of Cat Creek. Results of geotechnical land borings showed a mix of sand, silt, and clay layers with gravel of varying textures to a depth of approximately 30 m (100 ft) below the ground surface. The boring results from the Cat Creek samples showed a mix of peat, sand, silt, and clay layers with gravel and shells of varying textures to a depth of approximately 30 m (100 ft) below subaqueous bottom (JDH 2022 a, b). No bedrock was encountered during either geotechnical survey. No geotechnical investigations were conducted at the staging areas because no excavation or other disturbances below the ground surface are planned.

3.5.1.3 Soils

The Farmland Protection Policy Act (FPPA) requires that federal agencies examine the impacts of their actions on prime or unique agricultural lands and minimize any potential impacts.

Soils in the Project Area at the Causeway Bridge are comprised of two soil map units as classified by the Natural Resources Conservation Service (NRCS): udorthents and Chincoteague silt loam (NRCS 2023). An udorthent is a classification for native soils that have been completely removed from the landscape or so altered by cut and/or fill that they do not fit into any other native soil categories (they are typical of urban environments). The fill used in 1959 to construct the Causeway Road created this soil type. These udorthents are very deep soils that range from well-drained to somewhat poorly drained and are not hydric (meaning they are not permanently or seasonally saturated by water resulting in anaerobic conditions and are not indicative of wetlands).

The Chincoteague silt loam is a naturally occurring soil that is found on nearly level slopes (0-1%), very frequently floods, is very poorly drained, is very deep, and the water table is at the surface (NRCS 2023). This soil is classified as hydric. Most of the soils in the Causeway Bridge Project Area have been previously disturbed during construction of the existing Causeway Road and Bridge. Neither of the soil types are classified as prime farmland or unique agricultural lands.

The soils within the two staging areas on the north side of the Causeway Road are both classified entirely as Bojac loamy sand. The soil in the staging area south of Causeway Road is classified entirely as Magotha fine sandy loam. Neither of these soils is hydric; the Magotha soil has hydric inclusions in the low-lying areas, but none within the proposed staging area site. The Magotha soil is poorly drained and has low runoff. The Bojac soil is well drained with very low runoff. These soils have been previously disturbed by activities at WFF. The Bojac soil is classified as prime farmland (NRCS 2023).

3.5.2 Environmental Consequences

Impacts to land resources would be considered significant if major adverse changes to topography, underlying geology, or conversion of prime agricultural land to non-agricultural uses occurred. This would involve the alteration of unique geologic formations or creating a situation that would cause degradation or irreparable damage to natural landforms, topography, or exceptional loss of soils through erosion.

3.5.2.1 No Action Alternative

Under the No Action Alternative, there would be no ground disturbance, including during maintenance and repairs; therefore, no impacts would occur to topography, geology, or soils.

3.5.2.2 Proposed Action

Construction and Demolition

Under the Proposed Action, long-term changes to topography would occur in the approach areas to the new bridge from placement of fill, contouring, and grading that would be required to build

up the causeway and roadbed in a proposed new bridge alignment. Because the new alignment would be constructed north of the existing alignment, the changes to topography would primarily occur in the areas north of the existing causeway, west and east of Cat Creek. Plan Sheet B02 from the FHWA 30% design plans (**Appendix B**) provides an example of the embankment and road build-up compared to the existing ground. Although the final design is not known, it is likely that nearly all potential designs would result in similar build-up of the causeway in the approach areas shown on Plan Sheet B02. The Design-Build contractor would be required to use clean fill for use in construction.

The demolition of the existing Causeway Bridge would also alter topography due to the excavation of existing approaches and bridge. Excavations would be filled upon completion of the project and re-contoured to pre-disturbance elevations, to the extent practicable. The changes in topography due to construction and demolition would be minor. Therefore, there would be adverse short- and long-term minor impacts to topography.

Based on the JDH geotechnical boring results (2022a, b), pile driving for the temporary construction access or the permanent bridge piers is not anticipated to reach bedrock. No adverse impacts from pile driving to the underlying geology are anticipated. Although the Proposed Action may drill through geologic material during HDD operations, there would be no changes to the geologic material and thus no impacts to geology. However, there is potential for a frac-out in which drilling mud is inadvertently released from the borehole into the surrounding materials and typically moves upwards in fissures in the rock and soil.

A release could also occur in non-fissured cohesive soils when the pressure of the drilling fluid exceeds the strength of material above the borehole. If HDD is utilized, NASA's HDD contractor would evaluate the geologic and soil conditions along the borehole path as the drilling progresses and would plan appropriate drill fluid pressures to avoid or minimize the potential for frac-out. The HDD contractor would prepare a Frac-Out Contingency Plan, which would establish operational procedures and responsibilities for the prevention, containment, and clean-up of frac-outs, as described in Section 3.6.1 *Surface Waters and Stormwater Management*.

The Proposed Action would result in adverse minor short- and long-term impacts to soils from erosion and from being removed and/or covered by cut and fill activities. Short-term impacts would occur from ground disturbances associated with installation and removal of the temporary construction access, open trenching to connect from HDD to utility stubs, excavation, fill, and grading. Long-term impacts would occur from the placement of fill over existing soils north of the existing causeway in the new bridge approach areas on both sides of Cat Creek. Placement of permanent piles would also result in long-term impacts to soils. Placement of certified clean fill on top of the existing ground surface would bury existing soils, or in some areas, would result in the mixing/restructuring of soil horizons. Fill used for the new alignment embankments and roadbed would be compacted per design specifications. Excavated soils would be temporarily stored on-site, with any stockpiles being removed after work is complete.

At the staging areas, there would be negligible short-term minor impacts to soils due to disturbances of the surface from heavy equipment, storage of materials and piers, and accessory equipment. Soils have been previously disturbed when the sites were cleared of vegetation. No grading or excavations would occur at the staging areas; however, gravel may be added to portions of the areas to prepare them for use as parking and for equipment access. There would be negligible long-term minor impacts to any native topsoil from the addition of gravel and compaction from equipment and vehicles.

Access to both staging areas with Bojac sandy loam, a prime farmland soil, is restricted to authorized personnel and NASA has permanently designated the land for non-agricultural use. However, in accordance with the FPPA, NASA submitted a scoping request including a copy of the AD-1006 Form to NRCS on April 26, 2023, regarding potential impacts to prime farmland. NRCS responded on May 4, 2023, providing the required NRCS information for the AD-1006 Form; NASA then completed the form and sent it back for NRCS approval. NRCS responded on May 10, 2023, stating no further action will be taken by NRCS regarding the project (**Appendix A**).

Although NASA realizes that NRCS will not take additional action, on November 14, 2023, NASA sent NRCS a courtesy updated AD-1006 Form reflecting a revision to the acreage of the staging areas that contain prime farmland (**Appendix A**).

To minimize impacts to soils from erosion, the Design-Build contractor would develop site-specific ESC plans prior to ground-disturbing activities in compliance with the VSMP regulations and WFF's Stormwater, Erosion, and Environmental Development (SEED) Program. The contractor would implement ESC BMPs before, during, and after construction to stabilize soils. These BMPs could include using silt fencing, soil stabilization blankets, and matting. Bare soils would be revegetated with native, non-invasive plants immediately after construction to reduce erosion and stormwater runoff. Spills or leaks from construction vehicles and equipment could affect soils. The Design-Build contractor would implement BMPs addressing spill prevention and control measures in accordance with the site-specific SWPPP and WFF's ICP. Therefore, there would be adverse short- and long-term minor impacts to topography, no impacts to geology, and negligible to minor short- and long-term adverse impacts to soil.

Operation

Under the Proposed Action, periodic maintenance and repairs would continue throughout the 75-year lifespan of the new bridge and would occur for the utility lines as needed. While this could result in short-term disturbance of soils, BMPs would be implemented to prevent any significant impacts. No VSMP permit would be required.

With implementation of the measures described above, there would be minor short-term and long-term adverse impacts to land resources from the Proposed Action.

3.6 Water Resources

Water resources for this EA refer to surface and subsurface waters, wetlands, estuarine and tidal waters, floodplains, and the coastal zones that exist in and around the Causeway Bridge.

Regulations and Approvals

The CWA is the primary federal law that protects the nation's waters. Additionally, Section 10 of the Rivers and Harbors Act prohibits the obstruction or alteration of navigable WOTUS without a permit from USACE.

USACE Federal Navigation Project Review

The Causeway Bridge spans Cat Creek, a tidal channel that connects the Hog Creek and Bogues Bay Channel elements of the Waterway on the Coast of Virginia Federal Navigation Project, a 140-km- (87-mi)-long inland waterway system connecting the Chesapeake Bay to the Chincoteague Bay. The Waterway on the Coast of Virginia serves as a channel for recreational and commercial navigation along the Eastern Shore. The Waterway on the Coast of Virginia is a Federal Navigation Project and is a USACE federally authorized civil works project that is subject to periodic maintenance activities such as dredging. USACE reviews actions proposed within Federal Navigation Projects to determine whether the proposed action is injurious to the public interest or affects the ability of the Federal Navigation Project to meet its authorized purpose.

3.6.1 Surface Waters and Stormwater Management

VDEQ has designated WFF's SEED Program with the responsibility for administering VSMP regulations. VSMP requires that construction and land development activities incorporate measures to protect aquatic resources from the effects of non-point source pollution and the increased volume, frequency, and peak rate of stormwater runoff. The VSMP also requires that land-disturbing activities of 0.4 ha (1 ac) or greater, develop a SWPPP and acquire a General Virginia Pollutant Discharge Elimination System Permit for Discharges of Stormwater from Construction Activities from the WFF SEED prior to construction.

The VDEQ designated the surface waters in Cat Creek as Class II–Estuarine Waters, which establishes limits for the concentrations of various bacteria and toxic compounds, minimum dissolved oxygen concentrations, pH, and maximum temperature for the different surface water classifications.

3.6.1.1 Affected Environment

WFF is in two watersheds: the Eastern Lower Delmarva and the Chincoteague. Due to its elevation above natural topography, the causeway between the Mainland and Wallops Island (Causeway Road) forms the local divide between these two watersheds. All waters north of the causeway are part of the Chincoteague watershed drainage, and all waters south of the causeway are part of the Eastern Lower Delmarva watershed drainage (NASA 2016).

Cat Creek is part of a complex estuary system, connected to the Atlantic Ocean, where the flow of water (referred to as hydrodynamics) is driven predominantly by the tides and combined storm surges (such as Nor'easters and hurricane events). The MHW of Cat Creek is 0.2 m (0.7 ft), the mean tide line is -0.12 m (-0.4 ft), and the mean low water (MLW) is -0.46 m (-1.5 ft). The Cat Creek watershed drainage area is approximately 43.5 square km (16.8 square mi) (HWR 2021a).

The existing Causeway Road drains by sheet flow through a vegetated embankment, and stormwater flows naturally into the tidal marshes and Cat Creek. The existing bridge has a drainage system to collect and dissipate stormwater runoff.

3.6.1.2 Environmental Consequences

The significance of potential impacts to water resources is determined if large scale adverse impacts were to occur to the to the hydrologic function of the Project Area, or if runoff from the Project Area would include concentrations of pollutants and/or sediments that exceed Virginia saltwater criteria. Significance determination would depend on the nature of the water resource, its importance to the ecosystem, and the ability of the system to function if that resource were altered or removed completely.

No Action Alternative

Routine maintenance and repair, including stormwater infrastructure associated with the bridge (e.g., gutter replacement, removing blockages of storm drains), would continue to occur, as needed, until bridge closure. Any in-water work needed to conduct repairs could result in disturbance of the aquatic environment, including disturbances in the tidal marsh and sediments on the bottom of Cat Creek. Impacts would be minimized with the use of BMPs, as described for the Proposed Action; impacts are anticipated to be adverse, short-term, and minor.

Proposed Action

Construction and Demolition

The Proposed Action could result in adverse impacts to the water quality of surface waters in the following ways:

- Land disturbance and subsequent erosion and sedimentation from stormwater runoff,
- Sedimentation in estuarine waters from disturbances of the subaqueous bottom (e.g., pile driving)
- Contamination from leaks and spills of pollutants during construction, and
- Contamination from an inadvertent release of drilling mud into estuarine waters.

Construction and demolition activities on land have the potential to cause soil erosion, which could elevate turbidity levels in the tidal marsh and Cat Creek. Construction of the new alignment embankment would alter stormwater runoff patterns, and removal of vegetation or placement of fill would temporarily result in bare soils.

In-water work, such as installing and removing piles for the temporary construction access, installing piles for the new approaches and bridge, and demolishing piles of the existing approaches and bridge, would result in disturbance of the aquatic environment, including disturbances in the tidal marsh and sediments on the bottom of Cat Creek.

The number and type of piles would be determined during the design phase of the new Causeway Bridge. Construction of the new bridge and temporary construction access could involve both land-based and in-water work to install piles depending on design and construction methods. Construction could involve equipment such as tugboats, barge-mounted cranes, construction crew support vessels, and pile driving equipment with the potential to cause increased temporary turbidity in shallow marsh areas and Cat Creek during pile driving activities.

In-water pile driving activity can also result in increased turbidity from the pressure of the blows to the piles to drive the piles down into the channel bottom. Cofferdams, turbidity curtains, or other instruments to control turbidity, when operationally feasible, would minimize potential impacts to water quality. Therefore, although NASA anticipates that these impacts would be adverse, they would be short-term, minor, and localized to the area directly around where each pile would be installed.

NASA anticipates that any existing piles in what will become the old alignment of the bridge approaches and where the existing bridge spans the water would be left in place and cut below the creek/marsh bottom as needed for navigation safety. Piles left-in-place would likely be cut at least 0.6 m (2 ft) below the mudline.

Piles installed for temporary construction access would be removed, which could be accomplished with a vibratory hammer or by direct pull with a crane. Depending on the embedment, the use of a high-pressure water jet may be required to loosen or remove mud keeping some of the piles stuck in place. Any debris from the piles would be contained using measures such as tarps and/or floating booms. Debris booms could be placed around the in-water construction work areas to catch debris that would be removed from the water. Locations, types, and size of debris booms would depend on the type of equipment, wave action, and currents anticipated during construction/demolition. With implementation of these measures, impacts would be adverse, short-term, and minor.

The Design-Build contractor would obtain a WFF SEED construction site stormwater permit and develop a site-specific SWPPP. The SWPPP would identify all stormwater discharges at the site, actual and potential sources of stormwater contamination, and would require the implementation of both structural and non-structural BMPs to reduce the impact of stormwater runoff. ESC BMPs such as silt fencing, soil stabilization blankets, and matting would be installed around areas of soil disturbance.

Riprap may be used to protect abutments from scour and for slope stabilization. Bare soils would be vegetated immediately after construction to reduce erosion and sediment-laden runoff from entering Cat Creek. With implementation of BMPs, impacts would be adverse, short-term, and minor.

Since the proposed bridge would have wider shoulders and lanes, the new deck and approach ramps would have a larger surface area compared to the existing bridge. The new bridge's stormwater conveyance system could be designed to carry stormwater from the bridge to stabilized outfalls, and potentially into a stormwater treatment BMP at the outlets. Permanent BMPs to capture, convey, and manage stormwater from the bridge deck and approaches would be included in the final bridge design in accordance with FHWA design specification and VSMP regulations for stormwater discharge. With implementation of BMPs, impacts would be short-term and minor.

In accordance with Virginia's Offsite Compliance Options and the February 2022 VDEQ Guidance Memo GM21-2007 on "Local Water Quality Protections for Nonpoint Source Nutrient Credit Use for Regulated Land Disturbing Activities," Hassan Water Resources, PLC (HWR) determined that the Proposed Action qualifies for the use of nutrient credits to meet project pollution reduction requirements for water quality (HWR 2021b).

Potential short-term impacts to nearshore water quality could result from the accidental release of petroleum products, or other contaminants, from construction vehicles and heavy equipment used during construction and demolition activities. Impacts would be adverse and could range from negligible to major depending on the size of the release and how quickly it could be controlled and remediated. The potential for spills or releases would be minimal, as contractors would implement BMPs for vehicle and equipment fueling and maintenance and adhere to WFF's ICP and site-specific spill prevention and control measures. With these measures in place, adverse impacts are anticipated to be minimized to the greatest extent practicable.

An inadvertent release of drilling mud into estuarine waters during HDD operations would have short-term adverse impacts on water quality. The HDD operation would use equipment and procedures to maximize the recirculation and reuse of drilling mud to minimize waste disposal of the recovered solids. While drilling fluid seepage is most likely to occur near the HDD bore entry and exit points where the drill head is shallow, releases can occur in any location along an HDD borehole path. Drilling fluids that are released during a frac-out typically contain a lower concentration of bentonite when they surface because the bentonite is filtered out as its passes through existing sediments of varying types. However, if released into water bodies, bentonite has the potential to impact water quality. Bentonite is a naturally occurring clay. The impact on water quality from bentonite is likened to the environmental effects of sedimentation or turbidity from suspended solids (ASCE 2005).

If the utilities are installed via HDD, NASA's contractor would be required to prepare and implement a Frac-Out Contingency Plan that addresses the potential for release of drilling fluids to water resources. Any adverse impacts are anticipated to be localized and the effects would not be long-term.

The Design-Build contractor would submit a Joint Permit Application (JPA) to VMRC, which serves as the clearinghouse for federal, state, and local levels of CWA permitting including:

- Accomack County Wetlands Board permit,
- VMRC Habitat Management Subaqueous Lands and Tidal Wetland permit,
- VDEQ Virginia Water Protection (VWP) Permit/401 certification,
- USACE CWA Section 404 permit, and
- USACE Section 10 River and Harbors permit.

The Design-Build contractor would also be required to obtain the following:

- USACE Section 408 (Section 14 the Rivers and Harbors Act) for authorization to occupy a USACE Federal Navigation Project, and
- VSMP permits from the WFF SEED.

Operation

Under the Proposed Action, there would be ongoing maintenance and repairs to the Causeway Bridge during its 75-year lifespan and to the utility lines, as needed. These activities could impact surface waters through the transport of sediments, some of which may carry contaminants. With implementation of ESC controls and stormwater collection BMPs similar to those for construction and demolition, these adverse impacts would be short-term and minor.

3.6.2 Groundwater

Groundwater is subsurface water that occupies the space between sand, clay, and rock formations. Aquifers are areas of mostly high porosity soil where water can be stored between soil particles and within soil pore spaces.

3.6.2.1 Affected Environment

The Columbia aquifer and the Yorktown-Eastover multi-aquifer system lie under the Eastern Shore and are designated and protected by USEPA as a sole-source aquifer (USEPA 2023). WFF receives its potable water from seven groundwater supply wells, five of which are on the Main Base, and two of which are on the Mainland. The two Mainland wells, which supply the Mainland and Wallops Island with water, are in the Yorktown-Eastover aquifer, withdrawing water at 60 m to 80 m (195 ft to 255 ft) below ground surface. Neither of these groundwater supply wells are in or adjacent to the proposed bridge and staging area LODs.

Groundwater levels measured in June 2021 and March 2022 during a geotechnical investigation showed depth to groundwater is expected to be within 0.31 m to 5.2 m (1 to 17 ft) below ground surface (JDH 2022 a, b). The water table in the envelope Project Area is tidally influenced and can vary daily and seasonally.

WFF receives its potable water from seven groundwater supply wells that are located at the Main Base and the Mainland. There are no groundwater supply wells within or near the proposed project areas.

3.6.2.2 Environmental Consequences

Significant impacts to groundwater would occur if the Proposed Action caused a long-term change in underground hydrologic patterns or caused adverse effects to groundwater quality that could not be mitigated.

No Action Alternative

The No Action Alternative would have no impacts to groundwater; including during maintenance and repairs; therefore, the existing conditions would remain unchanged. However, if the existing utilities are not replaced, Wallops Island would not receive reliable potable water, which is obtained from groundwater wells on the Main Base and Mainland, due to the deterioration of the utility lines. Water would have to be obtained from other sources to supply Wallops Island in the event the utility lines were no longer operational.

Proposed Action

Construction and Demolition

Given the shallow depth to groundwater across the Causeway Bridge Project Area, de-watering may be required for excavations that may be needed for construction and demolition. The de-watering volume would be determined by the Design-Build contractor and could result in highly localized and temporary lowering of surficial groundwater levels in the immediate vicinity of the excavated area. Groundwater levels would quickly (i.e., within several hours) return to pre-disturbance levels. As noted in Section 3.3.2.2, if dewatering is planned, the Design-Build contractor would need to prepare a dewatering plan that addresses PFAS, which must be approved by the WFF MEMD. Impacts would be adverse, short-term, and minor, and the de-watering activities would be performed in accordance with VSMP and CWA permit conditions and BMPs.

If NASA uses HDD to install the utility lines, potable water would be piped from the closest fire hydrant for use in drilling operations.

Groundwater contamination could occur from an inadvertent spill of fuel, bentonite slurry, or hazardous liquids from HDD and/or construction equipment or vehicles. Hazardous liquids and materials, bentonite slurry, and petroleum-based fuels would be stored and handled according to the WFF ICP, the Frac-Out Contingency Plan, and the VSMP permit conditions. In accordance with these plans, NASA and the Design-Build contractor would immediately implement control and remediation measures in the event of an inadvertent release of bentonite slurry, petroleum-based materials, or hazardous materials. With the implementation of spill prevention and control measures, adverse short-term impacts to groundwater resources would be minimized and impacts are anticipated to be localized and minor. Due to the depth of the Yorktown-Eastover aquifer, NASA anticipates that there would be no impacts from a spill on this water source. Moreover, due to the distance of the Mainland water supply wells from the project LOD, no impacts to these wells are anticipated.

Operation

Under the Proposed Action, there would be ongoing maintenance and repairs to the Causeway Bridge throughout its 75-year lifespan and to the utility lines. These activities could impact groundwater through the transport of sediments, some of which may carry contaminants such as road salts and fuel. Adherence to BMPs similar to those of construction and demolition, would ensure that any adverse impacts are minor and short-term.

3.6.3 Wetlands

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Wetlands are transitional areas between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water (Cowardin 1979).

USACE, VDEQ, and VMRC regulate impacts to waters and wetlands and issue permits for projects in Virginia. USACE has regulatory authority over activities involving the discharge of dredged or fill material into WOTUS, pursuant to Section 404 of the CWA. VDEQ administers the VWP Permit Program for impacts to surface waters (all waters that are not groundwater) which may include isolated wetlands not under federal jurisdiction and grants CWA Section 401 certification that state water quality standards would not be violated by proposed work. VMRC, in conjunction with the Accomack County Wetlands Board (ACWB), regulates encroachments into state-owned submerged lands, non-vegetated wetlands (e.g., mudflats) between mean low tide and mean high tide, and vegetated wetlands from mean low tide to 1.5 times the mean tide range.

USACE also regulates activities in navigable waters (i.e., waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce) under Section 10 of the Rivers and Harbors Act. By definition, navigable waters include all tidal waterbodies. Additionally, EO 11990 *Protection of Wetlands* directs federal agencies to minimize the destruction, loss, and degradation of wetlands and to preserve and enhance the natural and beneficial values of wetland communities.

3.6.3.1 Affected Environment

On behalf of NASA and FHWA, a delineation of WOTUS within the FHWA 30% plan LOD was performed in August 2020 (NASA and FHWA 2020), pursuant to the USACE 1987 *Wetlands Delineation Manual* and USACE 2010 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region, Version 2.0* (**Figure 3-1**) (USACE 1987, USACE 2010). The delineation figures are provided in **Appendix C.**

Two areas of "estuarine, regularly flooded, intertidal emergent wetlands" (E2EM1N) jurisdictional WOTUS were identified in the delineation area as follows:

- **Wetland A**: 1.4 ha (3.36 ac) E2EM1N wetland on the west side of Cat Creek, including wetlands identified on both the north and south of Causeway Road.
- **Wetland B**: 1.9 ha (4.78 ac) E2EM1N wetland delineated on the east side of Cat Creek.

- **Total Vegetated (E2EM1N) Wetlands in the Causeway Bridge Envelope**: 3.29 ha (8.14 ac) (Wetlands A and B)

Additionally, 77 m (251 ft) of perennial stream/open water associated with Cat Creek were identified. While not classified in the Wetland Delineation Report, these waters include "estuarine intertidal unconsolidated shore" (E2US) and "estuarine subtidal unconsolidated bottom" (E1UB). The delineation was confirmed by USACE, and a Preliminary Jurisdictional Determination (PJD) (NAO-2020-1762) was issued in November 2020. The PJD is valid for 5 years (through November 2025). If the PJD expires prior to the end of construction, NASA would obtain an extension or a new PJD. There are no jurisdictional wetlands or waters at any of the staging areas.

