Federal Aviation Administration

Draft Environmental Assessment SpaceX Falcon 9 Operations at Space Launch Complex 40, Cape Canaveral Space Force Station, Florida

Federal Aviation Administration
Department of the Air Force
United States Coast Guard
National Aeronautics and Space Administration

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Environmental Assessment for SpaceX Falcon 9 Operations at Space Launch Complex 40, Cape Canaveral Space Force Station

AGENCIES: Federal Aviation Administration (FAA), lead federal agency; the U.S. Department of the Air Force (DAF), U.S. Coast Guard (USCG), and the National Aeronautics and Space Administration (NASA), cooperating agencies.

This Environmental Assessment (EA) is submitted for review pursuant to section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), as amended (42 United States Code 4321, et seq.); Section 4(f) of the Department of Transportation Act (49 U.S.C. § 303); Section 106 of the National Historic Preservation Act (16 U.S.C. § 470); Executive Order 11988, Floodplain Management; DOT Order 5650.2, Floodplain Management and Protection; and FAA Order 1050.1F, and FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*.

DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION: The FAA is evaluating Space Exploration Technologies Corporation's (SpaceX) proposal to increase the annual cadence of Falcon 9 launches and to construct and operate a Falcon 9 landing zone (LZ) at Space Launch Complex-40 (SLC-40) on Cape Canaveral Space Force Station (CCSFS). SpaceX must obtain a modification to its current FAA launch license from the FAA to increase the number of Falcon 9 launches and construct and operate a Falcon 9 LZ at SLC-40. Issuing a license modification is considered a major federal action subject to environmental review under NEPA. The completion of the environmental review process does not guarantee that the FAA will issue a license modification to SpaceX for the Proposed Action. SpaceX's license application must also meet FAA safety, risk, and financial responsibility requirements per 14 CFR Chapter III. The FAA's Federal Action also includes the FAA's issuance of temporary airspace closures.

PUBLIC REVIEW PROCESS: In accordance with the applicable requirements, the FAA is initiating a public review and comment period for the draft EA. The public comment period for the NEPA process begins with the publication of the draft EA on March 14, 2025 and ends on April 24, 2025.

CONTACT INFORMATION: Questions regarding the draft EA can be addressed to Ms. Eva Long, Environmental Protection Specialist, Federal Aviation Administration, 1902 Reston Metro Plaza, Reston, VA, 20190; project email address SpaceXFalconSLC40@icf.com.

This EA becomes a federal document when evaluated, signed, and dated by the Responsible FAA Official.

Responsible FAA Official:

_____ Date: _____

Stacey M. Zee
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Acronyms and Abbreviations

Acronym	Definition
°F	degrees Fahrenheit
ACAM	Air Conformity Applicability Model
ANSI	American National Standards Institute
APE	Area of Potential Effects
AQ-GHG	air quality and greenhouse gas emissions
ASA	Acoustical Society of America
BA	Biological Assessment
BEA	Bureau of Economic Analysis
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practice
CCSFS	Cape Canaveral Space Force Station
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMP	coastal management program
CNS	Canaveral National Seashore
CO_2e	carbon dioxide equivalent
COMDTINST	Commandant Instruction
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DAF	Department of the Air Force
dB	decibel
dBA	A-weighted decibels
DNL	day-night average sound level
DOD	Department of Defense
DOT	United States Department of Transportation
EA	Environmental Assessment
EFH	essential fish habitat
EIS	Environmental Impact Statement
EO	executive order
ERP	Environmental Resource Permit
ESA	Endangered Species Act

Acronym	Definition
FAA	Federal Aviation Administration
FDEP	Florida Department of Environmental Protection
FMC	Fishery Management Council
FMU	fire management unit
FONSI	Finding of No Significant Impact
GHG	greenhouse gas
HAP	hazardous air pollutant
HAPC	Habitat Areas of Particular Concern
Hz	hertz
INRMP	Integrated Natural Resource Management Plan
IPaC	Information for Planning and Consultation
KSC	Kennedy Space Center
L_{max}	maximum sound level
LA_{max}	maximum A-weighted sound level
LC	Launch Complex
LZ	landing zone
MBTA	Migratory Bird Treaty Act
MINWR	Merritt Island National Wildlife Refuge
MMPA	Marine Mammal Protection Act
MOU	memorandum of understanding
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSGP	Multi-Sector General Permit
MSL	mean sea level
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service

Acronym	Definition
NOAA	National Oceanic and Atmospheric Administration
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRHP	National Register of Historic Places
OSHA	Occupational Safety and Health Administration
PSD	Prevention of Significant Deterioration
psf	pounds per square foot
ROI	region of influence
SC-GHG	social cost of greenhouse gases
SDWA	Safe Drinking Water Act
SEA	Supplemental Environmental Assessment
SEL	sound exposure level
SHPO	State Historic Preservation Officer
SLC	Space Launch Complex
SLD	Space Launch Delta
SpaceX	Space Exploration Technologies Corporation
SWPPP	Stormwater Pollution Prevention Plan
TMDL	total maximum daily load
U.S.	United States
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USSF	United States Space Force
VSFB	Vandenberg Space Force Base

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Chapter 1. Introduction

The Federal Aviation Administration (FAA) is evaluating Space Exploration Technologies Corporation's (SpaceX) proposal to increase the annual cadence of Falcon 9 launches and to construct and operate a Falcon 9 landing zone (LZ) at Space Launch Complex-40 (SLC-40) on Cape Canaveral Space Force Station (CCSFS). SpaceX is requesting a modification to its current FAA launch license, LLO 18-105, to increase the maximum allowed annual launches of the Falcon 9 vehicle at SLC-40 and to conduct Falcon 9 first-stage booster landings at the new Falcon 9 LZ. SpaceX has also applied to the Department of the Air Force (DAF) for a real property agreement to construct and operate the new Falcon 9 LZ.

The FAA has prepared this Environmental Assessment (EA) to evaluate the potential environmental effects of an annual launch cadence of 120 launches per year at SLC-40 and the construction and operation of a new Falcon 9 LZ. A maximum annual launch cadence of 120 launches per year is an increase of 70 annually compared to the 50 previously analyzed. This EA also evaluates the potential environmental effects associated with the FAA's approval of related airspace closures.

This EA was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 as amended (42 United States [U.S.] Code [U.S.C.] §4321 *et seq*.); FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*; the DAF's NEPA implementing regulations (DAF Environmental Impact Analysis Process at 32 CFR Part 989); and the U.S. Coast Guard (USCG) Environmental Planning Policy, Commandant Instruction (COMDTINST) 5090.1 (series) and the Environmental Planning Implementing Procedures.[1] The USCG Environmental Planning Commandant Instruction mandates use of the Environmental Planning Implementing Procedures. The two documents align with the U.S. Department of Homeland Security NEPA policy, *Implementation of the National Environmental Policy Act*, Department of Homeland Security Instruction Manual 023-01-001-01 (series) and replace the USCG *National Environmental Policy Act Implementing Procedures and Policy for Considering Environmental Impacts*, COMDTINST 16475.1D, which has been cancelled. The FAA is the lead agency for the preparation and coordination of the EA; the DAF, USCG, and National Aeronautics and Space Administration (NASA) are cooperating agencies.

1.1 Background

The FAA and the DAF most recently assessed the environmental effects of Falcon launches and landings in the 2020 *Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station* (FAA, 2020), which evaluated up to 50 Falcon 9 launches annually from SLC-40, up to 20 annual launches from Kennedy Space Center (KSC) Launch Complex-39A (LC-39A), and up to 54 first-stage boosters returning annually to LZ-1 and LZ-2 (both located at what was formerly LC-13) at CCSFS.

Previously, the 2014 *Environmental Assessment for the Space Exploration Technologies Vertical Landing of the Falcon Vehicle and Construction at Launch Complex 13 Cape Canaveral Air Force Station, Florida*

[1] On January 20, 2025, President Trump issued Executive Order (EO) No. 14154, *Unleashing American Energy*, which revoked EO 11991, *Relating to Protection and Enhancement of Environmental Quality* (May 24, 1977), and instructed the Chair of the CEQ to rescind its NEPA-implementing regulations.

(DAF, 2014) evaluated potential effects of the construction of an LZ and ground infrastructure as well as Falcon 9 landing operations at LC-13 (LZ-1). The 2017 *Supplemental Environmental Assessment* [SEA] *to the December 2014 EA for Space Exploration Technologies Vertical Landing of the Falcon Vehicle and Construction at Launch Complex 13 Cape Canaveral Air Force Station, Florida* (DAF, 2017) evaluated potential effects of constructing a second LZ (LZ-2) at LC-13 to support Falcon Heavy landing operations.

NASA is currently evaluating construction and operation of a Falcon 9 LZ at LC-39A under a separate NEPA action. Under the Proposed Action at LC-39A, SpaceX would construct a new LZ adjacent to LC-39A, similar to the proposed LZ design for SLC-40 analyzed in this EA. The new LZ would accommodate booster landings for Falcon 9 and Falcon Heavy vehicles launched from LC-39A. Up to 20 boosters are anticipated to land at LC-39A, while the remainder would land on a drone ship. There would also be an increase in the annual number of Falcon 9 and Falcon Heavy launches, with up to 36 launches, up to five of which could be Falcon Heavy per year. Under the No Action Alternative, NASA would not enter into a real property agreement with SpaceX, and SpaceX would not construct an LZ at LC-39A or apply to the FAA for a license modification to conduct Falcon booster landings at LC-39A and conduct an increased number of launches. The Draft EA is anticipated to be published in early 2025. Falcon booster landings at LC-39A would only result from Falcon launches at LC-39A, and Falcon booster landings at SLC-40 would only result from Falcon launches at SLC-40; therefore, Falcon launch operations and LZ construction and operations are analyzed separately across the two sites.

1.2 Federal Agency Roles

The FAA is the lead Federal agency, and the DAF, USCG, and NASA are cooperating agencies. The FAA and the DAF maintain a memorandum of understanding (MOU) on the environmental review process for commercial launch and reentry operations, which identifies roles and responsibilities (FAA and DAF, 2023). The following sections explain each agency's involvement in the NEPA process.

1.2.1 Federal Aviation Administration

As the lead Federal agency, the FAA is responsible for analyzing the potential environmental effects of the Proposed Action. The Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. §§50901–50923, authorizes the Secretary of Transportation to oversee, license, and regulate commercial launch and reentry activities, and the operation of launch and reentry sites within the United States or as carried out by U.S. citizens. Section 50905 directs the Secretary of Transportation to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States. In addition, section 50903 requires the Secretary of Transportation to encourage, facilitate, and promote commercial space launches and reentries by the private sector. As codified at 49 CFR § 1.83(b), the Secretary of Transportation has delegated authority to carry out these functions to the FAA's administrator. The FAA is also responsible for creating airspace closure areas in accordance with FAA Order 7400.2P, *Procedures for Handling Airspace Matters,* to ensure public safety.

The FAA's Federal action is to issue a license modification, as well as potential future renewals and modifications to the license, within the scope of operations analyzed in this EA to SpaceX that would allow SpaceX to conduct an increased cadence of Falcon 9 launches at SLC-40 and conduct Falcon 9 booster

landings at the new LZ. In addition, the FAA must also approve related airspace closures for launch and landing operations. Successfully completing the environmental review process does not guarantee that the FAA would issue a license modification to SpaceX or approve related airspace closures.

1.2.2 Cooperating and Participating Agencies

1.2.2.1 U.S. Department of the Air Force

The DAF is a cooperating agency because the Proposed Action would occur on DAF property managed by the USSF and would require a real property agreement between the DAF and SpaceX. Space Launch Delta (SLD) 45 has a regulatory responsibility and specific expertise in all activities at CCSFS. SLD 45 also manages the environmental compliance activities performed by a growing number of tenants at CCSFS installations who may be affected by the Proposed Action. After the environmental review process is complete, the DAF may adopt this EA and issue a decision document, and the execution of a real property agreement could proceed. The successful completion of the environmental review process in accordance with the DAF Environmental Impact Analysis Process (32 CFR Part 989) does not guarantee that the USSF would approve a real property agreement with SpaceX or authorize the development and implementation of the Proposed Action, including an increase in launch rates.

1.2.2.2 U.S. Coast Guard

The USCG is a cooperating agency because the USCG has regulatory authority over waters subject to jurisdiction of the U.S. pursuant to the Ports and Waterways Safety Act, 46 U.S.C. § 700, regulatory authority of U.S.- and foreign-flagged vessels as outlined in CFR Titles 33 and 46, and expertise to review and advise SLD 45 on all launch and reentry site evaluation risk assessments with a focus on vessel navigation safety. The USCG also supports SLD 45 with early warning communication to the maritime industry with Notices to Mariners (NOTMARs) as outlined in 33 CFR Part 72. The USCG evaluates every launch and reentry activity with potential risk to the marine transportation system. The USCG and USSF have entered into a memorandum of agreement to assist with maritime safety and to review space operations that have a maritime nexus; the USCG advises the USSF on all launch and reentry site evaluations. The USCG and FAA maintain an MOU establishing a process for USCG input into the FAA's process for issuing licenses and permits for commercial space launch and reentry activities specific to operations in, on, and immediately adjacent to the navigable waters of the United States. This includes matters of public health, safety of property, safe navigation, and national security as they relate to those waters.

1.2.2.3 National Aeronautics and Space Administration

NASA is a cooperating agency because of special expertise with respect to potential environmental effects from space launches and the operation of a launch site. NASA also has special expertise and interest in the operation of reusable orbital launch vehicles through its programs, which are intended to foster the development of the commercial reusable orbital space transportation industry.

1.3 Purpose and Need for the Proposed Action

The FAA's authority with respect to SpaceX's launch license and license modification is stated in Section 1.2.1, *Federal Aviation Administration*. The purpose of SpaceX's proposal is to provide greater mission capability to the U.S. Department of Defense (DOD), NASA, and commercial customers by increasing Falcon 9's flight opportunities. This increase in flight opportunities and construction and operation of a new LZ would support future U.S. Government and commercial missions, which require or would benefit from a Falcon 9 vehicle. A new LZ is proposed to retain the ability to land first-stage boosters at CCSFS. SpaceX utilizes land-based LZs in addition to marine drone ship landings downrange to support the goal of first-stage booster reusability.

SpaceX's proposal is needed to meet current and anticipated near-term future U.S. Government launch requirements for national security, space exploration, science, and the Assured Access to Space process of the National Security Space Launch program. The proposed increased launch cadence at SLC-40 is needed so that SpaceX can continue to implement U.S. Government missions while simultaneously meeting its increasing commercial launch demands.

For DOD, the Proposed Action is needed to fulfill (in part) 10 U.S.C. § 2276(a), "Commercial space launch cooperation," authorizing the Secretary of Defense to:

- Maximize the use of the capacity of the space transportation infrastructure of the DOD by the private sector in the U.S.;
- Maximize the effectiveness and efficiency of the space transportation infrastructure of the DOD;
- Reduce the cost of services provided by the DOD related to space transportation infrastructure and launch support facilities and space recovery support facilities;
- Encourage commercial space activities by enabling investment by covered entities in the space transportation infrastructure of the DOD; and
- Foster cooperation between DOD and covered entities[2].

The new LZ is needed because SLD 45 does not intend on renewing SpaceX's license at LZ-1/2 after expiration in July 2025. SLD 45 has implemented a policy that phases out dedicated LZs to maximize opportunities for the number of commercial launch service providers, maximize the launch capacity of the Eastern Range, and minimize impacts that commercial launch service providers create for other users or government programs during operations (USSF, 2023a). SLD 45 policy now requires commercial launch service providers to conduct landing operations at their existing launch sites (DAF, 2023a). Landing boosters at the launch site allows reusable vehicle refurbishment to begin earlier, enabling an increased launch cadence as transit time from the landing site to the refurbishment facility is reduced compared to landing downrange. Additionally, landing at the launch site removes potential weather issues downrange that could delay a launch and reduces flight hardware exposure to corrosive environments.

Public interests largely intersect with the government interests identified, including greater mission capability for space exploration, and advancing reliable and affordable access to space which in turn advances the scientific and national security benefits of the U.S. space program as a whole.

[2] "Covered entity" means a non-Federal entity that is organized under the laws of the U.S. or of any jurisdiction within the U.S. and is engaged in commercial space activities.

1.4 Documents Incorporated by Reference

Agencies may incorporate relevant material into environmental documents by reference when the effect is to cut down on bulk without impeding agency and public review of the action. The following documents are incorporated by reference in this EA, and hyperlinks are included for access to each document:

- *Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station* (FAA, 2020), herein referred to as the 2020 EA
- *Final Environmental Assessment and Finding of No Significant Impact for Issuing a Reentry License to SpaceX for Landing the Dragon Spacecraft in the Gulf of Mexico* (FAA, 2018)
- *Supplemental Environmental Assessment to the December 2014 EA for Space Exploration Technologies Vertical Landing of the Falcon Vehicle and Construction at Launch Complex 13 Cape Canaveral Air Force Station, Florida* (DAF, 2017)
- *Environmental Assessment for the Space Exploration Technologies Vertical Landing of the Falcon Vehicle and Construction at Launch Complex 13 Cape Canaveral Air Force Station, Florida* (DAF, 2014)
- *Environmental Assessment for Launch of NASA Routine Payloads on Expendable Launch Vehicles* (NASA, 2011)
- *Environmental Assessment for the Operation and Launch of the Falcon 1 and Falcon 9 Space Vehicles at Cape Canaveral Air Force Station, Florida* (DAF, 2007)
- *Supplemental Environmental Assessment to November 2007 Environmental Assessment for Operation and Launch of the Falcon 1 and Falcon 9 Space Vehicles at Cape Canaveral Air Force Station, Florida* (DAF, 2013)

The FAA reviewed these documents to identify any changes in existing conditions or expected effects that have occurred since their publication. The FAA identified these changes in this EA.

1.5 Intergovernmental Coordination, Public, and Agency Participation

1.5.1 Public Engagement

A public notice for potential effects to a floodplain was published in the Hometown News (Melbourne, North Brevard, Palm Bay, Suntree-Viera, and The Beaches) on March 22, 2024, and in Florida Today on March 18 and March 24, 2024. One comment was received during the 30-day public comment period. The commentor requested an Environmental Impact Statement (EIS) be prepared, cumulative effects be analyzed, low impact development measures be applied, and Space Florida be added as a stakeholder.

In accordance with FAA Order 1050.1F, DAF Environmental Impact Analysis Process, and USCG COMDTINST 5090.1, the FAA released the Draft EA for public review on March 14, 2025. The FAA published

a Notice of Availability in the Federal Register, on its website[3], and in the following newspapers: Florida Today, Al Día, and Hometown News. Hard copies of the Draft EA were left at the following locations: Cape Canaveral Public Library, Merritt Island Public Library, Cocoa Beach Public Library, Titusville Public Library, and Catherine Schweinsberg Rood Central Library. The FAA also distributed the Draft EA to the Florida State Clearinghouse.

Following the close of the public comment period, the FAA will revise the Draft EA, as appropriate, in response to comments received, and a Final EA will be prepared. The Final EA will reflect the FAA's consideration of comments and will provide responses to substantive comments. Following review of the Final EA, the FAA will either issue a Finding of No Significant Impact (FONSI) or issue a Notice of Intent to prepare an EIS.

1.5.2 Native American Coordination

Executive Order (EO) 13175 of November 6, 2000, *Consultation and Coordination with Indian Tribal Governments*, charges all executive departments and agencies with engaging in regular, meaningful, and robust consultation with Tribal officials in the development of Federal policies that have Tribal implications. The FAA initiated government-to-government consultation The FAA initiated government-to-government consultation with the following Native American Tribes: the Miccosukee Tribe of Indians of Florida; the Muscogee (Creek) Nation, Oklahoma; the Seminole Nation of Oklahoma; and the Seminole Tribe of Florida.

1.5.3 Interagency Coordination

During the development of this EA, the FAA and the DAF coordinated with various local, state, and Federal agencies regarding the Proposed Action and will continue to coordinate with these agencies as required.

In accordance with Section 106 of the National Historic Preservation Act (NHPA), the DAF is consulting with parties interested in potentially affected historic properties. These agencies include the State Historic Preservation Office, Miccosukee Tribe of Indians of Florida, Seminole Nation of Oklahoma, and Seminole Tribe of Florida. The DAF has provided this Draft EA to the Florida State Historic Preservation Office.

In accordance with Section 7 of the Endangered Species Act (ESA), the DAF is consulting with the U.S. Fish and Wildlife Service (USFWS). The FAA is consulting with the National Marine Fisheries Service (NMFS) in accordance with Section 7 of the ESA.

Pursuant to the Coastal Zone Management Act (CZMA), the FAA engaged with the Florida Department of Environmental Protection (FDEP) and submitted this Draft EA to the Florida State Clearinghouse for review.

1.6 Permits, Approvals, and Agreements

This section provides a summary of the regulatory requirements that may need to be met, along with the permits and approvals that may need to be obtained, before implementing the Proposed Action.

[3] https://www.faa.gov/space/stakeholder_engagement/SpaceX_Falcon_SLC 40 EA

Discussions with the agencies identified in this section would be necessary to understand the extent of permits and approvals required in the future. This list is not intended to be all inclusive—there is the potential for additional required permits, approvals, or agreements.

- **The FAA Licensing Requirements:** Under CFR Title 14, SpaceX would need to request from the FAA a modification of its existing launch operator license (LLO 18-105), which authorizes pre-flight ground operations and flights of Falcon 9 from SLC-40 and landing of the Falcon 9 first-stage booster on land or on a drone ship.
- **Section 4(f) of the U.S. Department of Transportation (DOT) Act Consideration:** Under 49 U.S.C. § 303, before approving a project that uses a Section 4(f) property, the FAA must determine that there is no feasible and prudent alternative that avoids the Section 4(f) property and that the project includes all possible planning to minimize harm to the property. Section 4(f) pertains to effects to subject properties from direct contact and public accessibility, as well as effects from noise and/or airspace restrictions associated with the Proposed Action.
- **NHPA Section 106 Consultation:** Section 106 of the NHPA requires Federal agencies to consider the effect of Federal undertakings on historic properties, including historic, archaeological, and cultural resources. As part of the NHPA Section 106 process, the DAF is consulting with the Florida State Historic Preservation Office and federally recognized tribes to help determine the potential effects of the Proposed Action.
- **ESA Section 7 Consultation:** ESA Section 7 requires all Federal agencies to ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of any listed species or destroy or adversely modify designated critical habitat. Section 4(a)(3)(B)(i) of the ESA was amended by the National Defense Authorization Act of 2004 to preclude designation of critical habitat on lands owned or controlled by the DOD that are subject to an approved Integrated Natural Resource Management Plan (INRMP) developed under the Sikes Act Improvement Act of 1997 (16 U.S.C. § 670a), provided the INRMP benefits the species for which critical habitat is proposed. An INRMP that provides such benefits is in place for CCSFS (USSF, 2023b), and critical habitat is therefore not designated on the installation. DAF is consulting with the USFWS on this Proposed Action. The FAA is coordinating with NMFS on coverage for this Proposed Action under revisions to its existing programmatic ESA consultation.
- **Coastal Zone Management Act:** The CZMA establishes a policy to preserve, protect, develop, restore, and enhance the resources of the Nation's coastal zones. The FAA must ensure that the requirements of the National Oceanic and Atmospheric Administration's (NOAA) CZMA-implementing regulations at 15 CFR Part 930 are satisfied. Because CCSFS is Federal property, it is statutorily excluded from the coastal zone. However, due to proximity to Florida's designated coastal zone, activities at CCSFS may result in "spill over" effects to a coastal zone use or resource. Therefore, the FAA submitted this Draft EA to the Florida State Clearinghouse for review.
- **Florida Environmental Resources Permit Program and National Pollutant Discharge Elimination System (NPDES) Stormwater Program:** The State of Florida operates the Environmental Resource Permit (ERP) program, which regulates activities that would affect wetlands, alter surface water flows, or contribute to water pollution, as well as dredging and filling in wetlands and other surface waters. The State of Florida also administers the NPDES program within the state. Any

discharge of a pollutant from a point source to surface waters (i.e., the navigable waters of the United States or beyond) must obtain an NPDES permit. A modification to SpaceX's existing ERP at SLC-40 as well as a Florida NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities would be required prior to construction of the proposed LZ. Florida derives its authority to regulate Federal activities via sections 401 and 402 of the Clean Water Act (CWA).