3.6.3.2 Environmental Consequences

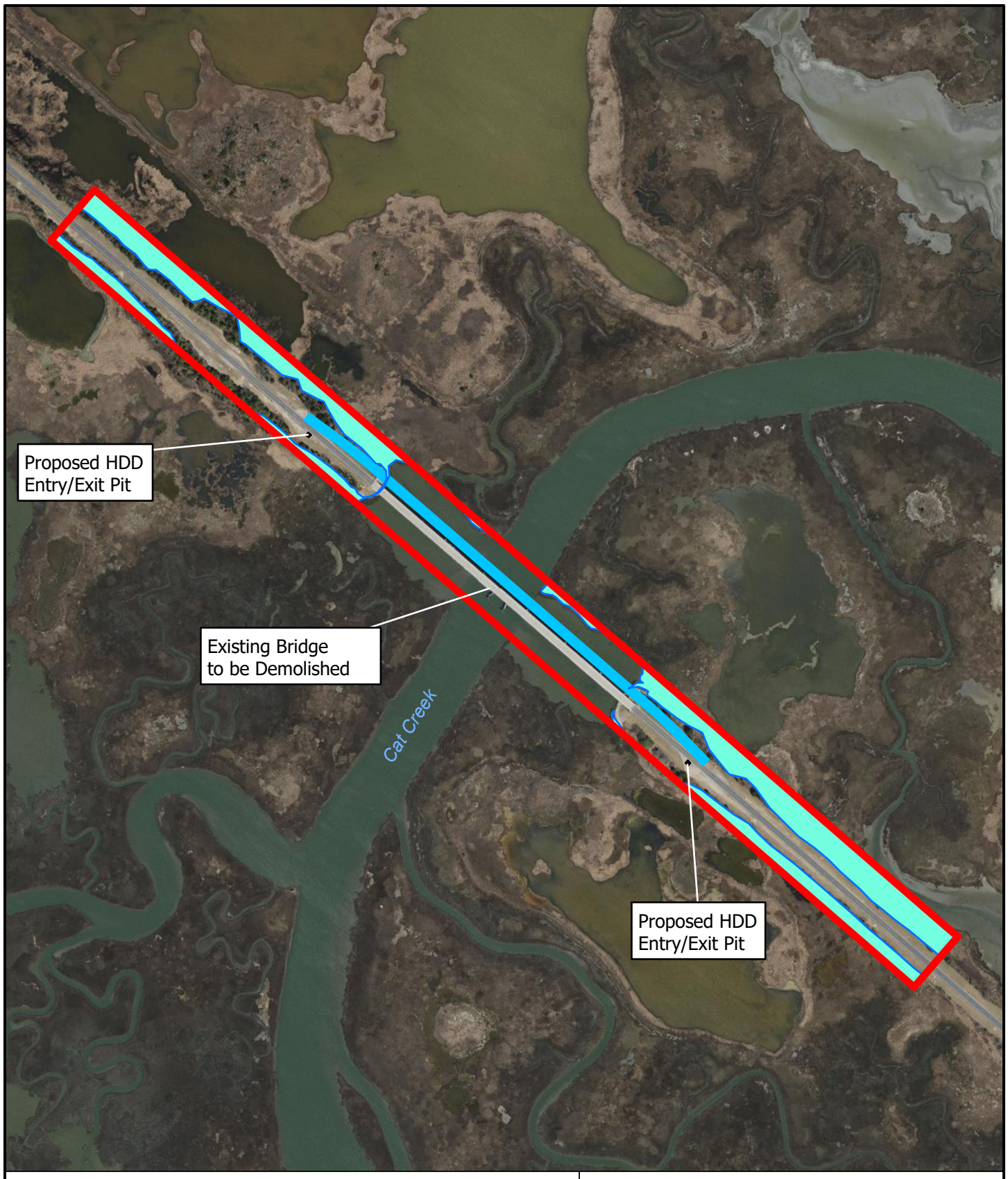
Significant impacts to wetlands would occur if the action caused a net loss of wetlands, or if direct impacts could not be mitigated.

No Action Alternative

It is unlikely that maintenance and repairs would result in impacts to wetlands, under the No Action Alternative. However, if equipment needs to be placed in a wetland to conduct any maintenance or repairs, NASA would obtain authorization from appropriate regulatory agencies for impacts through the JPA process prior to starting work. Adverse impacts, if any, would likely be negligible to minor and may be short or long-term. Impacts would be mitigated through the JPA process, as necessary.

Proposed Action

Construction and demolition activities would result in adverse, negligible to minor, short-term and long-term direct and indirect impacts to wetlands as described below. Impacts could be major if a spill occurred; the magnitude of the spill and the amount of permanent direct impacts would determine the degree of the impact. The evaluation of potential impacts assumed that all areas of wetlands within the FHWA 30% plan LOD would be impacted. Final quantification of impacts would occur during the Design-Build design and permitting process and may differ from preliminary impacts presented here.



Legend

- Wetlands
- Proposed Causeway Bridge
- FHWA 30% Plan Limits of Disturbance
- Bridge Envelope Limits of Disturbance

Sources: NASA, VGIN, Wetland Delineation Report
FHWA - September 29, 2020 / Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

FIGURE 3-1
FHWA DELINEATED WETLANDS

0 250 500
Feet

WFF Causeway Bridge Replacement Project

Secondary Impacts

Secondary, or indirect, impacts to wetlands may occur from ground disturbances in uplands associated with placement and operation of equipment, particularly in areas adjacent to wetlands, from the excavation and filling of HDD entry/exits pits (if needed), from open trenching (if needed), and from the placement of fill to build the embankments and roadbed. These activities could result in the transport of sediment into wetlands or waterways. Site-specific BMPs to minimize impacts could include silt fencing, soil stabilization blankets, and matting around areas of soil disturbance. Bare soils would be vegetated immediately after construction to reduce erosion and stormwater runoff velocities. The area of secondary impacts has not been quantified; secondary impacts only require permit authorizations if they result in loss of wetlands (e.g., hydrology is cut off). Secondary impacts, if they occur, would likely be negligible to minor and short-term. Although they would likely not require permitting, any secondary impacts would be identified in the JPA.

Temporary Direct Impacts

Temporary direct impacts may occur from construction and removal of temporary construction access, pile driving for temporary construction access, excavation to be returned to original contours, and from the removal of infrastructure during demolition of the existing bridge. Impacts would be minor and short-term. Based on FHWA 30% design, 1.34 ha (3.30 ac) of wetlands and waters, including estuarine emergent, estuarine intertidal, and estuarine open water (**Table 3-2**) would be temporarily impacted.

Table 3-2. Temporary Direct Impacts to Waters and Wetlands [1]

Classification of Water/Wetland	Area	Agency with Jurisdiction	Source of the Impact
Vegetated wetland (Estuarine emergent) (E2EM1N)	0.19 ha (0.47 ac)	USACE, VDEQ, ACWB[4]	Construction[2]
Vegetated wetland (Estuarine emergent) (E2EM1N)	0.001 ha (0.003 ac)	USACE, VDEQ, ACWB[4]	Demolition
Estuarine intertidal (E2US)[3]	0.69 ha (1.7 ac)	USACE, VDEQ, ACWB	Construction[2]
Estuarine intertidal (E2US)[3]	0.24 ha (0.59 ac)	USACE, VDEQ, ACWB	Demolition
Estuarine open water (E1UB)	0.16 ha (0.40 ac)	USACE, VDEQ, VMRC	Construction[2]
Estuarine open water (E1UB)	0.06 ha (0.14 ac)	USACE, VDEQ, VMRC	Demolition
Total	1.34 ha (3.30 ac)		

[1] Plan Sheets M05 and M06 in **Appendix B**
[2] Includes construction of the new bridge and any temporary construction access (construction and demolition)
3 The intertidal zone includes areas between MHW and MLW
4 Up to 1.5 mean tide range

To the extent practicable, the Design-Build contractor would use synthetic composite mats where equipment access is required in wetland areas to minimize impacts. Although permits are required for temporary impacts, no compensatory mitigation is required. Once work is completed, any previously vegetated bare areas would be revegetated with appropriate species known to occur near the Project Area, likely saltmeadow cordgrass (*Spartina patens*), and smooth cordgrass (*Spartina alterniflora*). Impacts would be minor and short-term.

There is also a potential for temporary direct wetland impacts from accidental leaks or spills from construction equipment or from frac-outs. Temporary direct impacts could range from negligible to major depending on the size of the release of petroleum-based fluids (fuel, hydraulic oil, bentonite slurry, etc.) and how quickly it could be controlled and remediated. Any spills would be minimized through compliance with all applicable spill prevention and control requirements. With implementation of a site-specific SWPPP and BMPs to avoid potential impacts to surface waters including wetlands, and adherence to permit requirements, the WFF ICP, the Frac-Out Contingency Plan, and a project-specific SPCC, if a release occurred during the Proposed Action, impacts to wetlands would likely be localized and short-term.

Permanent Impacts

Based on FHWA 30% design, 0.45 ha (1.10 ac) of wetlands and waters, including estuarine emergent, estuarine intertidal, and estuarine open water (**Table 3-3**) would be permanently impacted for construction of the new bridge. Permanent impacts would include 0.01 ha (0.02 ac) of vegetated wetland impacts. All other permanent impacts would occur in non-vegetated wetlands. Impacts would be minor and long-term, and would be mitigated as described below.

Table 3-3. Permanent Impacts to Waters and Wetlands [1]

Classification of Water/Wetland	Area	Agency with Jurisdiction	Source of the Impact
Vegetated wetland (Estuarine emergent) (E2EM1N)	0.01 ha (0.02 ac)	USACE, VDEQ, ACWB[3]	Construction
Estuarine intertidal (E2US)[2]	0.36 ha (0.88 ac)	USACE, VDEQ, ACWB	Construction
Estuarine open water (E1UB)	0.08 ha (0.20 ac)	USACE, VDEQ, VMRC	Construction
Total	0.45 ha (1.10 ac)		

[1] Plan Sheets M05 and M06 in **Appendix B**

[2] The intertidal zone includes areas between MHW and MLW

[3] Up to 1.5 mean tide range

Additionally, shading from the bridge structure has the potential to impact productivity and benthic invertebrate density and diversity of vegetated wetlands under and near the bridge. Bridge height and width influence the impact of shading on underlying vegetation. A study of the impact of bridge shading on estuarine wetlands found that bridges with height to width ratios of greater than 0.7 do not adversely impact the productivity or function of underlying marsh, with lower and wider

bridges reducing light to a point that marsh productivity is affected (Broome et al. 2005). Similarly, VDEQ uses a threshold of height to width ratio of 0.8 to determine the need for compensatory mitigation (VDEQ 2019). During the Design-Build process, the height to width ratio of the new bridge would be calculated. Potential mitigation requirements would be coordinated during the Joint Permit Application process. Impacts would be minor and long-term.

Summary of Impacts to Jurisdictional Wetlands

A summary of the direct temporary and permanent impacts to wetlands associated with FHWA's proposed 30% design is shown in **Table 3-4.**

Table 3-4. Direct Impacts to Jurisdictional Waters and Wetlands

Type of Impacts	Total
Temporary Impacts	1.34 ha (3.30 ac)
Permanent Impacts	0.45 ha (1.10 ac)

The FHWA 30% design avoided wetland impacts to the greatest extent practicable. However, the potential wetland impacts from the Design-Build contractor's design may vary from FHWA's 30% plans. NASA would work with the Design-Build contractor to avoid and minimize temporary and permanent impacts to wetlands to the greatest extent practicable.

Permits and Mitigation

Permits would be required for unavoidable permanent and temporary direct impacts to jurisdictional waters and wetlands. The Design-Build contractor would submit a JPA to VMRC for concurrent review by USACE, VMRC, VDEQ, and ACWB. Impacts to WOTUS would be regulated through permits issued by USACE pursuant to Section 404 of the CWA and Section 10 of the Rivers and Harbors Act, VDEQ pursuant to their VWP permit regulations and Section 401 of the CWA, and VMRC for waters and wetlands under their jurisdiction. VDEQ may waive their permitting requirements if VMRC issues a permit.

The Design-Build contractor would be responsible for preparing the JPA. Final permit and mitigation requirements would be determined after the Design-Build final design and in coordination with the regulatory agencies and would be the responsibility of NASA. A VMRC permit for impacts to subaqueous lands and tidal wetlands would be required. NASA anticipates that Individual Permits from USACE and VDEQ would be required. Individual Permits require formal description of 'purpose and need' public notices, adjacent property owner notifications, and an alternatives evaluation to verify wetlands and waters are avoided to the maximum extent practicable. Individual Permits are open to greater scrutiny by the public, USEPA, and other review agencies. Agency review times for Individual Permits vary with typical review times ranging from 8 to 14 months.

USACE and VDEQ require compensatory mitigation for all permanent impacts to streams and wetlands and VDEQ may also require mitigation for functional and productivity loss due to shading impacts. Mitigation measures would be developed during the Section 404/401 permitting process. Mitigation ratios are typically 1:1 for impacts to estuarine emergent wetlands; mitigation for intertidal impacts is typically determined on a per case basis and is generally in the range of 1:1; no mitigation is typically required for open water impacts but could be requested by the regulatory agencies during the permitting process.

As of October 2023, per the USACE Regulatory In-lieu Fee and Bank Tracking System, no commercial credits are available in the project watersheds (Hydrologic Unit Code [HUC] 2040304, HUC 2040303). NASA may purchase Advance/In-lieu Fee credits from the Virginia Aquatic Resources Trust Fund, if credits become available. Otherwise, NASA would evaluate on-site mitigation options. In accordance with existing regulations and standard permit conditions, all areas with temporary impacts, if any, would be restored to original contours and re-vegetated with the same or similar species.

Operation

Periodic maintenance and repair during the 75-year lifespan of the bridge and to the utility lines is not likely to have impacts on wetlands; however, NASA would evaluate the proposed activities on a case-by-case basis and would obtain permits as needed for impacts to waters and wetlands.

NASA would implement ESC BMPs to minimize secondary impacts to wetlands. If a spill occurs, impacts would likely be adverse and could be negligible to major, short- or long-term, depending on the magnitude and location of the spill.

3.6.4 Floodplains

Floodplains are lowland areas located adjacent to bodies of water in which the ordinary high-water level fluctuates on an annual basis. EO 11988 *Floodplain Management* requires federal agencies to minimize occupancy and modification of the floodplain. Flood Insurance Rate Maps (FIRMs) are produced by the Federal Emergency Management Agency (FEMA) and delineate the scope of potentially affected floodplains in the Project Area.

3.6.4.1 Affected Environment

The entire Causeway Bridge project area is included on FIRM Community Panel 51001C0480G. The bridge project area is in the 100-year floodplain Zone VE. Zone VE is defined as areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves (FEMA 2015). FIRM Community Panel 51001C0460G, shows that no staging areas are within a floodplain (FEMA 2015).

Cat Creek and the proposed bridge are located in a tidal zone where daily flows and flood flows are influenced by tides and storm surge from events such as Nor'easters and hurricanes.

3.6.4.2 Environmental Consequences

Significant impacts to floodplains would occur if the Proposed Action resulted in adverse changes to hydrologic function of the floodplain in the proposed Project Area.

No Action Alternative

The No Action Alternative would have no impacts to floodplains, including during maintenance and repairs, because there would be no changes to existing floodplain conditions.

Proposed Action

Construction and Demolition

Because the bridge project area is entirely in the 100-year floodplain, there are no practicable alternatives to avoid construction and demolition activities in the floodplain. During construction and demolition, if a weather event is predicted that could result in flooding of the Project Area, NASA would have equipment and materials associated with the project removed from the floodplain. With these contingency measures in place, the Proposed Action would have no impacts to floodplain functionality.

NASA would ensure that the Proposed Action complies with EO 11988, *Floodplain Management,* and NASA Regulations on Floodplain and Wetland Management. Since the Proposed Action would involve federally funded and authorized construction in the 100-year floodplain, this EA serves as NASA's means for facilitating public review as required by EO 11988.

Operation

In 2021, HWR conducted a detailed hydrologic and hydraulic analysis of the proposed bridge replacement project, including sea level rise impact, hydrodynamic modeling, and combined storm surge (HWR 2021a). The proposed bridge design used in the 2021 hydrologic and hydraulic analysis was similar to FHWA's 30% design plans, with the proposed bridge elevation ranging from approximately 2.8 m (9.26 ft) above mean sea level (MSL) at the start of the approaches to 9.5 m (31 ft) above MSL at the center of the bridge. The conclusions in HWR's (2021a) analysis for future flood events state "100-year flood elevations show no increase in the flood elevations at the proposed bridge location."

The new bridge would result in permanent encroachments to the floodplain beneath the bridge with installation of permanent piers that may differ in number and size from the existing bridge. However, with removal of the existing bridge and piers, the addition of new piers would likely result in a similar footprint, or "encroachments" within the floodplain. Encroachments are defined in FHWA's CFR §650.105 as "an action within the limits of the base flood plain." Encroachments

resulting from the Proposed Action would not be "significant encroachments[1]" as defined in 23 CFR §650.105(q).

The Design-Build contractor would be required to conduct hydraulic and hydrologic modeling of the final bridge design to determine the bridge's effects on flood elevations and floodplain functionality, with NASA and FHWA review to reach a final design that would not have adverse impacts to the functionality of the floodplain. Additionally, the proposed bridge footings would not induce flooding. Therefore, the Proposed Action would have no adverse impacts to the floodplain.

Under the Proposed Action, ongoing maintenance and repairs to the Causeway Bridge throughout its 75-year lifespan and to the utility lines would occur in the floodplain. Impacts would be similar to those for construction and demolition; therefore, no long-term adverse impacts to the floodplain from maintenance and repairs are expected.

3.6.5 Coastal Zone

Pursuant to the Coastal Zone Management Act (CZMA) of 1972 and federal consistency regulations, all federal actions that have reasonably foreseeable effects on any land or water use or natural resources in Virginia's designated coastal resources management area must be consistent with the enforceable policies of Virginia's Coastal Zone Management Program (VCZMP). As the lead agency for the VCZMP, VDEQ is responsible for coordinating Virginia's review of federal consistency.

3.6.5.1 Affected Environment

Virginia has developed and implemented the federally approved VCZMP, which includes 12 enforceable policies pertaining to:

- Tidal and Non-Tidal Wetlands
- Subaqueous Lands
- Dunes and Beaches
- Chesapeake Bay Preservation Areas
- Marine Fisheries
- Wildlife and Inland Fisheries
- Plant Pests and Noxious Weeds
- Commonwealth Lands
- Point Source Air Pollution
- Point Source Water Pollution
- Non-point Source Water Pollution
- Shoreline Sanitation

[1] Significant encroachment shall mean a highway encroachment and any direct support of likely base flood-plain development that would involve one or more of the following construction-or flood-related impacts:

(1) A significant potential for interruption or termination of a transportation facility which is needed for emergency vehicles or provides a community's only evacuation route.

(2) A significant risk, or

(3) A significant adverse impact on natural and beneficial flood-plain values.

3.6.5.2 Environmental Consequences

No Action Alternative

Under the No Action Alternative periodic maintenance and repair of the existing bridge and utility lines may be required. NASA would evaluate proposed activities on a case-by-case basis and coordinate with VDEQ pursuant to the CZMA, as necessary. If a spill occurs, impacts would likely be adverse and negligible to major and could be short or long-term, depending on the magnitude and location of the spill.

Proposed Action

NASA has determined that the Proposed Action would be consistent, to the maximum extent practicable, with the enforceable policies of VCZMP. NASA has prepared a Federal Consistency Determination (FCD) evaluating the effects of the Proposed Action on Virginia's coastal zone resources, which was submitted to VDEQ on September 21, 2023, for review concurrent with the Draft EA public review period. In a letter dated November 16, 2023, VDEQ stated that they concur "that the Proposed Action is consistent with the Virginia CZM Program, provided NASA obtains and complies with all applicable permits and approvals associated with the enforceable policies of the Virginia CZM Program." The FCD and VDEQ's response are included in **Appendix D**.

3.6.6 Sea Level Rise and Climate Change Resilience

On January 9, 2023, CEQ issued interim guidance, *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*. This guidance directs federal agencies to consider GHG emissions and climate change in NEPA reviews. Evaluation of GHGs is provided in Section 3.2, *Air Quality*. This section discusses sea level rise and climate change resilience.

Per the CEQ guidance, NEPA evaluations should consider (1) potential effects of a proposed action on climate change, and (2) potential effects of climate change on the proposed action and its environmental impacts. The guidance stresses the need to ensure climate-resilient infrastructure by considering the reasonably foreseeable effects of climate change on infrastructure investments and the resources needed to protect such investments over their lifetime and the importance of adaptation planning.

NASA's *Climate Action Plan* (NASA 2021) provides NASA's vision for adapting to climate change effects on its mission, facilities, infrastructure, natural lands, and other assets. It is NASA's policy to integrate climate considerations into agency actions. To implement this policy, NASA commits to identifying and applying adaptation strategies to avert potential mission impacts from climate change; integrate climate change adaptation planning actions into agency programs, policies, and operations; and minimize impacts to climate from agency programs, policies, and operations.

3.6.6.1 Affected Environment

Coastal environments are highly dynamic and particularly vulnerable to climate change and rising sea levels. The Project Area is in a coastal system that is highly influenced by the tides and storm surge (such as Nor'easters and hurricane events). Climate change impacts that may be experienced at WFF include rising sea levels, more frequent flooding, and increasingly intense, unevenly distributed rain events. These impacts may threaten infrastructure and lead to greater damage from hurricanes and storm events due to higher storm surge, which is the abnormal rise of water generated by a storm, over and above the predicted tide. The Project Area that includes the bridge structure is in FEMA flood zone VE with a base flood (100-year flood event) elevation of 2.7 m (9 ft) (FEMA Map Panel 51001C0480G).

The recently released federal report *Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines* (*2022 Sea Level Rise Technical Report*) (Sweet et al. 2022) is a synthesis of the latest available science on sea level rise. The *2022 Sea Level Rise Technical Report* provides global, regional, and local sea level rise scenarios and considers a variety of processes that could influence sea level across a wide range of future warming conditions, as well as observation-based extrapolations that represent an estimated continuation of sea level changes based on extending observed tide-gauge trends from 1970-2020.

The *2022 Sea Level Rise Technical Report* provides five plausible sea level change scenarios through 2150 (Low, Intermediate-Low, Intermediate, Intermediate-High, and High) that correspond to average global sea level rise magnitudes relative to a baseline of year 2000. Projections for the northeast region for year 2100 (which covers the life of Proposed Action) are provided in **Table 3-5.** The *2022 Technical Report* includes regional extrapolations out to year 2050 based on tide-gauge records for coastal regions and includes information on projected increased magnitude and frequency of flooding. The report found that all coastal U.S. regions can expect a shift in flood regime in the next 30 years, with damaging and dangerous flood events occurring more frequently as sea levels rise.

Table 3-5. Sea Level Scenarios (m) relative to 2000 baseline- Northeast Region

Year	Low	Intermediate-Low	Intermediate	Intermediate-High	High
2050*	0.36 [0.27-0.45]	0.40 [0.31-0.49]	0.43 [0.34-0.54]	0.49 [0.38-0.64]	0.54 [0.40-0.69]
2100	0.6	0.8	1.3	1.6	2.1

*Observation based, [likely ranges] are provided

Source: Sweet et al. 2022

3.6.6.2 Environmental Consequences

Significant impacts would occur if either the action caused an appreciable increase in the factors that affect sea level rise or if sea level rise would affect the ability of the action to function as designed.

No Action Alternative

There would be no effects to sea level rise under the No Action Alternative because no new human-built infrastructure or facilities contributing to sea level rise would be constructed. Sea level rise would impact the existing bridge and approaches under the No Action Alternative. Climate change may create long-term adverse impacts by accelerating the deterioration of the existing bridge structure through various mechanisms including accelerated materials degradation (e.g., CO_2 corrosion of concrete structures), exposure to more frequent flooding, damage to pavement (e.g., from more frequent precipitation events), higher scour rates, including scour at abutments and piers (e.g., due to higher rates of runoff), and more intense storm surges (Nasr et al. 2020). Depending on the magnitude of effects, sea level rise could affect the ability of the existing structure to function as designed. Impacts could range from minor to major and would be long-term.

Proposed Action

The Proposed Action's contributions to GHG emissions are discussed in Section 3.2, *Air Quality*.