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Chapter 2. Description of Proposed Action and Alternatives

2.1 Proposed Action

The Proposed Action is to increase the annual Falcon 9 launch cadence at SLC-40 to support future U.S. Government and commercial launch service needs, as well as the construction and operation of an LZ at SLC-40. The regional location of CCSFS and the location of SLC-40 at CCSFS can be seen in **Figure 2-1** and **Figure 2-2**, respectively.

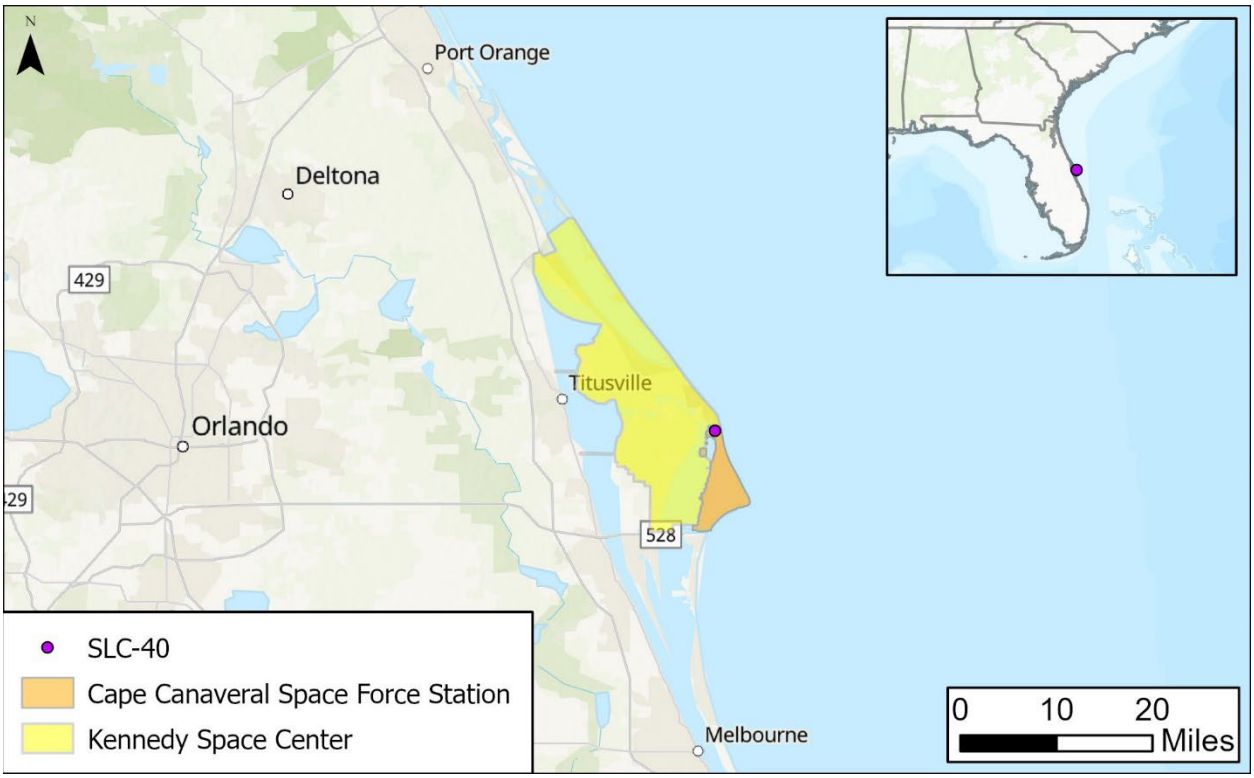

Figure 2-1. Regional Location Map

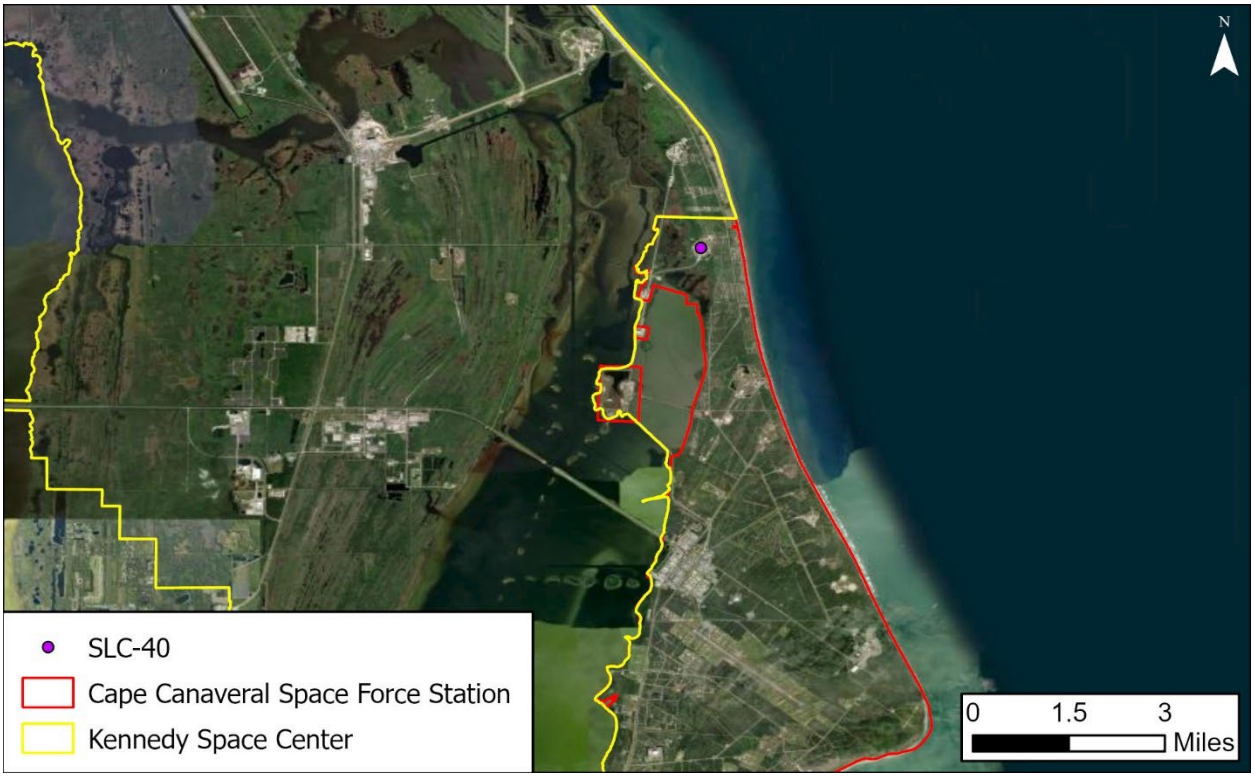

Figure 2-2. Project Location Map

2.1.1 Launch

2.1.1.1 Launch Vehicle

The Falcon 9 vehicle is approximately 229 feet tall with a diameter of 12 feet and produces approximately 1.7 million pounds of thrust at liftoff. A detailed discussion of the Falcon 9 vehicle, including the first and second stages, can be found in the 2020 EA. Falcon 9 launches from SLC-40 would occur with either a payload fairing (as shown in **Figure 2-3**) or with a Dragon capsule. Dragon is a spacecraft that launches as a payload on the Falcon 9 vehicle, delivers crew and cargo to the International Space Station, and conducts reentries under an FAA reentry license (RLO 20-007). Dragon landing and recovery operations in the marine environment are described and analyzed in the 2020 EA and the *Final Environmental Assessment and Finding of No Significant Impact for Issuing a Reentry License to SpaceX for Landing the Dragon Spacecraft in the Gulf of Mexico* (FAA, 2018).

2.1.1.2 Launch Operations

SpaceX proposes to launch Falcon 9 up to 120 times annually from SLC-40, which is an increase of 70 compared to the 50 currently authorized. SpaceX would conduct launch operations in the same way as described in the 2020 EA. One to 3 days before each launch, SpaceX may perform an engine static fire test, which would last for 7 seconds. The need to conduct a static fire test depends on the mission, and there would be no more than 40 static fire test events per year out of the 120 launches. Launch operations would occur at any time of day or night, at any time during the year. Following each launch, SpaceX would perform a series of first-stage burns and landing of the first stage, either downrange on a drone ship or at

an LZ at CCSFS. SpaceX would conduct a maximum of 34 first-stage booster land landings per year. SpaceX would continue to land first-stage boosters launched from SLC-40 at LZ-1 and LZ-2, with a maximum of 34 per year, through the end of SpaceX's real property agreement at LZ-1 and LZ-2 or when the SLC-40 LZ starts operation. Once the SLC-40 LZ is in operation, all of the up to 34 first-stage boosters launched from SLC-40 would only conduct land landings at SLC-40. There may be fewer boosters performing land landings than this maximum, so this EA analyzes the maximum of up to 120 landings per year that could occur downrange on a drone ship to provide flexibility in booster landing location. Mission objectives may occasionally require expending the first-stage booster in the Atlantic Ocean (**Figure 2-4**), as described in the 2020 EA. If expended, the first-stage booster would break up upon atmospheric reentry, and there would be no residual propellant or explosion upon impact with the Atlantic Ocean. The first-stage booster remnants would sink to the bottom of the ocean. SpaceX anticipates up to 10 expended missions from SLC-40 per year.

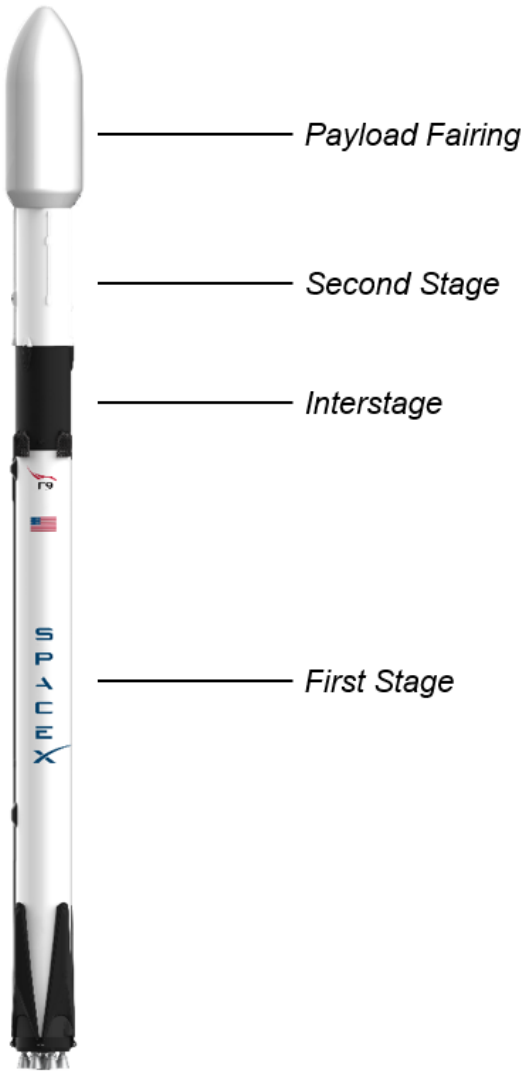

Figure 2-3. Falcon 9 Launch Vehicle

SpaceX, the DAF, the FAA, and the USCG implement numerous protocols and procedures to assess, avoid, mitigate, and minimize potential risks to public safety and the environment during space launches, which are discussed throughout this EA. The Falcon 9 launch vehicle has over a 99 percent launch success rate on more than 300 missions since June 2010. Due to the Falcon 9 vehicle success rate, launch failure would be an extremely low probability and would represent an off-nominal, worst-case scenario and is not assessed in detail for these reasons.

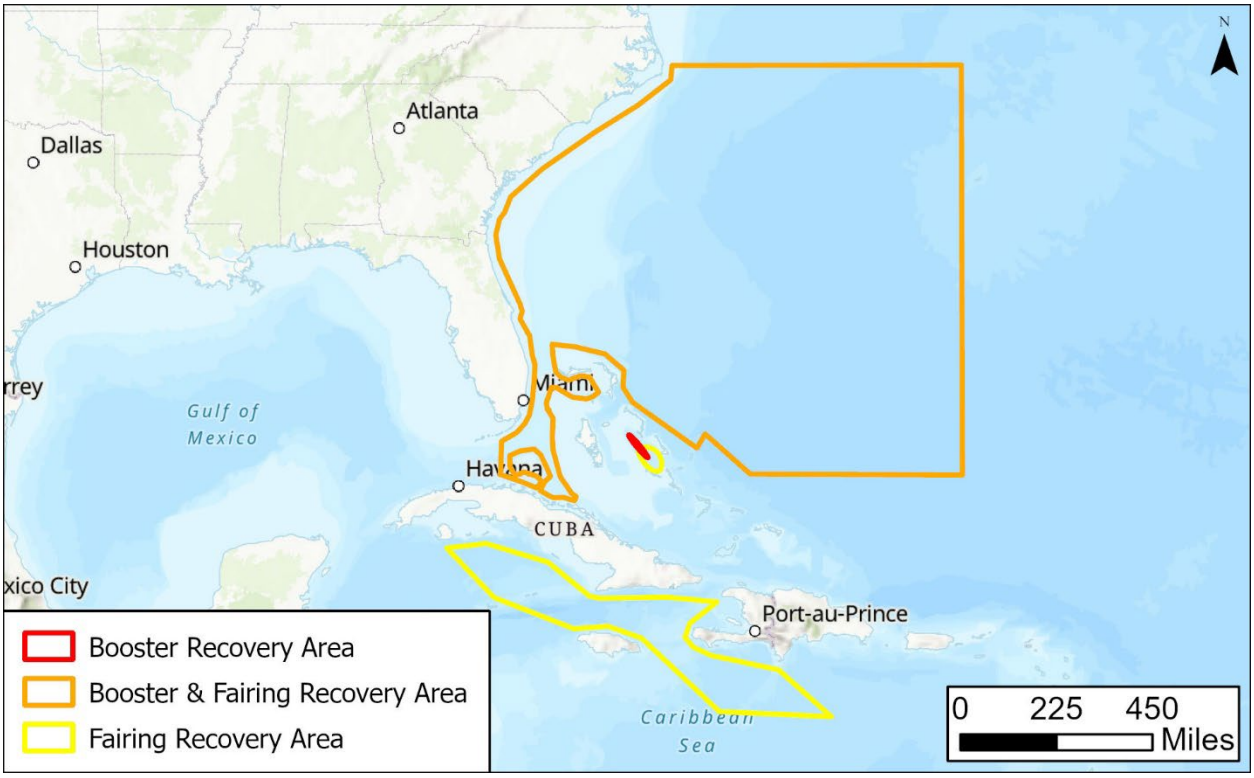

Figure 2-4. Downrange Recovery Areas

The Proposed Action does not include altering the dimensions (shape and altitude) of the airspace or shipping lanes. USCG District 7 was granted specific regulatory authority to restrict vessel movement, implement safety and warning zones, and provide early warning advisement for launches from CCSFS, but all responsibility to limit risk to navigation safety is solely on the acting space party. USCG District 7 will advise SpaceX and SLD 45 when the risk exceeds acceptable levels, and the primary applicant will be responsible for minimizing the risk with alternate strategies before formal publications of closures. Federal government agencies have regulatory authority to support maritime safety as outlined in applicable statutes and regulations, such as the Ports and Waterways Safety Act, 33 CFR Part 1 (*General Provisions*), 14 CFR Part 450 (*Launch and Reentry License Requirements*), and 40 CFR § 229.3 (*Transportation and Disposal of Vessels*). To comply with the necessary notification requirements, SLD 45 would notify the USCG of any upcoming launch operations to ensure safe launches over the high seas and navigable waters of the United States, consistent with current procedures.

All launch and reentry operations would comply with necessary notification requirements, including issuance of Notice to Mariners (NOTMAR)s, as defined in agreements required for a launch license issued by the Federal Aviation Administration (FAA). A NOTMAR provides a notification regarding a temporary hazard within a defined area (a Ship Hazard Area [SHA]) to ensure public safety during

proposed operations. A NOTMAR itself does not alter or restrict vessel movement; rather, the NOTMAR disseminates relative information regarding maritime activity and temporary hazards within a defined area to ensure public awareness and safety during the proposed operations.

To comply with FAA's licensing requirements, SpaceX has agreed through a Letter of Intent (LOI) with the United States Coast Guard (USCG) to establish procedures for the issuance of a NOTMAR prior to a launch or reentry, as well as other measures necessary to protect public health and safety, promoting safe operations over navigable waters. The LOI would describe the required responsibilities and procedures for both SpaceX and USCG during the event, which may include a launch, landing, and/or reentry operation resulting in the issuance of a NOTMAR.

USCG publishes NOTMARs through multiple media platforms to include Local Notice to Mariners (LNM), Broadcast Notice to Mariners (BNM), and Navigational Telex (NAVTEX) as needed to inform the maritime community of temporary changes in condition, Limited Access Areas (LAA), Regulated Navigation Areas (RNA), and/or hazards on navigable waterways. Notices in international areas are published by the National Geospatial Intelligence Agency. Advance notice via NOTMAR and the identification of SHAs would assist mariners in voyage planning and scheduling around any temporary operation.

In addition to publishing NOTMARs, USCG has broad authority to establish Limited Access Areas (LAA), which may include Safety and/or Security Zones, and RNAs on Navigable Waters subject to U.S. authority and schedule in advance to minimize interruption to the maritime community.

All landing operations would comply with necessary notification requirements, including issuance of NOTMAR and use of LAAs and RNAs by the USCG, as defined in agreements required for a vehicle operator license issued by the FAA. USCG maintains authority to establish and enforce LAAs and Regulated Navigation Areas as needed to support public health and safety during these events.

The use of USCG LAAs and RNAs may require the redirection of vessels to waters outside of the LAA during launch and landing events. The USCG uses all available data and information to provide a level of safety to the maritime community during prescribed launch/landing events.

All launch and reentry operations would comply with the necessary notification requirements, including issuing Notices to Airmen (NOTAMs) required by CFR Title 14 and the terms of SpaceX's launch operator license, LLO 18-105. Advance notice via NOTAMs and identifying aircraft hazard areas assist general aviation pilots to schedule around any temporary disruption of flight activities in the area of operation. A NOTAM provides notice of unanticipated or temporary changes to components of, or hazards in, the National Airspace System (FAA Order 7930.2T, *Notice to Airmen*). The FAA issues a NOTAM at least 24 hours before a launch activity in the airspace to notify pilots and other interested parties of temporary conditions. SpaceX regularly provides the FAA with updates and schedule changes to their notional 3-month launch schedule to provide advance notice for airspace planning.

2.1.1.3 Trajectories and Downrange Landing

Trajectories from SLC-40 would remain within the azimuth range previously analyzed in the 2020 EA. As discussed in the 2020 EA, each trajectory is provided in SpaceX's Flight Safety Data Package and submitted to the FAA and SLD 45 in advance of launch. SpaceX is not proposing to increase the number of annual polar launches from those previously analyzed in the 2020 EA. Landing trajectories would vary by mission type; an easterly launch would have a different trajectory than a polar launch that travels primarily south.

Downrange landing and fairing recovery locations would be the same as those analyzed in the 2020 EA (FAA, 2020) and subsequent Written Reevaluations, shown in **Figure 2-4**. Landings in the Atlantic Ocean (resulting from easterly launch trajectories) would occur for up to 120 launches (i.e., for up to 120 boosters). These landings would occur greater than 5 nautical miles from shore. These activities are not proposed to change or increase compared to what has been previously considered under NEPA and, thus, are not discussed further in this EA.

Landings in territorial waters of the Bahamas, such as the Exuma Sound, are coordinated directly with the Bahamas and the U.S. Department of State and subject to approval from the Bahamas. Landings occurring in Bahamian territorial waters would undergo an environmental review led by the Bahamian Department of Environmental Planning and Protection.

2.1.1.4 Payloads

Payloads would continue to be processed at existing facilities at CCSFS and KSC. Payloads and their associated materials/fuels/volumes are mission dependent but would be similar to current U.S. Government and commercial payloads as described in the 2011 *Environmental Assessment for Launch of NASA Routine Payloads* (NASA, 2011). Novel payloads, such as reentry capsules, may require a separate review under NEPA and require their own FAA vehicle operator license under CFR Title 14.

2.1.2 Landing Zone

2.1.2.1 Construction

SpaceX would construct a single LZ east of SLC-40 for the landing of Falcon first-stage boosters. The LZ would be made up of a 280-foot-diameter concrete pad surrounded by a 60-foot-wide gravel apron, with a total LZ diameter of 400 feet. Rocket Road would remain paved and traversable outside of landing events. SpaceX would construct a new nitrogen gas line from the existing metering station at SLC-40 to a fluids bay at the LZ. A 30-foot by 30-foot pedestal would be constructed adjacent to the landing pad to support post-landing vehicle processing. Crane storage is proposed along the existing SLC-40 fence line. The proposed lease boundary is approximately 10 acres. The proposed LZ is shown in **Figure 2-5**.

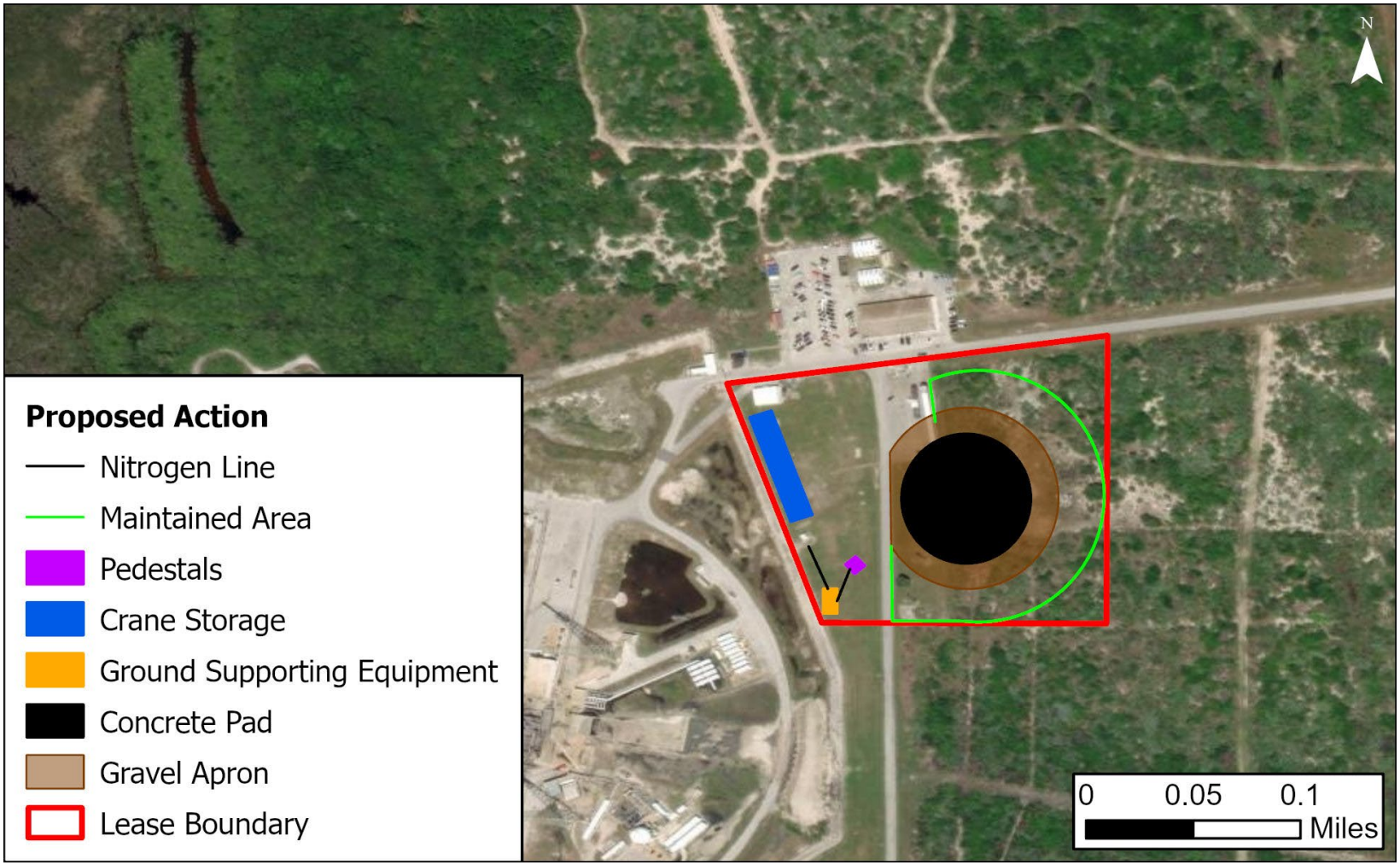

Figure 2-5. Proposed Landing Zone

2.1.2.2 Operation

SpaceX would land first-stage Falcon boosters at the proposed LZ in a similar manner as described in Section 2.1.2.3 of the 2020 EA. After first-stage engine cutoff and separation from the second stage, some first-stage engines are restarted to conduct a reentry burn. This reduces the velocity of the booster and places it in the correct angle for descent. Each booster has internal carbon overwrapped pressure vessels that are filled with either nitrogen or helium and are used to orient the position of the booster. Once the booster is in position and approaching its landing target engines are cut off to end the entry burn. A final engine burn slows the booster to a velocity of zero for landing at the proposed LZs. Following each landing, the booster(s) is safed and transported to a SpaceX facility for refurbishment. SpaceX would control access to and from the LZ via barrier arms, similar to the system currently utilized at LZ-1, LZ-2, and SLC-40.

The 2020 EA analyzed up to 54 first-stage boosters landing at LZ-1 and LZ-2 annually from launches at SLC-40 and LC-39A. SpaceX anticipates up to 34 boosters from Falcon 9 launches at SLC-40 would now land at SLC-40 each year. As described in Section 1.1, up to 20 boosters would be anticipated to land at LC-39A from Falcon 9 and Falcon Heavy launches at LC-39A; therefore, the total number of falcon boosters landing at CCSFS would remain within the maximum analyzed in the 2020 EA.

2.1.3 Transport and Vehicle Refurbishment

Following recovery of a booster from the drone ship, it would be transported to Port Canaveral and then overland to SpaceX's existing refurbishment facilities at CCSFS and KSC. Similarly, first-stage boosters landing at SLC-40 would be transported from the LZ to the refurbishment facility. SpaceX would continue to coordinate with CCSFS and KSC for scheduling of these movements to limit impacts to other operations on-base.

2.2 Selection Standards and Criteria

NEPA requires agencies to identify "a reasonable range of alternatives to the proposed agency action…that are technically and economically feasible, and meet the purpose and need of the proposal." 42 U.S.C. § 4332(C)(iii) (2024). The purpose and need is identified in Section 1.3, *Purpose and Need for the Proposed Action*. SpaceX proposed and the FAA evaluated and accepted the following criteria to select potential alternative sites to increase the Falcon 9 annual launch cadence:

- **Criterion 1:** Would not require additional construction to support Falcon 9 launch operations
- **Criterion 2:** Supports an eastward launch from the United States, with no changes to existing airspace or land use designations
- **Criterion 3:** Has available capacity to support a high launch cadence for Falcon 9 with minimal impacts to other operations at CCSFS and KSC

Alternative LZ locations were evaluated for reasonableness using the following criteria:

- **Criterion 4:** Meets operational and safety requirements during booster fly back
- **Criterion 5:** Is located within the vicinity of SLC-40 to meet SLD 45 policy

- **Criterion 6:** Balances environmental effects to various habitat types with operational requirements

2.3 No Action Alternative

Under the No Action Alternative, SpaceX would not increase the annual cadence for Falcon 9 operations from CCSFS or develop an LZ at SLC-40. SpaceX would continue to land boosters at LZ-1 and LZ-2 until its license expires; however, SLD 45 has advised of their intention to not renew the license. SpaceX would lose the ability to land boosters at CCSFS. This would increase the costs and time required for each launch. SpaceX would not meet the DOD requirements for Assured Access to Space nor fully meet the National Space Transportation Policy goals of providing low-cost reliable access to and from space, or the more short-term need to meet the increase in current and future manifest demands. Therefore, the No Action Alternative does not meet the purpose and need.

2.4 Alternatives Considered but Eliminated from Further Analysis

2.4.1 Alternative Launch Sites

Using the criteria above (Criterion 1–3), SpaceX evaluated facilities at CCSFS, KSC, and Vandenberg Space Force Base (VSFB). However, SpaceX and the FAA dismissed these sites from detailed review based on the following reasons (see **Table 2-1**).

Table 2-1. Candidate Launch Sites Compared Against Criteria

Candidate Launch Site	Criteria 1 – does not require construction	Criteria 2 – supports eastward launch	Criteria 3 – available capacity
LC-39A	Meets	Meets	**Does Not Meet**
Non-SpaceX Sites at CCSFS and KSC	**Does Not Meet**	Meets	Meets
VSFB LCs	Meets	**Does Not Meet**	Meets

Notes: CCSFS = Cape Canaveral Space Force Station; KSC = Kennedy Space Center; LC = Launch Complex; VSFB = Vandenberg Space Force Base.

2.4.1.1 Launch Complex-39A

SpaceX presently launches Falcon 9 and Falcon Heavy, including crew and cargo missions to the International Space Station, from LC-39A at KSC. LC-39A is the only LC on the Eastern Range that supports Falcon Heavy, which provides heavy-lift capability to the U.S. Government including NASA and the National Security Space Launch program. SpaceX is also proposing to launch Starship-Super Heavy from LC-39A and is currently preparing an EIS to evaluate potential environmental effects. Given the variety of missions LC-39A supports, there is limited capacity for additional Falcon 9 launches. LC-39A does not meet Criterion 3, thus was not carried forward.

2.4.1.2 Non-SpaceX Sites at CCSFS and KSC

Non-SpaceX LCs at CCSFS and KSC have been allocated to other launch operators and/or would require extensive construction to support Falcon 9 operations, thus would not meet Criterion 1. Therefore, non-SpaceX sites at CCSFS and KSC were not carried forward.

2.4.1.3 VSFB Launch Complexes

SpaceX presently launches Falcon from SLC-4E at VSFB and has been allocated SLC-6 for Falcon 9 and Falcon Heavy operations. However, VSFB does not support the eastward launches that CCSFS and KSC support, thus does not meet Criterion 2. Therefore, SLCs at VSFB were not carried forward.

2.4.2 Alternative Landing Zones

Using the criteria above (Criterion 4–6), SpaceX evaluated potential LZs at CCSFS and KSC to support first-stage booster landings launched from SLC-40. SpaceX and the FAA dismissed these sites from detailed review based on the following reasons (see **Table 2-2**).

Table 2-2. Candidate Landing Zones Compared Against Criteria

Candidate Launch Site	Criteria 4 – operational/safety requirements	Criteria 5 – vicinity of SLC-40	Criteria 6 – balance environmental effects
SLC-40 LZ alternatives	Partially Meets	Meets	**Does Not Meet**
LC-48	Meets	**Does Not Meet**	Meets
LC-39A	Meets	**Does Not Meet**	Meets

Notes: LC = Launch Complex; SLC = Space Launch Complex.

2.4.2.1 Space Launch Complex-40

Potential LZ locations around SLC-40 were evaluated against the above siting criteria. Initially, SpaceX proposed constructing two LZs at SLC-40 to support landing of both Falcon 9 and Falcon Heavy with potential sites east of SLC-40 (Concept 1; **Figure 2-6**), east of Phillips Parkway (Concept 2; **Figure 2-7**), and south of SLC-40 (Concept 3; **Figure 2-8**). Concepts 1 and 2 were determined to have substantial effects to Florida scrub-jay and southeastern beach mouse habitat. Concept 3 was sited predominantly in wetlands and would have flight safety concerns over potential impacts to the SLC-40 hangar. Accordingly, Concept 3 does not meet Criterion 4 and Concepts 1, 2, and 3 do not meet Criterion 6 and, thus, were not carried forward.

Potential LZs north and northwest of SLC-40 have flight safety concerns with overlying the lightning protection system and crew tower at SLC-40. These alternatives do not meet the site selection criteria for siting the LZ, thus were not carried forward.

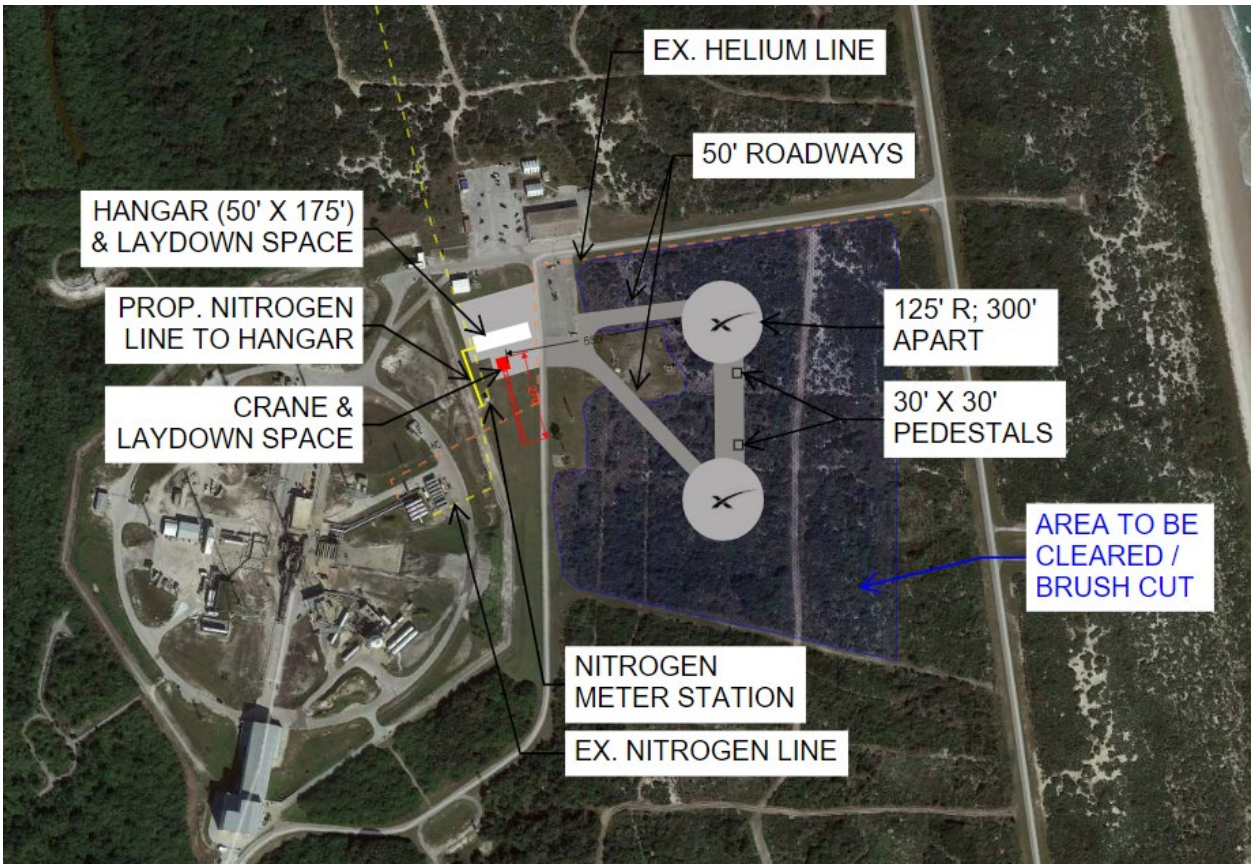

Figure 2-6. Landing Zone Concept 1

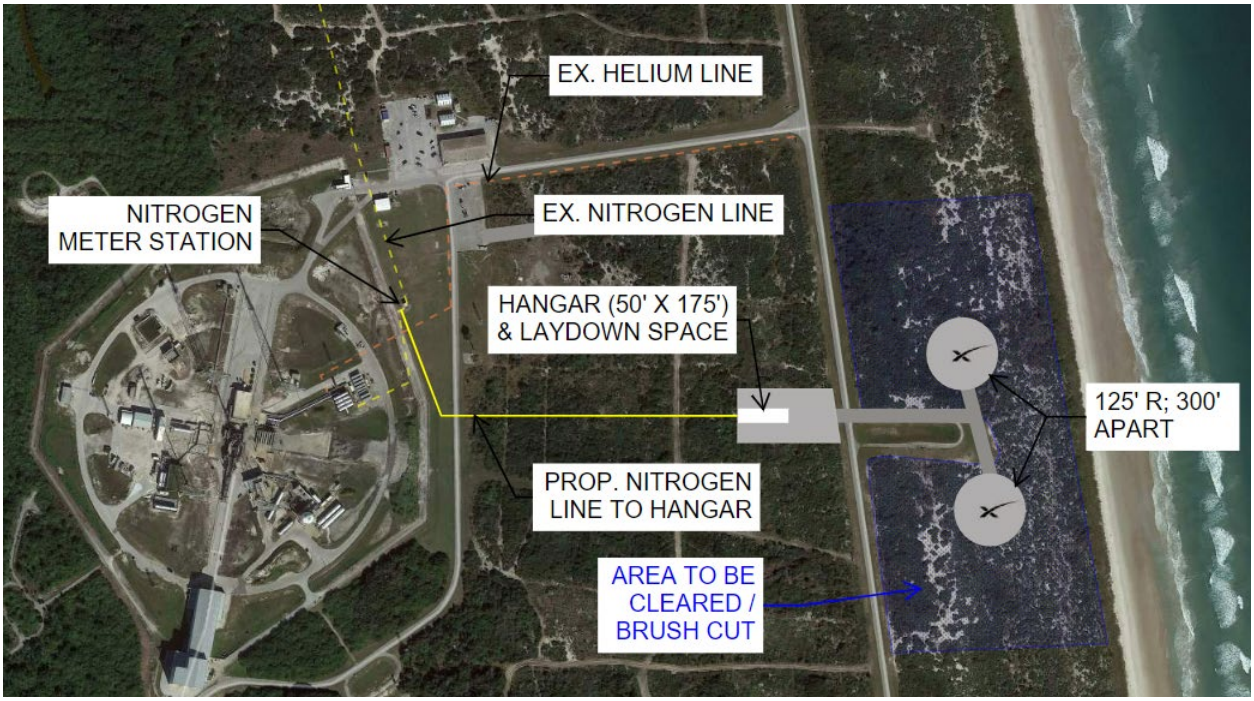

Figure 2-7. Landing Zone Concept 2

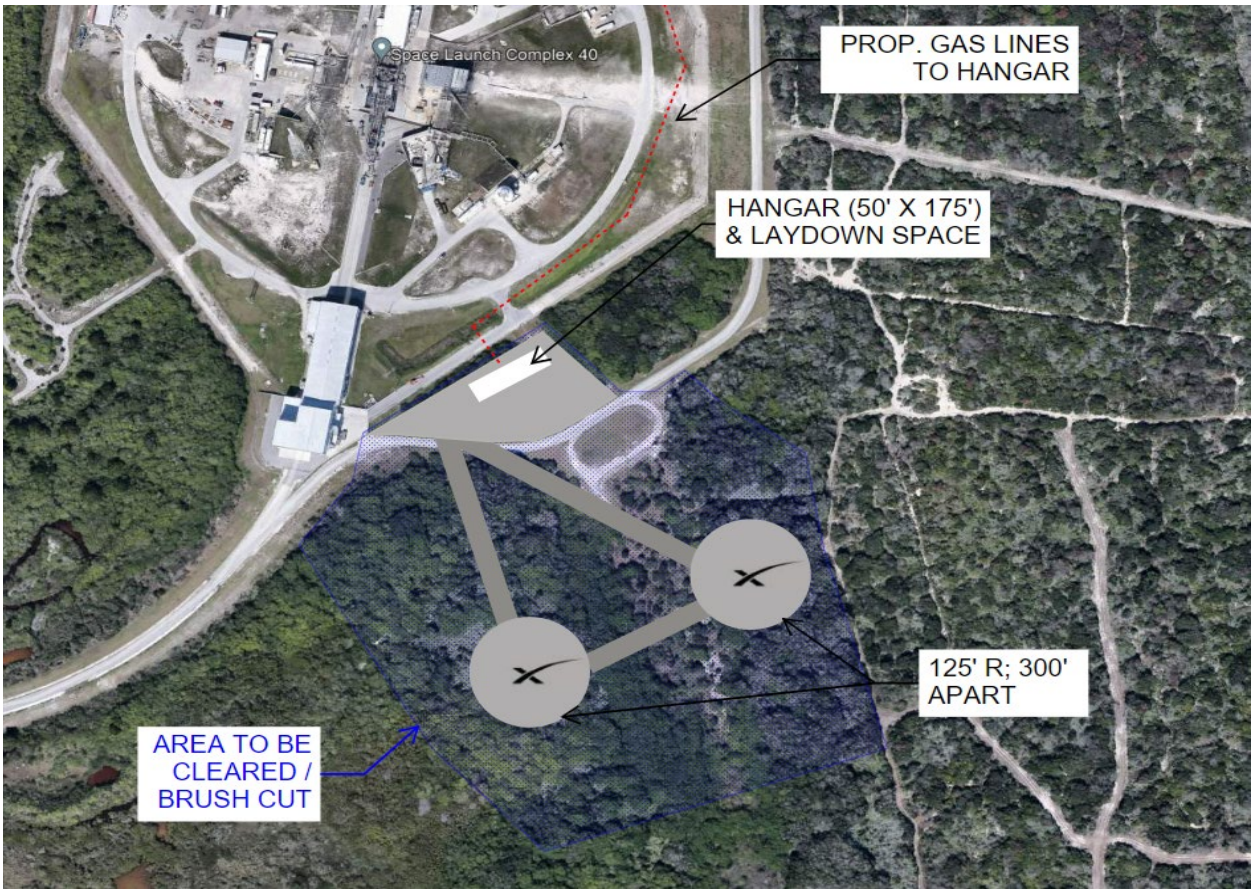

Figure 2-8. Landing Zone Concept 3

2.4.2.2 Launch Complex-48

SpaceX evaluated siting an LZ at LC-48, a NASA-owned small-lift class launch pad north of SLC-41. This alternative would require expansion of the existing LC-48 footprint to support the LZ. This alternative may also require closure of Phillips Parkway during operations at the LZ due to operational clear areas and could require closures of areas of KSC and CCSFS that otherwise would not be evacuated due to launch. Accordingly, this alternative does not meet Criterion 5 and was not carried forward.

2.4.2.3 Launch Complex-39A

SpaceX evaluated siting an LZ at LC-39A, a NASA-owned SpaceX-leased launch pad north of LC-48. LC-39A supports Falcon 9 and Falcon Heavy operations and is planned to also support Starship-Super Heavy operations. LC-39A is used for both crew and cargo missions to the International Space Station. Landing a first-stage booster at LC-39A launched from SLC-40 would require evacuation of the LC, adversely impacting operations occurring there, as LC-39A is not currently evacuated for a launch from SLC-40. Accordingly, this alternative does not meet Criterion 5 and, thus, was not carried forward.

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Chapter 3. Affected Environment and Environmental Consequences

3.1 Introduction

This chapter provides a description of the affected environment and potential environmental consequences for the environmental effect categories that have the potential to be affected by the Proposed Action. The environmental effect categories assessed in detail in this EA include air quality; climate; noise and noise-compatible land use; cultural resources; water resources; biological resources; coastal resources; land use; and socioeconomics. The study area varies based on the environmental effect category being analyzed and is defined for each environmental effect category in this chapter. The level of detail provided in this chapter is commensurate with the importance of the potential effect on the environmental effect categories. The following environmental effect categories are not analyzed in detail for the reasons stated.

- **Farmlands:** No prime farmland, unique farmland, or farmland of statewide or local importance is present at CCSFS or KSC. Therefore, the Proposed Action would not affect farmlands.
- **Children's Environmental Health and Safety:**The Proposed Action includes activities that regularly occur at CCSFS. No component of the Proposed Action would result in a disproportionate health and safety risk to children. **Wild and Scenic Rivers:** The Proposed Action would not affect wild and scenic rivers because there are no wild and scenic rivers located near KSC and CCSFS.

Additionally, effects to the following resources are described in the 2020 EA and hereby incorporated by reference (FAA, 2020):

- **Department of Transportation Act, Section 4(f):** The Proposed Action would not result in a physical use of any Section 4(f) property, as none would be located within the LZ construction footprint. Section 4(f) properties could be exposed to engine noise during launch and landing as well as to a sonic boom during booster returns to CCSFS (up to 34 times per year) and during a Falcon 9 polar launch (up to 5 times per year). Sonic booms from non-polar launches would occur over the ocean. In the 2020 EA, the FAA determined that Falcon 9 launches, including landings, would not result in substantial impairment of the Section 4(f) properties because sonic booms would occur infrequently, would be similar to or less than the noise experienced during a clap of thunder in the majority of the sonic boom footprints and would not substantially reduce the enjoyment of visitors. On launch days, there is a possibility of temporary restricted access due to visitor volume on sections of KSC managed by the USFWS and National Park Service (NPS), as have occurred for other space programs. These temporary closures of Section 4(f) properties are typically related to crowd control and access for emergency services. They are related to the volume of visitor traffic in an area and are not related to a public safety hazard from a launch. Any potential closures due to visitor volume would be coordinated between KSC security, the USFWS, and NPS by monitoring to ensure parking lot thresholds are not exceeded, and that roadways allow for emergency egress for any form of emergency associated with large crowds. Such closures would not be expected to cause more than a minimal disturbance to the enjoyment of

the resources of Merritt Island National Wildlife Refuge (MINWR) and Canaveral National Seashore (CNS) and would be determined by the land managing agencies. While the Proposed Action would increase the number of launches from 50 to 120 per year, sonic booms would continue to mostly occur over the open ocean as the increased launches would all have an easterly trajectory and there would be no change in the number of polar launches, which have sonic booms occurring partially over land. While the booster landing sonic booms would occur over the land, at the SLC-40 LZ instead of LZ-1/LZ-2, the frequency of booster land landings would be within what was analyzed in the 2020 EA. Therefore, the effects of sonic booms and access restrictions for the Proposed Action would not substantially impair the enjoyment or significance of any Section 4(f) resources. Thus, the Proposed Action would not result in a constructive use of any Section 4(f) property. In summary, the Proposed Action would not constitute a physical or constructive use of any Section 4(f) property and, therefore, would not result in significant impacts to Section 4(f) properties.

- **Hazardous Materials, Solid Waste, and Pollution Prevention:** All hazardous materials and solid wastes would be handled in accordance with all applicable Federal, state, and local laws and regulations. KSC and CCSFS have established plans and procedures to handle and dispose of hazardous materials and solid wastes, and the increased number of launches and addition of booster landings at SLC-40 would not exceed amounts able to be handled. The Proposed Action is partially within Solid Waste Management Unit CO46. However, Site CO46 has polychlorinated biphenyl concentrations that are less than industrial soil cleanup target level but greater than the residential soil cleanup target level, thus the site can be reused under the existing land use controls. Contractors would follow all applicable requirements for work within CO46 to ensure there are no adverse effects due to past soil contamination.
- **Natural Resources and Energy Supply:** The existing utilities and water supply at KSC and CCSFS are adequate to support Falcon launch operations. The increased number of launches and addition of booster landings at SLC-40 is not expected to increase demand or use of natural resources and energy supply beyond available supplies. Therefore, the Proposed Action would not result in significant impacts on natural resources and energy supply.

3.2 Air Quality

3.2.1 Definition of Resource and Regulatory Setting

Air quality in a given location is defined by the concentration of various pollutants in the atmosphere. Many factors influence the air quality of a region, including the type and amounts of pollutants emitted into the atmosphere, the size and topography of the affected air basin, and the prevailing meteorological conditions. Most air pollutants originate from human-made sources, including mobile sources (e.g., cars, trucks, aircraft) and stationary sources (e.g., factories, refineries, power plants), as well as indoor sources (e.g., cleaning solvents and some building materials). Air pollutants are also released from natural sources such as volcanic eruptions and wildfires.

The U.S. Environmental Protection Agency (USEPA) established the National Ambient Air Quality Standards (NAAQS) to regulate the following criteria pollutants: ozone, carbon monoxide, nitrogen

dioxide, sulfur dioxide, particulate matter less than or equal to 10 microns in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and lead. The Clean Air Act establishes air quality regulations and the NAAQS and delegates the enforcement of these standards to the states. The FDEP regulates sources of air quality in Florida. The FDEP enforces the NAAQS by monitoring air quality, developing rules to regulate and to permit stationary sources of air emissions, and contributing to air quality attainment planning processes statewide.