The Envision program developed by the Institute for Sustainable Infrastructure provides a framework for assessing sustainability and resilience of infrastructure. It was developed as a tool to assist government agencies in delivering infrastructure that helps tackle climate change by utilizing sustainability and resiliency criteria including 'Climate and Resilience.' The 'Climate and Resilience' criteria focus on minimizing emissions that may exacerbate climate change and magnify short- and long-term risks (ISI 2018). NASA is voluntarily pursuing Envision certification for the Proposed Action.

One 'Climate and Resilience' criterion is the reduction of net embodied carbon, which addresses the embodied carbon of materials (as a proxy for various impacts) used over the life of a project. This combines concepts of sourcing local materials, using materials more efficiently, and using lower-impact materials to reduce the combined environmental impacts of material use. By designing projects to use less material, use materials efficiently, and/or specifying materials with lower embodied carbon, projects can reduce their overall impact on climate change. NASA is investigating materials, including concrete mixes that incorporate pozzolan materials (blast furnace slag and/or fly ash) that would lower embodied carbon, and would encourage the Design-Build contractor to use such materials, where applicable.

The 2021 HWR hydraulic and hydrologic study provided preliminary bridge scour evaluation for a proposed bridge that was similar to FHWA's 30% design. Cat Creek and overbank areas were determined to be stable with no long-term scour potential in the Project Area. Based on preliminary

plans, contraction scour (removal of material from the bed and banks across all or most of the channel width from contraction of the flow area) from the 100-year storm surge was calculated as 2.1 m (6.8 ft). Local scour (removal of bed materials from around piers, abutments, and embankments) at the proposed abutments and piers from the 100-year storm surge was calculated as 3.99 to 4.36 m (13.1 to 14.3 ft) (HWR 2021a). The Design-Build contractor would be required to conduct hydraulic and hydrologic modeling of the final bridge design to determine the bridge's effects on scour.

Sea level rise and climate change resilience has been incorporated into planning and FHWA's preliminary project design. FHWA requires that freeboard shall be provided, where practicable, to protect bridge structures from debris and scour-related failure. As noted in Section 3.6.4, *Floodplains*, the preliminary FHWA 30% design plans provide freeboard above the 2.7 m (9 ft) base flood elevation. This bridge elevation would also remain above year 2100 sea level rise projections for all scenarios (Sweet et al. 2022).

Rock riprap as a scour countermeasure would likely be used at the proposed abutments. Based on preliminary FHWA 30% design, the riprap protection mat should be approximately 0.5 m (1.5 ft) and should extend from the toe of the embankment to an approximate elevation of 4 m (14 ft) (HWR 2021a).

Although final design would occur during the Design-Build process, scour protection and bridge elevations would be incorporated to meet all applicable specifications. Final design would incorporate sea level rise considerations over the 75-year lifespan of the bridge to meet minimum regulatory height requirements for the life of the new bridge.

Given the scale of the project, adverse impacts of the Proposed Action on climate change and sea level rise would be negligible and, therefore, would have no foreseeable potential to significantly impact either climate change or sea level rise. Sea level rise impacts would be incorporated into the final design and are not anticipated to shorten the projected life of the proposed bridge or impact the ability of the Proposed Action to function as designed.

3.7 Vegetation

Vegetation at Wallops Mainland and Wallops Island are discussed in detail in the *Final Site-wide PEIS*.

3.7.1 Affected Environment

Vegetation within the proposed bridge area of the Project Area consists primarily of estuarine emergent wetland vegetation, e.g., saltmeadow cordgrass, smooth cordgrass, and common reed (*Phragmites australis, 'Phragmites'*). Upland vegetation is found on the fill slopes of the causeway and includes eastern white pine (*Pinus strobus*), eastern red cedar (*Juniperus virginiana*), chokecherry (*Prunus virginiana*), southern wax myrtle (*Myrica cerifera*), poison ivy (*Toxicodendron radicans*), beaked panic grass (*Panicum anceps*), black rush (*Juncus roemerianus*), redtop (*Agrostis gigantea)*, wild rye (*Elymus riparius*), hairy crabgrass (*Digitaria*

sanguinalis) and other herbaceous plants (NASA and FHWA 2020). Vegetation within proposed staging areas consists of grasses and herbaceous species typical of disturbed areas. These habitats do not represent rare vegetation communities. Grasses that grow to the surface of, but do not emerge from, shallow water are called SAV. No SAV beds are within the Project Area (VMRC 2022).

Invasive species are species that are not native to a given ecosystem and whose introduction causes, or is likely to cause, economic or environmental harm and/or harm to human health (EO 13112 *Invasive Species;* EO 13751 *Safeguarding Nation from the Impacts of Invasive Species*). Invasive species typically thrive in disturbed conditions and can readily displace native species and create monoculture habitats threatening biodiversity, with *Phragmites* being a common threat in wetland systems in the Project Area. *Phragmites* is a tall (5 m [15 ft]) perennial grass that forms a dense vegetative mat, preventing other species from becoming established. *Phragmites* is an opportunistic species, which takes advantage of disturbances to local vegetative communities including from construction activities. *Phragmites* has been designated on the Virginia Invasive Species List as having a high invasiveness rank with demonstrable evidence that it poses a threat to Virginia's habitats. Species are ranked based on their potential to alter ecosystem processes, invade undisturbed natural communities, and cause substantial impacts to rare or vulnerable species or natural communities; their ability to disperse readily, and difficulty of controlling the species (Heffernan et al. 2014).

3.7.2 Environmental Consequences

Impacts to vegetation would be considered significant if species or habitats would be adversely affected over relatively large areas or there would be considerable harm to ecological function, diversity, or sustainability of the plant communities in the affected area. Additionally, impacts would be considered significant if habitat disturbances would result in reductions in the population size and/or distribution of a species, and/or invasive species (e.g., Phragmites) would be introduced to rare habitats.

3.7.2.1 No Action Alternative

Under the No Action Alternative, maintenance and repairs would occur until bridge closure and/or utility shutoff. Vegetation could be affected by maintenance or repair activities; adverse impacts would likely be minor and short-term. Vegetation would continue to be managed in accordance with NASA WFF policies and procedures.

3.7.2.2 Proposed Action

Minor impacts to upland vegetation would occur from construction access along roadway shoulders, embankments, the base of the approaches where fill would be imported, the HDD entry/exit pits (if needed), and at the proposed staging areas. Vegetation would be temporarily disturbed by vehicle and equipment access and would be permanently impacted in proposed

staging areas anywhere that gravel pads would be constructed. In general, these areas have been previously disturbed, are maintained by mowing, and consist of low-growing vegetation.

The removal of mature trees that may be located along the embankment and at the base of the causeway would be minimized to the extent practicable. Effects would occur at the individual rather than the community, population or species level and would not prevent or delay the continued propagation of any species. After construction, disturbed areas would be replanted with native vegetation in accordance with NASA WFF vegetation management policies.

Vegetated wetland impacts are discussed further in Section 3.6.3, *Wetlands*. Wetland areas that are disturbed may become more susceptible to colonization by invasive species, including *Phragmites*. The Design-Build contractor would adhere to requirements of WFF's Phragmites Control Plan (NASA 2014a). NASA may require the Design-Build contractor to prepare and implement project-specific *Phragmites* management/control measures. These measures may include mowing of small infestations, restricting access to the site, implementing cleaning measures for tracked equipment entering areas of known *Phragmites*, and post-construction monitoring. If possible, the top 30 cm (12 in) of material removed from wetlands would be preserved for use as wetland seed and rootstock in the excavated area unless the material contains *Phragmites*.

In its September 18, 2020, scoping comments, the Virginia Institute of Marine Science (VIMS) recommended that after the existing Causeway Bridge is removed, the area be regraded to tie into adjacent marsh contours and planted with appropriate tidal wetlands vegetation and stated that any construction access and/or disturbed areas should also be replanted. VIMS further recommended the development of a planting plan that includes monitoring and replanting as necessary as well as a *Phragmites* control plan.

Species or habitats would not be substantially affected over large areas, habitat disturbances would not result in reductions in the population size or distribution of a species, and invasive species would not be introduced to rare habitats. Short- and long-term adverse impacts to vegetation from the Proposed Action would be minor.

3.8 Wildlife

Common wildlife at Wallops Mainland and Wallops Island are discussed in detail in the *Final Site-wide PEIS*. Special status species, including federally listed threatened and endangered species, fish species managed under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), marine mammals, Migratory Bird Treaty Act (MBTA) protected species, and bald eagles (*Haliaeetus leucocephalus*) are discussed in greater detail in Section 3.9, *Special Status Species*.

3.8.1 Affected Environment

3.8.1.1 Terrestrial Wildlife

Terrestrial wildlife includes mammals, reptiles, amphibians, invertebrates, and birds.

Mammals

Most common mammals at WFF, such as white-tailed deer (*Odocoileus virginianus*), opossum (*Didelphis marsupialis*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), white-footed mouse (*Peromyscus leucopus*), meadow vole (*Microtus pennsylvanicus*), eastern cottontail (*Sylvilagus floridanus*), and grey squirrel (*Sciurus carolinensis)* use upland and freshwater habitats (NASA 2017). However, transient individuals may be found in or near the Project Area. River otters (*Lontra canadensis*) and muskrat (*Ondatra zibethicus*) may use tidal marshes in the Project Area (NASA 2017).

Reptiles and Amphibians

While most reptiles and amphibians found at WFF use freshwater or upland habitats, diamondback terrapins (*Malaclemys terrapin*) may be found in the tidal marshes and tidal flats in the Project Area (NASA 2017).

Invertebrates

Wallops Island, particularly the tidal marsh areas, has an extensive variety of invertebrates. Salt marsh cordgrass wetlands are home to herbivorous insects such as the salt marsh grasshopper (*Orchelimum fidicinium*) and the tiny plant hopper (*Magamelus spp.*), and snail species such as periwinkle snail (*Littorina irrorata*) and mud snail (*Ilyanassa obsolete*). Tidal marshes are home to parasitic flies, wasps, spiders, and mites. Salt marsh mosquitos (*Ochlerotatus sollicitans*) and greenhead flies (*Tabanus nigrovittatus*) are common insects (NASA 2017).

Birds

WFF is home to a wide variety of bird species. The Project Area is within the boundaries of the Audubon-designated Virginia Barrier Island Lagoon System Important Bird Area (IBA). IBAs are designated due to their importance to bird species as places that are critical to birds during some part of their life cycle (breeding, wintering, feeding, migrating) (CCB 2009 in VCZMP 2023). The Virginia Barrier Island Lagoon System IBA includes the most pristine chain of barrier islands along the Atlantic Coast, extensive salt marshes, intertidal mudflats, and open water that support significant populations of multiple sensitive bird species (Audubon 2023). Internationally, the IBA has also been designated a UNESCO Biosphere Reserve and a Western Hemisphere Shorebird Reserve Site (Audubon 2023).

While many of these sensitive species nest on beaches, the IBA also supports the most significant breeding populations in the state of waders such as little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), snowy egret (*Egretta thula*), glossy ibis (*Plegadis falcinellus*), black-crowned night heron (*Nycticorax nycticorax*), as well as other wading birds including American bittern (*Botaurus lentiginosus*), horned grebe (*Podiceps auratus*), and pied-billed grebe (*Podilymbus podiceps*), which may be found in the Project Area (Audubon 2023, NASA 2019).

Marsh-nesting species including the seaside sparrow (*Ammospiza maritimus*), saltmarsh sharp-tailed sparrow (*Ammodramus caudacutus*), least bittern (*Ixobrychus exilis*), Nelson's sharp-tailed

sparrow (*Ammodram nelson*), and sedge wren (*Cistothorus stellaris*) may inhabit the Project Area. Other species that are non-breeding in the region that may be found in marsh areas of WFF include the marbled godwit (*Limosa fedoa*), red-throated loon (*Gavia stellata*), short-billed dowitcher (*Limnodromus griseus*), and solitary sandpiper (*Tringa solitaria*) (NASA 2019). Raptors, including peregrine falcon (*Falco peregrinus*), northern harriers (*Circus cyaneus*), and osprey (*Pandion haliaetus*) as well as a variety of waterfowl may utilize tidal marshes in the Project Area (NASA 2017). No bald eagle nests are known to occur in the Project Area (CCB 2023).

Most of the bird species in the Project Area are protected by the MBTA. Bird species protected under the MBTA are discussed in Section 3.9, *Special Status Species*.

3.8.1.2 Aquatic Wildlife

Common aquatic species in the Project Area include fish and invertebrate species.

Fish

The tidal marshes in and around the Project Area serve as nursery habitat providing both shelter and forage for a variety of fish species, including spot (*Leiostomus xanthurus*), northern pipefish (*Syngnathus fuscus*), dusky pipefish (*Syngnathus floridae*), and bay anchovy (*Anchoa mitchilli*) (NASA 2017). The waters and wetlands in and around WFF also serve as important habitat for Atlantic menhaden (*Brevoortia tyrannuis*), and anadromous species alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), American shad (*Alosa sapidissima*), and striped bass (*Morone saxatilis*) (NASA 2019). Transient individuals of these species may be present in the Project Area.

Invertebrates

Important invertebrate species known to occur in the Project Area include eastern oyster (*Crassostrea virginica*) and ribbed mussel (*Guekensia demise*). Blue crab (*Callinectes sapidus*) may also be in the Project Area. Blue crabs, particularly juveniles, use structured habitats including oyster reefs as refuges and nursery areas (Longmire et al. 2021). While less likely to be present, hard clams or quahogs (*Mercenaria mercenaria*) have the potential to occur in the Project Area. Habitat conditions do not favor this species, as hard clams prefer sand over mud substrates (Roegner and Mann 1990).

Eastern oysters and ribbed mussels provide a variety of important habitat functions including improving water quality, providing forage for larger organisms, and supporting commercially important fisheries. Eastern oyster reefs are important features structuring the estuarine landscape. Oyster populations and reefs provide a suite of ecosystem services such as habitat for benthic macrofauna (Zimmerman et al. 1989 in Colden and Lipcius 2015), enhanced nutrient cycling (Kellogg et al 2013 in Colden and Lipcius 2015), and shoreline stabilization (Piazza et al. 2005 in Colden and Lipcius 2015). Ribbed mussels generally aggregate along marsh edges around *Spartina alterniflora* plant growth, stabilizing the marsh and reducing erosion (Bertness 1984), as well as enhancing water quality by filtering particulate matter (Moody and Kreeger 2020).

Due to their economic importance, the fisheries supported by these species are regulated by state agencies including the Virginia Department of Health (VDH) and VMRC. Under VDH, the Department of Shellfish Sanitation is responsible for approving the safety and health of the waters from which shellfish are harvested.

There are no shellfish condemnation areas in the project vicinity (VMRC 2022). VMRC promotes and regulates clam and oyster aquaculture in subaqueous lands. VMRC issues private aquaculture leases and designates public Baylor Grounds which are mandated to be held in trust for the benefit of the people of Virginia. There are no private oyster ground leases or oyster ground applications in the Project Area, but Cat Creek is designated as a public Baylor Ground (**Figure 3-2**).

VMRC also designates Fisheries Management Areas, which include blue crab sanctuaries, hard clam harvest areas, oyster management areas, and shellfish management areas. There are no Fisheries Management Areas in the Project Area or vicinity (VMRC 2022).

During project scoping, in comments dated September 22, 2020, the VMRC recommended that a survey be conducted of shellfish resources in the Project Area. The FHWA conducted both a presence/absence and a preliminary density survey of a representative portion of the shellfish beds fringing the tidal wetlands in the Project Area in May 2021 (FHWA 2021). Oysters were identified in the mudflats along the perimeter of the tidal wetlands and adhering to the concrete bridge piers, and mussels were identified in the spaces between concrete riprap at the base of the embankment.

Oyster beds generally extended an average of 6 m (20 ft) (0 to 12 m [40 ft] range) waterward from the vegetated wetland limit in the intertidal mudflats. Density was slightly higher on the western side of the bridge where 134.5 oysters per m^2 (12.5 oysters per ft^2) were observed. There are 0.6 ha (1.45 ac) of shellfish beds within the Project Area (**Figure 3-3**).

3.8.2 Environmental Consequences

Determination of the significance of the potential impacts to common terrestrial and aquatic species is based on the sensitivity of the species to the proposed activities and the amount of habitat that would be temporarily or permanently impacted. Impacts would be considered significant if a species would be substantially affected over relatively large areas or if disturbances would result in a reduction in the population size or distribution of one or more species.

3.8.2.1 No Action Alternative

Under the No Action Alternative, there would be no construction or demolition activities and current conditions would continue. Periodic maintenance and repair of the existing bridge and utilities may impact terrestrial and aquatic species due to the presence of humans and equipment/vessels, disturbances to vegetation/habitat, or in-water work. In-water work would have the potential for increased underwater noise and turbidity. The predominant reaction among mobile species would likely be avoidance of the area. Maintenance and repair events would be similar to those of the Proposed Action and background conditions would be expected to return quickly. Impacts, if they occur, would likely be adverse, minor, and short-term.

Legend

- Staging Area
- Bridge Envelope Limits of Disturbance
- Private Oyster Ground Leases
- Public Baylor Grounds

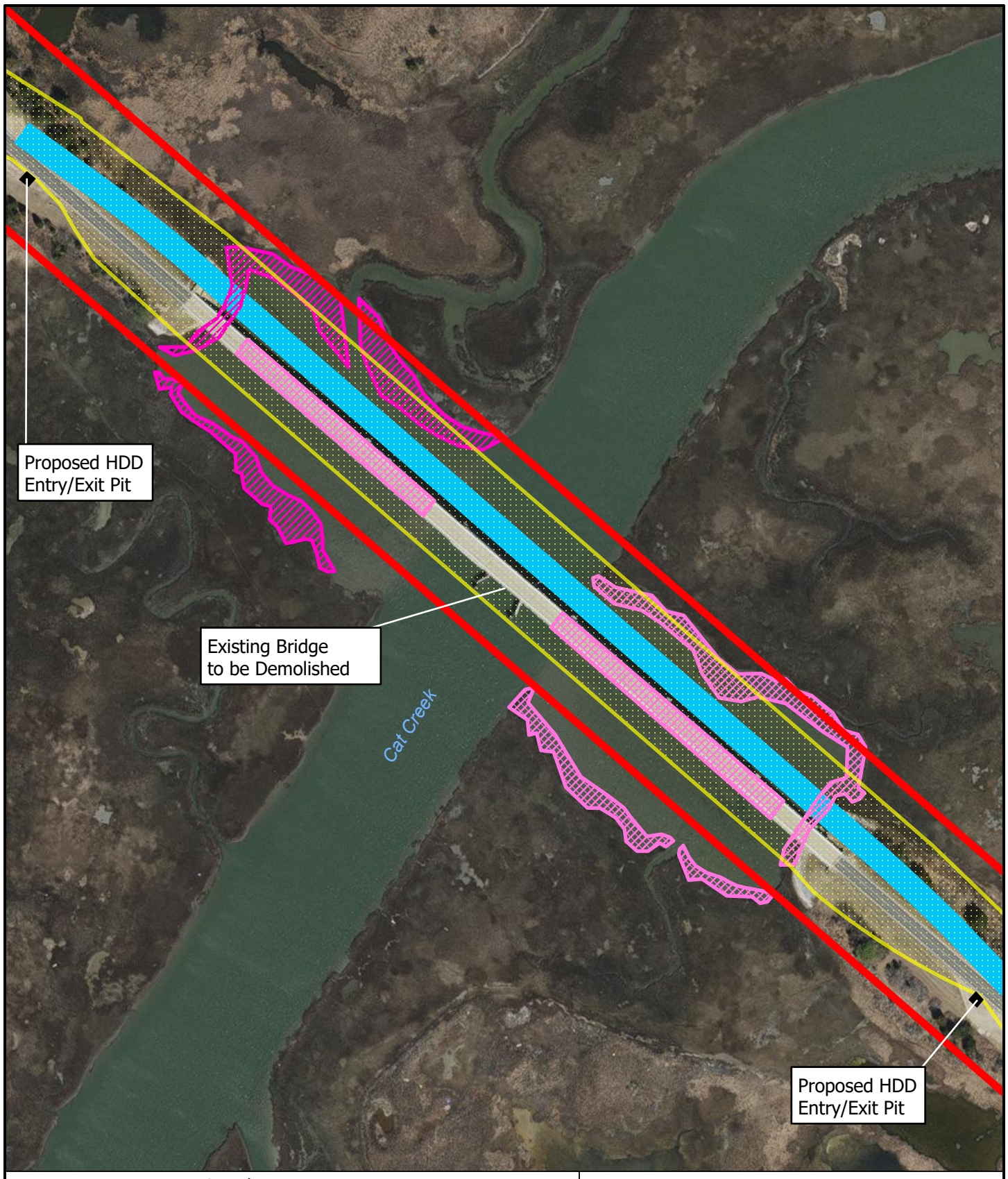
N

Sources: NASA, VGIN, VMRC / Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

FIGURE 3-2
PUBLIC BAYLOR GROUNDS AND PRIVATE OYSTER LEASES

0 2,000 4,000
Feet

WFF Causeway Bridge Replacement Project



Legend

Oyster Beds and Reefs
- Digitized to FHWA Map - 2021
- Data Provided by FHWA - 2021
- Proposed Causeway Bridge
- FHWA 30% Plan Limits of Disturbance
- Bridge Envelope Limits of Disturbance

N

Sources: NASA, VGIN, FHWA Shellfish Survey Report 2021 / Prepared by: WSSI, 32529.01, JB
Projection: NAD 1983 StatePlane Virginia North FIPS 4501 Feet

FIGURE 3-3
LOCATION OF OYSTER BEDS AND REEFS

0 250 500
Feet

WFF Causeway Bridge Replacement Project

3.8.2.1 Proposed Action

Terrestrial Wildlife

The Proposed Action would adversely impact terrestrial wildlife through removal of habitat as well as disturbance and displacement by construction and demolition activities, including associated noise, light, and increased activity. Mobile and faster-moving species, including most mammals and birds, would likely relocate to undisturbed areas offering similar habitat in or near the Project Area. Slower-moving or less mobile species, such as insects, may be injured or killed by construction equipment and vehicles. If construction occurs during breeding season (generally spring and summer), marsh-nesting birds could be adversely affected. Impacts to marsh-nesting birds protected by the Endangered Species Act (ESA) and MBTA are discussed further in Section 3.9, *Special Status Species*.

Impacts on terrestrial wildlife would occur at the individual level rather than the population or species level. The Proposed Action would not substantially affect species over large areas or result in a reduction in the population size or distribution of one or more species. Impacts would be minor and may be short- or long-term.

Aquatic Wildlife

The Proposed Action would adversely impact aquatic species through in-water work associated with bridge construction and demolition. Impacts on aquatic wildlife would occur at the individual level rather than the population or species level. The Proposed Action would not substantially affect species over large areas or result in a reduction in the population size or distribution of one or more species. Impacts would be minor and may be short- or long-term.

Impacts to species protected by the ESA and Marine Mammal Protection Act (MMPA) are discussed further in Section 3.9, *Special Status Species*.

Fish

Potential adverse impacts to fish would be associated with underwater noise, increased turbidity and sedimentation, entanglement and increases in vessel traffic. In general, highly mobile species like fish would relocate to nearby similar habitats during construction and demolition. Avoidance of the Project Area by individuals would not be anticipated to substantively affect behaviors such as migration, mating, or foraging for food.

Underwater noise – Underwater sound pressure waves can injure or kill fish, with fish species having swim bladders (a chamber of air in the abdominal cavity) most susceptible to physical injury. Fish species lacking a swim bladder (e.g., flatfish including flounder) or those that have a small or reduced swim bladder (many benthic species including some flatfish) tend to have poor auditory sensitivity and are less susceptible to injury (NMFS 2016). For fish with swim bladders, as a pressure wave passes through a fish, the swim bladder is rapidly squeezed due to high pressure and then rapidly expanded as the under-pressure component of the wave passes through the fish; this may rupture capillaries in the internal organs (Hastings and Popper 2005).

In-water work, including pile driving and bridge demolition activities, would create temporary adverse underwater noise impacts. Sound levels generated during pile driving operations depend on numerous factors including pile size, shape, and material; hammer type and energy; sediment or bedrock type; and water depth and bathymetry. As the distance from the source increases, underwater sound levels dissipate rapidly. As described further in Section 3.9, *Special Status Species,* the NMFS Greater Atlantic Regional Fisheries Office (GARFO) Acoustics Tool using the Simplified Attenuation Formula for riverine systems (NMFS 2020) was used to determine potential acoustic effects of proposed pile driving activities based on preliminary design plans including both concrete bridge piles and steel piles for temporary construction access trestles.