Ozone and some nitrogen dioxide and particulates are formed through atmospheric chemical reactions from other pollutant emissions (called precursors) that are influenced by weather, ultraviolet light, and other atmospheric processes. Ozone is formed in the atmosphere by photochemical reactions of previously emitted nitrogen oxides and photochemically reactive volatile organic compounds.

In addition to criteria pollutants, USEPA also regulates hazardous air pollutants (HAPs). HAPs are emitted from a range of industrial facilities and vehicles. USEPA sets Federal regulations to reduce HAP emissions from stationary sources in the National Emission Standards for Hazardous Air Pollutants (USEPA, 2024a).

3.2.2 Study Area

The project study area for air quality includes Brevard County and the adjacent Atlantic coastline and nearshore waters, as emissions under 3,000 feet associated with LZ construction and Falcon launch and booster recovery operations would be localized. The transport of project emissions beyond this area would disperse to low ambient levels.

3.2.3 Existing Conditions

Brevard County currently is in attainment for all NAAQS (EPA, 2024). Compliance with the NAAQS in the region is due to a lack of substantial emission sources, abundant sunshine, sea breezes, and frequent rain showers that promote atmospheric mixing and limit the buildup of air pollutants in a given location.

CCSFS operates under an FDEP General Permit that covers internal combustion engines and generators. All other air emission units at CCSFS are exempt under the General Permit. Additional details of the existing air quality conditions of the study area are available in Section 3.3 of the 2020 EA (FAA, 2020).

In February 2024, USEPA lowered the $PM_{2.5}$ annual NAAQS from 12 to 9 micrograms per cubic meter, and they estimate that the design value for Brevard County is below this new standard (USEPA, 2024b). Therefore, the project air quality analysis treats $PM_{2.5}$ as an attainment pollutant within the project study area.

3.2.4 Environmental Consequences

3.2.4.1 Proposed Action

Air quality effects from the Proposed Action would occur from construction and operational activities. Construction effects would occur from (1) combustive emissions from fossil-fuel-powered equipment, trucks, and worker commuter vehicles and (2) fugitive dust emissions from operating equipment and vehicles on exposed soils and the handling of soils and aggregates. Operational effects would occur from

the Falcon 9 launch vehicle, the first-stage booster during reentry, vessels and helicopters used for recovery operations, and operation of the SLC-40 facility.

The analysis estimated the magnitude of emissions that would occur from proposed activities. The significance of project emissions was determined by assessing their potential to cause or contribute to an exceedance of a NAAQS. In addition, the analysis compared proposed emissions to applicable insignificance indicators for attainment areas (AFCEC/CZTQ, 2023). Brevard County currently attains all NAAQS, and the insignificance indicator used to evaluate actions in such areas is the USEPA Prevention of Significant Deterioration (PSD) permitting threshold of 250 tons per year of a criteria pollutant besides lead. The insignificance indicator for lead in this area is 25 tons per year. The insignificance indicators do not denote a significant impact; however, they do provide a threshold to identify actions that have insignificant effects to air quality. Any action with net emissions below the insignificance indicators is considered so insignificant that the action would not cause or contribute to an exceedance of any NAAQS. Appendix A, *Air Quality*, includes an air quality and greenhouse gas (GHG) emissions technical report (AQ-GHG technical report) that documents the project emissions estimates.

The analysis limited the evaluation of proposed Falcon 9 launch/recovery and aircraft operations to operations that would occur within the lowest part of the atmosphere, known as the mixing layer, because this is where the release of aircraft emissions would affect ground-level pollutant concentrations. Proposed operational emissions released above the mixing layer would not appreciably affect ground-level air quality. USEPA accepts 3,000 feet above ground level as the nominal height of the atmospheric mixing layer for assessing the contribution of aircraft emissions to ground-level ambient air quality (USEPA, 1992), and the analysis adopted this approach for the estimation of proposed operational emissions.

3.2.4.1.1 Construction

Emissions from the construction of the proposed LZ at SLC-40 were estimated with the use of the DAF Air Conformity Applicability Model (ACAM) (version 5.0.23a) (Solutio Environmental, 2022). Activity data developed for project construction were used as inputs to ACAM. The air quality analysis assumed that construction of the Proposed Action would take approximately four months.

Table 3-1 presents estimates of emissions due to construction of the Proposed Action at SLC-40. These data show that total construction emissions would remain well below the annual insignificance indicators of 250 tons per year of a criteria pollutant (Air Force Civli Engineer Center, Compliance Technical Support Branch, 2023) and, therefore, would have a minor effect on air quality. Thus, project construction activities would not cause or contribute to an exceedance of a NAAQS and would not result in significant air quality impacts.

Table 3-1. Annual Emissions Estimated for Construction of the Proposed Action

Activity	Criteria Pollutant (tons/year)						
	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb
Construction	0.14	1.23	1.48	<0.01	14.38	0.05	<0.01
Insignificance Indicator	**250**	**250**	**250**	**250**	**250**	**250**	**25**
Exceed Indicator?	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Notes: CO = carbon monoxide; NOx = nitrogen oxides; PM_{10} and $PM_{2.5}$ = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SOx = sulfur oxides; VOC = volatile organic compound; <0.01 = value less than 0.01. Pb = lead

Source: Table 6 of Air Quality and Greenhouse Gas Emissions Technical Report (Appendix A, *Air Quality*)

Construction activities would implement best management practices (BMPs) to minimize fugitive dust emissions. Example BMPs include staging construction to minimize exposed areas, watering soil for dust suppression, covering or watering exposed dirt or storage piles, covering truck loads that transport materials that would generate dust, and rinsing truck undercarriages before leaving the construction site.

3.2.4.1.2 Operations

SpaceX proposes to increase Falcon 9 launches at SLC-40 from 50 to 120 times per year. The proposed Falcon 9 static fire, launch, landing, and recovery operations would occur in the same manner as those described in Section 2.1, *Proposed Action*, of this EA. The analysis estimated annual emissions for baseline conditions, which equates to 50 Falcon 9 launches and associated activities, and the Proposed Action. To estimate the incremental increase in emissions from the Proposed Action, the analysis subtracted baseline emissions from those estimated for the Proposed Action. The project AQ-GHG technical report (Appendix A) presents details of operational emission source activity data and resulting air emission calculations for both scenarios.

Table 3-2 presents estimates of annual air emissions that would occur from operations due to the baseline and Proposed Action scenarios. These data show that the net increase in emissions from the Proposed Action would remain well below all insignificance indicators. The launch of a Falcon 9 would reach the top of the mixing layer (3,000 feet) within 23 seconds and would emit a total of about 220 pounds of nitrogen oxides within this portion of the atmosphere. Reentry of the first-stage booster within the mixing layer would emit about 90 pounds of nitrogen oxides. Emissions from helicopters and vessels that take part in recovery activities would occur across several square miles of ocean. These intermittent emissions would occur over a large area and depth of the atmosphere and, therefore, would disperse to low ambient concentrations. As a result, project operational emissions would not cause or contribute to an exceedance of a NAAQS and would not result in significant air quality impacts. This also would be the case in the event that emissions from project operations are cumulatively combined with emissions from project construction.

Table 3-2. Net Increase in Annual Air Emissions for Operation of the Proposed Action

Scenario/Activity – Annual Number of Events	Criteria Pollutant (tons/year)						
	VOC	NO_x	CO	SO_x	PM_{10}	$PM_{2.5}$	Pb
Proposed Action							
Falcon 9 Launches – 120 and CCSFS Landings – 34	0.00	18.68	0.00	0.00	0.00	0.00	0.00
Marine Recovery Operations – 120	7.00	129.69	38.60	3.94	2.78	2.53	0.00
Launch Facility Operations	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Total – Proposed Action	**7.00**	**148.36**	**38.60**	**3.94**	**2.78**	**2.53**	0.00
Annual Total – Baseline (No Action)	**4.21**	**80.06**	**32.20**	**1.86**	**1.53**	**1.41**	0.00
Proposed Action Annual Net Increase[1]	**2.79**	**68.30**	**6.40**	**2.08**	**1.25**	**1.12**	0.00
Insignificance Indicator	**250**	**250**	**250**	**250**	**250**	**250**	**25**
Exceed Indicator?	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Notes: CCSFS = Cape Canaveral Space Force Station; CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} and $PM_{2.5}$ = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO_x = sulfur oxides; VOC = volatile organic compound.
Values of 0.00 are greater than zero but less than 0.005 tons per year.
[1] Equal to Proposed Action minus Baseline emissions.
Source: AQ-GHG technical report page 71 (Appendix A, *Air Quality*).

3.2.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, *No Action Alternative*. In addition, other operations that contribute to air emissions would continue, consistent with the existing conditions. The No Action Alternative, analyzed as the Proposed Action in the 2020 EA, would not result in significant impacts to air quality.

3.3 Climate

3.3.1 Definition of Resource and Regulatory Setting

Climate is defined as the long-term manifestation of weather of an area, as expressed by various measurements of the atmosphere and environment. Climate is caused by physical conditions such as latitude, elevation, topography, and proximity to oceans or bodies of water. However, recent scientific evidence indicates a correlation between the worldwide proliferation of GHG emissions from human activities and increasing global temperatures over the past century. Future climate change due to this global warming is predicted to produce negative environmental, economic, and social consequences across the globe (Marvel et al., 2023; Intergovernmental Panel on Climate Change, 2022).

GHGs are air pollutants that trap heat in the atmosphere. These emissions occur from natural processes and human activities. The natural balance of GHGs in the atmosphere regulates Earth's temperature. Examples of GHGs from human activities include carbon dioxide, methane, nitrous oxide, and fluorinated gases. Each GHG has a global warming potential, which is its ability to trap heat in the atmosphere. To account for global warming potentials, GHG emissions are reported as a carbon dioxide equivalent (CO_2e). CO_2e emissions are commonly expressed in units of metric tons.

3.3.2 Study Area

The project study area for climate includes CCSFS and the adjacent Atlantic coastline and nearshore waters. The potential effects of proposed GHG emissions are by nature global effects, as worldwide sources of GHGs contribute to climate change. These global effects would be manifested as effects to resources and ecosystems in the study area.

3.3.3 Existing Conditions

The climate of the study area is classified as subtropical, which is characterized by hot and humid summers with substantial amounts of rainfall and thunderstorms and mild, relatively dry winters. Occasional hurricanes do affect the area with potentially damaging storm surges and winds. Hurricane season extends from June through November. Additional details of the existing climate of the study area are available in Section 3.4 of the 2020 EA.

Regarding climate change, observed changes across the globe include rising temperatures, shrinking glaciers and sea ice, thawing permafrost, sea level rise, a lengthened growing season, increases in droughts and severe weather, and shifts in plant and animal ranges. The latest National Climate Assessment documents the following recent changes in climate in the study area: (1) the annual average temperature has risen about 2 degrees Fahrenheit (°F) and annual precipitation has decreased about 3 percent (for the 2002–2021 average, compared to the average for 1901–1960), and (2) hurricanes have intensified more rapidly since the 1980s and caused heavier rainfall and higher storm surges (Marvel et al., 2023). In addition, sea levels along the eastern Florida coast have risen about 4 to 6 inches from 1993 to 2020, including 6 inches at the Trident Pier in Port Canaveral (Sweet et al., 2022).

3.3.4 Environmental Consequences

3.3.4.1 Proposed Action

The analysis estimated annual GHG emissions from activities associated with the Proposed Action and baseline scenarios with the same methods described above in Section 3.2.4, *Air Quality, Environmental Consequences*. In addition, the analysis included GHG emissions that would occur from electricity used onsite but generated from offsite generation sources, in addition to GHG emissions from water and sewer usages. This approach is consistent with the analysis approach recommended in FAA Desk Reference Order 1050.1F (FAA, 2023a). Appendix A, *Air Quality*, includes an AQ-GHG technical report that details the construction and operational emission sources and resulting GHG emission calculations for both scenarios.

Regarding effects from proposed GHG emissions, the analysis used the PSD threshold for GHGs of 75,000 tons per year of CO_2e (or 68,039 metric tons per year) as an indicator or threshold of insignificance for NEPA air quality effects, as a source this large would trigger major source PSD permitting requirements for GHGs assuming the source first triggered PSD permitting for another regulated pollutant. Actions with a net change in GHG (CO_2e) emissions below the insignificance indicator (threshold) are considered too insignificant on a global scale to warrant any further analysis (AFCEC/CZTQ, 2023).

Unlike criteria pollutants, effects of GHG emissions are not limited to sources that occur in the atmospheric mixing layer or within 3,000 feet above ground level. For Falcon 9 launch and landing operations, the analysis estimated GHG emissions from these activities that would occur up to 100,000 feet mean sea level (MSL).

An emerging area of research focuses on the potential effects of rocket launches on ozone levels and emissions in the upper atmosphere. The scientific literature on this topic is limited, and the underlying science is either poorly understood or, in some cases, not yet studied (World Meteorological Organization, 2022). Much of the body of literature concerning potential environmental effects of rockets relates to solid rocket motors, which Falcon 9 does not use. The limited studies of emissions from rocket engines using liquid propellent reveal that while they do result in some stratospheric ozone loss, the effect is significantly smaller compared to that caused by solid rocket motors (Dallas et al., 2020). The World Meteorological Organization's 2022 Scientific Assessment of Ozone Depletion identified that rocket launches currently have a small effect on total stratospheric ozone, amounting to less than 0.1% (World Meteorological Organization, 2022). Emissions from the Proposed Action would represent only a small fraction of global launch emissions, resulting in an effect much less than this 0.1%. Thus, the Proposed Action is not expected to result in significant impacts to climate due to ozone depletion or upper atmosphere emissions.

Table 3-3 presents estimates of annual GHG emissions that would occur from construction and operation of the Proposed Action and the baseline scenarios. These data show that the net increase in GHG emissions from the Proposed Action would remain well below the GHG insignificance indicator. The Proposed Action GHG emissions would incrementally contribute to future climate change, some effects of which are identified in Section 3.3.3, *Existing Conditions*.

Table 3-3. Net Increase in Annual GHG Emissions for Construction and Operation under the Proposed Action

Scenario/Activity – Annual Number of Events	CO_2e (mt)
Proposed Action	
Construction	219
Falcon 9 Launches – 120 and CCSFS Landings – 34	47,528
Marine Recovery Operations – 120	9,432
Launch Facility Operations	14,794
Annual Total – Proposed Action Operations	**71,754**
Annual Total – Baseline Operations (No Action)	**32,071**
Proposed Action Operations Annual Net Increase[1]	**39,683**
Insignificance Indicator	**68,039**
Exceed Indicator?	**No**

Notes: CO_2e (mt) = carbon dioxide equivalent in metric tons; GHG = greenhouse gas.
[1] Equal to Proposed Action Operations minus Baseline Operations emissions.
Source: Tables 9 and 10 in Appendix A, *Air Quality*

Climate change could impact implementation of the Proposed Action at CCSFS and the adaptation strategies needed to respond to future conditions. For the study area and the location of CCSFS, predictions of future climate change include the following: (1) an increase in annual mean temperature of 2 to 6°F, based on low to high emission scenarios; (2) 20 to 30 additional extreme heat days (maximum

temperature at or above 95°F) in 2050, relative to 1991 to 2020, under a high emissions scenario (SSP3-7.0); (3) a marginal increase in annual precipitation, based on the range of global warming levels; (4) more North Atlantic hurricanes will undergo rapid intensification and will strengthen to at least Category 4 intensity; (5) an increase in extreme precipitation events (e.g., precipitation of 3 inches or more in 24 hours); and (6) an average sea level rise of 1 to 2 feet (low to high emission scenarios) by 2050 (relative to 2000) and 2.2 to 7.3 feet in 2100 (relative to 2000) under the same scenarios (Marvel et al., 2023). CCSFS is adapting its infrastructure to thechanging climate by constructing flood and storm resilient facilities, for example. However, exacerbation of these conditions in the future could impede proposed activities during extreme events. Implementation of these adaptation measures would mitigate the effects of climate change on the Proposed Action.

In sum, the Proposed Action would not result in significant impact to climate change. A more in-depth evaluation of climate impacts on the Proposed Action (and vice versa) is presented in Appendix A, *Air Quality*.

3.3.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, No Action Alternative. The No Action Alternative, analyzed as the Proposed Action in the 2020 EA, would not result in significant impacts to climate change. Climate change would continue to impact the project region as discussed in Section 3.3.3, *Existing Conditions*.

3.4 Noise and Noise-Compatible Land Use

3.4.1 Definition of Resource and Regulatory Setting

Noise is defined as unwanted sound that interferes with or disrupts normal human activities. A person's response to a noise event depends on several factors including the characteristics of the noise, perceived importance of the activity generating the noise, its appropriateness in the setting, time of day, type of activity being conducted when the noise occurs, and the sensitivity of the individual. The same noise can have a different set of effects on different people or on a single individual at different times. Characteristics of noise that affect how it is perceived include its intensity, frequency content, and duration. Multiple noise metrics (i.e., units of measure) have been developed to best describe different types of noise and to support the prediction of specific types of noise effects. Descriptions of the methodology and metrics used to assess noise effects in this EA and a more detailed discussion of noise concepts are provided in Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*, and in Section 3.5 of the 2020 EA, which is hereby incorporated by reference. Block 5 is the iteration of Falcon 9 that is currently in use.

Noise-compatible land use means the use of the land is normally consistent with the outdoor noise environment at the location. DOT regulations at 14 CFR §150.7 establish that noise-sensitive land uses, such as residential areas, are generally not compatible with noise levels greater than 65 A-weighted decibels (dBA) day-night average sound level (DNL). For impulsive noises (e.g., banging sounds such as sonic booms), 65 decibels (dB) C-weighted DNL is the threshold level above which not all land uses are considered compatible (FAA, 2020) and (Galloway, 1981). Land use noise compatibility analysis considers

the effects of noise on special management areas, such as national parks, national wildlife refuges, and other sensitive noise receptors, where a quiet setting is a generally recognized purpose and attribute.

FAA Order 1050.1F also states that while the basic elements of the FAA noise assessment for NEPA including the standard DNL 65 dB significance threshold applies, it also recommends that supplemental noise metrics be used to characterize specific effects, such as activity interference. Noise levels exceeding background levels are more likely to be noticed. Noise levels exceeding the 90 dB maximum A-weighted sound level (LA_{max}) have a high likelihood of interfering with activities. Rocket launches during the late night have some potential to awaken people who are sleeping. Prediction of awakening is affected by several factors including familiarity with the noise source and the sensitivity of the individual. A quantitative method for estimation of awakenings has been published by the Acoustical Society of America (ASA) in 2008 (ANSI/ASA, 2008) but has since been rescinded, in part because it is generally viewed as overpredicting effects (ANSI/ASA, 2018). The American National Standards Institute (ANSI)/ASA method is used as a point of reference in this EA because no replacement method has been developed to date. According to the highly conservative method published by ANSI/ASA, less than 4 percent of people sleeping indoors are expected to be awakened by exterior noise levels of up to 100 dBA sound exposure level (SEL). The SEL represents both the magnitude of a sound and its duration by stating total noise energy of an event as if the event occurred within a single second. Additionally, sleep disturbance may be possible if launches occur at night.

Hearing conservation regulations such as the Occupational Safety and Health Administration (OSHA) regulations published at 29 CFR §1910.95 are applicable to workplace environments but are also referenced in this EA as a conservative threshold for hearing conservation in non-workplace settings. The OSHA regulations established 115 dBA as the upper noise level limit in a workplace environment. OSHA regulations also state that exposure to impulsive noise (e.g., banging sounds such as sonic booms) should not exceed 140 dB peak sound pressure level. A peak sound pressure level of 140 dB is approximately equivalent to 4 pounds per square foot (psf). The OSHA regulations are designed to protect workers exposed to the noise levels each workday over a 40-year career, and they reference allowable noise levels without protective equipment. Therefore, they provide a conservative hearing conservation impact threshold when applied to people who experience rocket noise on an irregular basis and who are indoors and, thus, exposed to substantially lower noise levels during some of the rocket operations.

Structural damage is possible at high noise levels or intense sonic boom overpressures, and SpaceX is responsible for resolving any structural damage caused by its rockets. A NASA technical memo estimated that one damage claim in 1,000 households exposed is expected at an average continuous unweighted sound level of 111 dB (Guest & Slone, 1972). Because the study considered the effects of steady noise generated by a static fire test, this relationship is a highly conservative estimate of the effects of launch noise, which remains at maximum level for only a few seconds. It is also worth noting that the study considered damage claims rather than proven instances of structural damage caused by noise. A less overly conservative threshold decibel value for structural damage is provided in the Committee on Hearing, Bioacoustics and Biomechanics *Guidelines for Preparing Environmental Impact Statements on Noise*, which states: "While certain frequencies (such as 30 Hz [hertz] for window breakage) might be of more concern than other frequencies, one may conservatively consider all sound lasting more than 1 second above a sound pressure level of 130 dB (1 Hz to 1000 Hz) as potentially damaging to structures" (CHABA, 1977). The level of risk to structures was discussed in Appendix A of the 2020 EA, which is hereby incorporated by reference. As described in Appendix A of the 2020 EA and in Appendix B, *Technical*

Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40, at sonic boom overpressures below 1 psf, no damage to structures is expected. At peak overpressure levels between 2 to 4 psf, there is a low probability of structure damage (to glass, plaster, roofs, and ceilings) for well-maintained structures, and this probability increases for levels between 4 to 10 psf (Hershey & Higgins, 1976; Haber & Nakaki, 1989). The level of risk is higher for structures that are very old or not well maintained.

3.4.2 Study Area

The study area for the current analysis is the same as the study area considered in the 2020 EA. It includes the area within 55 miles of KSC and CCSFS, which has experienced sonic booms generated by previous booster landings (DAF, 2017) as well as Space Shuttle landings at KSC between 1977 and 2011. It also includes the recovery area, which is located 5 to 140 nautical miles off the Atlantic coast, where most reentry sonic booms and some landings occur.

As described in the 2020 EA, CCSFS SLCs are several miles from the closest communities. The city of Cape Canaveral is 10.5 miles to the south, while Titusville and other urban areas are located farther away on the western shore of the Indian River or on Merritt Island. The closest residences are in a low-density housing area 8.5 miles southwest of SLC-40.

3.4.3 Existing Conditions

Existing conditions in the study area, which include rocket operations noise and background noise levels, are approximately the same as described in Section 3.5 of the 2020 EA. Descriptions of background sound levels in the 2020 EA are based on sound levels typically associated with various land uses and population densities. Land use patterns and associated human activities have not changed substantively since publication of the 2020 EA. As described in the 2020 EA, rural or remote portions of the study area can be expected to have DNLs less than 49 dB, while urbanized commercial or industrial areas may have DNLs as high as 59 dBA. During the daytime, rural or remote areas within the study area could experience equivalent sound levels below 48 dBA, while noise levels at night are likely less than 42 dBA. In urbanized commercial or industrial areas, daytime equivalent levels are typically 60 dBA, and nighttime levels are typically 54 dBA (ANSI/ASA, 2013).

Noise levels generated by individual Falcon 9 launches and landings also have not changed since the publication of the 2020 EA. However, in the years since publication of the 2020 EA, SpaceX has conducted additional measurements of rocket operations noise levels, which revealed that the noise model used in the 2020 EA had overpredicted A-weighted SEL values. The noise levels detailed in Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*, reflect updated modeling of individual static fire tests, launches, and landings. The noise modeling methodology and results have been submitted to the FAA Office of Environment and Energy for review and approval.

Activity Interference. When rocket operations noise levels exceed background levels, they are likely to be noticed. As described in the 2020 EA, rocket operations are sometimes noticeable as far away as Orlando. Rocket operation noise levels that exceed 90 dB LA_{max}, and which have a high likelihood of being disruptive, remain within the boundaries of KSC/CCSFS, as shown in Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*.

Falcon 9 launches from SLC-40 generate noise levels between 90 and 100 dBA SEL, which could awaken up to 4 percent of people, in parts of the cities of Titusville, Port St. John, Sharpes, Merritt, Cape Canaveral, and Cocoa Beach (see Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*, Figure 2). Landings of a booster at LZ-1 and/or LZ-2 currently generate noise levels that exceed 90 dBA SEL in portions of the cities of Cape Canaveral and Cocoa Beach (see 2020 EA Appendix A, Technical Note 18093, Figure 19).

Noise-Compatible Land Use. The frequency of rocket launches from KSC and CCSFS has increased steadily in recent years, with 66 total launches across both locations in 2023, resulting in increases in time-averaged noise levels. Of the launches that occurred in 2023, 62 were Falcon 9, two were Falcon Heavy, and two were other rocket types with less thrust than a Falcon 9 rocket (FAA, 2023b). The 2020 EA analyzed noise effects associated with an operational scenario that included 10 Falcon 9 and 10 Falcon Heavy launches from LC-39A as well as 50 Falcon 9 launches per year from SLC-40 at CCSFS. It also included Falcon 9 static fire tests at LC-39A and SLC-40, Falcon Heavy static fire tests at LC-39A associated with each launch, and booster landings at LZ-1 and LZ-2. Under this operational scenario, the DNL was found to be less than 65 dB at all land areas outside the boundaries of KSC/CCSFS and offshore areas.

Hearing Conservation. Falcon 9 maximum noise levels exceed 115 dB LA_{max} (a conservative threshold for hearing conservation) only within approximately 1.5 miles of SLC-40 (see Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*, Figures 1, 4, and 7). The area affected by this noise level is within KSC/CCSFS and nearby offshore areas in which access is tightly restricted during launch and landing operations. Any people outdoors in the affected area during launch and landing operations are participants in the rocket operations and are equipped with protective equipment as required by regulations.

As described in Section 4.5.1.2 and Figure 4-3 of the 2020 EA, most of the surface area affected by sonic booms generated by ongoing operations outside of KSC/CCSFS experience overpressures of 0.25 to 0.5 psf, which is similar to distant thunder. Launches toward the south (i.e., polar trajectories) generate sonic booms that affect land areas near Vero Beach, Florida. The intensities of sonic booms experienced near Vero Beach are less than 4 psf, and the risk of damage to hearing associated with sonic booms is minimal (Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*).

Structural Damage Potential. Engine noise generated during rocket operations generates unweighted maximum noise levels exceeding 111 dB maximum sound level (L_{max}) only within approximately 7 miles of SLC-40—an area entirely within the boundaries of KSC/CCSFS or offshore. Noise levels exceeding 111 dB L_{max}, which have been associated with a 1 in 1,000 chance of a structural damage claim, occur only on KSC/CCSFS property or offshore, and the level of risk to structures outside of KSC/CCSFS is low.

Most sonic booms generated by launches affect areas offshore. As described in the 2020 EA and summarized above, only very small areas are exposed to booms exceeding 4 psf for polar launches. Sonic booms generated during landings typically are 1 psf or lower and occur in areas adjacent to KSC/CCSFS.

3.4.4 Environmental Consequences

3.4.4.1 Proposed Action

Potential noise effects could occur from the proposed construction or the increased number of static fire tests, launches, and landings at SLC-40. Significant noise effects would occur if the Proposed Action would increase noise by 1.5 dBA DNL or more for a noise-sensitive area that is exposed to noise at or above the 65 dBA DNL, or that will be exposed at or above the 65 dBA DNL due to a 1.5 dBA DNL or greater increase, when compared to the No Action Alternative for the same timeframe. The FAA considers an increase or decrease of 3 dBA DNL in areas between 60 and 64.99 dBA DNL and 5 dBA DNL in areas between 45 and 59.99 dBA DNL to be reportable. Noise effects would also be considered significant if supplemental metrics indicate a dramatic increase in activity interference, an exceedance of hearing conservation criteria, or a substantial risk of widespread structural damage.

3.4.4.1.1 Noise-Generating Activities

This section describes noise levels associated with proposed noise-generating activities (i.e., construction, static fire tests, launches, and landings).

Construction. Noise generated by heavy equipment during construction would be temporary and localized to the vicinity of the construction site. Workers would wear hearing protection, as required, in accordance with applicable regulations. Because there are no noise-sensitive locations in the immediate vicinity of proposed construction activities, noise effects associated with construction activities would be minimal and are not discussed further in this section.

Static Fire Test. Individual Falcon 9 static fire engine test noise levels would not change relative to the static fire events being conducted currently. These noise levels are described briefly in Section 3.4.3, *Existing Conditions*, and in greater detail in Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*. In the 2020 EA, 50 Falcon 9 static fire events were analyzed at SLC-40, whereas no more than 40 static fire events per year would be conducted at SLC-40 under the Proposed Action.

Launch. Launch noise levels would be the same as individual Falcon 9 launch events, but the number of launches per year would increase from 50 to 120. SpaceX is not proposing to increase the number of polar trajectory launches relative to the five launches per year that were previously analyzed in the 2020 EA. Individual launch noise levels are detailed in Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*. Sonic booms generated during launches would also be the same as sonic booms generated by individual launches currently but would occur more frequently commensurate with the increase in launches per year.

Landing. The noise levels generated by individual booster landing events at the proposed SLC-40 LZ would be similar to noise levels that are currently generated by Falcon 9 booster landings at LZ-1 and LZ-2, but they would occur at a different location. SLC-40 is located 10.5 miles from the nearest urbanized area (the city of Cape Canaveral), while LZ-1 and LZ-2 are located 6 miles from the city. SLC-40 and LZ-1 and LZ-2 are both located approximately 8 miles from the closest residences located in the unincorporated community of Courtenay. Landing noise levels, which are detailed in Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*, would occur during each of the 34 landings per year at SLC-40.

Sonic booms generated during landings at SLC-40 would not be expected to result in damage to structures outside the boundaries of KSC/CCSFS (**Figure 3-1**).

Falcon 9 landings on a drone ship in the Atlantic Ocean would generate engine noise and sonic booms similar to those described for landings at the SLC-40 LZ and which are the same as ocean landings ongoing currently.

SpaceX also proposes to land first-stage boosters in territorial waters of The Bahamas, such as in the Exuma Sound. As noted previously, landings in Bahamian territorial waters are subject to an environmental review and approval by the Bahamian Department of Environmental Protection and Planning. Sonic booms during landing in Bahamian territorial waters would be similar to those described for landings in the Atlantic Ocean and at the SLC-40 LZ. Both engine noise and sonic booms may be audible by the general public in The Bahamas. The peak overpressure level of the sonic boom during landing from the new azimuth is expected to occur over a small area in the open ocean. The overpressure level would attenuate quickly and most of the Bahamas would experience levels near or less than 1 psf. Within the Exuma Cays Land and Sea Park, overpressures between 1 and 2 psf are expected.

3.4.4.1.2 Potential Noise Effects

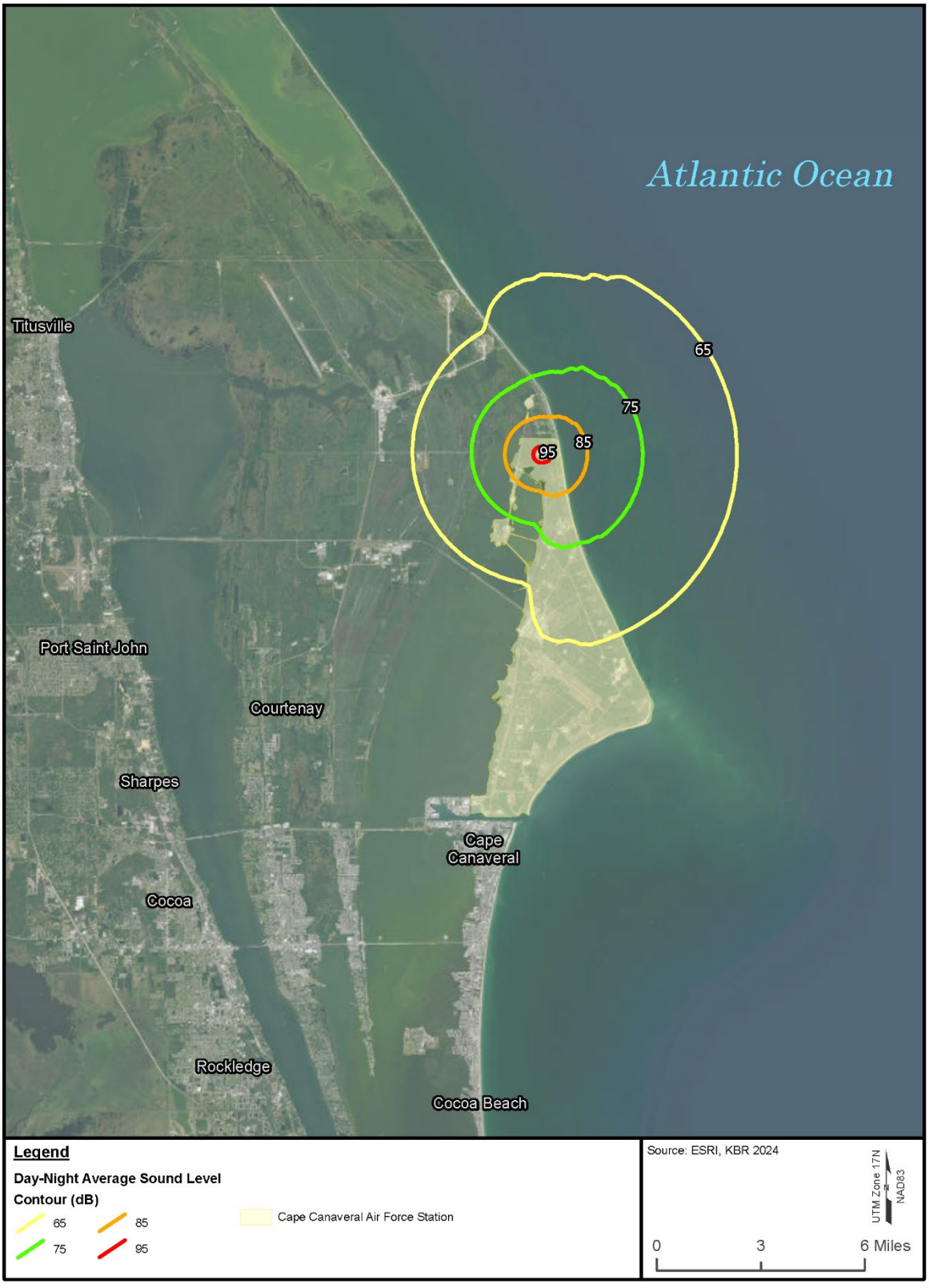
This section discusses noise effects associated with the noise-generating activities. Effect categories considered include activity interference, noise-compatible land use, hearing conservation, and structural damage potential. Sonic booms generated during most launches would intersect the surface in the Atlantic Ocean and would not affect land use compatibility. As noted in Section 2.1.1.3, *Trajectories and Downrange Landing*, SpaceX is not proposing to increase the number of annual polar launches from those previously analyzed in the 2020 EA. Because there would be no changes to polar trajectory launches previously analyzed, there would be no additional noise effects.

Activity Interference. Maximum A-weighted noise levels during individual launch and static fire operations would be the same as Falcon 9 launches occurring currently, and the potential for activity interference associated with individual launch and static fire test events would not change. Rocket noise events would continue to be brief, and interruptions would continue to be short-lived. The frequency of rocket operations at SLC-40 would increase from 50 per year (one per week on average) to 120 per year (about every 3 days on average) under the Proposed Action.

Consistent with current operations, launch operations would occur at any time of day or night, and it is possible that all launch operations could occur during the late-night period between 10:00 p.m. and 7:00 a.m. Noise levels during Falcon 9 launches from SLC-40 would continue to exceed 90 dB SEL in several communities adjacent to KSC/CCSFS. Based on highly conservative noise modeling referenced above, a small fraction of people (up to 4 percent) could be awakened by launch noise levels of up to 100 dB SEL (See Page 3-11, Section 3.4.1). .

As detailed in Appendix B, *Technical Memorandum – Noise Modeling Updates for Falcon 9 Block 5 Flight and Test Operations at SLC-40*, noise levels exceeding 90 dB LAmax generated during booster landings at the SLC-40 LZ would not extend beyond the boundaries of KSC/CCSFS. During these events, noise levels in nearby communities would generally be as loud as or less loud than booster landings at LZ-1 and LZ-2 due to distances to sensitive locations being equal to or greater. Booster landings would exceed the 90 dB A-weighted SEL (a level associated with a non-negligible probability of awakening) only in a small portion of the city of Cape Canaveral.

Noise-Compatible Land Use. As shown in **Figure 3-1**, time-averaged noise levels reflecting subsonic operations noise associated with proposed launches, static fire tests, and booster landings would remain below 65 dBA DNL in all land areas outside of KSC/CCSFS boundaries under the Proposed Action. MINWR and CNS, which surround CCSFS, have experienced rocket noise regularly, and parts of these properties provide viewing areas for people to watch launches. A quiet setting is not considered to be a generally recognized purpose and attribute of these properties. All land uses would remain compatible with engine noise under the Proposed Action.



1 Figure 3-1. DNL for Falcon 9 Launches, Static Fire Tests, and Booster Landings at SLC-40 under the
2 Proposed Action

Operations at LC-39A, which include Falcon Heavy operations, were analyzed in the 2020 EA, as discussed in Section 3.4.3, *Existing Conditions*. The combined DNL generated by operations at SLC-40 with DNL generated at SLC-39A would also not exceed 65 dB DNL at locations outside KSC/CCSFS.

Sonic booms generated during most launches would intersect the surface in the Atlantic Ocean and would not affect land use compatibility. SpaceX is not proposing to increase the number of polar trajectory launches per year, and the number, intensity, and location of sonic booms on land generated by polar trajectory launches would not change relative to those analyzed in the 2020 EA. Sonic booms associated with landings in Bahamian territorial waters would not be expected to result in structural damage in populated areas of The Bahamas, as the peak overpressures occur over the ocean **(Figure 3-2**)

Sonic booms associated with landings at the proposed SLC-40 LZ would not be expected to result in damage to structures outside of KSC/CCSFS (**Figure 3-3**). Cumulative sonic boom noise levels associated with all operations at SLC-40 would remain well below land use compatibility thresholds. Given that the sonic boom contours are expected to generally stay within the bounds of KSC and CCSFS, CDNLs were calculated for the 0.5, 1, and 2 psf overpressure contours assuming all 34 sonic booms occurred at night with a 10 dB penalty. The 0.5 psf overpressure events equate to a CDNL of 45.9 dBC, the 1 psf overpressure events equate to a CDNL of 51.9 dBC, and the 2 psf event equates to a CDNL of 57.9 dBC. These are all below the FAA's significance threshold of CDNL 60 dBC for impulsive noise sources (equivalent to DNL 65 dBA). The potential for hearing damage (with regards to humans) is negligible, as the modeled sonic boom overpressure levels on populated areas off of KSC and CCSFS are lower than the approximate 4 psf impulsive hearing conservation noise criteria.

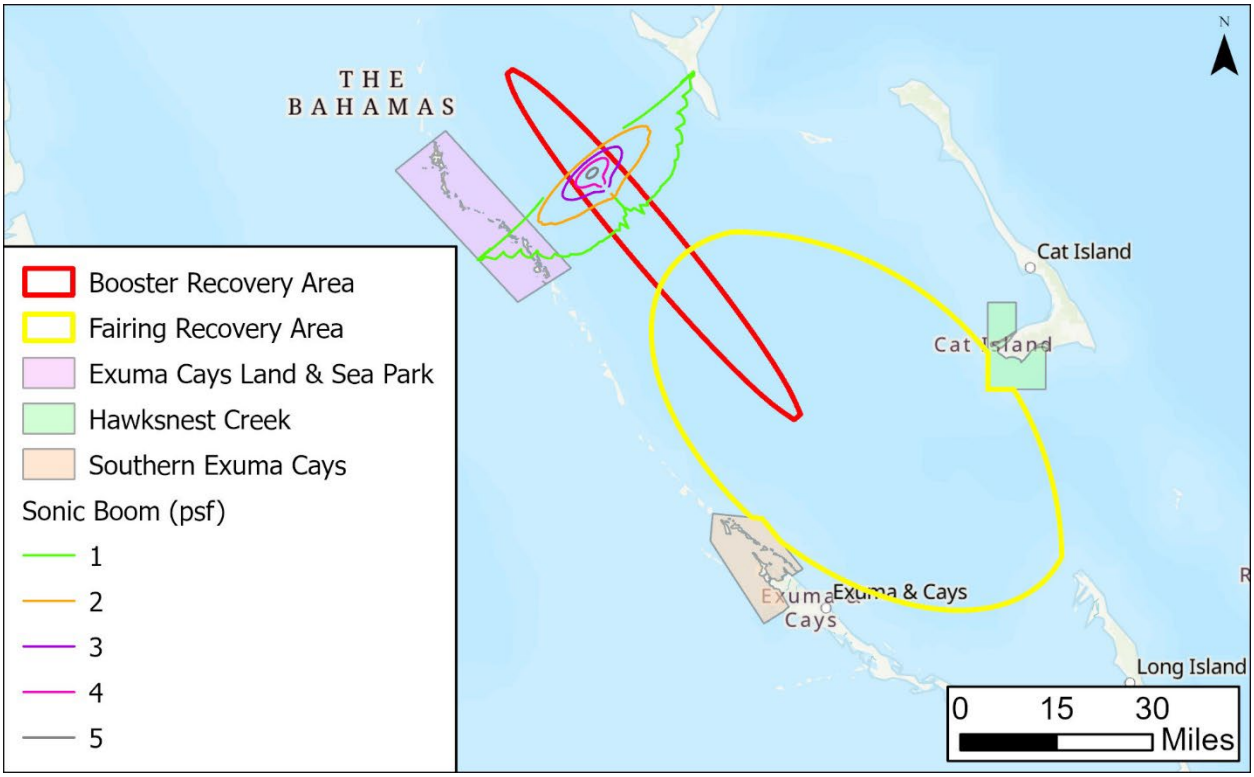


Figure 3-2. Sonic Boom Overpressures Associated with Booster Landings at the Exuma Sound for Example Trajectory

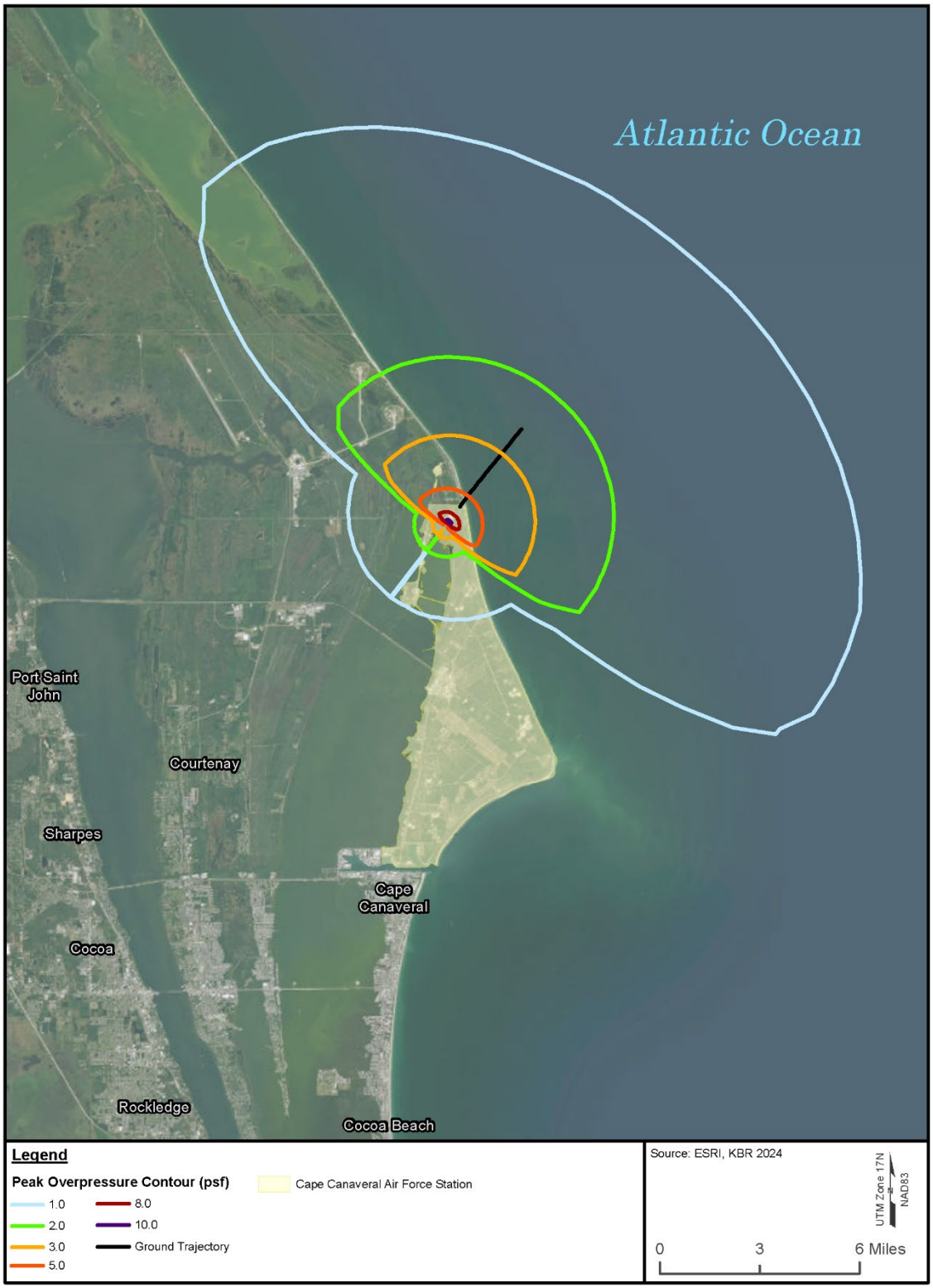


Figure 3-3. Sonic Boom Overpressures Associated with Booster Landings at the Proposed SLC-40 Landing Zone for Example Trajectory

Hearing Conservation. Maximum A-weighted noise levels would remain below 115 dBA in all areas in which people not properly equipped with protective equipment would be located during rocket operations (see Section 3.4.3, *Existing Conditions*). Peak overpressure levels during individual launch, landing, or static fire operations would not exceed levels considered in the 2020 EA (i.e., remaining below 4 psf in all locations except 0.01 square miles during polar trajectory launches). Therefore, hearing loss risk would remain negligible under the Proposed Action.

Structural Damage Potential. Unweighted maximum noise levels during individual launch, landing, or static fire operations would continue to not exceed 111 dB at locations outside the boundaries of KSC/CCSFS, resulting in minimal risk of structural damage. Sonic booms occurring outside of KSC/CCSFS would not exceed overpressures analyzed in the 2020 EA (i.e., remaining below 4 psf in all locations except 0.01 square miles during polar trajectory launches), including booster landings at SLC-40. Therefore, engine noise and sonic booms associated with individual launches would continue to result in negligible risk of structural damage under the Proposed Action.

Impact Overview. Because overall the launches do not exceed hearing conservation criteria, the fact that launches are increasing up to every three days does not present a significant impact. Time-averaged engine noise and sonic boom noise levels would not exceed land use compatibility thresholds in land areas outside of KSC/CCSFS. The proposed operational changes would not exceed hearing conservation criteria for people lacking appropriate hearing protection. The risk of structural damage would remain minimal. Therefore, noise impacts associated with the Proposed Action are not considered to be significant.

3.4.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, *No Action Alternative*. Noise levels would be as analyzed in the 2020 EA with the exception that sonic booms and subsonic operations noise generated by landings at CCSFS LZ-1 and LZ-2 would not occur. Because the number of loud events would decrease slightly at SLC-40, noise effects would be beneficial under the No Action Alternative. However, launches in the area would continue to occur and contribute to the overall noise environment.

3.5 Cultural Resources

Cultural resources consist of prehistoric and historic sites, structures, artifacts, and any other physical or traditional evidence of human activity considered relevant to a particular culture or community for scientific, traditional, religious, or other reasons. Cultural resources include archaeological resources, historic architectural resources, and American Indian sacred sites and traditional cultural properties.