Modeling results indicate that noise levels would be below the physiological injury threshold for fish. However, injury to a fish could occur if an individual remained in the immediate vicinity while the pile was being driven. This is unlikely to occur as fish are expected to vacate the pile driving area. Cat Creek at the Causeway Bridge is approximately 70 m (230 ft) wide; adequate passage exists for fish to vacate the area. Modeled noise levels are above the threshold for behavioral effects, which would most likely include avoidance behavior. The GARFO Acoustics Tool also estimates the distance of potential acoustic effects from the point of pile driving. Fish may experience behavioral effects within 50 m (165 ft) of concrete pile driving activity and 60 m (200 ft) of steel pile driving activity. No impacts to ambient noise levels are anticipated.

Water Quality and Benthic Habitat Effects – Adverse water quality and benthic habitat effects may occur due to direct loss of benthic habitat, direct disturbances to the benthic environment from boat anchors, as well as temporary increases in water turbidity due to construction and demolition activity. Increased turbidity has the potential to affect the foraging and escape abilities of fish species that rely on visual means for feeding and navigation and may impact fish health by reducing the ability of fish's gills to extract dissolved oxygen from the water.

Sediment resuspension from pile driving is anticipated to be minimal and any increase in turbidity would be localized to the area around the pile being driven. Suspended sediment is expected to settle out of the water column within a few hours and any increase in turbidity would be short term and localized. Pile removal during bridge demolition would also cause a temporary increase in turbidity. The magnitude of this impact would depend on demolition means and methods as determined under the Design-Build Process. Directly pulling broken piles may suspend a larger amount of sediment, as sediments clinging to the pile slough off as it is raised through the water column. Clamshell buckets may suspend additional sediment if they penetrate the substrate while grabbing the pile. Conversely, vibratory pile removal can cause the sediments to slough off within the substrate, resulting in lower levels of suspended sediments (Hansen et al. 2003 in NOAA Fisheries and FHWA 2017). Breaking or cutting the pile below the mudline may suspend small amounts of sediment, if the stub is left in place and little digging is required. If project vessels, such as barge-mounted cranes, are used in shallow water, resuspension of bottom sediments may occur. The degree of sediment resuspension and turbidity produced in the water column from vessel activity is generally dependent on the wave energy and wake produced by the vessel, size

of the sediment particles, water depth, and number of vessels passing through an area (NOAA Fisheries and FHWA 2017) and may be more pronounced in shallow water habitats with fine sediments (Johnson et al. 2008 in NOAA Fisheries and FHWA 2017).

Studies of the effects of turbid water on fish suggest that concentrations of suspended solids can reach thousands of milligrams per L (mg/l) before an acute toxic reaction is expected for most species, while sensitive species may be impacted at 580 mg/l (Burton 1993 in NOAA Fisheries 2023b). Benthic communities may be impacted at 390 mg/l (USEPA 1986 in NOAA Fisheries 2023b). Pile driving activities can be expected to produce total suspended solids (TSS) concentrations of approximately 5 to 10 mg/l above ambient levels within approximately 90 m (300 ft) of the pile being driven (FHWA 2012 in NOAA Fisheries 2023b). Therefore, the TSS levels expected for pile driving are below those shown to have adverse effect on fish or benthic prey communities. Inadvertent smothering of benthic prey species by increased turbidity and sedimentation would be localized and would not substantially affect the quantity or prey available in waters near the Project Area.

Although bentonite is a naturally occurring clay (IMA-EU 2023), an inadvertent release of drilling mud (bentonite slurry) into estuarine waters may result in indirect impacts on aquatic species such as fish if HDD is used to install the utility lines. Because bentonite would behave as a suspended sediment if discharged in water (ASCE 2005), when it settles out, fish and their eggs can be smothered by the fine particles. Although the bentonite slurry is not toxic, the tiny micro-particles of bentonite could attach to fish gills and cause them to suffocate due to the lack of oxygen (Jefferis & Lam 2013).

Adherence to the Frac-Out Contingency Plan, which would include steps to contain and remediate an inadvertent release of drilling mud, would minimize the potential for indirect adverse impacts from HDD operations on marine wildlife and habitat in and around the Project Area. If HDD is used, to minimize potential impacts to fish and their eggs, NASA may require the construction contractor to use non-toxic polymer additives, which could be combined with the bentonite clay, as part of the Frac-Out Contingency Plan. A site-specific SWPPP would be prepared and implemented, which would minimize impacts on water quality from ground disturbances in all project areas.

Entanglement – Cables, turbidity curtains, cofferdams, or other objects associated with construction or demolition could be a potential entanglement risk. Less mobile organisms, such as juvenile fish, may be more susceptible (Nightingale and Simenstad 2001). Entanglement in in-water lines or detached turbidity curtains can cause serious injury or mortality. Entanglement can cause fish to become impaired or incapacitated, leading to starvation, increased vulnerability to predators, or physical wounds (Milliken and Lee 1990; Johnson et al. 2008 in NOAA Fisheries and FHWA 2017). Proper deployment and monitoring of in-water construction and turbidity control devices would minimize entanglement impacts.

Vessel Traffic – Collision with vessels (boat hulls and propellers) is a potential source of mortality and injury for fish. The Proposed Action would not lead to a permanent increase in vessel traffic

above existing levels; however, the proposed work may result in a small, temporary increase in the number of vessels moving through the Project Area during construction and demolition. Generally, fish are more vulnerable to being struck by faster moving, deep-draft vessels in narrow channels. Project related construction vessels are anticipated to be generally slow moving or anchored, minimizing risks.

Invertebrates

Eastern oysters and ribbed mussels are known to be in the Project Area. Blue crabs and hard clams may be in the Project Area. Potential adverse impacts to invertebrate species include habitat loss associated with disturbance to the existing embankment during bridge demolition, pile placement and vessel anchoring during bridge construction, and disturbance to benthic habitat from increased turbidity and sedimentation during construction and demolition. Impacts would be minor and short- or long-term.

Habitat Conversion – Ribbed mussels occupying the existing embankment may be killed or suffer reduced fitness from trauma or suffocation during bridge demolition. The Proposed Action may directly impact oyster beds through the placement of bridge piers as well as trestles or anchoring of construction vessels for construction access, if required. Based on FHWA's 30% plans, approximately 0.40 ha [1.0 ac]) of shellfish beds may be directly impacted. Final bridge design as well as construction and demolition means and methods would be determined during the Design-Build process. NASA anticipates that final impacts to shellfish beds would be of similar magnitude to the FHWA 30% plans and would remain within the Project Area evaluated in this EA.

Water Quality and Benthic Habitat Effects – Eastern oysters and ribbed mussels may be adversely impacted by sedimentation and increased turbidity during construction and demolition. Mobile organisms such as fish can move away from areas of increased sediment loads, but filter feeding benthic organisms such as oysters and mussels are at particular risk due to their sessile nature. Turbidity affects the ability of oysters to filter feed because high sediment loads trigger oysters to close and stop filtering. Excessive sedimentation can also bury oyster beds, smothering the organisms and increasing mortality (NMFS 2007). In its September 18, 2020, scoping comments, VIMS stated that impacts to oysters could be reduced through strict ESC measures, and, if necessary, a time of year restriction (TOYR) for instream work.

Thresholds for lethal effects on eastern oyster egg development have been reported to occur at sedimentation rates as low as 188 mg/l (Nightengale and Simenstad 2001). Suspended solids concentrations <750 mg/l have been shown to allow for continued larval development, but higher concentrations for durations of 10 to 12 days have been shown to have lethal effects for oysters. One study found that oysters are tolerant of partial burial in terms of survival; however, burial may adversely affect metabolic processes and therefore negatively impact reef persistence (Colden and Lipcius 2015). Given the expected TSS concentrations from pile driving activities, direct mortality is not anticipated, but oysters may suffer reduced fitness. To mitigate impacts, in correspondence dated October 15, 2021 (**Appendix E**), VMRC recommended that oyster shells and clusters within the project footprint be relocated to an adjacent reef, outside the Project Area. The Design-Build

contractor would be responsible for oyster relocation and coordination with VMRC and VIMS regarding additional appropriate mitigation, based on final bridge design and as necessary. The proposed utility relocation (and thus the potential HDD operations) was not included in the original 2021 coordination for this project; NASA would coordinate with VMRC during the CWA permitting process when more project details, including details about the HDD operations, are known. NASA anticipates that a Subaqueous Bed Permit would be needed for the Proposed Action if NASA decides to use HDD.

Thresholds for lethal effects on hard clam egg development have been reported at 1,000 mg/l TSS (Mullholland 1984 in Nightengale and Simenstad 2001). As such, if they are in the Project Area, significant population level impacts to clams are not anticipated. Clams would be expected to re-establish following construction due to the extensive presence of local benthic habitat for recruitment. Turbidity is not anticipated to impact blue crabs, as they rely on chemosensory methods for foraging and do not rely on visual methods (Lunt and Smee 2015). Turbidity has been found to be positively correlated with juvenile blue crab abundance (Hyman et al 2022).

If drilling mud (bentonite slurry) is released into estuarine waters, it may result in indirect impacts on aquatic species. Invertebrates would also be negatively affected by the fine particles. If HDD is utilized, NASA would adhere to the Frac-Out Contingency Plan to minimize the potential for indirect adverse impacts from HDD operations on marine wildlife and habitat in and around the project area.

Operation

Periodic maintenance and repair during the 75-year lifespan of the bridge and during the utilities' lifespan may adversely impact terrestrial and aquatic species due the presence of humans and equipment/vessels, disturbances to vegetation/habitat, or in-water work. In-water work would have the potential for increased underwater noise and turbidity. The predominant reaction among mobile species would likely be avoidance of the area due to increased human/vessel activity, noise, etc. Maintenance and repair events would be infrequent and short in duration, and background conditions would be expected to return quickly. Impacts would likely be minor and short-term.

3.9 Special Status Species

This section addresses species that have a special, legally protected status based on the following federal legislation:

ESA: The U.S. Fish and Wildlife Service (USFWS) and NOAA Fisheries designate, regulate, and protect federally listed threatened or endangered species, proposed and candidate for listing species, and proposed and designated critical habitat under Section 7 of the ESA. USFWS primarily has jurisdiction over terrestrial and freshwater aquatic species (as well as sea turtles when nesting onshore), and NOAA Fisheries primarily has jurisdiction over marine species (including sea turtles when in water).

MSA: The MSA established regional Fishery Management Councils (FMCs) which are responsible for the management and protection of marine fishes. The Sustainable Fisheries Act, which amended the MSA, created a requirement for FMCs to describe and identify Essential Fish Habitat (EFH). The MSA requires all federal agencies to consult with NOAA Fisheries on proposed actions that may impact designated EFH. EFH includes "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." and may be designated for an individual species or an assemblage of species. NOAA Fisheries and the FMCs also identify Habitat Areas of Particular Concern (HAPCs). HAPCs are considered high priority areas for conservation, management, or research because they are rare, sensitive, stressed by development, or important to ecosystem function.

Fish and Wildlife Coordination Act (FWCA): The FWCA requires that all federal agencies consult with NOAA Fisheries when proposed actions might result in modifications to a natural stream or body of water. The FWCA also requires federal agencies consider the effects that these projects would have on fish and wildlife. Under the FWCA, NOAA Fisheries works to protect, conserve, and enhance species and habitats for a wide range of aquatic resources such as shellfish, diadromous species, and other commercially and recreationally important species that are not federally managed and do not have designated EFH. NOAA Fisheries typically provides comments for resources protected under the FWCA during MSA consultation.

MMPA: The MMPA established requirements for federal agencies to prevent or minimize effects from their actions on marine mammals. NOAA Fisheries has jurisdiction over most marine mammals, including whales, dolphins, porpoises, seals, and sea lions. USFWS has jurisdiction over manatees, dugongs, polar bears, sea otters, and walruses.

Bald and Golden Eagle Protection Act (BGEPA): The BGEPA prohibits "taking" (pursuing, shooting, poisoning, wounding, killings, capturing, trapping, collecting or disturbing) of bald and golden eagles or nests by anyone without a USFWS permit.

MBTA /EO 13186 *Responsibilities of Federal Agencies to Protect Migratory Birds*: The MBTA prohibits the taking (killing, capturing, selling, trading, and transport) of protected migratory bird species including eggs and nests without prior coordination and authorization by USFWS. In October 2021, USFWS issued a Final Rule reinstating the incidental take prohibition. Incidental take means the taking or killing of migratory birds that results from but is not the purpose of an activity. EO 13186 provides a framework for federal agencies to comply with the MBTA and aids in incorporating bird conservation planning into agency programs.

Fish and Wildlife Conservation Act: The Fish and Wildlife Conservation Act mandates USFWS to identify species, subspecies, and populations of all migratory nongame birds, that without additional conservation actions, are likely to become candidates for listing under the ESA.

3.9.1 Affected Environment

The special status species that may occur in the Project Area are discussed below. The species are grouped for discussion in the following sub-sections: Section 3.9.1.1 *ESA Listed Threatened and Endangered Species,* Section 3.9.1.2 *Essential Fish Habitat*, Section 3.9.1.3 *Marine Mammals*, Section 3.9.1.4 *Bald Eagles*, and Section 3.9.1.5 *Migratory Birds*.

3.9.1.1 ESA Listed Threatened and Endangered Species

Federally listed species that may occur within or in the vicinity of the ESA Action Area were identified using the USFWS Information for Planning and Consultation system (USFWS 2022), the NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper (NOAA Fisheries 2022a), and the Virginia Department of Wildlife Resources (VDWR) Virginia Fish and Wildlife Information Service (VDWR 2023a) (**Appendix F**) and are summarized in **Table 3-6**.

The ESA 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." The Action Area includes portions of Cat Creek and adjacent mudflats, shellfish areas, and tidal wetlands in the vicinity of the proposed project, as well as a radius of approximately 60 m (200 ft) in Cat Creek where ensonification from pile driving may impact protected species. For each species, the table provides the habitats preferred by the species, and its potential or documented occurrence in the ESA Action Area.

Species other than tri-colored bat (*Perimyotis subflavus)* and eastern black rail (*Laterallus jamaicensis jamaicensis*) are discussed in greater detail in the *Final Site-wide PEIS;* these two species are described in and below **Table 3-6**. No critical habitat has been designated in or near the ESA Action Area.

Table 3-6. Federally Listed Species with Potential to Occur in the ESA Action Area

Common Name	Scientific Name	Status[1]	Habitat Type	Notes
Northern long-eared bat	*Myotis septentrionalis*	FE, SE	Summer: Under bark, or in cavities or crevices of live and dead trees Winter: Caves and mines Any time: Anthropogenic structures including bridges	Suitable habitat including the bridge structure and trees are within the ESA Action Area. Per the 'Northern Long Eared Bat Winter Habitat and Roost Trees' database maintained by the VDWR (VDWR 2023b), there are no known occupied maternity roosts (summer habitat) or hibernaculum on the Eastern Shore. An acoustic and visual presence/absence survey was conducted in the Project Area in May 2023 in accordance with the *2023 Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines* (USFWS 2023a) and *Federal Transportation Agency/State Department of Transportation Bridge/Structure Bat Assessment Guidelines* (FHWA, FRA, FTA & USFWS 2022). No

Table 3-6. Federally Listed Species with Potential to Occur in the ESA Action Area				
Common Name	**Scientific Name**	**Status[1]**	**Habitat Type**	**Notes**
				echolocation call sequences of the northern long-eared bat were recorded, therefore this species is presumed absent. No indicators of bat presence were found during the survey of the existing bridge.
Tri-colored bat	*Perimyotis subflavus*	PE, SE	Summer: caves, trees, cliffs and barns Winter: caves	Suitable habitat may be present in the ESA Action Area Per the 'Little Brown Bat and Tri-colored Bat Winter Habitat and Roosts Application" maintained by VDWR (VDWR 2023c), there are no known hibernaculum on the Eastern Shore. An acoustic and visual presence/absence survey was conducted in the Project Area in May 2023 in accordance with the *2023 Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines* (USFWS 2023a) and *Federal Transportation Agency/State Department of Transportation Bridge/Structure Bat Assessment Guidelines* (FHWA, FRA, FTA & USFWS 2022). No echolocation call sequences of the tri-colored bat were recorded, therefore this species is presumed absent. No indicators of bat presence were found during the survey of the existing bridge.
Monarch butterfly[2]	*Danaus plexippus*	FC	Breeding: meadows and weedy fields with milkweed	No suitable breeding habitat in ESA Action Area. Proposed staging areas are maintained by mowing and do not harbor mature herbaceous species.
Red knot[2]	*Calidris canutus rufa*	FT, ST	Coastal marine and estuarine habitats with large areas of exposed intertidal sediments	Regularly forages on Wallop Island beaches during northerly spring migration. The Proposed Action would not occur on beaches or near red knot habitat; therefore, no suitable habitat present.
Piping plover[2]	*Charadrius melodus*	FT, ST	Coastal beaches and tidal flats	Transient and summer resident of the upper Virginia barrier islands. Regularly nests and forages on Wallops Island beaches. The Proposed Action would not occur on beaches or near piping plover habitat; therefore, no suitable habitat present.
Eastern black rail[2]	*Laterallus jamaicensis jamaicensis*	FT, SE	Salt and brackish marshes with dense cover and upland areas of such marshes (USFWS 2021a)	Potential habitat exists within the ESA Action Area. NASA completed three rounds of acoustic surveys during the 2022 breeding season. No visual or auditory observations of eastern black rails were recorded (Stein et al. 2022).

Table 3-6. Federally Listed Species with Potential to Occur in the ESA Action Area				
Common Name	**Scientific Name**	**Status[1]**	**Habitat Type**	**Notes**
Atlantic sturgeon	*Acipenser oxyrinchus oxyrinchus*	FE, SE	Spawn in flowing fresh waters between the salt front and fall line then migrate to estuarine and marine waters as sub-adults and adults	Species have been documented in deeper waters off WFF (NASA 2019). Potential occurrence in ESA Action Area: adults and subadults migrating and foraging from January 1 to December 31. Per the NOAA Fisheries ESA Section 7 Consultation database (NOAA Fisheries 2022a), Atlantic sturgeon adults and sub-adults may be found migrating or foraging in the ESA Action Area any time of the year. As there are no known spawning or congregation areas in the project vicinity, presence is likely limited to transient individuals that enter Cat Creek while opportunistically foraging.
Loggerhead sea turtle	*Caretta caretta*	FT, ST	Coastal and offshore waters Nesting: ocean beaches and occasionally on estuarine shoreline	No loggerhead sea turtle nests have been observed on Wallops Island since 2013 (NASA 2022a). There is no suitable nesting habitat within the ESA Action Area. Per the NOAA Fisheries ESA Section 7 Consultation database (NOAA Fisheries 2022a), adult and juvenile loggerheads may be found in the ESA Action Area migrating and foraging between May and November.
Leatherback sea turtle	Dermochelys coriacea	FE, SE	Coastal and offshore waters	No nesting habitat in the ESA Action Area. Leatherbacks have never been sighted on WFF but are known to occur in the water offshore of Accomack County (NASA 2017). Per the NOAA Fisheries ESA Section 7 Consultation database (NOAA Fisheries 2022a), adult and juvenile leatherback sea turtles may be found in the ESA Action Area migrating and foraging between May and November.
Kemp's ridley sea turtle	*Lepidochelys kempii*	FE, SE	Coastal ocean waters	This species has never been observed at WFF (NASA 2017). No nesting habitat is found in the ESA Action Area. Per the NOAA Fisheries ESA Section 7 Consultation database (NOAA Fisheries 2022a), adult and juvenile Kemp's ridley sea turtles may be found in the ESA Action Area migrating and foraging between May and November.
Green sea turtle	*Chelonia mydas*	FT, ST	Coastal ocean waters	No nesting habitat in the ESA Action Area. This species has been observed in waters off WFF (NASA 2017). Per the NOAA Fisheries ESA Section 7 Consultation database (NOAA Fisheries 2022a), adult and juvenile green sea turtles may be found in the ESA Action Area migrating and foraging between May and November.
Hawksbill sea turtle	*Eretmochelys imbricata*	FE, SE	Coastal ocean waters	No nesting habitat in the ESA Action Area. Hawksbill sea turtles have never been observed at WFF. They may

Table 3-6. Federally Listed Species with Potential to Occur in the ESA Action Area				
Common Name	**Scientific Name**	**Status[1]**	**Habitat Type**	**Notes**
				occur in offshore waters, but they prefer tropical waters and are unlikely to occur in the ESA Action Area (NASA 2017).

[1]FE = federally listed as endangered; FT = federally listed as threatened; PE= proposed for federal endangered listing, C= candidate for federal listing, SE = state listed as endangered; ST = state listed as threatened; (SE and ST species are only listed for species that are federally listed)

[2]This species has not been documented at WFF and is unlikely to be present in the ESA Action Area or affected by the Proposed Action. Therefore, it is not addressed further in this EA.

Sources: VDWR 2023a, USFWS 2022, NOAA Fisheries 2022a, NASA 2017

Tri-colored bat: The tri-colored bat is proposed for federal listing as endangered and is state listed as endangered. This species roosts in caves in the winter and in caves, trees, cliffs, and barns in summer months (VDWR 2023a). Per the '*Little Brown Bat and Tri-colored Bat Winter Habitat and Roosts Application"* maintained by DWR (VDWR 2023c), there are no known hibernaculum on the Eastern Shore.

Eastern black rail: The eastern black rail was federally listed as threatened in November 2020. It is state listed as endangered. This species is a small marsh bird that occurs in salt, brackish, and freshwater wetlands and is most often found in coastal areas. They historically inhabited the Virginia barrier Islands (Watts 2016). This species requires dense overhead cover and occurs between lower and wetter portions of marshes and their contiguous uplands (USFWS 2019).

WFF administers a *Protected Species Management Plan* (NASA 2023b). The Plan is reviewed annually in cooperation with USFWS and revised as necessary. The Plan outlines procedures for monitoring protected species that are likely to occur at Wallops Island including: red knot, piping plover, northern long-eared bat, and sea turtles; as well as sea turtle and marine mammal stranding protocols. Monitoring reports for the protected species are prepared annually.

3.9.1.2 Essential Fish Habitat

EFH includes open water, shallow water habitat, areas of benthic habitat (intertidal mudflats, hard bottom habitat, SAV, shellfish areas), and tidal wetlands. EFH types in the Project Area include open water, tidal wetlands, intertidal mudflats, shellfish areas, and shallow water habitat.

Managed Species

Managed species found in the Project Area fall under the responsibility of the Mid-Atlantic Fishery Management Council and New England Fishery Management Council. The NOAA Fisheries' online EFH Mapper (NOAA Fisheries 2022b, **Appendix G**) identified eight species as having EFH for adult or juvenile life stages in Cat Creek: Atlantic butterfish, Atlantic herring, black sea bass,

bluefish, clearnose skate, summer flounder, windowpane flounder, and winter skate (**Table 3-7**). Additional species descriptions are provided in **Appendix G**.

Table 3-7. Species and Life States with Designated EFH

Species Common Name (Scientific Name)	Juveniles	Adults	Potential Presence in Project Area
Atlantic butterfish (*Peptrilus triacanthus)*		X	Atlantic butterfish are unlikely to be in Cat Creek, although transient individuals may be present primarily during the summer months.
Atlantic herring (*Clupea harengus*)		X	Atlantic herring are unlikely to be in Cat Creek, although transient individuals may be present.
Black sea bass (*Centropristis striata*)	X	X	Juvenile and adult black sea bass are most likely to be in the Project Area in the summer.
Bluefish (*Pomatomus saltatrix*)	X	X	Bluefish are unlikely to be in Cat Creek, although transient individuals may be present.
Clearnose skate (*Raja eglanteria*)	X	X	Clearnose skate are unlikely to be in Cat Creek, although transient individuals may be present.
Summer flounder (*Paralicthys dentatus*)	X	X	Juvenile and adult summer flounder are most likely to be in the Project Area during spring through fall.
Windowpane flounder (*Scophthalmus aquosus*)		X	Juvenile and adult windowpane flounder are most likely to be in the Project Area during spring through fall.
Winter skate (*Leucoraja ocellata*)	X	X	Winter skate are unlikely to be in Cat Creek, although transient individuals may be present.

Note: An "X" indicates that EFH has been designated within the Project Area for that species and life stage.
Source: NOAA Fisheries 2022b. No eggs or larvae/neonates have been designated for any species in the Project Area.

The NOAA Estuarine Living Marine Resources Database (ELMR; Nelson and Monaco 2000) that identifies distribution and relative abundance of estuarine fishes was used to determine life-stages present for summer flounder and black sea bass. In the absence of site-specific listings in the ELMR for Cat Creek and Bogues Bay, listings from the nearby Chincoteague Bay were utilized. EFH for egg or larval life stages has not been designated in the project vicinity.