3.5.1 Definition of Resource and Regulatory Setting

The NHPA is the Nation's primary historic preservation law, which defines the legal responsibilities of Federal agencies for the identification, management, and stewardship of historic properties. Section 106 of the NHPA requires Federal agencies to consider the effects of their undertakings on historic properties. Through consultation with interested parties, the Federal agency identifies historic properties potentially affected by the undertaking, assesses effects, and seeks ways to avoid, minimize, or mitigate any adverse effects on historic properties. The Area of Potential Effects (APE) for cultural resources is the geographic area or areas within which an undertaking (project, activity, program, or practice) may cause changes in

the character or use of any historic properties present. The APE is influenced by the scale and nature of the undertaking and may be different for various kinds of effects caused by the undertaking. More information about cultural resources can be found in Chapter 8 of the FAA Order 1050.1F Desk Reference (FAA, 2023a).

As defined under the NHPA at 36 CFR §800.16(l)(1), "Historic Property means any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization and that meet the National Register criteria." A traditional cultural property, as defined by National Register Bulletin 38, "is eligible for listing in the National Register because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker & King, 1990).

This section describes known historic properties within the affected areas that are potentially eligible for listing on the NRHP and evaluates whether elements of the Proposed Action would potentially affect these resources. The DAF engaged the appropriate State Historic Preservation Officers (SHPOs) and Native American Tribes with potential interest in the Proposed Action in accordance with Section 106 of the NHPA (54 U.S.C. §306108). The FAA engaged in government-to-government consultation to Native American Tribes with potential interest in the Proposed Action.

3.5.2 Study Area

The study area for cultural resources evaluated under this assessment is the equivalent of the APE and includes SLC-40 at CCSFS and the surrounding construction expansion as depicted in **Figure 2-5**. The noise and sonic APE environment is described in the 2020 EA (FAA, 2020). As a conservative approach and to account for variability in weather conditions that may influence sound propagation, the FAA has defined the APE as a 7-mile radius centered at SLC-40 (**Figure 3-3**). This area encompasses the 2-psf sonic boom contour.

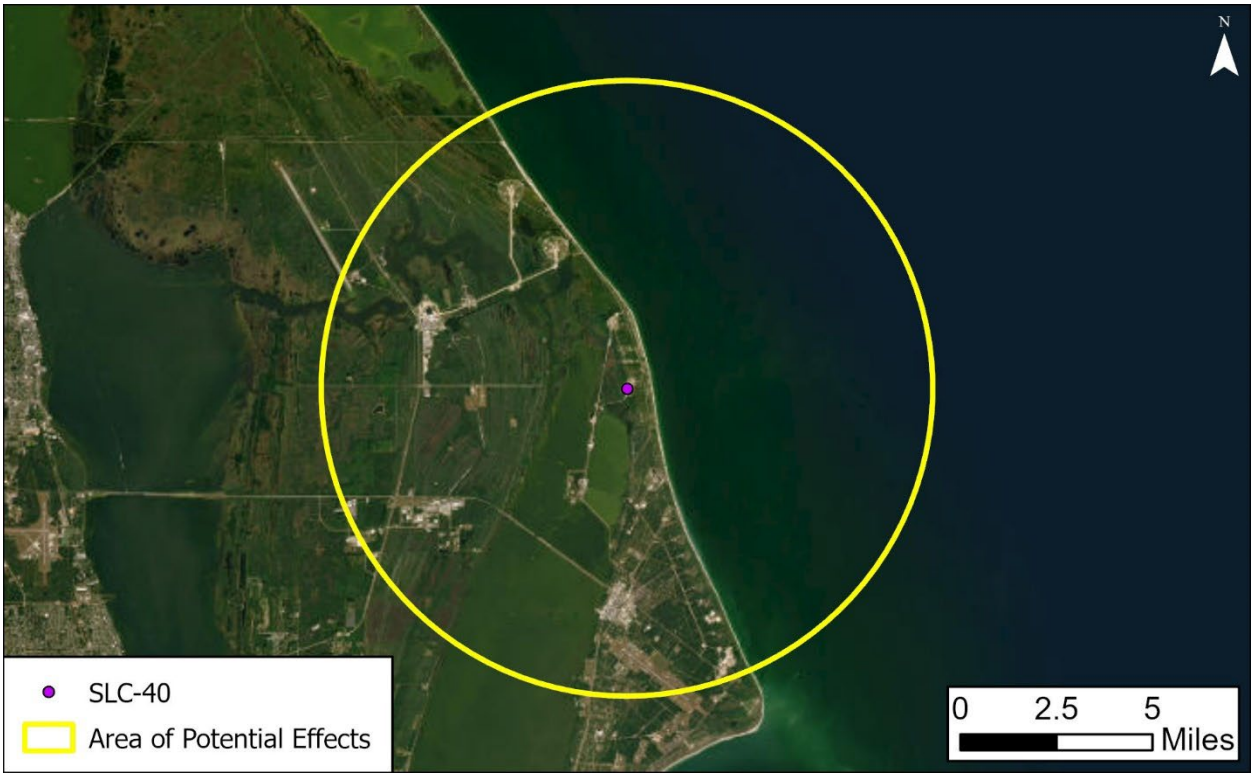


Figure 3-4. Area of Potential Effects

3.5.3 Existing Conditions

The first human occupation of Florida (i.e., the Paleoindian period) dates to approximately 12,000 to 8,000 years before common era (BCE) (DAF, 2023b). There is archaeological evidence that the entire area was exploited for a wide variety of marine, estuarine, and terrestrial resources. European contact with the native population first occurred in the early 1500s with the first description of the area coming from Spanish explorer Ponce de León who landed at "Cabo de Canaveral" (i.e., "Cape of the Cane Break") in 1513. The area remained sparsely populated until 1843 when a lighthouse was constructed at the cape and the first wave of settlers arrived in the area. Maritime activities increased during the early 1900s, and additional homesteads and roads were established. The U.S. Government began purchasing land for the establishment of a long-range proving ground and missile test center in the late 1940s (DAF, 2023b).

A complete review of environmental and regulatory actions regarding SpaceX can be found in Section 3.6 of the 2020 EA (FAA, 2020). In addition, all NRHP properties in the sonic boom APE for a Falcon 9 polar launch are presented in the 2020 EA, and no additional properties within the APE have been listed on the NRHP since 2020 (DAF, 2023b).

One hundred and sixty-three archaeological sites have been identified at CCSFS, of which 113 sites are ineligible and 50 of which have been either determined eligible for listing in the NRHP or are unevaluated. Sites include middens, burial mounds, both prehistoric and historic artifact scatters, homesteads, historic crash sites, historic roads, and a settler's cemetery associated with one mound (DAF, 2023b). There are eight cemeteries/grave sites on CCSFS; these are protected under Florida cemetery statutes (2021 Florida Statutes, Chapter 497) and are monitored as historically significant (DAF, 2023b).

There are six SLCs at CCSFS that form a discontinuous National Historic Landmark district. Two of these SLCs are NASA property; therefore, they are not under the jurisdiction of SLD 45. In addition, eight other sites are eligible for National Historic Landmark listing, including six SLCs, Hangar C, and the Cape Lighthouse (DAF, 2023b).

3.5.4 Environmental Consequences

3.5.4.1 Proposed Action

The FAA has not established a significance threshold for cultural resources. Factors to consider when assessing the significance of potential effects on cultural resources include whether the action would result in a finding of *Adverse Effect* through the Section 106 process. However, an adverse effect finding does not automatically trigger preparation of an EIS.

The 2013 DAF SEA (DAF, 2013) analyzed potential effects to historic properties from Falcon 9 launch operations at SLC-40. The DAF's analysis concluded that Falcon launch operations at SLC-40 would have no effect on cultural resources because there are no historic properties located at or near SLC-40. Similarly, the 2017 DAF SEA (DAF, 2017) for Falcon Heavy first stage boost-back and landing at LZ-1 and LZ-2 concluded that Falcon booster landings at LZ-1 and LZ-2 would not affect historic properties, and the SHPO concurred with that finding. The FAA previously consulted the SHPO regarding potential effects to historic properties from Falcon 9 polar launches and landings. The SHPO concurred with the FAA's determination that the Proposed Action would have no adverse effect to historic properties (FAA, 2020).

The FAA's undertaking involves minimal construction, and no known resources are present in the construction footprint. However, if previously unknown cultural resources are identified during construction, work would cease in compliance with the standard operating procedures detailed in Section 7 of the SLD 45 Integrated Cultural Resource Management Plan (DAF, 2023b). As noted above, in previous consultations with the SHPO, the SHPO has determined that launches (including landings) at KSC and CCSFS would not adversely affect historic properties.

Construction and operation of a new LZ at SLC-40 is the only aspect of the Proposed Action that has not been previously consulted on. The Proposed Action also includes an increase in the frequency of launch operations (including noise effects), as well as a shift in location of landing operations to the new LZ.

DAF is consulting with the SHPO to comply with Section 106. The draft EA was provided to SHPO to support this consultation. The FAA initiated government-to-government consultation with the following Native American Tribes: the Miccosukee Tribe of Indians of Florida; the Muscogee (Creek) Nation, Oklahoma; the Seminole Nation of Oklahoma; and the Seminole Tribe of Florida.

3.5.4.1.1 Construction

As shown in **Figure 2-5**, SpaceX would construct an LZ east of SLC-40 for the landing of Falcon first-stage boosters. The LZ would have a total diameter of 400 feet and would be partially in a developed area with approximately three fourths of improvements accounting for new ground disturbance. SpaceX would construct a new nitrogen gas line, a 30-foot by 30-foot pedestal, and crane storage along the existing SLC-40 fence line. Approximately 4 acres would be cleared for construction of the LZ. A 2024 archaeological survey of the construction boundary found no resources potentially eligible for the NRHP

(SEARCH, 2024) (Appendix C). DAF sent archaeological survey reports to the SHPO, Miccosukee Tribe of Indians of Florida, Seminole Nation of Oklahoma, and Seminole Tribe of Florida on June 14, 2024. The Seminole Tribe of Florida responded in a July 22, 2024, letter stating they had no objections to the Proposed Action (Appendix C). No response was received from the other tribes.

3.5.4.1.2 Operations

As discussed in the following sections, no significant impacts to cultural resources are anticipated due to launch and landing at SLC-40.

3.5.4.1.2.1 Auditory

The Proposed Action would not result in significant auditory effects to cultural resources. Previous analysis considered sonic booms and vibrational effect, not annoyance from the auditory environment. As per the noise analysis discussed in Section 3.4.4.1.2, *Potential Noise Impacts*, of this EA, noise interference would remain relatively infrequent and short lived. Time-averaged engine noise and sonic boom noise levels would not exceed land use compatibility thresholds in land areas outside of KSC and CCSFS. The risk of structural damage would remain minimal. Therefore, impacts associated with the Proposed Action are not considered to be significant. While operational cadence will increase, effects would be similar to those analyzed in the 2020 EA (FAA, 2020). The FAA does not expect any adverse effects related to the setting of historic sites within the APE.

3.5.4.1.2.2 Vibration/Sonic Boom

The Proposed Action would not result in significant vibration or sonic boom effects to cultural resources. As previously noted, prior consultations have found that launches from SLC-40 and landings at LZ-1 and LZ-2 would not adversely affect historic resources. Relocating landing operations from LZ-1 and LZ-2 to SLC-40 would result in different resources on CCSFS and KSC experiencing sonic booms greater than 2 psf. However, these resources also routinely experience high sound levels from launches at SLC-41, SLC-40, LC-39A, and SLC-37. Accordingly, no adverse effects to historic resources due to vibration or sonic booms are anticipated.

3.5.4.1.2.3 Visual

The Proposed Action would not result in significant visual effects to cultural resources. The FAA does not expect any adverse effects related to the setting of historic sites within the sonic boom APE or landing areas (FAA, 2020). The activities discussed in the Proposed Action are consistent with the current use of the site and historic setting. The primary changes will be an increase in operational tempo, which will not affect the visual landscape of the launch facilities. As no changes to the viewshed will deviate from its current purpose, no visual effects are anticipated. No mitigations are required.

3.5.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, *No Action Alternative*. The No Action Alternative, analyzed as the Proposed Action in the 2020 EA, would not result in significant impacts to historical, architectural, archaeological, and cultural resources.

3.6 Water Resources

3.6.1 Definition of Resource and Regulatory Setting

Water resources include groundwater and surface water, and their physical, chemical, and biological characteristics; they are important in providing drinking water and in supporting recreation, transportation and commerce, industry, agriculture, and aquatic ecosystems. This effect category includes surface waters, groundwater, floodplains, and wetlands because these resources do not function as separate and isolated components of the watershed but rather as a single, integrated natural system. Disruption of any one part of this system can have consequences to the functioning of the entire system.

The major laws and EOs pertaining to water resources include the CWA; EO 11990, *Protection of Wetlands*; EO 11988, *Floodplain Management*; Safe Drinking Water Act (SDWA); and Florida's ERP program.

The CWA establishes the basic structure for regulating the discharge of pollutants into waters of the United States, including wetlands. Through the NPDES program, the CWA Section 402 establishes Federal limits on the amounts of specific pollutants that can be discharged into surface waters. The NPDES program regulates the discharge of point (i.e., end of pipe) and nonpoint (i.e., stormwater) sources of water pollution. FDEP implements the NPDES permitting program in the State of Florida.

EO 11990, *Protection of Wetlands*, requires that Federal agencies adopt a policy to avoid, to the extent possible, long- and short-term adverse effects associated with destruction and modification of wetlands and to avoid the direct and indirect support of new construction in wetlands whenever there is a practicable alternative. DOT Order 5660.1A, *Preservation of the Nation's Wetlands,* implements the guidelines set forth in EO 11990.

EO 11988, *Floodplain Management*, requires Federal agencies to avoid to the extent possible the long- and short-term adverse effects associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development unless it is the only practicable alternative. Flood potential of a site is usually determined by the 100-year floodplain, which is defined as the area that has a 1 percent chance of inundation by a flood event in a given year. DOT Order 5650.2, *Floodplain Management Protection,* implements the guidelines set forth in EO 11988.

The SDWA is the Federal law that protects public health by regulating the Nation's public drinking water supply. The SDWA prohibits Federal agencies from funding actions that would contaminate a USEPA-designated sole source aquifer or its recharge areas.

Florida's ERP program regulates activities involving the alteration of surface water flows. ERP permits are required for many types of work within those waters, such as dredging or filling, construction of dams, impoundments, docks or other structures, as well as the construction of stormwater management systems that discharge to those waters. In Brevard County, the ERP program is implemented by the St. Johns River Water Management District.

3.6.2 Study Area

The study area for groundwater includes the local aquifers that underlie CCSFS. The surface water study area is the watershed in which CCSFS is located and the ocean water recovery areas.

3.6.3 Existing Conditions

The affected environment for water resources at the launch and landing sites has been described in previous EAs (DAF, 2007; DAF, 2013; DAF, 2014; DAF, 2017; FAA, 2020) and is summarized here. SpaceX operates under ERP 149413 at SLC-40.

3.6.3.1 Surface Waters

3.6.3.1.1 Surface Waters (Inland)

CCSFS is located within the Banana River subwatershed (Hydrologic Unit Code 030802020201) of the Indian River Lagoon watershed (Hydrologic Unit Code 3080202) and is bounded to the east by the Atlantic Ocean and to the west by the Banana River. There are no inland surface waters present at the proposed construction sites. The construction site for the proposed LZ and proposed crane storage locations are over 0.25 miles from the nearest inland surface waters.

Section 303(d) of the CWA authorizes USEPA to assist states, territories, and authorized Tribes in listing impaired waters and developing total maximum daily loads (TMDLs) for these waterbodies. A TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point or planning tool for restoring water quality. The Section 303(d) list includes Florida waterbodies that are not attaining one or more designated uses and require the establishment of TMDLs to meet and maintain Water Quality Standards. Both the Indian River (above the 520 Causeway) as well as the Banana River (above and below the 520 Causeway), located in close proximity to CCSFS, are listed as impaired waters (FDEP, 2022). Causes of impairment for the Indian River include low dissolved oxygen as well as fecal coliform and mercury in fish tissue above required thresholds. Similarly, causes of impairment in the Banana River include low dissolved oxygen and mercury in fish tissue above required thresholds. A TMDL for dissolved oxygen and nutrients has been developed for the Indian River Lagoon and the Banana River Lagoon (Gao, 2009). A Basin Management Action Plan was created by Banana River Lagoon stakeholders (including CCSFS) in 2013 to restore seagrass in the Indian River Lagoon Basin through the watershed load reduction of total nitrogen and total phosphorus (Banana River Stakeholders, 2013).

Construction that results in ground disturbance greater than 1 acre must obtain coverage under an NPDES Construction Generic Permit and implement appropriate pollution prevention techniques to minimize erosion and sedimentation and properly manage stormwater. As with the MSGP, a SWPPP must be developed and implemented to comply with the permit.

3.6.3.1.2 Surface Waters (Ocean)

The study area for ocean waters is the recovery areas (**Figure 2-4**). Waters within the study area include deep high-salinity offshore waters that are defined by prevailing currents. Water quality in ocean waters may be characterized by temperature, salinity, dissolved oxygen, and nutrient levels. There are no ocean surface waters present at proposed construction sites. The construction site for the proposed LZ and proposed crane storage locations are over 0.25 miles from the nearest ocean surface waters.

3.6.3.2 Groundwater

Groundwater at CCSFS consists of the surficial aquifer and the Floridian aquifer. Recharge to the surficial aquifer system is primarily from precipitation. Only the surficial aquifer has the potential to be affected by the Proposed Action. Surficial aquifer groundwater quality is influenced by the intrusion of saline and brackish surface waters from the Atlantic Ocean and the Indian River Lagoon. There are no USEPA-designated sole source aquifers at CCSFS (USEPA, 2024a). Groundwater use is not a component of the Proposed Action.

Groundwater in Florida is classified under four categories (Class G-I to G-IV). These categories are based on three criteria: (1) potable versus non-potable water use (i.e., high quality and can be used to supply drinking water), (2) the total of dissolved solids the water contains, and (3) confined versus unconfined aquifer as defined by Florida Administrative Code 62-520.410(1). The surficial aquifer at CCSFS is classified as Class G-II, which means that it is a potential potable water source and generally has a total dissolved solids content of less than 10,000 milligrams per liter (parts per million) (USSF, 2023b). The surficial aquifer does not, nor is planned to, supply potable water at CCSFS.

3.6.3.3 Wetlands

The U.S. Army Corps of Engineers (USACE), through Section 404 of the CWA, regulates the discharge of dredged and fill material into waters of the United States (33 CFR §328.3), including wetlands. Wetlands are defined as "those areas that are inundated or saturated with ground or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted to life in saturated soil conditions" (USACE, 1987). Wetlands generally include swamps, marshes, bogs, and similar areas. The discussion here on wetlands is based primarily on National Wetlands Inventory data, which is inherently limited due to the lack of ground truthing and does not overlap exactly with criteria determining whether a wetland meets USACE wetland criteria or whether it is jurisdictional under Section 404 of the CWA. Wetlands occurring on CCSFS include mangrove wetlands, salt marsh, and freshwater wetlands as well as human-made wetland habitats created by impoundments and borrow pits (USSF, 2023b). Field delineations found no wetlands within the Proposed Action area that would be disturbed during construction. Wetlands would not be affected by the Proposed Action and are not discussed further. The construction site for the proposed LZ and proposed crane storage locations are over 0.25 miles from the nearest identified wetlands.

3.6.3.4 Floodplains

On CCSFS, the 100-year floodplain extends to 7 feet above MSL on the ocean side and 4 feet above MSL on the Banana River side. The 500-year floodplain elevations are 10 feet above MSL on the ocean side of CCSFS and 6 feet above MSL along the Banana River (USSF, 2023b). Current SLC-40 infrastructure is outside of both the 100- and 500-year floodplains. A portion (less than 0.25 acres) of the proposed LZ is within the 500-year floodplain. All proposed construction is located outside of the 100-year floodplain (**Figure 3-4**).

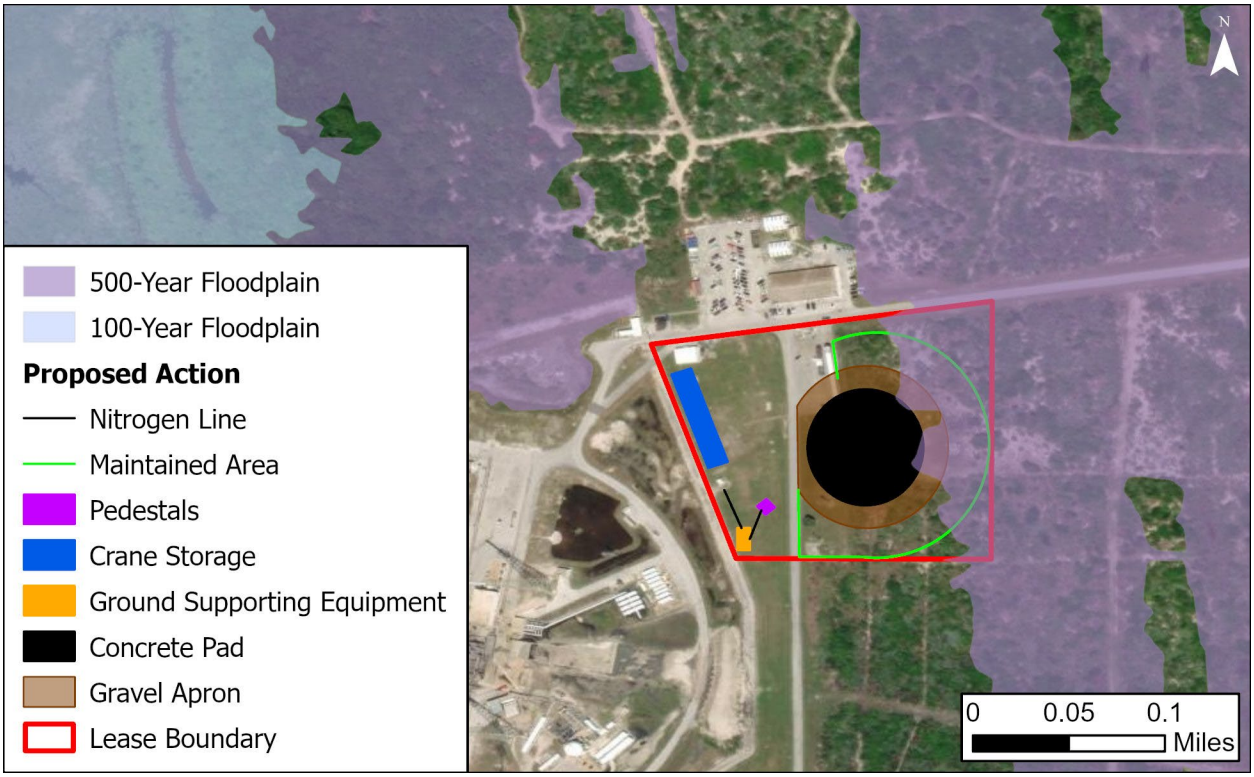


Figure 3-5. Floodplains Near SLC-40

3.6.4 Environmental Consequences

3.6.4.1 Proposed Action

This section addresses effects to water resources. Determination of water resource effects is based on an analysis of the potential for activities to affect water resources as defined by applicable laws and regulations. Considered in this analysis is activity-related introduction of contaminants into surface water or groundwater resources, and potential effects on floodplains. The Proposed Action does not involve physical alterations or disturbances of overland surface water flows, and the increase in impervious surfaces would not be expected to affect groundwater recharge or exacerbate flooding (there are no regulatory floodways on CCSFS; flooding concerns at CCSFS are from future sea level rise coastal flooding, not precipitation events). Potential effects to water quality could occur; however, most of these potential effects would be avoided and minimized through CWA compliance (e.g., NPDES permits) and ERP conditions, notably the requirement that the post-development peak rate of stormwater discharge cannot exceed the predevelopment peak rate (design is for a 24-hour 25-year frequency storm).

Under the FAA's significance threshold, a significant impact to surface waters would occur if the action exceeded water quality standards established by Federal, state, local, and Tribal regulatory agencies; or contaminated the public drinking water supply such that public health may be adversely affected. A significant impact to groundwater would occur if the action would exceed groundwater quality standards established by Federal, state, local, and Tribal regulatory agencies; or contaminate an aquifer used for public water supply such that public health may be adversely affected. A significant impact to floodplains

would occur if encroachment in the 100-year floodplain would result in a high likelihood of loss of human life, substantial costs or damages, or a notable adverse impact on floodplain natural and beneficial values.

3.6.4.1.1 Construction

Construction activities could affect surface waters through ground disturbance activities and use of construction equipment. Construction would involve clearing, grading, filling, and excavation. When stormwater flows over the construction site, various pollutants such as sediments, chemicals, and metals can be picked up and transported to nearby waterbodies. Additionally, use of construction equipment could result in the accidental release of contaminants (e.g., leaks, drips, and spills of petrochemicals) that could reach nearby waterways and adversely affect water quality. Implementation of the Proposed Action would require a Florida NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities. Permit requirements include the preparation and implementation of a site-specific SWPPP to manage stormwater discharges as well as control erosion during and after construction until the area is stabilized. The SWPPP would require regular compliance inspections and specify BMPs that would minimize effects to water quality. BMPs would be project specific but may include using silt fences, covering soil stockpiles, using secondary containment for hazardous materials, and revegetating the site in a timely manner.

Construction of the LZ at SLC-40 would result in an increase in impervious surfaces by approximately 3 acres at CCSFS. Replacement of predevelopment (natural) pervious surfaces with impervious surfaces, such as concrete, eliminates any potential for stormwater infiltration and can result in increases to the volume, peak flow, duration, pollutant load, and temperature of stormwater runoff. Due to the flat nature of the area and at-grade construction of the largest impervious surface (proposed LZ and gravel apron – 2.88 acres), effects to stormwater quality post-construction would be minor. For most precipitation events, stormwater would sheet flow on, around, and over the new impervious surfaces and infiltrate into adjacent pervious surfaces and not flow directly to area waters. SpaceX would obtain a new ERP or modify its existing ERP prior to construction.

Because a SWPPP would be employed to reduce stormwater pollution, including sedimentation during construction of the facilities associated with the Proposed Action, significant impacts to surface waters would not be expected from construction activities. The Proposed Action would not affect CWA Section 303(d) impaired waters or TMDLs because these waters are impaired for nutrients, bacteria, and mercury, and are primarily caused by fertilizer runoff, septic systems, wastewater treatment plant effluent, and in the case of mercury, atmospheric deposition from coal-fired power plants. The Proposed Action does not produce these pollutants.

Potential effects to groundwater quality during construction could include contamination from spills or leaks from construction vehicles and machinery. If such fluids were spilled on the ground, they could migrate to shallow groundwater underlying the project site. The SWPPPs developed for the NPDES permits would put in place BMPs to address and prevent spills that could potentially enter the surficial aquifer. In addition, implementation of the SpaceX Spill Prevention Control and Countermeasure Plan at SLC-40 would further ensure protection of water resources. Therefore, no significant, long-term, major, adverse effects to groundwater would result from implementation of the Proposed Action. Due to the depths to the other aquifer and the confining layers in between, there would be no effects to other, deeper aquifers.

Construction of the SLC-40 LZ would not occur in the 100-year floodplain; however, there would be construction in a small part (less than 0.25 acres) of the 500-year floodplain. Potential effects of construction in floodplains include loss of natural functions and habitat, increased erosion and pollution, and increased water temperatures. However, construction of a flat LZ in such a small area (less than 0.25 acres) of a much larger 500-year floodplain (greater than 400 acres) in an area that is mostly undeveloped/natural surfaces would not result in significant impacts to the floodplain or exacerbate flooding at CCSFS.

In summary, no significant impacts on surface waters, groundwater, and floodplains are expected from construction of an LZ at SLC-40.

3.6.4.1.2 SLC-40 Operations

Falcon 9 launch operations include launches, landings, and associated activities. These effects have been addressed in previous EAs and are summarized here.

Operations could introduce minor amounts of pollutants from vehicles and equipment (e.g., leaks, drips, and spills of petrochemicals) to water resources in the vicinity of SLC-40; however, effects to water quality would be expected to be negligible and would not result in an exceedance of any water quality regulatory parameter due to implementation of BMPs and the Spill Prevention Control and Countermeasure Plan. The launch exhaust cloud formed from the rocket exhaust and evaporation and subsequent condensation of deluge water could potentially introduce negligible amounts of rocket propellant-1 combustion products to area waters. The temporary and minimal volume of water condensing from the exhaust cloud would not result in significant impacts to water quality.

Discharge of industrial wastewater (deluge water) into nearby waters at SLC-40 is highly unlikely. The maximum discharge of deluge water (100,000 gallons maximum for a Falcon 9 launch) is within SLC-40's deluge basin capacity of 160,000 gallons. SpaceX implements a water recycling program at SLC-40 to reuse deluge water where practicable. Any remaining water is collected in a wastewater pond and is characterized (tested) and disposed of in accordance with Federal, state, and local solid waste regulations.

Deluge or other water is not utilized for LZ landings. Potential effects to water resources of a failed landing from spilled fuel, if not consumed by combustion or contained inside the tank, would be relatively minor. If an incident were to occur during a landing operation at the new LZ, actions in accordance with CCSFS emergency/disaster response procedures would be employed to minimize effects to water resources.

In summary, no significant impacts on surface waters, groundwater, and floodplains are expected during Falcon 9 launch operations. All materials and procedures would remain essentially the same as those analyzed in previous EAs. Even with an increased number of launches, implementing procedures already in place and adhering to NPDES permit conditions would avoid and minimize water quality effects.

3.6.4.1.3 Ocean Operations

Ocean landing operations along with recovery activities are evaluated for the possible release of contaminants and hazardous constituents into ocean waters. In the event of a failed launch operation, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan). Procedures may include containing the spill using disposable containment materials and cleaning the area with absorbents or other materials to reduce the

magnitude and duration of any impacts. In most launch failure scenarios, at least a portion of the propellant will be consumed by the launch, and any remaining propellant will evaporate within hours or be diluted by seawater and degrade over time (timeframes are variable based on environmental conditions, but generally hours to days).Expended boosters that land in the ocean would not be expected to affect ocean water quality because fuel would be expended and any remaining booster components (e.g., metals) would be largely inert. If any propellant were to be released, it would rapidly disperse and does not represent a source of substantial environmental degradation to water quality (NMFS, 2022).

Ocean recovery operations have the potential to release small amounts of oil and gas into the water. However, vessel operations would be conducted in accordance with the International Convention for the Prevention of Pollution from Ships (International Maritime Organization, 1987), which prohibits certain discharges of oil, garbage, and other substances from vessels. Offshore landing and recovery operations are not expected to have a significant impact on Atlantic Ocean waters.

3.6.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, *No Action Alternative*. The No Action Alternative, analyzed as the Proposed Action in the 2020 EA, would not result in significant impacts to water resources.

3.7 Biological Resources

3.7.1 Definition of Resource and Regulatory Setting

Biological resources include vegetation, wildlife, and the habitats in which they occur. The biological resources considered in this section are found in terrestrial and marine environments. Some of the included species and habitats are protected by Federal laws, which consist of the ESA, Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act (BGEPA), the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and Marine Mammal Protection Act (MMPA). The ESA of 1973 (16 U.S.C. §1531 et seq.) established protection over and conservation of threatened and endangered species and the ecosystems upon which they depend. Sensitive and protected biological resources include plant and animal species listed as threatened, endangered, or special status by the USFWS and NMFS. Under the ESA (16 U.S.C. §1536), an "endangered species" is defined as any species in danger of extinction throughout all or a significant portion of its range. A "threatened species" is defined as any species likely to become an endangered species in the foreseeable future. The USFWS maintains a list of species considered to be candidates for possible listing under the ESA. The ESA also allows the designation of geographic areas as critical habitat for threatened or endangered species. Although candidate species receive no statutory protection under the ESA, the USFWS has attempted to advise government agencies, industry, and the public that these species are at risk and may warrant protection under the ESA. Section 7 of the ESA requires all Federal agencies to consult with the USFWS and/or NMFS before initiating any action that may affect a listed species or designated critical habitat. As described in Section 1.6, *Permits, Approvals, and Agreements*, critical habitat is not designated on CCSFS because the installation has an approved INRMP in place. The MBTA protects migratory birds and their habitats and establishes a permitting process for legal taking. Migratory birds are defined by the USFWS as any species or family of

birds that lives, reproduces, or migrates within or across international borders at some point during the annual life cycle. The BGEPA prohibits the take of bald and golden eagles (e.g., disturbing) without a USFWS permit. Permits may be general or may apply to specific types of activities. The MSA requires agencies to consult with NMFS on actions that may affect EFH for managed commercial fisheries. The MMPA prohibits take of marine mammals without a Letter of Authorization requiring formal rulemaking.

3.7.2 Study Area

The study area collectively consists of the locations where terrestrial and marine habitats and species could be affected by noise (including sonic booms), vibration, heat and exhaust plumes, habitat removal and alteration, items striking the ground or water surface (e.g., capsules, boosters, fairings, or debris), and wildlife disturbance and collisions with vehicles or equipment during construction and operations. These locations generally include (1) terrestrial and nearshore habitats on and near CCSFS affected by launches, booster landings, LZ construction, and general launch facility operations (e.g., vehicle operation and vegetation maintenance); (2) terrestrial and nearshore habitats remote from CCSFS affected by sonic booms associated with polar mission launches and booster landings; and (3) downrange (offshore) recovery areas. Hazardous materials would be handled in accordance with all applicable Federal, state, and local laws and regulations, as well as established KSC and CCSFS procedures. Therefore, effects to vegetation and wildlife from hazardous materials would not be expected (See Section 3.1, see also Section 4.11 of 2020 EA).

3.7.3 Existing Conditions

The description of biological resources within the study area is organized into four parts: terrestrial habitat and wildlife, marine habitats and wildlife, EFH, and protected species and critical habitat. Descriptions are provided in several previous documents, including those identified in Section 1.4, *Documents Incorporated by Reference*, (FAA, 2018; DAF, 2017; NASA, 2011; FAA, 2020; DAF, 2014) and the CCSFS INRMP (USSF, 2023b). Information on relevant biological resources is also provided in the *Environmental Assessment for the Operation and Launch of the Falcon 1 and Falcon 9 Space Vehicles at Cape Canaveral Air Force Station Florida* (DAF, 2007) and Supplemental EA (DAF, 2013). Resource descriptions in these documents are incorporated by reference and summarized in the following subsections. Additional information that has become available since publication of these documents is noted in applicable locations.

3.7.3.1 Terrestrial Habitat and Wildlife

Habitats in and/or adjacent to the SLC-40 lease boundary area generally consist of uplands (oak and rosemary scrub, palmetto scrub, hardwood hammocks, coastal strand, dune), wetlands (freshwater marsh, brackish marsh, cabbage palm hammock, wetland scrub-shrub), and disturbed areas consisting of maintained and unmaintained ruderal vegetation. Invasive plant species such as rose natal grass (*Melinis repens*) and Brazilian pepper (*Schinus terebinthifolia*) may also be present. The Banana River and Indian River provide large open areas of fresh and brackish water habitat.

Habitats on and near CCSFS support a great diversity of wildlife, including hundreds of combined mammal, bird, reptile, and amphibian species such as bobcat (*Felis rufus*), yellow warbler (*Setophaga petechia*), great blue heron (*Ardea herodias*), box turtle (*Terrapene carolina*), and leopard frog (*Rana utricularia*).

The property is adjacent to the Indian River Lagoon, which is considered one of the most biologically diverse estuaries in North America (Florida State Parks, 2024). The St. Johns River Basin ecosystem, one of the largest freshwater marsh systems in the state, lies to the west. CNS and the MINWR, which supports more than 1,500 plant and animal species (USFWS, 2024a), are also adjacent to CCSFS property. Much of the land in these areas is undeveloped and in a natural or semi-natural state. Wetlands are abundant on and near CCSFS. These factors contribute to exceptional wildlife species diversity in the area.

The area of east-central Florida that includes CCSFS is considered by the Audubon Society to be a particularly diverse Important Bird Area in Florida. Important Bird Areas are habitats that the Audubon Society considers important to the health of bird populations based on factors such the presence of particularly large numbers of birds and the presence of at-risk species. Many species are year-round residents, while some are present during the breeding season, winter, or spring and fall migration periods. The MINWR is one of the top birding destinations in the United States, with more than 350 species documented (USFWS, 2024b). More detailed information on bird species at MINWR, including seasonal occurrence, is provided in the *Merritt Island National Wildlife Refuge Bird List* (USFWS, 2019).

3.7.3.2 Marine Habitats and Wildlife

The marine portion of the study area includes offshore downrange recovery areas (**Figure 2-4**) and nearshore waters. The offshore marine study area begins at least 5 nautical miles from the coastline and extends seaward, consisting of pelagic ocean waters and the underlying substrates that provide habitat for a wide range of species. While the offshore portion of the study area is vast, encompassing waters from North Carolina to Bermuda and south to the Bahamas, the primary area (i.e., the area where booster landing and recovery operations would typically occur) is restricted to within 400 nautical miles of Cape Canaveral. The downrange polar mission landing area extends just south of Cuba and Hispaniola and north of Jamaica. The study area does not include territorial waters of Cuba, the Dominican Republic, or Jamaica. The marine water column supports numerous species of marine mammals, sea turtles, fish (including important commercial and recreational species), marine birds, and invertebrates. The offshore Atlantic Ocean seafloor consists mostly of soft, unconsolidated sediments (e.g., sand and mud), but a relatively small amount of hard and intermediate habitat (e.g., hard bottom) also occurs (DON, 2018). Many invertebrates and bottom-associated fishes use benthic habitats.

As described in Section 3.8 of the 2020 EA, the nearshore benthic area off Cape Canaveral consists primarily of elevated sand ridges that provide food resources for fish and other organisms. Sand shoal habitat off Brevard County is known to support more than 60 fish taxa and more than 30 invertebrate taxa, including several economically valuable fish species such as red drum (*Sciaenops ocellatus*) and pompano (*Trachinotus carolinus*). Additionally, the surf zone and longshore troughs serve as nursery habitat for species such as the lemon shark (*Negaprion brevirostris*).

Part of a zone of deep-water coral occurrence known as the Oculina Bank is located about 20 nautical miles east of Cape Canaveral. This reef is in water depths of 200 to 350 feet and runs approximately 130 nautical miles north-to-south from St. Augustine to Fort Pierce, Florida. The area contains dense occurrence of the slow-growing ivory tree coral (*Oculina varicosa*), which forms massive thickets that support finfish and invertebrate communities (NOAA Ocean Exploration, 2024a). Extensive areas of deep-water coral occurrence, primarily *Desmophyllum pertusum*, are also found on the Blake Plateau

(NOAA Ocean Exploration, 2024b). The plateau is located about 100 miles offshore, extending from Charleston, South Carolina, to Miami, Florida, in water depths of 2,500 to 3,000 feet.

The Florida Keys National Marine Sanctuary is located along the southern Florida coast. The sanctuary spans coastal and ocean waters including estuaries of south Florida, the Florida Keys archipelago, and the Dry Tortugas National Park. The Florida Keys National Marine Sanctuary protects approximately 3,800 square miles of water and encompasses more than 1,700 islands, reaching into the Atlantic Ocean, Florida Bay, and Gulf of America. The sanctuary contains the only coral barrier reef in the continental United States and the largest documented contiguous seagrass community in the Northern Hemisphere (NOAA, 2024a; NOAA, 2024b).

3.7.3.2.1 Essential Fish Habitat Assessment

The MSA requires regional Fishery Management Councils (FMCs) to designate EFH for each commercially managed fishery species in their geographic area of responsibility. EFH is defined as waters and substrate necessary for spawning, breeding, feeding, or growth to maturity. In addition to general EFH, areas called Habitat Areas of Particular Concern (HAPC) are also designated. HAPCs are subsets of EFH that provide extremely important ecological functions or that are especially vulnerable to degradation. The South Atlantic FMC is the primary managing entity for eight fishery resources in the study area, although the Mid-Atlantic FMC shares responsibility for some resources. Managed fisheries include several fish and crustacean species, coral and live bottom habitat, and *Sargassum* habitat (U.S. Regional Fishery Management Councils, 2024). NMFS has management responsibility for highly migratory species (e.g., tunas, billfishes, and sharks).

Because of the variety of species, life stages, and habitats covered, EFH encompasses the water column and most substrates in the study area. Benthic substrates considered EFH include live/hard bottom, coral reefs, submerged aquatic vegetation, outcroppings around the shelf break zone, estuarine nursery areas, oyster reefs or shell banks, unconsolidated soft sediments, estuarine scrub/shrub (e.g., mangroves), offshore shoals/bars, tidal creeks, and coastal inlets (USSF, 2023a). HAPCs are designated in some areas near Cape Canaveral for multiple shrimp and fish species, *Sargassum*, and live/hard bottom. The Oculina Bank HAPC and Closed Area provides essential habitat for many species. The site has been expanded to cover 300 square miles (FSU, 2024). All activities that cause mechanical disruption to bottom habitat (e.g., trawling, dredging, and anchoring) within this HAPC are prohibited.

3.7.3.3 Protected Species and Critical Habitat

This subsection describes the species and habitats in the study area with legal protection, including species and habitats protected by the ESA, BGEPA, MBTA, and MMPA. Generally, the USFWS is responsible for terrestrial species and NMFS is responsible for marine species. The USFWS and NMFS share jurisdiction over sea turtles because they have life stages that occur on land and in the sea. The USFWS has jurisdiction over the West Indian manatee (*Trichechus manatus latirostris*) under the ESA and MMPA in all areas of the species' occurrence, including freshwater and nearshore marine environments. NMFS has jurisdiction under the MMPA over whales and dolphins.

The FAA previously conducted ESA consultations with the USFWS (FAA, 2020) and NMFS (NMFS, 2022) for terrestrial and marine species, respectively. The species evaluated in those consultations are generally included in this EA. Exceptions related to ESA listing decisions are described in the following subsections.

Two additional species, the roseate tern (*Sterna dougallii dougallii*) and black-capped petrel (*Ptreodroma hasitata*), were added to the current Biological Assessment (BA) (USSF, 2024) (Appendix D) because of their potential occurrence in the downrange portion of the study area. Eleven terrestrial species evaluated in the 2020 USFWS consultation are not included in the current BA because the study area for polar launch sonic booms is not part of the project area in this EA (or action area in the BA). As stated in Section 2.1.1.3, SpaceX is not proposing to increase the number of annual polar launches from those previously analyzed in the 2020 EA. As such, the USFWS Information for Planning and Consultation (IPaC) query that was used to generate the USFWS species list in the project area does not include the polar launch sonic boom area that was included in the 2020 USFWS consultation. As identified in the current BA and previous consultation with NMFS, species potentially occurring in the study area that are listed under the ESA, proposed for listing, or that are ESA candidate species, are shown in **Table 3-4**.

Table 3-4. Endangered Species Act-Listed Species in the Study Area

Common Name	Scientific Name	Federal Status	State Status
Mammals			
Northern long-eared bat	*Myotis septentrionalis*	E	-
Tricolored bat	*Perimyotis subflavus*	PE	-
Southeastern beach mouse	*Peromyscus polionotus nineiventris*	T	T
West Indian manatee	*Trichechus manatus latirostrus*	T	T
North Atlantic right whale	*Eubalaena glacialis*	E	E
Blue whale	*Balaenoptera musculus*	E	-
Fin whale	*Balaenoptera physalus*	E	E
Sei whale	*Balaenoptera borealis*	E	E
Sperm whale	*Physeter macrocephalus*	E	E
Birds			
Audubon's crested caracara (Florida DPS)	*Caracara cheriway*	T	T
Black-capped petrel	*Petrodroma hasitata*	E	-
Roseate tern	*Sterna dougallii dougallii*	E	T
Eastern black rail	*Laterallus jamaicensis ssp. jamaicensis*	T	T
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E	E
Florida scrub-jay	*Aphelocoma coerulescens*	T	T
Piping plover	*Charadrius melodus*	T	T
Rufa red knot	*Calidris canutus rufa*	T	T
Whooping crane	*Grus americana*	EXPN	E
Wood stork	*Mycteria americana*	T	T
Reptiles			
Atlantic salt marsh snake	*Nerodia clarkii taeniata*	T	T
Eastern indigo snake	*Drymarchon couperi*	T	T
Green sea turtle (North and South Atlantic DPSs)	*Chelonia mydas*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	*Caretta caretta*	T	T
Kemp's ridley sea turtle	*Lepidochelys kempii*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Insects			

Table 3-4. Endangered Species Act-Listed Species in the Study Area

Common Name	Scientific Name	Federal Status	State Status
Monarch butterfly	*Danaus plexippus*	PT	-
Fish			
Smalltooth sawfish	*Pristis pectinata*	E	E
Shortnose sturgeon	*Acipenser brevirostrum*	E	E
Atlantic sturgeon (Carolina, South Atlantic DPS)	*Acipenser oxyrinchuus oxyrinchus*	E	E
Nassau grouper	*Epinephelus striatus*	T	T
Scalloped hammerhead shark (Central and Southwest Atlantic DPS)	*Sphyrna lewini*	T	-
Giant manta ray	*Mobula birostris*	T	T
Oceanic whitetip shark	*Carcharhinus longimanus*	T	-
Plants			
Carter's mustard	*Warea carteri*	E	-
Lewton's polygala	*Polygala lewtonii*	E	-

Notes: - = no identified status; C = Candidate; DPS = distinct population segment; E = Endangered; EXPN = Experimental population, Non-essential; PE = Proposed Endangered; T = Threatened.

3.7.3.3.1 Terrestrial

In the 2020 EA, the FAA identified ESA-listed, ESA-proposed, and ESA candidate species potentially present in the study area. Refer to Appendix B of the 2020 EA for the USFWS ESA consultation letter and species list, which includes a total of 31 mammal, bird, reptile, insect, and plant species. There have been changes in the status of some terrestrial species in the study area since completion of the 2020 EA. In October 2022, the USFWS announced that listing the eastern distinct population segment of the gopher tortoise (*Gopherus polyphemus*) under the ESA is not warranted (87 *Federal Register* 61834). The eastern black rail (*Laterallus jamaicensis jamaicensis*) was listed as threatened under the ESA in October 2020 (85 *Federal Register* 63764); however, this species was included in the analysis in Section 4.8 of the 2020 EA because it was proposed for listing at that time. In December 2023, the USFWS announced a decision to list the black-capped petrel (*Petrodroma hasitata*) as an endangered species under the ESA (88 *Federal Register* 89611). The black-capped petrel is a pelagic seabird that breeds on the island of Hispaniola and mostly inhabits the open western Atlantic Ocean during the non-breeding season, feeding by picking food from the water surface. Offshore of the eastern United States, this species occurs primarily from North Carolina to northern Florida. Abundance is generally greater in offshore areas than near the coast. Critical habitat is not designated for the black-capped petrel. In November 2022, the USFWS announced a decision to reclassify the northern long-eared bat (*Myotis septentrionalis*) as an endangered species under the ESA (87 *Federal Register* 73488). In January 2023, the USFWS delayed the effective date of the final rule to finalize conservation tools and guidance documents (88 *Federal Register* 4908). The northern long-eared bat is a wide-ranging species that overwinters in caves or mines and occurs the rest of the year in forested habitats. Critical habitat is not designated for this species.

The USFWS proposed to list the tricolored bat (*Perimyotis subflavus*) as an endangered species under the ESA in September 2022 (87 *Federal Register* 56381). The species occurs across the central and eastern United States, including Florida. During winter, these bats hibernate mostly in caves but may use other

structures such as mines and culverts. During spring, summer, and fall, they occur in wooded areas where they roost in trees and buildings and under bridges (USFWS, 2024c). The monarch butterfly (*Danaus plexippus*) was listed as a Proposed Threatened species on December 12, 2024 (89 *Federal Register* 100662. This widely distributed species is composed of migratory and non-migratory populations (USFWS, 2020). The eastern North America population migrates annually between Canada and central Mexico. Monarchs are found throughout Florida from approximately March to November.

Bald eagles are regularly observed foraging on CCSFS and also nest in the area. Nests are typically built in tall pine trees near lakes, marshes, or coastlines. The nearest known active bald eagle nest is located about 5.2 miles west of SLC-40. Information provided by the Florida Fish and Wildlife Conservation Commission indicates that bald eagle nests have previously been located within about 3.4 miles of SLC-40 (the last known active nests near SLC-40 were documented in 2016) (FWC, 2024a). Nesting activity at this distance of SLC-40 would not likely be substantially affected by noise disturbance during launches or booster returns. The *National Bald Eagle Management Guidelines* recommend avoidance of blasting and other activities that produce loud noises within 0.5 miles of active nests (USFWS, 2007).