None of the identified species are listed as threatened or endangered by NOAA Fisheries. HAPC for summer flounder is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. The Project Area contains no macroalgae, seagrass, or macrophyte beds. Therefore, no summer flounder HAPC is located within the Project Area. No other HAPC areas were identified in the project vicinity by the EFH Mapper (NOAA Fisheries 2022b).

3.9.1.3 Marine Mammals

The following marine mammals protected under the MMPA have the potential to be in the Project Area.

Bottlenose dolphin (*Tursiops truncatus*)

Bottlenose dolphins are found in both offshore and coastal waters, including harbors, bays, and estuaries. The 'Western North Atlantic Southern Migratory Coastal Stock' of bottlenose dolphin is considered depleted under the MMPA which means that the species or stock is below its optimum sustainable population. During the warm water months (July and August), this stock is presumed to occupy coastal waters from Cape Lookout, North Carolina to Assateague, Virginia (NMFS 2021). Transient individuals may be found in the Project Area.

Harbor porpoise (*Phocoena phocoena*)

Harbor porpoises prefer coastal areas and are commonly found in bays, estuaries, and harbors. In the North Atlantic, they range from Greenland to Cape Hatteras, North Carolina (NOAA Fisheries 2023a). This species is the only member of the porpoise family seasonally endemic to the waters of Virginia. This species is most common in the region in winter and spring (Hayes et al. 2022, Wingfield et al. 2017). Transient individuals may be found in the Project Area.

3.9.1.4 Bald Eagles

The bald eagle is protected under the BGEPA, which prohibits disturbance of eagles that may include human activities or alteration of habitat surrounding a nest, without prior authorization. Both the USFWS and VDWR have developed guidelines for minimizing disturbance to bald eagles and defining threshold distances where impacts may occur: the *National Bald Eagle Management Guidelines* (USFWS 2007) and '*Virginia Exceptions to the National Bald Eagle Management Guidelines'* in *Management of Bald Eagle Nests, Concentration Areas, and Communal Roosts in Virginia* (DGIF & CCB 2012). Per the Center for Conservation Biology Virginia Eagle Nest Locator (CCB 2023), there are no known bald eagle nests within the threshold distance of 200 m (660 ft) of the Project Area. This species will not be discussed further.

3.9.1.5 Migratory Birds

For the purposes of the MBTA and EO 13186, migratory birds have been defined to include all native birds in the U.S., except certain non-migratory game species managed by the state (e.g., quail [*Colinus virginianus*], turkey [*Meleagris gallopavo*]), grouse [*Bonasa umbellus*]). The Project Area includes habitats that are used by a variety of birds protected under the MBTA.

In accordance with the FWCA, under the Migratory Bird Program, USFWS designates Bird Species of Conservation Concern (BCCs) (USFWS 2021b). BCC are species that, without additional conservation measures, are likely to become candidates for listing under the ESA. BCCs that have suitable habitat and may be found in the Project Area are shown in **Table 3-8**, with ruddy

turnstone (*Arenaria interpres morinella*), short-billed dowitcher (*Limnodromus griseus*), and willet (*Tringa semipalmata*) being most likely (USFWS 2022) to be present.

Table 3-8. Birds of Conservation Concern

Species Common Name (Scientific Name)	Breeding population	Breeding Season
Chimney swift (*Chaetura pelagica*)	X	March 15-Aug 25
King rail (*Rallus elegans*)	X	May 1- Sep 5
Lesser yellowlegs (*Tringa flavipes*)		
Ruddy turnstone (*Arenaria interpres morinella*)		
Rusty blackbird (*Euphagus carolinus*)		
Short-billed dowitcher (*Limnodromus griseus*)		
Willet (*Tringa semipalmata*)	X	Apr 20-Aug 5

Source: USFWS 2022

3.9.2 Environmental Consequences

3.9.2.1 No Action Alternative

Potential adverse impacts associated with maintenance and repairs of the bridge and/or utilities may occur; these would be similar to those described from the Proposed Action below. NASA would evaluate the proposed activities on a case-by-case basis and would coordinate with NOAA Fisheries and USFWS, as needed, and would implement BMPs to minimize the potential for adverse effects to species. NASA would continue monitoring and management of species of concern in accordance with the *Protected Species Management Plan* (NASA 2023b). Impacts, if they occur, would likely be minor and may be short- or long-term.

3.9.2.2 Proposed Action

ESA Listed Species

Evaluation of potential impacts to ESA federally listed species is based on the sensitivity of the species to the proposed activities and the amount of habitat that would be temporarily or permanently affected. Adverse impacts would be considered significant if an unauthorized take were to occur, if habitats of concern were substantially affected over relatively large areas, or if disturbances resulted in reductions in the population size or distribution of a species.

Per USFWS and NOAA Fisheries guidance, a 'no effect' determination is only appropriate in cases where 1) no listed species or critical habitat occurs in the ESA Action Area, 2) listed species are in the ESA Action Area seasonally, but the action is timed to avoid the presence of listed species, or 3) the listed species occur in the ESA Action Area and may be present at the time of the project, but there is no plausible route of effects to the species. A 'may affect but is not likely to adversely affect (NLAA)' finding is appropriate when effects on listed species are expected to be

discountable (extremely unlikely to occur), insignificant (so small they cannot be meaningfully measured, detected, or evaluated), or wholly beneficial.

ESA listed or proposed bats (northern long-eared bat, tri-colored bat), sea turtles (loggerhead sea turtle, leatherback sea turtle, Kemp's ridley sea turtle, green sea turtle, hawksbill sea turtle), and fish (Atlantic sturgeon) have potential to be in the ESA Action Area.

Table 3-9 summarizes effect determinations for federally listed species included on the USFWS Official Species List and the NOAA Fisheries Greater Atlantic Region ESA Section 7 Mapper. A discussion of the effects to species where an NLAA determination was made is included after the table. No Effect determinations were made based on no habitat being available in the ESA Action Area.

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Table 3-9. ESA Effect Determinations		
Common Name	**USFWS Determination[1]**	**NOAA Fisheries Determination**
Northern long-eared bat	NLAA	n/a
Tri-colored bat	NLAA	n/a
Monarch butterfly	No Effect	n/a
Red knot	No Effect	n/a
Piping plover	No Effect	n/a
Eastern black rail	NLAA	n/a
Atlantic sturgeon	n/a	NLAA[2]
Loggerhead sea turtle	No Effect	NLAA[2]
Leatherback sea turtle	No Effect	NLAA[2]
Kemp's ridley sea turtle	No Effect	NLAA[2]
Green sea turtle	No Effect	NLAA[2]
Hawksbill sea turtle	No Effect	n/a

[1]USFWS responded on September 8, 2023, concurring with the determinations of effects provided to USFWS in the Species Determination Table dated July 17, 2023. Since no USFWS ESA listed species or habitat was identified in the Project Area during the original consultation, NASA did not reinitiate consultation with USFWS to address the potential addition of HDD to the Proposed Action.

[2]In accordance with the FHWA GARFO 2018 NLAA Program (NMFS and FHWA 2018a).

n/a = not applicable (this species was not included on the project-specific species list)

Bat Species

In May 2023, NASA conducted acoustic presence/absence surveys for bat species including the northern long-eared bat and tri-colored bat in the Project Area, and a visual survey of the existing bridge structure from land and from the water in accordance with the *2023 Range-wide Indiana Bat and Northern Long-Eared Bat Survey Guidelines* (USFWS 2023a) and the *Federal Transportation Agency/State Department of Transportation Bridge/Structure Bat Assessment Guidelines* (FHWA, FRA, FTA & USFWS 2022), respectively. No echolocation call sequences of either the northern long-eared bat or the tri-colored bat were recorded during the acoustic survey. No indicators of the presence of bats (visual observation, hearing a bat, the presence of bat droppings and staining) were observed during the bridge inspection. Therefore, both species are presumed absent in the Project Area.

NASA submitted the survey results to USFWS on July 18, 2023. USFWS responded on September 8, 2023, concurring with the determinations of effects provided in the Species Determination Table dated July 17, 2023. Since no USFWS ESA listed species or habitat was identified in the Project Area during the original consultation, NASA did not reinitiate consultation with USFWS to address the potential addition of HDD to the Proposed Action.

Sturgeon species

While Atlantic sturgeon sub-adults and adults may be found in the ESA Action Area any time of the year (NOAA Fisheries 2022a), presence is likely limited to transient individuals that enter Cat Creek while opportunistically foraging. The likelihood of sturgeon being present in the ESA Action Area would be greatest during fall and early spring, which are times of peak migration (NASA 2019). Potential stressors to sturgeon species may include underwater noise, water quality and benthic habitat effects, entanglement, and interaction with construction vessels, and are discussed further below. Adverse impacts to sturgeon would be minor and short-term.

Underwater noise – As described in Section 3.8.2.2, in-water work, including pile driving and bridge demolition activities, would create temporary underwater noise impacts. Based on FHWA's 30% design plans, NASA assumes that up to 90, 91-cm (36-in) square, prestressed, concrete piles would be installed during bridge construction, and 186, 30-cm (12-in) steel H-type piles would be installed for temporary construction and demolition trestles below MHW. Land-based pile driving would also be required for east and west-bound bridge approaches and to provide stability for the road base at the east-bound approach.

NOAA Fisheries uses threshold criteria for physiological effects of Peak SPL 206 dB_{Peak} (re 1µPa) and Cumulative Sound Exposure Level (cSEL) 187 dBcSEL (re 1µPa2/second [sec]) for impulsive sounds for all fish, including sturgeon, except those that are less than two grams in mass (FHWG 2008 in NMFS 2023). Physiological effects could range from minor injuries that a fish is expected to completely recover from with no impairment to major injury that increase potential for mortality (Oestman et al. 2009). NOAA Fisheries uses a threshold for behavioral effects of RMS SPL of 150 dB (re 1µPa_{RMS}), which could range from a temporary startle to avoidance of an ensonified area (NMFS 2023, Oestman et al. 2009).

The NMFS GARFO Acoustics Tool using the Simplified Attenuation Formula for riverine systems (NMFS 2020) was used to determine potential acoustic effects of proposed pile driving activities based on preliminary design plans. The NMFS GARFO Acoustics Tool models anticipated noise levels associated with proposed pile types and site conditions using noise measurements collected from pile driving projects throughout the country as proxy projects. In cases where model data was not available for the exact combination of pile type, size, hammer size and water depth, the most conservative model proxy was used. Ground-radiated noise is dominated by low frequencies, which cannot propagate efficiently through shallow water (Buehler et al. 2015). As such, land-based pile driving is not anticipated to impact aquatic species.

Modeling results indicate that the estimated Peak SPL for all pile types is 190 dB_{Peak} (re 1µPa), which is below the physiological injury threshold for sturgeon. However, based on the sound exposure level (SEL) exposure criterion, injury to a sturgeon potentially could occur if the individual remained within 30 m (100 ft) while the pile was being driven. This is unlikely to occur as sturgeon are expected to vacate the pile driving area. At the Project Area, Cat Creek is approximately 70 m (230 ft) wide; adequate passage exists for sturgeon to vacate the area.

The estimated RMS SPL for all modeled scenarios ranges from 170 to 175 dB (re 1µPa$_{RMS}$), which is above the 150 dB (re 1µPa$_{RMS}$) threshold for behavioral effects. The GARFO Acoustics Tool also estimates the distance of potential acoustic effects from the point of pile driving. Sturgeon may experience behavioral effects within 50 m (165 ft) of concrete pile driving activity and 60 m (200 ft) of steel pile driving activity. Individuals would likely vacate and avoid the area, representing a temporary loss of foraging habitat; however, similar habitat would continue to be available in the vicinity. It is unlikely that avoidance of the area would affect essential sturgeon behaviors such as spawning, foraging, resting, or migration. Project Design Criteria (PDC), in accordance with the 'FHWA GARFO NLAA Program' as listed in **Appendix F**, including a soft start for pile driving activities would further minimize potential impacts.

Noise generated by vessels during project construction also has the potential to adversely impact sturgeon. The noise produced by vessels during project construction would vary depending on the vessel size, speed, and whether it uses dynamic positioning thrusters. Project vessels are anticipated to be shallow-draft, slow moving, and would likely produce noise levels less than behavioral effect levels for sturgeon. Tug and barge operations have been found to have an average Peak SPL 128.7 dB (re 1µPa) (Grette Associates 2022). Noise from project vessels during construction and demolition would not be expected to cause more than local and temporary behavioral responses if sturgeon are nearby. PDCs in accordance with the 'FHWA GARFO 2018 NLAA Program', as listed in **Appendix F**, including limiting vessel speeds to below 10 knots, which generally decreases noise levels, would further minimize potential impacts. Underwater noise effects to Atlantic sturgeon are expected to be insignificant.

Water Quality and Benthic Habitat Effects – Construction and demolition activities may cause a temporary increase in the amount of turbidity in the ESA Action Area; however, sedimentation is expected to be short term and localized. Eggs and non-mobile larvae of sturgeon are life stages most vulnerable to burial and suffocation from suspended sediment; however, the life stages of sturgeon expected in the project vicinity are sub-adults and adults.

It has been recommended (Johnson 2018) that sturgeon should not be exposed to TSS levels of 1,000 mg/l above ambient levels for longer than 14 days at a time to avoid behavioral and physiological effects. TSS from pile driving is expected to be well below the impact threshold. Sedimentation may also impact benthic communities used as forage by sturgeon. The temporary loss of benthic communities would have minimal impacts of prey availability given the limited area of disturbance and widespread availability of benthic habits in the project vicinity. PDCs, as listed in **Appendix F**, including use of cofferdams, turbidity curtains, or other instruments to control turbidity, when operationally feasible, would further minimize potential impacts to insignificant levels.

If drilling mud (bentonite slurry) is released into estuarine waters, it may result in indirect impacts on aquatic species. Because bentonite would behave as a suspended sediment if discharged in water (ASCE 2005), when it settles out, fish and their eggs (such as sturgeon) can be smothered by the fine particles. Although the bentonite slurry is not toxic, the tiny micro-particles of bentonite

could attach to fish gills and cause them to suffocate due to the lack of oxygen (Jefferis & Lam 2013). If HDD operations occur, NASA would adhere to the Frac-Out Contingency Plan to minimize the potential for indirect adverse impacts from HDD operations on marine wildlife and habitat in and around the project area.

Entanglement – As described in Section 3.8.2.2, cables, turbidity curtains, cofferdams, or other objects associated with construction or demolition could be a potential entanglement risk for fish, including sturgeon. Less mobile organisms, such as juvenile sturgeon, may be more susceptible (Nightingale and Simenstad 2001). Proper deployment and monitoring of in-water construction and turbidity control devices would minimize entanglement impacts. Entanglement impacts are expected to be insignificant.

Vessel Traffic – Collision with vessels (i.e., boat hulls and propellers) is a potential source of mortality and injury for sturgeon. The Proposed Action would not lead to a permanent increase in vessel traffic above existing levels; however, the proposed work may result in temporary increases in the number of vessels moving through the ESA Action Area and vicinity during construction and demolition. Sturgeon are more vulnerable to being struck by faster moving, deep-draft vessels in narrow channels. Construction barges and vessels are likely to be shallow draft vessels. PDCs, as listed in **Appendix F**, including limiting construction vessels and construction vessel speed limits, would minimize potential impacts to insignificant levels.

As all impacts to sturgeon are expected to be insignificant (so small they cannot be meaningfully measured, detected, or evaluated), a determination of NLAA is appropriate.

Sea Turtle Species

While sea turtle species may be found migrating and foraging in the ESA Action Area between May and November (NOAA Fisheries 2022a), their presence is unlikely. Leatherback, Kemps' ridley, and hawksbill sea turtles have never been observed at WFF (NASA 2017). Given the absence of SAV/sea-grass beds in the ESA Action Area, foraging loggerhead or green sea turtles are unlikely. If transient individuals are in the ESA Action Area, potential stressors to sea turtles may include underwater noise, water quality and benthic habitat effects, entanglement, interaction with construction vessels, and artificial lighting, which are discussed further below. Adverse impacts would be minor and short-term.

Underwater Noise – The biological significance of hearing in sea turtles remains largely unstudied, but it seems likely that they use sound for navigation, to locate prey, to avoid predators, and for general environmental awareness; sea turtles do not appear to use sound for communication (NMFS 2016). The effects of exposure to sound may include physical injury, behavioral modifications, or masking of important sounds in the environment. Behavioral effects can range from minor effects (such as brief startle or avoidance) to those being potentially severe or sustained (such as abandonment of higher quality habitat).

The NMFS GARFO Acoustics Tool (NMFS 2020) was used to evaluate potential underwater noise impacts to sea turtles from pile driving during construction of the Proposed Action. Exposure to

impulsive noise levels of Peak SPL 232 dB_{Peak} (re 1µPa) or cumulative SEL 204 dBcSEL[2] (re 1μPa^2/sec) (DoN 2017 in NMFS 2023) can result in a permanent threshold shift (PTS) or permanent injury to sea turtle hearing, and exposure to lower levels can result in temporary threshold shifts (TTS). Behavioral effects may occur in sea turtles exposed to RMS SPL above the behavioral threshold of 175 dB (re $1\mu Pa_{RMS}$). Based on modeling results, permanent physiological injury to sea turtles is not anticipated. Behavioral effects may occur within 10 m (30 ft) of steel pile driving activity. As sea turtles are highly mobile, they are expected to avoid the ESA Action Area during pile driving activities. The Design-Build contractor would be required to have sea turtle observers on site to ensure that pile driving activities are not occurring when sea turtles are present in the ESA Action Area. Additionally, PDCs, in accordance with the FHWA GARFO 2018 NLAA Program as listed in **Appendix F,** including a soft start for pile driving activities, would further minimize potential impacts.

Sea turtles in the ESA Action Area may also be affected by noise generated by vessels during construction. Similar to the discussion of sturgeon, project vessels would likely produce noise levels less than behavioral effect levels for sea turtles and would not be expected to cause more than local and temporary behavioral responses if sea turtles are nearby. PDCs, as listed in **Appendix F**, including limiting vessel speeds to below 10 knots would further minimize potential impacts. Underwater noise impacts to sea turtles are anticipated to be insignificant.

Water Quality and Benthic Habitat Effects – Construction and demolition activities in subaqueous bottoms may cause a temporary increase in the amount of turbidity in the ESA Action Area; however, increases in turbidity are expected to be short term and localized. One of the major issues associated with suspended sediments is its effect on the respiration of marine fauna. However, sea turtles breathe air and increased suspended sediments are not likely to affect turtle respiration. Elevated turbidity may reduce visibility and alter movement patterns and behaviors of sea turtles. Effects to turtle species can also be caused by disturbance to the substrate that reduces the availability of prey species or alters the composition of forage. However, the Proposed Action would not measurably reduce the ability of sea turtle species to opportunistically forage, rest, and migrate in nearby suitable habitat. PDCs, as listed in **Appendix F**, including use of cofferdams, turbidity curtains, or other instruments to control turbidity when operationally feasible, would further minimize potential impacts to insignificant levels.

Accidental spills of fuel, oil, hydraulic fluid, or other potentially hazardous substances would be prevented or minimized through the contractor's adherence to spill prevention and control measures, as specified in WFF's ICP and the project-specific SPCC. If HDD is used to install the new utility lines, an inadvertent release of drilling mud could occur. Drilling mud is nontoxic, and any release would be short-term and contained in accordance with the Frac-Out Contingency Plan. Potential effects could include increased turbidity from suspended clay particles in the immediate vicinity of the release, which may temporarily interfere with respiration by invertebrates that are

[2] The accumulation period for sea turtles is generally 24 hours (NMFS 2023)

the main prey of sea turtles. Conditions would return to a pre-disturbance condition once particles disperse in the water column and/or settle to the bottom. Any effects on water quality from inadvertent releases of such substances or increases in turbidity would be highly localized and temporary. A site-specific SWPPP, developed in compliance with the VSMP permit, would minimize impacts on water quality from ground disturbances.

Entanglement – Cables, turbidity curtains, cofferdams, or other objects associated with construction or demolition could be a potential entanglement risk for sea turtles. Proper deployment and monitoring of in-water construction or turbidity control devices would minimize entanglement impacts. Entanglement impacts are expected to be insignificant.

Vessel Traffic – Collision with vessel hull and propellers is a potential source of mortality and injury for sea turtles. Sea turtles are vulnerable to vessel strikes as they surface to breath and often forage in shallow water or on prey near the sea surface. The proposed project would not lead to a permanent increase in vessel traffic above existing levels; however, the proposed work would result in temporary increase in the number of vessels moving through the ESA Action Area and vicinity during construction and demolition activities. PDCs, as listed in **Appendix F**, including limiting construction vessels and construction vessel speed limits, would minimize potential impacts to insignificant levels.

Artificial Lighting – Artificial lighting has been shown to affect sea turtles, specifically during their nesting season, when hatchlings use light cues to guide their movement from the nest to the marine environment (NMFS 2013). The Proposed Action would not impact potential nesting habitat. As such, impacts to sea turtles from artificial light are unlikely and discountable.

As all impacts to sea turtle species are expected to be discountable (extremely unlikely to occur) or insignificant (so small they cannot be meaningfully measured, detected, or evaluated), a determination of NLAA is appropriate.

Federal ESA Listed Species Consultations

FHWA, a Participating Agency and design lead for the project, initiated informal consultation with the USFWS on December 20, 2022, providing USFWS with FHWA/NASA's determination of No Effect or NLAA for all ESA-listed species under USFWS jurisdiction potentially impacted by the Proposed Action (**Appendix F**). No comments from USFWS were received within the 60-day review period. After completion of the bat surveys for the Project in May 2023, FHWA provided the USFWS with updated informal consultation. The USFWS responded on September 8, 2023, stating that they concurred with the determinations provided by NASA in the Species Determination Table dated July 17, 2023 (**Appendix F**). Since no USFWS ESA listed species or habitat was identified in the Project Area during the original consultation, NASA did not reinitiate consultation with USFWS to address the potential addition of HDD to the Proposed Action.

FHWA also completed a Verification Form pursuant to the NOAA Fisheries *FHWA Programmatic Determination of Not Likely to Adversely Affect* (FHWA GARFO 2018 NLAA Program) (NMFS and FHWA 2018a), which was developed to streamline consultation for project types routinely

funded, authorized, or carried out by FHWA, including bridge demolition and replacement. The Verification Form identifies potential stressors that may impact listed species including underwater noise, impingement/entrainment and entanglement, water quality/turbidity, habitat alteration, and vessel traffic. GARFO Protected Resources Division (PRD) concurred with FHWA/NASA's NLAA determination on December 12, 2022. FHWA submitted updated coordination to NOAA Fisheries on December 7, 2023, to address the potential addition of HDD to the Proposed Action, which occurred after publication of the Draft EA (**Appendix F**). There were no changes to the effects determinations since the previous coordination and NOAA Fisheries concurrence (as shown in **Table 3-9**). No response has been received to date; NASA will incorporate recommendation measures, as needed, as a result of coordination and will complete the Section 7 process prior to the start of construction.

Final bridge design, and bridge construction and demolition means and methods would be determined during the Design-Build process. If design and/or construction means and methods differ significantly from the preliminary design evaluated via the FHWA GARFO 2018 NLAA Program, or if new information becomes available that affects the basis for the evaluation, re-coordination with NOAA Fisheries GARFO PRD may be required. The Verification Form assumed up to 40 permanent concrete piles and 180 temporary steel piles may be used.

To qualify for certification under the FHWA GARFO 2018 NLAA Program, the project would be required to adhere to the PDCs and conditions listed in **Appendix F**, which must be included as commitments in project bid documents. Adherence to these PDCs would avoid and minimize the effects of stressors produced by the Proposed Action to levels that are insignificant or discountable.

Essential Fish Habitat

An adverse effect on EFH would be deemed significant if the effect was considered substantial under the MSA. Substantial adverse effects may pose a serious threat to EFH and typically could not be alleviated through minor modifications to a Proposed Action. The determination of substantial adverse effects should be based on project-specific considerations, such as the ecological importance or sensitivity of an area, the type and extent of EFH affected, and the type of activity (NMFS 2004).

Adverse impacts to managed fish species including underwater noise and entanglement would be the same as those presented for fish in Section 3.8.2.2. EFH Conservation Recommendations, as listed in **Appendix G** including pile driving soft starts, and proper deployment and monitoring of turbidity control devices would minimize impacts. Underwater noise and entanglement effects are not anticipated to be substantial. Additional stressors that could impact habitats considered EFH include water quality/turbidity effects, alteration of habitat, and vessel traffic which are discussed below.

Water Quality/Turbidity – Construction and existing bridge demolition could result in temporary, localized impacts from turbidity and sedimentation. Sediment resuspension from pile driving and pile removal would be minimal and any increase in turbidity would to localized to the area around

the pile being driven. Suspended sediment is expected to settle out of the water column within a few hours and any increase in turbidity would be short term and localized. EFH prey species including filter feeding benthic organisms are at particular risk from increased turbidity due to their sessile nature (refer to Invertebrates in Section 3.8.2.2). Due to relatively low levels and temporary nature of TSS resulting from pile driving and demolition activities, impacts to benthic organism populations are not anticipated. Benthic prey species would be expected to re-establish in the Project Area following construction due to the extensive presence of benthic habitat in the vicinity for recruitment.

Accidental spills of fuel, oil, hydraulic fluid, or other potentially hazardous substances would be prevented or minimized through the contractor's adherence to spill prevention and control measures, as specified in WFF's ICP and the project-specific SPCC. If HDD is used to install the new utility lines, an inadvertent release of drilling mud could occur. Drilling mud is nontoxic, and any release would be short-term and contained in accordance with the Frac-Out Contingency Plan. Potential effects could include increased turbidity from suspended clay particles in the immediate vicinity of the release, which may temporarily interfere with respiration by EFH prey species. Conditions would return to a pre-disturbance condition once particles disperse in the water column and/or settle to the bottom. Any effects on water quality from inadvertent releases of such substances or increases in turbidity would be highly localized and temporary. A site-specific SWPPP, developed in compliance with the VSMP permit, would minimize impacts on water quality from ground disturbances.

EFH Conservation Recommendations, as listed in **Appendix G**, including appropriate turbidity controls would further minimize impacts. Water quality/turbidity impacts are not expected to be substantial.

Habitat Alteration – Open water and intertidal mudflat benthic habitat would be permanently lost for placement of bridge support piles. There may be some shading of minimal areas of tidal vegetated wetlands. Submerged portions of piles would provide substrate for colonization by invertebrates, and shelter and foraging habitat for fish. Open water, intertidal mudflats, and tidal vegetated wetland habitats could be temporarily disturbed during installation of construction access. Pile extraction could result in altered sediment composition in the depressions that may fill in with fine sediments and silt, changing the characteristics of the benthic habitat (Johnson et al. 2008). EFH Conservation Recommendations as described below would minimize impacts. Habitat alteration impacts are not expected to be substantial.

Vessel Traffic – EFH within Cat Creek could be disturbed by movement and anchoring of barges for construction and/or demolition access. The presence of vessels can interrupt migrating, foraging, or sheltering of prey species (NOAA Fisheries and FHWA 2017). Direct disturbances to bottom habitat include propeller scouring and vessel wake impacts to sensitive benthic habitats and direct contact from bottoming out (NOAA Fisheries and FHWA 2017). Barges would be positioned, and barge anchors deployed in such a manner as to avoid disturbance to oyster beds to the maximum extent practicable. Accidental spills of fuel, oil, hydraulic fluid, or other potentially

hazardous substances would be prevented or minimized through the contractor's adherence to spill prevention and control measures. Vessel traffic EFH Conservation Recommendations, as listed in **Appendix G**, would further minimize impacts. Vessel traffic impacts are not expected to be substantial.

EFH Effect Determination

Per the MSA, 'adverse effect' means any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH.

While the Proposed Action may adversely affect EFH, impacts would generally be localized to the Project Area or vicinity, and their extent, intensity, and duration would vary throughout implementation of the project. Areas of undisturbed EFH would remain outside the Project Area and potential impacts would occur at the individual rather than the population or species level and would not prevent or delay the continued propagation of any species. In general, individuals are expected to relocate to nearby areas offering similar habitat conditions. Adverse effects on EFH would not be substantial.

EFH Consultations

FHWA, a Participating Agency and design lead for the project, completed an EFH Verification Form in accordance with the NFMS *FHWA Programmatic Essential Fish Habitat Consultation for Select Transportation Actions in the NMFS Greater Atlantic Region* (EFH Programmatic Consultation) (NMFS and FHWA 2018b), which was submitted to NOAA Fisheries GARFO Habitat Conservation Division (HCD) on December 13, 2022. The EFH Programmatic Consultation was developed to streamline consultation for project types routinely funded, authorized, or carried out by FHWA, including bridge demolition and replacement. Work impacting oyster beds, an area ≥ 93 square m (1,000 square ft) containing shellfish or intertidal areas, new fill/stabilization placed below MLW in excess of 60 m (200 linear ft), as well as any replacement causeways (raised roadways across waters or wetlands) are typically excluded from utilizing the EFH Programmatic Consultation. However, FHWA provided justification in the EFH Verification Form that the Proposed Action is consistent with the EFH Programmatic Consultation. No comments were received from NOAA Fisheries GARFO HCD within the 30-day review period.

On December 8, 2023, FHWA resubmitted the EFH Verification Form to address the potential addition of HDD to the Proposed Action, which occurred after publication of the Draft EA (**Appendix G**). No comments were received from NOAA Fisheries GARFO HCD within the 30-day review period. Per EFH Programmatic Consultation guidance, NOAA Fisheries GARFO HCD concurrence can be assumed. NASA will incorporate recommendation measures, as needed, as a result of coordination and will complete the Section 7 process prior to the start of construction.

Final bridge design, and bridge construction and demolition means and methods would be determined during the Design-Build process. If design and/or construction means and methods differ significantly from the preliminary design evaluated via the EFH Programmatic Consultation, or if new information becomes available that affects the basis for the EFH Conservation Recommendations, re-coordination with NOAA Fisheries GARFO HCD may be required.

In accordance with the EFH Programmatic Consultation, the project would adhere to the EFH Conservation Recommendations listed in **Appendix G** that must be included as commitments in project bid documents. These EFH Conservation Recommendations provide recommended measures to avoid, minimize, and offset substantial adverse effects to EFH (NOAA Fisheries and FHWA 2017). Adherence to these Conservation Recommendations ensures that the project would not be likely to have a substantial adverse effect on EFH.

Marine Mammals

Effects to marine mammals protected under the MMPA would be significant if disturbances resulted in reductions in the population size or distribution of a species. Potential stressors include underwater noise, entanglement, and vessel traffic which are discussed below.

Underwater Noise – In-water work including pile driving and bridge demolition would create underwater noise impacts. The duration of these adverse impacts would be limited to the construction period; no long-term changes to underwater noise are anticipated. As described in Section 3.9.2.2, the NMFS GARFO Acoustics Tool (NMFS 2020) was used to determine potential acoustic effects of proposed pile driving activities.

Marine mammals are considered harassed when exposed to elevated sound levels that may lead to mortality, PTS or TTS, non-auditory physical or physiological effects, and behavioral disturbance (NMFS 2022). Based on differing hearing sensitivities, bottlenose dolphins are classified as mid-frequency cetaceans (hearing range between 150 hertz [Hz] to 160 kilohertz [kHz]) and harbor porpoises are classified as high-frequency cetaceans (hearing range between 275 Hz to 160 kHz). NOAA Fisheries has established auditory injury or PTS thresholds at Peak SPL 230 dB_{Peak} (re 1µPa) or cumulative SEL 185 dBcSEL (re $1\mu Pa^2$/sec) for mid-frequency cetaceans and Peak SPL 202 dB_{Peak} (re 1µPa) or cumulative SEL 155 dBcSEL (re $1\mu Pa^2$/sec) for high-frequency cetaceans (NMFS 2018). NOAA Fisheries assumes that marine mammals are likely to be behaviorally harassed when exposed to underwater RMS SPL above 160 dB (re $1\mu Pa_{RMS}$) for non-explosive, impulsive or intermittent sources, such as pile driving (NMFS 2022).

Based on model results, peak SPL would be below physiological injury thresholds. However, based on the SEL exposure criterion, physiological injury to bottlenose dolphins, as mid-frequency cetaceans, potentially could occur if an individual remained within the immediate area while the pile was being driven. This is unlikely to occur as marine mammals are expected to vacate the pile driving area. At the Project Area, Cat Creek is approximately 70 m (230 ft) wide with adequate passage for marine mammals to vacate the area.

Behavioral impacts are possible within 30 m (100 ft) of concrete pile driving and 40 m (130 ft) of steel pile driving activities. Behavioral effects may include avoidance of the area or disruption of foraging activities. Dolphins and porpoises are highly mobile and would be expected to vacate and avoid areas impacted by pile driving noise. It is unlikely that these movements would affect essential behaviors such as migration, breathing, nursing, breeding, feeding, or sheltering. A soft-start for pile driving activities would allow individuals to vacate the area and avoid adverse impacts of pile driving noise.

Noise generated by vessels during project construction also has the potential to impact marine mammals. Noise from project vessels during construction and demolition would not be expected to cause more than local and temporary behavioral responses if marine mammals are nearby. PDCs discussed in Section 3.9.2.2, which would be instituted for the protection of ESA-listed species, including limiting vessel speeds to below 10 knots, would also be protective of marine mammals. Underwater noise effects to marine mammals are expected to be minor and short-term.

Final bridge design, and bridge construction and demolition means and methods would be determined during the Design-Build process. If design and/or construction means and methods differ significantly from the preliminary design evaluated in the GARFO Acoustics Tool, or if new information becomes available that affects the basis for the evaluation, model results may need to be re-evaluated.

Vessel Traffic – Collision with vessel hulls and propellers is a potential source of mortality and injury for marine mammals. Construction barges and vessels are likely to be shallow draft vessels. PDCs as discussed in Section 3.9.2.2, which would be instituted for the protection of ESA-listed species, including limiting construction vessels and construction vessel speed limits, would also be protective of marine mammals. Vessel traffic effects are expected to be adverse, minor, and short-term.

Migratory Birds

Adverse impacts to migratory birds would be considered significant if an activity would diminish the capacity of a population of migratory bird species to maintain genetic diversity or limit the ability of a local or regional population to sustain itself.

The Project Area includes habitats that are used by a variety of birds protected under the MBTA. As described in Section 3.8, *Wildlife*, marsh nesting species may be found in the Project Area. Adult birds are highly mobile and able to avoid construction activities that could cause injury. Immobile nestlings or eggs have the greatest susceptibility to injury or mortality. Construction in estuarine wetlands could result in direct mortality of eggs and nestlings. While less likely, direct take of adult birds may occur during vegetation clearing or vehicle strikes. Most of these conflicts would occur during breeding and nesting season (generally May to August [VDWR 2023a]). Some loss of foraging habitat would occur, but adequate foraging habitat would remain in the project vicinity.

The USFWS Migratory Bird Program maintains a comprehensive list of beneficial practices to avoid and minimize the incidental take of migratory birds (USFWS 2023b, USFWS 2015), including practices specific to transportation projects (USFWS 2023b). These include:

- A qualified wildlife biologist would inspect the area for MBTA-listed nesting birds from March 15 to August 31 prior to tree trimming, tree removal, brush clearing, or clearing of other vegetation.
- Projects should be designed in a manner that does not unnecessarily disturb migratory bird habitat during project implementation.
- Projects should avoid destroying active nests and injuring migratory birds during demolition, repair, or cleaning.
- Projects should use downcast, shielded lights to reduce the potential for fallout and should avoid steady burning lights. Fallout may occur when birds become disoriented and land instead of continuing their migration.

Project adherence to these beneficial practices, to the extent practicable, would minimize potential impacts. Adverse impacts are not anticipated to diminish the capacity of a population of migratory bird species to maintain genetic diversity or limit the ability of a local or regional population to sustain itself and as such are anticipated to be negligible and short-term.

Operation

Periodic maintenance and repair of the utility lines and of the bridge during its 75-year lifespan may result in disturbances to special status species due to in-water work, removal of vegetation/habitat, the presence of humans and noise, or the presence of vessels. The predominant reaction among mobile species (both terrestrial and marine) would likely be avoidance of the area due to increased human activity, noise, and similar activities. In-water work would have the potential for increased underwater noise and turbidity. Maintenance and repair events would be infrequent and short in duration, and background conditions would be expected to return quickly. In the long term, adverse impacts on special species would occur at the individual level rather than the population or species level and would not prevent or delay the continued propagation of any species or population in or around the Project Area. NASA would evaluate the proposed activities on a case-by-case basis and would coordinate with NOAA Fisheries and USFWS as needed, and would implement BMPs as discussed above to minimize the potential for adverse effects to species. Impacts, in that they occur, would likely be minor and may be short- or long-term.

3.10 Transportation

Transportation resources refer to the infrastructure and equipment required for the movement of people and goods in geographic space. For this EA, transportation refers to the movement of vehicles on roads, primarily along Causeway Road, and boats in Cat Creek and the waterways surrounding the Project Area. There are no ferries, shipping lanes, or other large commercial maritime transportation uses in the Project Area. There are no air transportation routes that would be affected by the proposed project.

3.10.1 Affected Environment

Roads

Details on access to WFF Mainland and to Route 803 (Causeway Road) are provided in the *Final Site-wide PEIS*. Route 803 is the only way to access the WFF Mainland and, therefore, Wallops Island by road. Public access to the Mainland is restricted by a manned security gate across Route 803. The gate is approximately 1.9 km (1.2 mi) west of the Causeway Bridge. The proposed staging areas are only accessible after passing through the security gate and are along dead-end roads off Route 803 (**Figures 2-1 and 2-2**).

The Wallops Island Space Transit Corridor is a special zoning district established by Accomack County to (1) provide safe transit for over-sized loads from the WFF Payload Processing Facility on the Main Base to the MARS launch facilities at Wallops Island; and (2) to promote the health, safety, and general welfare by providing a corridor for space transportation and commerce that is vital to the economic interest and the economic development potential of Accomack County. The Wallops Space Transit Corridor runs along the VDOT right-of-way from the WFF Main Base, through the town of Atlantic, to Wallops Island. Accomack County has buried existing utility lines and cleared the overhead path along the Space Transit Corridor. This zoning ensures a clear pathway free from overhead obstruction along the route taken by large rockets and payloads.

Traffic occurs along Causeway Road and over the Causeway Bridge daily from employees, visitors, and other authorized personnel accessing the facilities on Wallops Island. On weekdays, a larger number of vehicles typically use the Causeway Bridge to access Wallops Island compared to weekends. However, depending on launch schedules and other training and activities at Wallops Island that may occur on weekends, traffic can vary throughout the week. The Causeway Bridge has a weight limit that restricts the weight of unpermitted vehicles crossing the bridge onto Wallops Island. Other restrictions such as limiting speed for specific loads, positioning of vehicles, and closure to other traffic are periodically required.

FHWA requested comments on the project from the Virginia Commercial Space Flight Authority/MARS on August 18, 2020, regarding any potential impacts of the Proposed Action on future operations of the Spaceport. MARS responded on September 10, 2020, stating they had no comments and no concerns about the project (**Appendix A**).

Water

Although the water off the coast of Wallops Island is one of the busiest in the world in terms of maritime traffic (commercial, recreational, and military), almost all of this maritime traffic remains in the Atlantic Ocean and does not enter Cat Creek. Waterways near Wallops Island, including Cat Creek, are open year-round for commercial and recreational fishing and boating. However, natural processes and severe weather negatively impact water depths, resulting in restricted navigability. The area of Cat Creek at the Causeway Bridge is primarily used for recreation since the water depth is too shallow for larger vessels. In a USCG Bridge Project Questionnaire form completed in 2023, NASA identified the following recreational vessels as possibly using Cat Creek: canoes,

row boats, small motorboats, and pontoon boats. According to the Marine Cadastre database, from 2017-2021 between 1 and 25 vessels each year have traveled Cat Creek (the data does not specify how many vessels within the range of 1 to 25); none of these vessels were cargo, fishing, passenger, tanker, or tug and tow related (BOEM and NOAA 2023).

Cat Creek connects the Hog Creek and Bogues Bay Channel elements of the Waterway on the Coast of Virginia Federal Navigation Project, which connects the Chesapeake Bay to the Chincoteague Bay. Although Cat Creek has not been dredged or maintained by USACE in recent years, the Waterway on the Coast of Virginia is subject to periodic operation and maintenance activities (e.g., dredging).

Cat Creek is also part of the 160-km- (100-mi-) long Virginia Seaside Water Trail that runs between Chincoteague Island and the Eastern Shore of Virginia National Wildlife Refuge (NWR) at Cape Charles. This water trail is for non-motorized use by paddlers using kayaks or canoes, and has several public access points, the closest of which is approximately 5 km (3 mi) north of the Causeway Bridge (Virginia Water Trails 2023).

USACE has the authority to designate maritime danger zones and to set specific requirements, limit access, and control navigation activities by closing the danger zone to the public on a full-time or intermittent basis. NOTMARs are published prior to the temporary USACE closure of an area of interest within a danger zone or for the entire danger zone.

3.10.2 Environmental Consequences

Significant impacts would occur if the Proposed Action created long-term traffic congestion on waterways or roadways that could not be alleviated or resulted in unsafe transportation conditions that could not be mitigated.

3.10.2.1 No Action Alternative

There would be adverse short- and long-term minor impacts to transportation under the No Action Alternative. In the short-term, the bridge would require extensive and regular maintenance to remain functional and may cause disruptions in road and water transportation due to potential road and Cat Creek closures. However, in the long-term, the bridge would eventually be closed for safety. Closure of the bridge would eliminate the means to access Wallops Island by road, which would not uphold NASA's mission, and would not meet the Purpose and Need of the Proposed Action.

3.10.2.2 Proposed Action

Roads

Construction-related traffic could include heavy equipment and transport vehicles, cranes, concrete trucks, dump/haul trucks, personnel transport vehicles, and other vehicles as necessary. Because Route 803 (Causeway Road), including the Causeway Bridge, are critical to provide daily access to Wallops Island, the road would remain open during construction and demolition. The

road along the bridge approaches and deck would likely be narrowed to one lane during portions of the work. Temporary closures would occur periodically for moving equipment and construction/demolition activities; closures are expected to be short in duration and would result in minor traffic backups on either side of the bridge.

There would be an increase in traffic on the Causeway Road from construction-related vehicles and equipment traveling between the staging areas and the project site at the bridge. The additional traffic could cause temporary delays to drivers traveling to/from Wallops Island due to slow-moving and turning vehicles. Use of the Causeway Road shoulders for temporary parking and/or staging of equipment or materials may result in slower-moving traffic along the road as motorists take precautions. Delays would be short-term and minor. The Design-Build contractor would be required to adhere to all NASA and FHWA traffic and safety measures for temporary use of the shoulder, such as providing flaggers, signage, and temporary lane closures. Therefore, adverse impacts would be minor and short-term.

No public roads would be closed or rerouted, and although there would be an increase in construction-related traffic on local public roads, adverse impacts would be short-term and negligible. NASA would notify staff, visitors, and authorized personnel that may travel to Wallops Island during the project of the potential for temporary lane or road closures and traffic control along Causeway Road.

The new bridge would be built to FHWA specifications. Although an increase in weight capacity is not required for the new bridge, depending on final design, the weight capacity of the new bridge may increase. The height of the new bridge above Cat Creek would be decreased compared to the height of the existing bridge and a corresponding lower percent slope of the bridge deck would result in less time required to haul large loads across the bridge with special equipment. Compared to existing conditions, the need for temporary road closures to transport these large loads across the bridge would be substantially reduced.

The Proposed Action would result in major long-term beneficial impacts to transportation for the next 75+ years to/from Wallops Island, providing vehicles with safe access to/from Wallops Island.

Water

Cat Creek would remain open for navigation during construction and demolition activities; however, portions of the waterway where work would be actively occurring would be inaccessible to boaters. USCG issues Bridge Permits that approve the location and plans of bridges and causeways and impose any necessary conditions relating to the construction, maintenance, and operation of these bridges in the interest of public navigation. As stated in Section 2.3.4.3, *Bridge Size*, NASA and FHWA are also in the process of reviewing the Preliminary Navigation Clearance Determination with USCG.

USCG would issue NOTMARs prior to construction to warn boaters who may plan to be in the project vicinity of the need to proceed with caution for the duration of the construction and demolition activities. The new Causeway Bridge would not restrict access in Cat Creek for boats

less than 3.9 m (12.8 ft) high; larger boats would be restricted from passing underneath the bridge. However, any adverse impacts would be long-term and negligible since Cat Creek is not currently used for navigation purposes by larger vessels.

Since the Proposed Action would occur within a Federal Navigation Project, the Design-Build contractor would be required to submit materials in accordance with USACE guidance *Policy and Procedural Guidance for Processing Requests to Alter U.S. Army Corps of Engineers Civil Works Projects Pursuant to 33 USC 408 dated September 10, 2018* (Engineer Circular 1165-2-220) to facilitate Section 408 review. The Section 408 process may also require stakeholder outreach with navigation stakeholders and the development of a Navigation/Marine Operations Plan to describe proposed in-water operations and vessel traffic.

Maintenance activities over the life of the new bridge and the utilities would result in similar types of impacts to transportation as discussed above for construction and demolition, but impacts would be less due to the smaller scale of maintenance and repairs. There would be short-term minor adverse impacts to traffic from the Proposed Action, including maintenance and repairs. Long-term, there would be substantial beneficial impacts to transportation from replacing the existing bridge.

3.11 Employment and Income

Socioeconomics is defined as the study and analysis of the human environment, specifically the study of human population, employment, personal income, and housing. Only employment and income are evaluated in this EA, as housing and population would not be affected by the Proposed Action.

3.11.1 Affected Environment

The region of influence for employment is Accomack County which includes the town of Chincoteague, a popular tourist destination north of Wallops Island. Data for Virginia is provided as a comparison.

The median household income for 2021 (the most recent year data is accessible) for Accomack County is $50,601. This is lower than the 2021 reported median household income for Virginia ($80,615) (USCB 2021). In Accomack County, the largest industries were educational services, health care, and social assistance (19.8 percent); manufacturing (19.1 percent); and retail trade (9.4 percent). By comparison, the three largest industries in Virginia were educational, health, and social services (22.2 percent); professional, scientific, management, administrative, and waste management services (16.2 percent); and retail trade (9.9 percent) (USCB 2021).

The Eastern Shore, including the waters and back bays surrounding Wallops Island and the Project Area, provides ecotourism destinations for boating, paddling, birdwatching, and fishing, which benefit local businesses.

3.11.2 Environmental Consequences

Significant impacts would occur if the Proposed Action were to substantially alter availability of employment.

3.11.2.1 No Action Alternative

The No Action Alternative would have major, long-term adverse impacts to employment and income because the Causeway Bridge would not be replaced and therefore, would eventually be closed, substantially affecting operations at Wallops Island, and thus employment and income of those whose jobs rely on facilities and activities at Wallops Island. There would be indirect long-term adverse impacts associated with cancelled, reduced, or modified NASA, Navy, and MARS activities on Wallops Island due to bridge closure, which would impact their missions and supporting industries. Additionally, if the utilities are not replaced, Wallops Island would eventually not have access to potable water, which would also affect operations at Wallops Island and therefore, the employment and income of those whose work at Wallops Island. There would be beneficial short-term minor impacts to the local economy, similar to those of the Proposed Action, for maintenance and repair activities that last for more than a few days.

3.11.2.2 Proposed Action

Construction and Demolition

Under the Proposed Action, construction and demolition activities would potentially provide short-term benefits to local stores and businesses due to workers associated with the construction and demolition activities purchasing food and goods, using local lodging, and fueling vehicles and equipment. However, such effects would be minor in the context of the regional economy.

A reduced width of Cat Creek would remain open during construction and demolition activities. However, commercial fishing boats and charter boats for recreational fishing would be adversely affected from the inability to use the other portions of Cat Creek directly around the Causeway Bridge during construction and demolition. Therefore, adverse impacts to income and employment from ecotourism, commercial, and recreational fishing would be short-term and minor.

Operation

The height of the new Causeway Bridge over Cat Creek would likely be lower than the existing bridge; this may alter the ability of some commercial vessels to travel the extent of Cat Creek by going under the bridge. NASA anticipates that the number of vessels this affects is negligible, since Cat Creek is not currently used for navigation purposes by larger vessels (vessels typically include row boats, canoes, small motorboats, and pontoons). Periodic maintenance and repairs of the utilities and of the bridge over its 75-year lifespan would not likely result in closures of Cat Creek, although there could be temporary adverse effects to using some of the areas of Cat Creek around the bridge during these activities. Adverse impacts are expected to be minor and long-term.

3.12 Recreation

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.

3.12.1 Affected Environment

There are water-based recreational opportunities at the project site including boating, paddling, fishing, and shellfish harvesting. VMRC regulates aquaculture (shellfish harvest) in tidal waters, including recreational harvests by the public in areas designated as Baylor Grounds. Boaters can travel along Cat Creek and in the tidal waters underneath and around the Causeway Bridge. Although Cat Creek is open to the public year-round for commercial and recreational fishing, shellfish harvesting, and boating; recreation primarily occurs in the warmer months of the year between spring and fall.

In 2006, the VCZMP developed the Virginia Seaside Water Trail, which runs along the seaside coast of the Delmarva Peninsula in the state of Virginia between Chincoteague Island and the Eastern Shore of Virginia NWR at Cape Charles. A portion of a 14-km (8.5-mi) section of this Trail, referred to as the NASA Docks to Water's Edge Restaurant leg, runs directly underneath the Causeway Bridge. Recreational access to the Virginia Seaside Water Trail and the Causeway Bridge area is provided for NASA employees on the south side of the Causeway Bridge ramp – this location is not open to the public. There is one main area designated for employee recreational use on Wallops Island, but it is a beach on the east side of the island facing the Atlantic Ocean and not near the Project Area.

3.12.2 Environmental Consequences

Impacts to recreation would be considered significant if a large portion of a particular type of recreation was lost and could not be suitably substituted with a similar activity, or if demand could not be met by similar facilities or natural areas.

3.12.2.1 No Action Alternative

Maintenance and repair events could result in partial or full closure of Cat Creek depending on the nature of the repairs, and the eventual permanent closure of the bridge would likely result in closure of Cat Creek under the bridge for safety. Therefore, the No Action Alternative would have long-term minor adverse impacts to recreation.

3.12.2.2 Proposed Action

Construction and Demolition

Although a portion of Cat Creek would remain open under the Proposed Action, boaters and fisherman would not be able to access all waters under and in the immediate vicinity of the Causeway Bridge for approximately 2 to 3 years during construction and demolition activities.

The portion of the Virginia Seaside Water Trail that runs under the Causeway Bridge would remain open throughout construction and demolition; however, portions of Cat Creek in the Project Area would be inaccessible for most of the project duration. Lack of access to all waters would cause short-term moderate adverse impacts to recreational boaters. The waters north and south of the Causeway Bridge, including other sections of the Virginia Seaside Water Trail, would be accessible.

The presence of humans and anthropogenic noise are likely to scare away wildlife that is the focus of recreational viewers and hunters. Additionally, human presence and noise would temporarily alter the characteristic of the natural setting that would be expected by recreational users. Therefore, the presence of project-related boats, barges, and the use of construction and demolition equipment would result in adverse minor impacts to recreation. These effects would be short-term, occurring periodically over approximately 2 to 3 years. Cat Creek would reopen to public use once the new bridge is opened. USCG would issue NOTMARs, and the WFF Office of Communications would issue notices to warn boaters who may be in the vicinity of the activity to proceed with caution for the duration of construction and demolition activities.

The potential exists for short-term, adverse impacts on recreation in the event of a frac-out from the HDD process. Temporary closure of Cat Creek could result until the release is remediated. If HDD occurs, NASA's contractor would implement a Frac-Out Contingency Plan and would immediately implement containment and restoration measures to minimize impacts.

Operation

The height of the new Causeway Bridge over Cat Creek would likely be lower than the existing bridge; this may alter the ability of some recreational vessels to travel the extent of Cat Creek by going under the bridge. NASA anticipates that the number of recreational boaters this would affect would be negligible, and the boaters can access both sides of the bridge via alternate routes. Periodic maintenance and repairs over the 75-year lifespan of the bridge and the lifespan of the utilities would not likely result in closures of Cat Creek, although there could be temporary adverse effects to using some of the areas of Cat Creek around the bridge during these activities. Impacts are expected to be minor but long-term.

3.13 Archaeological 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. These include both architectural and archaeological resources. Archaeological resources are places where humans changed the ground surface or left artifacts or other physical remains (e.g., arrowheads or bottles). Section 106 of the National Historic Preservation Act (NHPA), as amended, requires federal agencies to consider the effects of their actions on historic properties that are listed or eligible for listing in the National Register of Historic Places (NRHP). The NRHP administered by the National Park Service (NPS), is the official inventory of cultural resources including National Historic Landmarks.

In consideration of NHPA, federal agencies are required to initiate consultation with the State Historic Preservation Office (SHPO) informing them of a planned action and requesting their comments or concerns. As described in Section 3.18 of the *Final Site-wide PEIS*, in accordance with Sections 106 and 110 of the NHPA, NASA developed a Programmatic Agreement with the Virginia SHPO and the President's Advisory Council on Historic Preservation to outline how WFF manages its cultural resources as an integral part of its operations and missions (NASA 2014b, NASA 2022b). As part of this process, NASA identified 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.

The discussion of cultural resources in this EA is limited to archaeological resources because the Proposed Action would have no potential to affect architectural resources.

3.13.1 Affected Environment

The affected environment for archaeological resources consists of the areas where ground disturbance, including disturbances to underwater substrate, would occur in association with construction, demolition, and operational activities, collectively referred to as the Area of Potential Effect (APE). The APE includes the envelope at the Causeway Bridge and the staging areas.

A review of the Virginia Cultural Resource Information System (V-CRIS) identified four archaeological sites, Virginia 44AC0567, 44AC0562, 44AC0563, and 44AC0558, approximately 0.6 km (1 mi) northwest of the APE (VDHR 2023). No portion of these four archaeological resources overlap with the Proposed Action's APE. According to V-CRIS, no previously recorded archaeological resources are in the APE.

To support prior projects, NASA had Phase I Archaeological surveys performed at the proposed staging areas; these surveys either confirmed "no effect to historic properties," or in accordance with the Programmatic Agreement, that they have low sensitivity for cultural resources. No excavation would occur at the staging areas.

In November 2020, Cultural Resources Analysts, Inc. (CRA), on behalf of NASA and FHWA, conducted a Phase I Archaeological Survey of the Causeway Bridge Project Area that included a terrestrial archaeological and geoarchaeological survey, and a marine survey (CRA 2021). The APE used for this survey consisted of all areas within the LOD shown on **Figure 2-3**, which corresponds to the Causeway Bridge envelope.

The terrestrial survey included a pedestrian survey of the APE, geoarchaeological testing with 18 probe tests, and 110 shovel test pits. The objective of the pedestrian survey was to identify any aboveground cultural resources such as cemeteries, artifact scatters, etc. The goal of the geoarchaeological survey was to differentiate causeway fill sediment and preexisting native tidal marsh sediments, and to assess the potential for either sediment to hold archaeological evidence such as human remains, pottery, etc. This was completed by taking samples ranging in depth from 78 to 345 cm (2.5 to 28.8 ft) and screened through a mesh hardware cloth.

The survey results indicated that the two sediments demonstrate no potential for the causeway fill, and limited potential for the tidal marsh, to contain archaeological content. During field work, no cultural material or features were identified.

The underwater survey consisted of marine remote sensing. Data analysis resulted in the identification of nine magnetometer anomalies, two side scan sonar contacts, and no sub-bottom profiler reflectors; these anomalies and contacts represent modern infrastructure, bridge pilings, and former overhead transmission cable piling pieces. No submerged cultural resources were identified within the data.

No cultural resources were identified during the geoarchaeological, terrestrial, or underwater surveys for the Proposed Action.

3.13.2 Environmental Consequences

Impacts to archaeological resources would be significant if a measurable effect could not be resolved through the Section 106 consultation process.

3.13.2.1 No Action Alternative

The No Action Alternative would have no impacts to archaeological resources because the Causeway Bridge and the utilities would not be replaced and therefore, none of the associated construction and demolition activities with potential to affect archaeological resources would occur. Maintenance and repair activities would have no impacts on archaeological resources based on the results from the Phase I Archaeological Survey provided below.

3.13.2.2 Proposed Action

In August of 2020, FHWA, on behalf of NASA, sent scoping letters to the Virginia Department of Historic Resources (VDHR) which initiated Section 106 coordination for the project. VDHR responded on September 21, 2020, recommending that a Phase I Archaeological Survey be completed for the Causeway Bridge envelope. As discussed above, in late 2020, CRA conducted a Phase I Archaeological Survey for the Project Area and did not identify any cultural resources during the geoarchaeological, terrestrial, or underwater surveys. In February 2021, CRA, on behalf of NASA, submitted the Phase I Archaeological Survey results to VDHR. VDHR responded on February 9, 2021, stating that they concur that "…no further archaeological work is necessary for the proposed project. No historic properties will be affected by the project." Therefore, there would be no impacts to archaeological resources during construction, demolition, or operational maintenance. Please refer to **Appendix H** for VDHR consultation.

Additionally, on behalf of NASA, FHWA sent scoping letters to five federally recognized and one state recognized Native American Tribes with potential cultural affiliation to the project site in August 2020. These tribes were the Catawba Indian Nation, Chickahominy Indian Tribe, Nansemond Indian Tribal Association, Pamunkey Indian Tribe, Rappahannock Tribe of Virginia, and Pocomoke Indian Nation. On September 23, 2020, the Pamunkey Indian Tribe responded stating that the Tribe would like to be a consulting party for the proposed undertaking, they

concurred with the plans for an archaeological survey, and would like to review the results of the survey and review the draft EA once complete. The Draft EA, including the archaeological survey results, was sent to the Pamunkey Indian Tribe on September 12, 2023. No other responses were received since the initial scoping request.

On January 12, 2021, FHWA on behalf of NASA, sent a scoping letter to the Chickahominy Indians Eastern Division initiating Section 106 consultation. This letter shared results from the draft Phase I Archaeological Survey and general project information. No response from this January 2021 letter has been received to date.

In late January and early February 2023, FHWA on behalf of NASA, sent another set of letters to the same seven tribes listed above. This letter outlined the results from the Phase I Archaeological Survey and VDHR's concurrence that "…no further archaeological work is necessary for the proposed project. No historic properties will be affected by the project." On March 1, 2023, Caitlin Rogers, the Tribal Historic Preservation Officer (THPO) for the Catawba Indian Nation, responded stating that the Tribe had "no immediate concerns with regard to traditional cultural properties, sacred sites or Native American archaeological sites within the boundaries of the proposed project areas." Additionally, Caitlin Rogers stated that the Tribe requests notification if any Native American artifacts and/or human remains are discovered during ground disturbance. No other responses have been received from the January/February 2023 letters to date.

In September 2023, a copy of the Draft EA was sent to the seven tribes listed above. There have been no responses to the Draft EA to date. Please refer to **Appendix H** for all Tribal consultation.

In the case of inadvertent discovery of human or ancestral remains and/or cultural resources during construction, the WFF Cultural Resources Manager would immediately halt activities and notify the appropriate Tribal governments; the VDHR; and, for remains, the coroner and local law enforcement, as to the treatment of the remains and/or archaeological resources. NASA WFF personnel would make all reasonable efforts to avoid disturbing any gravesites including those containing Native American human remains and associated funerary artifacts. All human remains would be treated in a manner consistent with Section XIII Human Remains of the *WFF Programmatic Agreement for Management of Facilities, Infrastructure, and Sites* (NASA 2014b, NASA 2022b).

4 Permits, Plans, BMPs, and Mitigation

As defined in CEQ regulations (40 CFR 1508.1(s)) mitigation includes: 1) avoiding the impact altogether by not taking a certain action or parts of an action; 2) minimizing impacts by limiting the degree or magnitude of the action and its implementation; 3) rectifying the impact by repairing, rehabilitating, or restoring the affected environment; 4) reducing or eliminating the impact over time by preservation and maintenance operations during the lifetime of the action; and 5) compensating for the impact by replacing or providing substitute resources or environments. Section 4.1 provides a summary of proposed permits NASA would secure prior to implementing the Proposed Action as well as those existing and project-specific plans that would be followed during implementation of the Proposed Action.

Once implementation of a Proposed Action is underway, a federal agency has a responsibility to continually monitor that implementation to ensure that mitigation or other protective measures are being employed. Section 4.2 provides a summary of NASA's proposed mitigation and monitoring of various resource areas during and after implementation of the Proposed Action.

4.1 Summary of Permits and Plans Required

As part of the NEPA process, NASA has obtained the following approvals:

- VDEQ CZMA Consistency Determination
- USFWS ESA Section 7 Letter of Concurrence
- NOAA Fisheries ESA Section 7 Letter of Concurrence
- NOAA Fisheries EFH Letter of Concurrence

However, since the publication of the Draft EA, NASA added relocation of the utilities currently attached to the existing Causeway Bridge to the Proposed Action. Therefore, NASA and FHWA have submitted the following updated coordination addressing utility relocation via HDD, and will continue coordination with these agencies as needed prior to construction:

- NOAA Fisheries ESA Section 7 Letter of Concurrence
- NOAA Fisheries EFH Letter of Concurrence

The Design-Build contractor, on behalf of NASA and FHWA, would be required to obtain the following permits and concurrence prior to starting construction:

- Accomack County Wetlands Board Permit
- VMRC Tidal Wetlands and Subaqueous Bottom Permits
- VDEQ CWA Section 401, Water Quality Certification/VSMP Permit
- VDEQ CWA Section 402, National Pollutant Discharge Elimination System (NPDES) Permit and project specific SWPPP

- VMRC Offshore Reef Program Coordination
- VMRC Habitat Management Subaqueous Lands and Tidal Wetland Permit
- USACE CWA Section 404 Dredge and Fill Permit
- USACE Section 408 Authorization to Use or Alter a Federal Civil Works Project
- USACE Rivers and Harbors Act Section 10, Navigable Waters Permit
- USCG Preliminary Navigation Clearance Determination
- USCG Bridge Permit
- WFF SEED Construction Site Stormwater Permit
- Agreement with USACE for Dredging Equipment Access

If fuel-burning equipment is anticipated to remain on site for 12 months or longer, the Design-Build contractor may need to obtain an air quality permit from VDEQ for stationary sources.

Additionally, the following plans would be implemented prior to starting construction:

- WFF ICP
- Project specific SPCC
- ESC and stormwater best practices
- Project specific Dewatering Plan
- WFF Phragmites Control Plan
- Envision Objectives and Requirements
- Frac-Out Contingency Plan

4.2 BMPs, Mitigation and Monitoring

Table 4-1 outlines the BMPs, mitigation, and monitoring responsibilities of NASA and the Design-Build contractor during construction and demolition activities.

Table 4-1. Summary of BMPs, Mitigation and Monitoring Measures

Resource Area	Measures
Noise	• A soft start for pile driving activities would allow individuals to vacate the area • The number and speed of in-water construction vessels may be limited to reduce noise impacts • Pile driving associated with construction of the pier may require the use of mitigation measures (e.g., bubble curtains) to minimize underwater noise impacts
Air Quality	• BMPs would be followed for operation of diesel-powered equipment to prevent excessive emissions • VDEQ air pollution regulations for Open Burning Restrictions (i.e., no open burning of waste would be permitted) and Fugitive Dust Precautions (e.g., water may be

Table 4-1. Summary of BMPs, Mitigation and Monitoring Measures	
Resource Area	**Measures**
	sprayed to lessen impacts from activities that generate dust), and volatile organic compound content of architectural coatings would be followed • If fuel-burning equipment is anticipated to remain on site for 12 months or longer, the Design-Build contractor would obtain any required air quality permit from VDEQ for stationary sources
Toxic Substances, Hazardous and Regulated Materials and Waste	• BMPs for operation of diesel-powered equipment to prevent spills or releases would be employed, and an SPCC plan would be prepared and implemented if more than 5,000 L (1,320 gal) of petroleum products are stored on site • WFF ICP BMPs would be implemented to prevent and minimize impacts of potentially hazardous substances • Sampling of demolition debris for ACM and LBP would be conducted to identify waste disposal requirements • If dewatering is required due to PFAS levels, a WFF MEMD-approved dewatering plan would be implemented
Health and Safety	• Safety Plans would be prepared, implemented, and followed • Safety Officers would be identified to perform regular inspections and document compliance • Bridge Permit conditions would be adhered to including the approved vertical clearance over the water, and installation of navigational lights and/or markers, as needed
Land Resources	• SWPPP, ESC, and stormwater management BMPs could include using silt fencing; soil stabilization blankets; and matting construction entrances at material laydown areas, and around areas of land disturbance during construction • Bare soils would be vegetated immediately after construction to reduce erosion and stormwater runoff • WFF ICP would be implemented and followed to prevent or swiftly respond to spills or releases • Heavy equipment, located in temporarily impacted wetland areas, would be placed on mats, geotextile fabric, or other suitable measures to minimize soil disturbance to the maximum extent practicable • Certified clean fill would be used, as needed
Water Resources	• The need for dewatering, requirements regarding handling of PFAS (as needed), and de-watering volumes and methods would be identified • Hydraulic modeling of the final bridge design would be conducted to determine the effects on scour • Machinery and construction vehicles would be operated outside of wetlands to the greatest extent practicable; synthetic mats, low-pressure tires, and/or other best practices may be used when wetland work is unavoidable • If possible, the top 30 cm (12 in) of material removed from wetlands would be preserved for use as wetland seed and rootstock in the excavated area unless the material contains *Phragmites* • ESC would be designed in accordance with the most current edition of the Virginia Erosion and Sediment Control Handbook, controls would be in place prior to clearing and grading and maintained in good working order to minimize impacts to state waters, and the controls would remain in place until the area stabilizes • WFF ICP and project specific SWPPP would be implemented to reduce impacts of stormwater runoff and fueling and maintenance of vehicles and equipment

Table 4-1. Summary of BMPs, Mitigation and Monitoring Measures	
Resource Area	**Measures**
	• Wetland ground and vegetation disturbance would be returned to pre-construction conditions, in accordance with permit requirements • Monitoring of wetlands, streambeds, channels, etc. in construction areas would occur in accordance with all project permits • Turbidity curtains would be used, if necessary, for open water work • Materials including concrete mixes that incorporate pozzolan materials (blast furnace slag and/or fly ash) that would lower embodied carbon, would be used, where applicable • Frac-Out Contingency Plan would be implemented to reduce impacts from an inadvertent release of drilling mud
Vegetation	• As required by permits (e.g., VMRC and USACE permits), construction and post-construction monitoring would be conducted to identify and document if and when disturbed areas achieve final stabilization as specified in the permits; NASA would implement corrective action measures such that permit requirements are met
Wildlife, Special Status Species, Essential Fish Habitat	• TOYRs that are required as a result of NOAA Fisheries or USFWS coordination would be implemented • Conditions of the existing WFF Protected Species Monitoring Plan for tree clearing would be followed • A soft start for pile driving activities would allow individuals to vacate the area and avoid adverse impacts of pile driving noise • The number and speed of in-water construction vessels may be limited to reduce strike impacts. • Mitigation of invasive species (e.g., *Phragmites*) would occur in accordance with the WFF Phragmites Control Plan • Turbidity curtains or other measures may be deployed to reduce turbidity • Project would adhere to the WFF ICP, SWPPP, and other applicable permits and plans • Bubble curtains could be utilized for noise attenuation during pile driving • Vegetation disturbance would be minimized, and vegetation returned to existing conditions as practicable to restore habitat • Oysters would be relocated as needed, and coordination with VMRC and VIMS regarding additional mitigation for shellfish would be conducted as necessary • Sea turtle observers would be on site to ensure that pile driving activities are not occurring when sea turtles are present in the ESA Action Area • Periodic vegetation maintenance would be conducted • Frac-Out Contingency Plan would be implemented to contain an inadvertent release of drilling mud
Transportation	• All transportation activities, including road closures, traffic control, safety issues, etc., would be coordinated with Accomack County and VDOT Accomack Residency Office • Adherence to Bridge Permit conditions and coordination with USCG would occur for any required waterway closures, as needed • NOTMARs would be issued for all in-water work and in-water signage of construction area would be posted

Table 4-1. Summary of BMPs, Mitigation and Monitoring Measures	
Resource Area	**Measures**
Employment and Income	• VMRC, USCG, and Virginia Department of Conservation and Recreation (VDCR) would be notified prior to project start so they can notify the public, as needed, regarding work which may affect commercial activities
Recreation	• VMRC, USCG, and VDCR would be notified prior to project start so they can notify the public, as needed, regarding work that may affect recreational activities • Frac-Out Contingency Plan would be implemented if a frac-out occurs; recreation in the immediate vicinity may be temporarily closed until the release is cleaned
Archaeological Resources	• Work would halt and WFF Historic Preservation Officer would be contacted immediately if cultural resources are discovered during ground disturbing activities

5 Cumulative Effects

CEQ regulations define cumulative effects 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."

Section 5 of the *Final Site-wide PEIS* provided a detailed analysis of potential cumulative effects from the NASA actions evaluated in the PEIS, including the Causeway Bridge Replacement Project, along with past, present, and reasonably foreseeable future actions. The analysis covered a temporal range from the mid-1940's (when federal activities began on the Main Base and Wallop's Island) through 2039.

The geographic scope of the cumulative effects analysis for this project includes a radius of approximately 0.8 km (0.5 mi), which was determined as the range in which direct impacts on resources would be expected to occur. The temporal range of this cumulative effects analysis is from the start of construction, which could commence in late 2024 through the 75-year lifespan of the new bridge (75 years beyond when the new bridge is open), which is anticipated to be approximately 2100. Because of the nature of the Proposed Action and the smaller geographical review area, only two of the projects evaluated in the *Final Site-wide PEIS* were considered in this EA:

- NASA *Phragmites* Control and Monitoring Program, and
- USACE Federal Navigation Projects.

Because the *Final Site-wide PEIS* is incorporated into this EA by reference, details of these projects/actions are not repeated here. However, there is one activity that was not included in the *Final Site-wide PEIS* that is being evaluated due to its potential for cumulative impacts.

- **Ongoing commercial, recreational, and USCG vessel traffic in the area between Wallops Island and the Mainland, including anchoring**

The waters surrounding the Causeway Bridge would continue to be used for recreation, and commercial and recreational fishing, commercial charters, and by USCG vessels. These activities are not anticipated to increase during the temporal scale of this analysis.

5.1 Potential Cumulative Effects by Resource

NASA has determined that the following resources would have a potential for cumulative impacts due to past, present, and reasonably foreseeable future actions.

- Soils – Short-term impacts from ground disturbances. Site-specific ESC Plans and BMPs would be implemented to reduce erosion and stormwater runoff. Cumulative impacts would be negligible.
- Water quality – Negligible short-term impacts could occur from upland erosion during construction. NASA would implement the WFF ICP, ESC BMPs, and the project SWPPP

to reduce turbidity and erosion that leads to sedimentation of stormwater runoff. Cumulative impacts would be short-term, adverse, minor.

- Water-based Transportation and Recreation – Minor short-term impacts to boaters on Cat Creek from the presence of boats and/or barges during maintenance and repair activities during the service life of the bridge and during the lifespan of utilities. Waterway closures are unlikely, but implementation of a safety lane may be required for transportation of large and heavy water-based equipment to the Project Area. Cumulative impacts would be short-term, adverse, and minor.
- Wildlife – Short-term minor impacts from disturbances during construction activities on terrestrial and aquatic species (e.g., noise, habitat impacts, turbidity), but wildlife would not experience cumulative, long-term impacts as they currently reside in an area dominated by WFF operations.

6 Agencies and Persons Consulted

On behalf of NASA, FHWA began outreach to participating and cooperating agencies, tribes with a demonstrated cultural affiliation with the Project Area, and interested members of the public in 2020. **Table 6-1** provides a list of the parties who were consulted as part of the project review process.

Table 6-1. List of Agencies and Persons Consulted for the EA

Name	Organization	Letter	Draft EA
Federal Agencies			
Barbara Rudnick	USEPA, Office of Environmental Programs	X	X
Carrie Traver	USEPA, Office of Environmental Programs	X	X
Ryan Kimberley	FHWA, Eastern Federal Lands Division		X
Kevin Rose	FHWA, Eastern Federal Lands Division		X
Katerina Roman	FHWA, Eastern Federal Lands Division		X
Brian Hopper	NOAA Fisheries, PRD	X	X
David O'Brien	NOAA Fisheries, HCD	X	X
Victor Grycenkov	NOAA, Wallops Command and Data Acquisition Station	X	X
Deborah Darden	NPS, Assateague Island National Seashore	X	X
Kayleen Meinen	NRCS	X	X
Peter Kube	USACE, Norfolk District	X	X
Michael Anderson	USACE, Norfolk District		X
Robert Berg	USACE, Norfolk District		X
Hal Pitts	USCG, Commander, Fifth Coast Guard District	X	X
Mickey Sanders	USCG, Bridge Administration Branch Fifth District	X	X
LT Joshua Zirbes	USCG, Sector Field Office Eastern Shore	X	X
Kevin Holcomb	USFWS, Chincoteague NWR	X	X
Robert Leffel	USFWS, Chincoteague NWR	X	X
Nancy Finley	USFWS, Chincoteague NWR	X	X
Cindy Schulz	USFWS, Virginia Field Office	X	X
Emily Argo	USFWS, Virginia Field Office	X	X
State Agencies			
Sean Mulligan	MARS	X	X
Rene Hypes	VDCR	X	X

Table 6-1. List of Agencies and Persons Consulted for the EA			
Name	**Organization**	**Letter**	**Draft EA**
Sheri Kattan	VDEQ, Office of Wetlands and Water Protection	X	X
Ruth Boettcher	VDWR, Fish and Wildlife Information Services	X	X
Amy Ewing	VDWR, Fish and Wildlife Information Services	X	X
Laura Lavernia	VDHR, Review and Compliance	X	X
Karen Duhring	VIMS	X	X
Lyle Varnell	VIMS	X	X
Hank Badger	VMRC, Habitat Management Division	X	X
Allison Lay-Norris	VMRC, Habitat Management Division	X	X
Tony Watkinson	VMRC, Habitat Management Division	X	X
Alicia Nelson	VMRC, Artificial Reef Program	X	X
Local Government*			
Michael Mason	Accomack County Administration	X	X
C. Renata Major	Accomack County Board of Supervisors	X	X
William Tarr	Accomack County Board of Supervisors	X	X
Ronald Wolff	Accomack County Board of Supervisors	X	X
Vanessa Kay Johnson	Accomack County Board of Supervisors	X	X
Rich Morrison	Accomack County Department of Building and Zoning	X	X
Program Staff	Accomack County Environmental Programs	X	X
Chontese Ridley	Accomack County Wetlands Board	X	X
Shannon Alexander	Accomack-Northampton Planning District Commission	X	**
Ashley Mills	Accomack-Northampton Planning District Commission	X	X
Craig Mathies, Sr.	Somerset County, MD, Board of Supervisors	X	X
Mayor J. Arthur Leonard	Town of Chincoteague	X	X
Mike Tolbert	Town of Chincoteague	X	X
Craig Mathies, Sr.	Town of Princess Anne, MD	X	X
Kevin Smith	Maryland Coastal Bays Program	X	X
Julie Wheatley	Wallops Research Park	X	X
Other Organizations and Individuals			
Peter Bale	Wallops Island Regional Alliance	X	X
Chet Chesterfield	Chincoteague Bay Field Station	X	X

Table 6-1. List of Agencies and Persons Consulted for the EA			
Name	**Organization**	**Letter**	**Draft EA**
Dr. Bryan Watts	College of William and Mary, Center for Conservation Biology	X	X
John Haag	US Navy	X	X
Tribes			
Norris Howard, Sr. Paramount Chief	Pocomoke Indian Nation	X	X
Lee Lockamy, Chief	Nansemond Indian Nation	X	X
Chief Stephen Adkins	Chickahominy Indian Tribe	X	X
Anne Richardson, Chief	Rappahannock Tribe	X	X
Caitlin Rogers, THPO	Catawba Indian Nation	X	X
Chief Dr. Robert Gray	Pamunkey Indian Tribe	X	X
Gerald Stewart	Chickahominy Indians Eastern Division	X	X

*Unless otherwise indicated, local officials are in the state of Virginia

**Ms. Alexander no longer worked at the Accomack-Northampton Planning District Commission in September 2023 when the Draft EA was distributed for comment.

Ten of the agencies/individuals that were consulted responded: USEPA, USACE, USFWS, VDHR, VDCR, VIMS, VMRC, MARS, NRCS, the Catawba Indian Tribe, and the Pamunkey Indian Tribe. Details on the responses are provided in the appropriate subsections of Section 3.

7 List of Preparers

The individuals listed in **Table 7-1** were involved in the preparation of this document.

Table 7-1. List of Preparers

Name	Title, Education and Years of Experience	Area of Responsibility in EA
NASA		
Shari Miller	Environmental Engineer, BS Chemistry, BS Biology, 26 years	Center NEPA Manager, Document Development and Review
Douglas Bruner, PG	Environmental Engineer, MS Engineering Geology, 25 years	NEPA Project Co-Lead, Document Development and Review
John Saeker	Civil Engineer, 23 years	Facilities Management Division, Project Manager
Bluestone Environmental Group, Inc. (Contractor to NASA)		
Matthew Lindsey	Environmental Scientist, BS Sustainable Biomaterials, 4 years	Document Development and Review
Wetland Studies and Solutions, Inc. (Contractor to NASA)		
Suzie Richert, AICP, CEP	NEPA Specialist, MS Soil Science, 22 years	Contractor Project Manager, Document Development
Susan Liszeski, CEP	NEPA Specialist, MS Wildlife Management, 33 years	Document Preparation and Review
Zaneta Hough	NEPA Specialist, MS Ecology, 18 years	Document Preparation and Review
Jeremy Bradley, GISP, CFM	Environmental Scientist, MS Natural Resources, 13 years	Figures
Abby Spotswood	Environmental Technician, BS Environmental Resource Management, 3 years	Document Preparation

8 References

American Society of Civil Engineers (ASCE). 2005. HDD Design Guideline Task Committee of the Technical Committee on Trenchless Installation of Pipelines (TIPS) of the Pipeline Division of the American Society of Civil Engineers. *Pipeline Design for Installation by Horizontal Directional Drilling - ASCE Manuals and Reports on Engineering Practice (MOP) No. 108.* Available at: https://app.knovel.com/hotlink/toc/id:kpPDIHDD0B/pipeline-design-installation/pipeline-design-installation. Accessed December 4, 2023.

Audubon. 2023. Barrier Island/Lagoon System Virginia. Accessed April 14, 2023, at https://netapp.audubon.org/iba/Reports/2430.

Berglund, B. and T. Lindvall (Eds). 1995. Community Noise. Archives of the Center for Sensory Research, 2: 1 – 195.

Bertness, M.D. 1984. Ribbed Mussels and Spartina Alterniflora Production in a New England Salt Marsh, *Ecology,* 65:1794-1807.

BOEM and NOAA (Bureau of Ocean Energy Management and National Oceanic and Atmospheric Administration). 2023. Marine Cadastre National Viewer. Accessed March 13, 2023, at https://marinecadastre.gov/nationalviewer/.

Broome, S.W., C.B. Craft, S.D. Struck, and M. SanClements. 2005. Effects of Shading from Bridges on Estuarine Wetlands, North Carolina State University College of Agriculture and Life Sciences, June 2005.

Burton, W.H. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Versar, Inc.

Buehler, D., R. Oestman, J. Reyff, K. Pommerenk, and B. Mitchell. 2015 Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish, California Department of Transportation CTHWANP-RT-15-306.01.01, November 2015.

CCB (Center for Conservation Biology). 2009. Important Bird Areas. Accessed January 27, 2023 at https://gaia.vcu.edu/GEMS_3_legacy/Factsheet.ashx?layerName=Important^Bird^Areas.

CCB. 2023. CCB Mapping Portal. Accessed January 27, 2023, at http://www.ccbbirds.org.

Clark Nexsen. 2020. Bridge inspection report for the Causeway Bridge.

Clark Nexsen. 2022. Bridge inspection report for the Causeway Bridge.

Colden, A.M. and R.N. Lipsius. 2015. Lethal and sublethal effects of sediment burial on the eastern oyster Crassostrea virginica. *Marine Ecology Progress Series,* 527:105-117.

Cowardin, L., V. Carter, F. C. Golet and E. T. LaRoe 1979. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Fish and Wildlife Service Document OBS/79-31. U. S. Government Printing Office, Washington, DC.

CRA (Cultural Resources Analysts, Inc.). 2021. A Phase I Archaeological Survey of Wallops Island Causeway Bridge, Accomack County, Virginia NASA Project No.: 1(9) VDHR File No.: 2020-4275. February 26, 2021.

DGIF (Virginia Department of Game and Inland Fisheries) and CCB at the College of William and Mary and Virginia Commonwealth University. 2012. Management of Bald Eagle Nests, Concentration Areas, and Communal Roosts in Virginia, A Guide for Landowners.

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

eNoiseControl. 2023. https://www.enoisecontrol.com/sound-barrier-horizontal-directional-drilling/. Accessed December 4, 2023.

FEMA (Federal Emergency Management Agency). 2015. FIRM Communities and Panel. Panels 510001C0460G and 510001C0480G. Effective date May 18, 2015. Accessed March 3, 2023, at: https://msc.fema.gov/portal/search?AddressQuery=wallops%20island#searchresultsanchor.

FHWA (Federal Highway Administration). 2006. Construction Noise Handbook, Appendix A FHWA Roadway Construction Noise Model User's Guide, A-1. http://www.fhwa.dot.gov/environment/noise/construction_noise/rcnm/index.cfm.

FHWA. 2014. FHWA's *Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects* FP-14 manual. Available at https://highways.dot.gov/federal-lands/specs.

FHWA. 2021. Wallops Island Causeway Bridge Shellfish Survey, Accomack County, Virginia, July 2021.

FHWA. 2023. Post-1945 Highway Bridge Engineering. https://www.environment.fhwa.dot.gov/env_topics/historic_pres/post1945_engineering/this_bridge.aspx. Accessed February 5, 2023.

FHWA, FRA (Federal Railroad Administration), FTA (Federal Transit Administration) and USFWS (U.S. Fish and Wildlife Service). 2022. User's Guide for the Range-side Programmatic Consultation for Indiana Bat and Northern Long-eared Bat, Version 5.0, updated March 2022.

FHWG (Fisheries Hydroacoustic Working Group). 2008. Agreement in Principle for Interim Criteria for Injury to fish from Pile Driving Activities. Memorandum of Agreement between NOAA Fisheries Northwest and Southwest Regions, USFWS Regions 1 and 8, California, Washington, and Oregon Departments of Transportation, California Department of Fish and Game, and Federal Highway Administration, June 12, 2008.

Grette Associates. 2022. T-5 Dredge Monitoring Hydroacoustic Monitoring Report, for Port of Seattle, May 2022.

Hastings, M.C. and A.N. Popper. 2005. Effects of Sound of Fish (J&S 43A0139) for California Department of Transportation.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, and J. Wallace, eds. 2022. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2021, NOAA Technical Memorandum NMFS-NE-288, August 2022.

Heffernan, K., E. Engle, and C. Richardson. 2014. Virginia Invasive Plant Species List. Virginia Department of Conservation and Recreation, Division of Natural Heritage. Natural Heritage Document 14-11.

HWR (Hassan Water Resources, PLC). 2021a. Wallops Flight Facility (WFF) Causeway Bridge Hydraulic Study Phase II- Hydraulic Report, April 15, 2021.

HWR. 2021b. Stormwater Management & Bridge Drainage Report Phase II, Wallops Flight Facility (WFF) Causeway Bridge Hydraulic Study. Parsons FaCETS Work Request E2224-2200, Accomack County, VA. April.

Hyman, A.C., G.S. Chiu, M.C. Fabrizio, R. Lipcius. 2022. Spatiotemporal Modeling of Nursery Habitat Using Bayesian Inference: Environmental Drivers of Juvenile Blue Crab Abundance, *Frontiers in Marine Science,* 9.834990.

Industrial Minerals Association – Europe (IMA-EU). 2023. Bentonite. Web site. Available at https://ima-europe.eu/about-industrial-minerals/bentonite/. Accessed December 4, 2023.

ISI (Institute for Sustainable Infrastructure). 2018. Envision: Sustainable Infrastructure Framework Guidance Manual, Third Edition.

JDH (John D. Hynes & Associates, Inc.) 2022a. *Wallops Flight Facility Causeway Bridge Geotechnical Study Wallops Island, Virginia*. Test Borings and Laboratory Test Results. January 26, 2022.

JDH (John D. Hynes & Associates, Inc.) 2022b. *Wallops Flight Facility Causeway Bridge Geotechnical Study Wallops Island, Virginia*. Supplemental Test Borings and Laboratory Test Results. April 27, 2022.

Jefferis, S. A., & Lam, C. 2013. Polymer support fluids: use and misuse of innovative fluids in geotechnical works. In *Proceedings of the 18th International Conference on Soil Mechanics and Geotechnical Engineering* (pp. 2-6). Presses des Ponts, Paris, France.

Johnson, M.R., C. Boelke, L.A. Chiarella, P.D. Colosi, K. Greene, K. Lellis-Dibble, H. Ludemann, M. Ludwig, S. McDermott, J. Ortiz, D. Rusanowsky, M. Scott, and J. Smith. 2008. Impacts to Marine Fisheries Habitat from Nonfishing Activities in the Northeastern United States, February 2008.

Johnson, A. 2018. The Effects of Turbidity and Suspended Sediments on ESA-Listed Species from Projects Occurring in the Greater Atlantic Region. Greater Atlantic Region Policy Series 18-02. NOAA Fisheries Greater Atlantic Regional Fisheries Office.

Kirk and JMT. 2018. *Value Analysis Study Conducted June 5-7, 2018, for Wallops Island Causeway Bridge over Cat Creek.*

Kellogg, M.L., J.C., Cornwell, M.S. Owens, and K.T. Paynter. 2013. Denitrification and nutrient assimilation on a restored oyster reef. *Marine Ecology Progress Series,* 480:1-19.

Longmire, K.S., R.D. Seitz, A. Smith, and R.N. Lipcius. 2021. Saved by the shell: Oyster reefs can shield juvenile blue crabs *Callinectes sapidus. Marine Ecology Progress Series,* 672:163-173.

Lunt, J. and D.L. Smee. 2015. Turbidity interferes with foraging success of visual but no chemosensory predators, *PeerJ.*

Milliken, A.S. and V. Lee. 1990. Pollution Impacts from Recreational Boating A Bibliography and Summary Review, Rhode Island Sea Grant, January 1990.

Moody, J., and D. Kreeger. 2020. Ribbed mussel (*Geokensia demissa*) filtration services are driven by seasonal temperature and site-specific seston variability, *Journal of Experimental Marine Biology and Ecology,* 522.

NASA (National Aeronautics and Space Administration). 2014a. Wallops Island Phragmites Control Plan, Wallops Environmental Office.

NASA. 2014b. Programmatic Agreement Among the National Aeronautics and Space Administration, The Virginia State Historic Preservation Office, and the Advisory Council on Historic Preservation Regarding the Management of Facilities, Infrastructure, and Sites at the National Aeronautics and Space Administration's Wallops Flight Facility, Wallops Island, Accomack County, Virginia. December 17, 2014. Accessed April 4, 2023, at https://code200-external.gsfc.nasa.gov/250-WFF/program-areas-cultural-historical-preservation.

NASA. 2017. Environmental Resources Document Goddard Space Flight Center Wallops Flight Facility, August 2017.

NASA. 2019. *Wallops Flight Facility Site-wide Programmatic Environmental Impact Statement*. May 2019. https://code200-external.gsfc.nasa.gov/250-WFF/site-wide_eis.

NASA. 2021. Climate Action Plan, September 2021.

NASA. 2022a. 2022 Wallops Island Protected Species Monitoring Report.

NASA. 2022b. Final Integrated Cultural Resources Management Plan for Wallops Flight Facility. Prepared for National Aeronautics and Space Administration Goddard Space Flight Center Wallops Flight Facility. September. Accessed February 17, 2023. Available at: https://code200-external.gsfc.nasa.gov/250-WFF/sites/code250wff/files/inline-files/GSFC-WFF-ICRMP_final-signed-09-2022.pdf

NASA. 2023a. Wallops Flight Facility Integrated Contingency Plan.

NASA. 2023b. Wallops Island Protected Species Management Plan.

NASA and FHWA. 2020. Wetland Delineation Report Project NASA 1(9)- Wallops Island Causeway Bridge, September 29, 2020.

Nasr, A., E. Kjellstrom, I. Bjornsson, D. Honfi, O.L. Ivanov, and J. Johansson. 2020. Bridges in a changing climate: a study of the potential impacts of climate change on bridges and their possible adaptations. *Structure and Infrastructure Engineering* 16:4, 738-749.

Nelson, D.M. and M.E. Monaco. 2000. National Overview and Evolution of NOAA's Estuarine Living Marine Resource (ELMR) Program, NOAA Technical Memorandum NOS NCCOS CCMA 144, November 2000.

Nightingale, B. and C.A. Simenstad. 2001. Dredging Activities: Marine Issues, White Paper Research Project T1803, July 2001.

NMFS (National Marine Fisheries Service). 2004. Essential Fish Habitat Consultation Guidance Version 1.1, April 2004.

NMFS. 2007. Status Review of the Eastern Oyster (*Crassostrea virginia*). NOAA Technical Memorandum NMFS-F/SPO-88.

NMFS. 2013. Biological Report on the Designation of Marine Critical Habitat for the Loggerhead Sea Turtle, *Caretta caretta.*

NMFS. 2016. Ocean Noise Strategy Roadmap. Appendix A: The Status of Science for Assessing Noise Impacts on NOAA-Managed Species, September 2016.

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

NMFS. 2020. Greater Atlantic Regional Fisheries Office Acoustics Tool: *Analyzing the effects of pile driving in riverine/inshore waters on ESA-listed species in the Greater Atlantic Region*. Last updated September 14, 2020. Available at https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-consultation-technical-guidance-greater-atlantic.

NMFS. 2021. Common Bottlenose Dolphin (*Tursiops truncates truncates)*: Western North Atlantic Southern Migratory Coastal Stock, April 2021.

NMFS. 2022. National Marine Fisheries Service: Summary of Marine Mammal Protection Act Acoustic Thresholds, May 2022.

NMFS. 2023. National Marine Fisheries Service: Summary of Endangered Species Act Acoustic Thresholds (Marine Mammals, Fishes, and Sea Turtles), January 2023.

NMFS and FHWA. 2018a. FHWA/NMFS Consultation Process Guide for Transportation Actions in the NMFS Greater Atlantic Region, April 2018.

NMFS and FHWA. 2018b. FHWA Programmatic Essential Fish Habitat Consultation for Select Transportation Actions in the NMFS Greater Atlantic Region, April 2018.

NOAA Fisheries. 2022a. *Greater Atlantic Region ESA Section 7 Mapper*, updated August 2022:, Accessed February 21, 2023 at https://noaa.maps.arcgis.com/apps/webappviewer/index.html?id=1bc332edc5204e03b250ac11f9914a27&utm_medium=email&utm_source=govdelivery.

NOAA Fisheries. 2022b. *Essential Fish Habitat Mapper:* Accessed November 11, 2022, at https://www.habitat.noaa.gov/apps/efhmapper/?page=page_3.

NOAA Fisheries. 2023a. Harbor Porpoise. Accessed February 23, 2023, at https://www.fisheries.noaa.gov/species/harbor-porpoise#conservation-management.

NOAA Fisheries. 2023b. Section 7 Effect Analysis: Turbidity in the Greater Atlantic Region Guidance, last updated September 27, 2022. Accessed February 21, 2023 at https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-effect-analysis-turbidity-greater-atlantic-region.

NOAA Fisheries and FHWA. 2017. NOAA Fisheries/FHWA Best Management Practices (BMPs) Manual for Transportation Actions in the Greater Atlantic Region, June 1, 2017.

NRCS (Natural Resources Conservation Service). 2023. Web Soil Survey. Accessed April 3, 2023, at https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm.

Oestman, R., D. Buehler, J. Reyef, and R. Rodkin. 2009. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish, California Department of Transportation, February 2009.

Piazza, B.P., P.D. Banks, M.K. LaPeyre. 2005. The potential for created oyster shell reefs as a sustainable shoreline protection strategy in Louisiana. *Restoration Ecology,* 13:499-506.

Roegner, G.C. and R.L. Mann. 1990. Habitat requirements for the hard clam, *Mercenaria mercenaria,* in the Chesapeake Bay. Special scientific report No 126. Virginia Institute of Marine Science, College of William and Mary.

Stein, J., N. Bartok, and J. Ritzert. 2022. Eastern Black Rail (*Laterallus jamaicensis jamaicensis)* Acoustic Surveys for the National Aeronautics and Space Administration Goddard Space Flight Center's Wallops Flight Facility, Accomack County, Virginia, Draft Report: May 1-June 6, 2022.

Sweet, W.V, B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak. 2022. Global and Regional Sea Level Rise Scenarios

for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01.

USACE (United States Army Corps of Engineers). 1987. *Corps of Engineers Wetlands Delineation Manual,* January 1987 – Final Report.

USACE. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Atlantic and Gulf Coastal Plain Region (Version 2.0),* November 2010.

USCB (U.S. Census Bureau). 2021. QuickFacts - Accomack County, Virginia. https://www.census.gov/quickfacts/fact/table/accomackcountyvirginia,VA/PST045222,PST045221. Accessed February 15, 2023.

USCG (United States Coast Guard). 2021. Preliminary Navigation Clearance Determination. May 11, 2021.

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

USEPA. 2023. Sole Source Aquifers for Drinking Water. Available at https://epa.maps.arcgis.com/apps/webappviewer/index.html?id=9ebb047ba3ec41ada1877155fe31356b. Accessed on April 12, 2023.

USFWS (United States Fish and Wildlife Service). 2007. National Bald Eagle Management Guidelines, May 2007.

USFWS. 2015. Migratory Bird Treaty Act Nationwide Standard Conservation Measures, April 20, 2015.

USFWS. 2019. Species Status Assessment Report for the Eastern Black Rail (*Laterallus jamaicensis jamaicensis),* August 2019.

USFWS. 2021a. Recovery Outline for the Eastern black rail, South Carolina Ecological Services Field Office.

USFWS. 2021b. Birds of Conservation Concern 2021 Migratory Bird Program.

USFWS. 2022. *Information for Planning and Consultation System*. Accessed December 20, 2022 at http://ecos.fws.gov/ipac/.

USFWS. 2023a. Range-wide Indiana Bat & Northern Long-Eared Bat Survey Guidelines, March 2023.

USFWS. 2023b. Incidental Take Beneficial Practices: Transportation. Accessed April 10, 2023. Available at https://www.fws.gov/story/incidental-take-beneficial-practices-transportation

VCZMP (Virginia Coastal Zone Management Program). 2023. Coastal Geospatial and Educational Mapping System (GEMS). Accessed January 27, 2023, at https://gaia.vcu.edu/GemsMap/.

VDEQ (Virginia Department of Environmental Quality). 2019. VWP Permit & Compliance Manual. Site accessed October 18, 2023, from https://www.deq.virginia.gov/permits/water/wetlands-streams-vwp.

VDEQ. 2023. Air Toxics Web site. Site accessed March 23, 2023 from https://www.deq.virginia.gov/air/monitoring-assessments/air-monitoring/pollutant-monitoring.

VDHR (Virginia Department of Historic Resources). 2023. Virginia Cultural Resource Information System (V-CRIS). Accessed March 13, 2023, at https://vcris.dhr.virginia.gov/VCRIS/Account/Login?ReturnUrl=%2fvcris%2f.

VDWR (Department of Wildlife Resources). 2023a. Virginia Fish and Wildlife Information Service. Accessed February 21, 2023, at https://services.dwr.virginia.gov/fwis/index.asp.

VDWR. 2023b. NLEB Winter Habitat and Roost Trees Application. Accessed February 21, 2023 at https://dgif-virginia.maps.arcgis.com/apps/webappviewer/index.html?id=32ea4ee4935942c092e41ddcd19e5ec5.

VDWR. 2023c. Little Brown Bat and Tri-colored Bat Winter Habitat and Roosts Application. Accessed February 21, 2023 at https://dwr.virginia.gov/wildlife/bats/little-brown-bat-tri-colored-bat-winter-habitat-roosts-application/.

VMRC (Virginia Marine Resources Commission). 2022. Chesapeake Bay Map. Accessed January 27, 2023, at https://webapps.mrc.virginia.gov/public/maps/chesapeakebay_map.php.

Virginia Water Trails. 2023. *Eastern Shore* at https://virginiawatertrails.org/eastern-shore/. Accessed April 4, 2023.

Watts, B.D. 2016. Status and Distribution of Eastern Black Rail Along the Atlantic and Gulf Coasts of North America. The Center for Conservation Biology Technical Report Series, CCBTR-16-09. College of William and Mary, Williamsburg, VA.

Wingfield, J.E., M. O'Brien, V. Lyubchinch, J.J. Roberts, P. N. Halpin, A. N. Rice, and H. Bailey. 2017. Year-round spatiotemporal distribution of harbour porpoises within and around the Maryland wind energy area, *PLoS ONE 12 (5).*

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