In the regulatory context of the MBTA, a migratory bird belongs to a family or group of species for which the United States has signed migratory bird treaties with certain other nations. Migratory birds are abundant in the study area because of the proximity to the coast and occurrence within a major flyway. The USFWS IPaC system lists 48 species of migratory Birds of Conservation Concern in Brevard County, Florida (USFWS, 2024d). Birds of Conservation Concern are all migratory and non-migratory birds that without additional conservation action are likely to become candidates for listing under the ESA; they represent the USFWS' highest conservation priorities beyond those birds already designated as federally threatened or endangered.

3.7.3.3.2 Marine

The ESA and the MMPA are the primary Federal statutes protecting marine species in U.S. waters. ESA Section 7 implementing regulations and take provisions under Section 9 do not apply to Federal actions occurring in territorial waters of foreign countries (see 50 CFR §402.01; ESA Section 9(a)(1)(B) and (C); 16 U.S.C. §1538(a)(1)(B) and (C); 50 CFR §17.21(c)(1); and 50 CFR §17.31). However, all marine mammals, sea turtles, and sharks are also protected in Bahamian waters (potential downrange location of Falcon first-stage booster drone ship landings) by the Minister of Agriculture and Fisheries of the Bahamas. Fairing recovery locations include exclusive economic zones of the Bahamas, Cuba, Jamaica, and Haiti. All marine mammals, sea turtles, and sharks are protected in Cuban waters by the Minister of Science, Technology, and Environment of the Republic of Cuba. Wildlife in Jamaica is protected by the National Environment and Planning Agency under the Wildlife Protection Act. As discussed in the 2020 EA, a sonic boom would be produced during landings in waters offshore of Andros Island, Bahamas, and north of Cuba.

The FAA conducted marine species ESA consultations with NMFS for Falcon launches in 2017 and 2018. A total of seven marine mammal (whale) species, six sea turtle species, and eight fish species were considered. Refer to Appendix B of the 2020 EA for the consultation letters, which include species lists. In 2022, the FAA consulted with NMFS regarding all combined activities that could affect ESA-listed marine species and designated critical habitats (refer to Section 3.7.4.1.3.2, *Marine Species*). Bryde's whale (*Balaenoptera edeni*) was included in the 2017 and 2018 consultations, but only individuals in the Gulf of

America are protected under the ESA. The Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) was also included in these consultations, but the species only occurs in the Gulf of America. The humpback whale (*Megaptera novaeangliae*) was included in the 2017, 2018, and 2020 consultations. However, the West Indies distinct population segment, which is associated with the Caribbean Sea and waters offshore of the U.S. Atlantic coast, is not listed under the ESA. Therefore, the humpback whale is not considered further in this EA.

Numerous whale and dolphin species, which are covered under the MMPA, occur in the nearshore and open-ocean portion of the study area. The bottlenose dolphin (*Tursiops truncatus*) is the most commonly observed dolphin species in coastal waters offshore of Florida (FWC, 2024b). The West Indian manatee occurs in freshwater and coastal areas that support submerged vegetation (FWC, 2024c).

3.7.3.3.3 Critical Habitat

As described in Section 3.8 of the 2020 EA, critical habitat for the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) occurs in terrestrial portions of the study area (i.e., specific to sonic booms during polar launches only); however, as stated Section 2.1.1.3 of this EA, SpaceX is not proposing to increase the number of annual polar launches from those previously analyzed in the 2020 EA. In the Atlantic Ocean, critical habitat is designated for the North Atlantic right whale (*Eubalaena glacialis*) and loggerhead sea turtle (*Caretta caretta*). Refer to Appendix B of the 2020 EA (consultation documents associated with the 2020 EA) for a discussion of these habitats.

Critical habitat for additional species has been designated or proposed since completion of the 2020 EA. The USFWS proposed to designate critical habitat for the rufa red knot (*Calidris canutus rufa*) in July 2021 (86 *Federal Register* 37410). As described in the *Federal Register* notice, Proposed Unit FL-2, Ponce Inlet Complex, Florida, consists of beach, inlet, and intertidal sandflats in Volusia and Brevard Counties. Proposed Unit FL-3, MINWR Impoundments, consists of impoundments and intertidal mudflats within the MINWR. Essential features include beaches and tidal flats used for foraging; upper beach areas used for roosting, preening, resting, or sheltering; ephemeral and/or dynamic coastal features used for foraging and roosting; ocean vegetation deposits or surf-cast wrack used for foraging and roosting; intertidal peat banks used for foraging and roosting; features landward of the beach that support foraging and roosting; and artificial habitat mimicking natural conditions or that maintains the above features.

In September 2024, the USFWS published a proposed rule to revise the existing designated critical habitat for the West Indian manatee based on physical or biological features essential to conservation of the species. The total area proposed for West Indian manatee critical habitat is 1,904,191 acres. In the proposed rule, the USFWS identifies the following physical or biological features as essential to species conservation: warm-water refuges with either reliable thermal quality throughout winter or established manatee use each year; foraging areas (i.e., areas that support submerged, emergent, or floating aquatic vegetation) within 18.6 mi of warm-water refuges; and foraging areas within 18.6 mi of other established winter manatee aggregations areas. The proposed revision of the spatial boundaries of designated critical habitat would remove previously designated areas along the Atlantic Coast and the east turning basin of Port Canaveral. The proposed rule would add new areas of critical habitat within the Canaveral barge canal at Port Canaveral and include the west and middle turning basins at the port. Based on the proposed revisions, the nearest area of critical habitat would be located approximately 4,110 feet west-northwest of the Project Area. Threats to manatee critical habitat identified in the proposed rule include the loss of

warm water or aquatic vegetation, algal blooms, climate change, contaminants, and tropical storms and hurricanes.

In July 2023, NMFS proposed to designate critical habitat for the green sea turtle (*Chelonia mydas*) (88 *Federal Register* 46572). In the study area, proposed critical habitat that contains reproductive, migratory, and benthic foraging/resting essential features extends from the Florida Keys to north of CCSFS, from the mean high water line to 20 meters water depth. As described in the *Federal Register* notice, essential biological features consist of sufficiently dark and unobstructed nearshore waters, underwater refugia, and food resources. Proposed surface-pelagic *Sargassum* critical habitat occurs in the Atlantic Ocean and Gulf of America from 10 meters depth to the outer boundary of the U.S. Exclusive Economic Zone and, therefore, coincides with part of the offshore drone ship booster landing and recovery areas. Essential biological features consist of surface water characteristics (e.g., convergence zones and surface currents) that concentrate *Sargassum*-dominated drift communities and carry post-hatchling and juvenile turtles to these communities.

NMFS designated critical habitat for the Nassau grouper (*Epinephelus striatus*) in January 2024. Essential features consist of (1) nearshore and offshore areas necessary for recruitment, development, and growth, and containing a variety of benthic types that provide cover from predators and habitat for prey; and (2) marine sites used for spawning and adjacent waters that support movement and staging associated with spawning. In the study area, critical habitat for this species occurs in discrete nearshore areas from Biscayne Bay/Key Largo to Marathon Key (89 *Federal Register* 126) but does not extend offshore into the polar mission booster and fairing recovery area or other parts of the study area.

3.7.4 Environmental Consequences

3.7.4.1 Proposed Action

This section addresses effects on biological resources from the Proposed Action, including construction of an LZ at SLC-40 and an increased number of Falcon launches, landing operations, and recoveries. The types of effects and effect mechanisms associated with these activities have generally been addressed in the previous EAs identified in Section 3.7.3, *Existing Conditions*. Generally applicable analyses in these documents are incorporated by reference and summarized in the following subsections, along with additional focused discussion related to specific aspects of the Proposed Action and changes in the status of ESA-listed species and critical habitats.

Under the FAA's significance threshold, impacts to biological resources would be significant if the USFWS or NMFS determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat resources (FAA, 2015; FAA, 2023a). The FAA has not established a significance threshold for non-listed species but has identified factors to consider when evaluating the context and intensity of potential impacts. These factors include whether the action would have the potential for the following:

- A long-term or permanent loss of unlisted plant or wildlife species (i.e., extirpation of the species from a large project area)

- Adverse effects to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats
- Substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations
- Adverse effects on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum population levels required for population maintenance

3.7.4.1.1 Terrestrial Habitats and Wildlife

3.7.4.1.1.1 Landing Zone Construction

Construction of the LZ at SLC-40 has the potential to affect wildlife in the vicinity due to habitat loss and degradation, direct effects, noise, and other disturbance. The proposed construction site occurs within an area consisting generally of previously disturbed areas, coastal scrub, and hammocks. Part of the site has been developed previously and contains a mixture of native scrub vegetation, maintained vegetation, exposed soil, and impervious surface. Habitat value of the previously developed areas is lower than that of adjacent areas. However, undisturbed land would also be cleared. Construction in the expansion area would affect a total of about 2 acres of native scrub habitat and about 7 combined acres of grassy area, existing impervious surface, and existing structures. The affected area would be small relative to similar habitat available at CCSFS and nearby areas. For example, approximately 7,300 acres of scrub, shrub, and hammock habitat occur on CCSFS, although natural habitats are fragmented by structures such as LCs, buildings, and roads (USSF, 2023b). In the context of other available habitat, construction would not likely affect wildlife populations.

Wildlife within and near the construction site would react behaviorally to noise, visual perception of activities, and general disturbance. Activities such as foraging could be interrupted and individuals may leave the area, which in some cases could potentially involve effects such as nest abandonment. The effects would be temporary, as construction duration is estimated at three to four months, and would affect relatively few individuals. Wildlife at the construction site could be struck by vehicles and construction equipment, potentially resulting in injury or mortality, but it is expected that most mobile individuals would leave the area before being struck. In addition, construction, operations, and maintenance personnel would be subject to a vehicle speed limit of 25 miles per hour at SLC-40 and posted speed limits on neighboring roads, which would reduce the potential for collisions. SLD 45 would conduct an educational briefing with SpaceX and its contractors regarding wildlife protection prior to construction.

Erosion and sediment control requirements identified in construction permits (e.g., using silt fences and covering soil stockpiles) would be implemented during and after construction to minimize the potential for soil erosion and sedimentation on the surrounding environment. Invasive plants can become established in areas of ground disturbance and may displace native vegetation, which can disrupt and alter the overall ecosystem. Due to the potential for invasive plant species to negatively affect native vegetative communities, heavy equipment would need to be cleaned and determined to be free of weeds before entering the construction site. Any fill, landscaping, and erosion control materials would also need to be certified free of weeds.

LZ construction would not cause extirpation of species from the study area, substantial habitat loss, or adverse effects any species' reproductive success, mortality rate, or ability to sustain minimum population levels. Therefore, LZ construction would not result in significant impacts on terrestrial habitats and wildlife.

3.7.4.1.1.2 Falcon 9 Launch and Booster Landing

As described in previous analyses of Falcon 9 and other launch programs (FAA, 2020; DAF, 2013) and in the BA prepared for this Proposed Action (USSF, 2024), significant impacts on vegetation and wildlife from the fire, heat, and fuel combustion products produced during launches would not be expected. Vegetation scorching and destruction have been noted previously within an area of less than 2.5 acres, extending about 150 meters from the launch pad. The deluge system used during launches would reduce the likelihood of fire and absorb most of the heat. Substantial vegetation scorching and changes in vegetation community composition have not been documented in association with ongoing operations at SLC-40. Increased launch tempo could prevent recovery of any affected vegetation, but the effects would generally be limited to disturbed or maintained areas within or close to the launch pad fence line. It is assumed that wildlife present in areas affected by fire and heat would be disturbed, injured, or killed. The area that would be affected is not high-quality habitat and does not support high wildlife abundance. Therefore, the number of animals affected would likely be low compared to overall population numbers. The liquid fuels used in Falcon vehicles produce no acid or particulates that could be deposited in nearby areas and substantially impact vegetation and wildlife.

Direct strikes of birds and bats during launch operations would be unlikely. In many instances, noise and visual perception of pre-launch activities and vehicle operation would cause individuals to leave or avoid the immediate area. The generally dispersed distribution of birds and bats, along with the small airspace volume occupied by a vehicle, would further decrease the potential for interactions. The potential would be greater for relatively large groups, such as flocks of migratory birds. Overall, the probability of a launch vehicle intersecting the path of an individual or group of birds or bats would be very small.

Wildlife would be exposed to noise (including sonic booms in some cases) and substrate vibration from launches, first-stage landings, and static fire tests. The effects of noise on wildlife are varied and are influenced by the type of noise, proximity to the noise source, duration of the sound, frequency of events, the affected species, and an animal's history of noise exposure. However, a common reaction in animals exposed to a loud noise is a startle response, which can include behavioral responses (e.g., running or flying away) and physiological responses (e.g., elevated heart rate and stress hormone production). For example, a sudden noise can cause birds to abandon nests or roosts, which may increase the potential for predation and affect reproductive success. The intensity and duration of startle and physiological responses may vary by species and may depend on the environmental context of the exposure.

Section 4.8 of the 2020 EA summarizes discussions of noise analyses for previous launch operations. Monitoring of the Florida scrub-jay (*Aphelocoma coerulescens*) after Delta, Atlas, and Titan launches found no apparent behavioral effects related to noise, although the operational tempo was only about 16 launches per year. Monitoring associated with the Space Shuttle program (about five launches per year) documented an initial flight response from birds in the vicinity, but no long-term effects were observed. Nesting wood storks (*Mycteria americana*) flew from active nests, typically returning within

about 4 minutes. Based on these observed reactions, noise from launch events was not expected to cause a long-term or permanent loss of general wildlife species or adverse effects on reproductive success.

Under the Proposed Action, there would be up to 70 additional launches annually at SLC-40 compared to the number evaluated in the 2020 EA (increasing from 50 to 120 annual launches). In addition, there could be up to 40 pre-launch static fire tests (which is a decrease from the number included in the 2020 EA) and up to 34 first-stage landings (a relocation of previously analyzed existing activities on CCSFS). Subsonic noise would be produced during static tests. Subsonic noise and sonic booms would be produced during launches and landings. For most launches, the sonic boom would occur at sea. However, a small number of polar launches annually would produce sonic booms on land south of CCSFS. First-stage landings from polar launches would produce sonic booms near CCSFS and at land areas south of CCSFS.

The increased tempo of launches and landings would increase the frequency at which wildlife near CCSFS, and at other locations exposed to sonic booms, could respond behaviorally and physiologically to noise. There could be a corresponding increase in effects such as fleeing, nesting disruption, and nest abandonment, which could affect reproductive success. Substrate vibration from launches could also cause behavioral and physiological responses in species such as ground-nesting birds, frogs, and tortoises. Chronic disturbance could theoretically cause some wildlife to leave the affected area long term. Habitat is available in other nearby areas, but survivorship of displaced individuals is difficult to predict. Based on previous observations, wildlife exposed to increased noise events might exhibit only temporary reactions rather than long-term displacement. Individuals that regularly use habitats near CCSFS are sporadically exposed to noise and vibration under existing conditions and could potentially become habituated to increased operations. Although effects such as long-term extirpation and reduced reproductive success may be significant, predicting the number of noise exposures that would correspond to such effects is not feasible. Given the lack of quantitative criteria, monitoring of representative species may be used to evaluate long-term noise effects on wildlife in general. The CCSFS INRMP conceptually states that further wildlife monitoring is warranted because of increased launch and landing tempo and the use of more powerful launch vehicles (USSF, 2023b), although specific areas, methods, or species are not identified.

The increase in launches could affect the frequency of prescribed burning on CCSFS due to safety restrictions. Fires are important for maintaining quality habitat for wildlife such as migratory birds and Florida scrub-jay (*Aphelocoma coerulescens*). As discussed in Section 3.9, *Land Use*, although there could be a loss of burn days due to operations, significant impacts on current fire management program activities would not be expected. SpaceX and land managing agencies will continue to coordinate to maintain an adequate burn schedule.

Long-term loss of habitat and wildlife from the portion of the study area most affected by noise and vibration, as well as associated adverse effects on reproductive success and mortality rate, would be possible, although the likelihood is difficult to predict. These effects, if they occurred, could represent potential impacts. The amount of habitat loss and number of animals potentially displaced would be small relative to overall habitat availability and population numbers, and would not likely cause detectable changes in reproductive success. Substantial habitat fragmentation effects would not be expected because the affected habitats occur within a mosaic of land uses, including natural habitat and developed areas (e.g., buildings and roads). The Proposed Action would result in no significant impacts to terrestrial habitats and wildlife.

3.7.4.1.2 Marine Habitats and Wildlife

As with terrestrial habitats and wildlife, potential effects on marine biological resources from launches and splashdowns were analyzed in the previous EAs and consultations identified in Section 3.7.3, *Existing Conditions*. The same effect mechanisms and effects described in these documents, including a letter of concurrence issued by NMFS in association with a 2021 consultation, are generally applicable to non-listed marine species and habitats, including waters offshore of Andros Island, Bahamas. A summary of the effect conclusions are provided below.

Potential effects from direct strikes, entanglement with parachute or parafoil lines and material, ingestion of pieces of latex weather balloons, and exposure to sonic booms were described as part of the FAA's 2017 ESA Section 7 consultation that addressed SpaceX's landing and recovery operations (see Appendix B of the 2020 EA). In 2021, the FAA consulted with NMFS regarding all SpaceX Falcon 9 launch and reentry operations, as well as Starship-Super Heavy launch operations at Boca Chica, Texas, and the resulting effects on ESA-listed marine species and designated critical habitats (refer to Section 3.7.4.1.3.2, *Marine Species*). NMFS subsequently issued a programmatic letter of concurrence for launch, landing, and recovery operations in the marine environment, which provided discussion of the potential effects of direct strike by fallen objects; entanglement in unrecovered parachutes and parafoils; ingestion of materials; exposure to hazardous materials; exposure to sonic booms and impulse noise from spacecraft reentry and stage landings; ship strike; and aircraft overflight (NMFS, 2022). The letter of concurrence identified project design criteria, which include required measures intended to limit the effects of operations. Project design criteria consist of general measures and measures specific to education and observation; reporting of stranded, injured, or dead animals; vessel operations; aircraft procedures; and hazardous materials emergency response. NMFS concurred that, with implementation of project design criteria, operations may affect, but are not likely to adversely affect, ESA-listed species and designated critical habitats. The FAA is currently coordinating with NMFS on an updated programmatic consultation with NMFS that would include the proposed launch increase in this EA.

Given NMFS' previous concurrence regarding operational activities, the FAA is making a preliminary determination that the Proposed Action would not result in long-term loss of marine species, substantial loss or degradation of marine habitats, or adverse effects on any species' reproductive success, mortality rates, or ability to sustain minimum population levels. Therefore, it is anticipated that the Proposed Action would not result in significant impacts on marine habitats and wildlife.

3.7.4.1.2.1 Essential Fish Habitat Assessment

As discussed above, parachutes, parafoils, fairing lines, and other debris may impact soft or hard substrates, which function as EFH, but the area affected would be small relative to available habitat and would not measurably reduce the quantity of EFH for managed fisheries. Liquid and hypergolic propellants would not have a detectable effect on water quality in the study area. The Proposed Action would not result in significant impacts on EFH.

3.7.4.1.3 Protected Species and Habitat

ESA-listed species reported to occur or that have the potential to occur within the proposed action area are identified using the USFWS IPaC online application and/or the NMFS ESA Section 7 Mapper. For each

species, a separate "may affect" determination must be made based on an analysis of potential effects. The Federal agency then makes one of three determinations:

- "No effect" when the agency determines there will be no impacts, positive or negative, to listed species or its designated critical habitat. Generally, this means listed species will not be exposed to the proposed action or its environmental consequences. Concurrence from the USFWS and/or NMFS is not required.
- "May affect, but not likely to adversely affect" when the agency determines that all effects to listed species or its designated critical habitat are expected to be beneficial, insignificant, or discountable. Beneficial effects have contemporaneous positive effects without any adverse effects to listed species or its designated critical habitat. Insignificant effects relate to the size of the impact and include those effects that are undetectable, not measurable, or cannot be evaluated. Discountable effects are those extremely unlikely to occur. This determination requires written concurrence from the USFWS and/or NMFS, usually through informal Section 7 consultation.
- "May affect, and is likely to adversely affect" when the agency determines that a listed species and/or its designated critical habitat are likely to be exposed to the proposed action or its environmental consequences and will likely respond in a negative manner to that exposure.

When the Federal agency determines, through the preparation of a BA or other review (e.g., NEPA), that its proposed action is likely to affect (adversely or otherwise) a listed species or its designated critical habitat, the agency requests Section 7 consultation (informal or formal) with the USFWS and/or NMFS, providing them with the BA.

3.7.4.1.3.1 Terrestrial Species

SLD 45 is currently undergoing formal ESA Section 7 consultation with the USFWS regarding the Proposed Action. Potential effects on ESA-listed, proposed, and candidate species were evaluated in the associated BA (USSF, 2024). Conclusions are summarized in **Table 3-5**.

Table 3-5. Effects Conclusions for Endangered Species Act-Listed Species under USFWS Jurisdiction

Common Name	Scientific Name	Effects Determination
Mammals		
Northern long-eared bat	*Myotis septentrionalis*	No effect
Tricolored bat	*Perimyotis subflavus*	May affect, not likely to adversely affect
Southeastern beach mouse	*Peromyscus polionotus nineiventris*	May affect, likely to adversely affect because of habitat loss and potential physical impacts during construction
West Indian manatee	*Trichechus manatus latirostrus*	May affect, not likely to adversely affect
Birds		
Audubon's crested caracara (Florida DPS)	*Caracara cheriway*	May affect, not likely to adversely affect
Black-capped petrel	*Petrodroma hasitata*	May affect, not likely to adversely affect
Roseate tern	*Sterna dougallii dougallii*	May affect, not likely to adversely affect
Eastern black rail	*Laterallus jamaicensis ssp. Jamaicensis*	May affect, not likely to adversely affect

Table 3-5. Effects Conclusions for Endangered Species Act-Listed Species under USFWS Jurisdiction

Common Name	Scientific Name	Effects Determination
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	May affect, not likely to adversely affect
Florida scrub-jay	*Aphelocoma coerulescens*	May affect, likely to adversely affect because of permanent habitat loss
Piping plover	*Charadrius melodus*	May affect, not likely to adversely affect
Rufa red knot	*Calidris canutus rufa*	May affect, not likely to adversely affect
Whooping crane	*Grus americana*	No effect
Wood stork	*Mycteria americana*	May affect, not likely to adversely affect
Reptiles		
Atlantic salt marsh snake	*Nerodia clarkii taeniata*	No effect
Eastern indigo snake	*Drymarchon couperi*	May affect, likely to adversely affect
Green sea turtle (North and South Atlantic DPSs)	*Chelonia mydas*	May affect, likely to adversely affect because of the effects of night lighting on nesting sea turtles and hatchlings
Hawksbill sea turtle	*Eretmochelys imbricata*	May affect, likely to adversely affect because of the effects of night lighting on nesting sea turtles and hatchlings
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	*Caretta caretta*	May affect, likely to adversely affect because of the effects of night lighting on nesting sea turtles and hatchlings
Kemp's ridley sea turtle	*Lepidochelys kempii*	May affect, likely to adversely affect because of night lighting on nesting sea turtles and hatchlings
Leatherback sea turtle	*Dermochelys coriacea*	May affect, likely to adversely affect because of night lighting on nesting sea turtles and hatchlings
Insects		
Monarch butterfly	*Danaus plexippus*	May affect, not likely to adversely affect
Plants		
Carter's mustard	*Warea carteri*	No effect
Lewton's polygala	*Polygala lewtonii*	No effect

Notes: DPS = distinct population segment; USFWS = United States Fish and Wildlife Service.

Landing Zone Construction

The effect types and mechanisms of LZ construction discussed in Section 3.7.4.1.1, *Terrestrial Habitats and Wildlife*, would generally apply to protected species as well. Numerous migratory bird species and ESA-listed species, including but not limited to the southeastern beach mouse (*Peromyscus polionotus niveiventris*), tricolored bat, and eastern indigo snake (*Drymarchon couperi*), may potentially occur near SLC-40. All ESA-listed species in the study area are shown in **Table 3-4**. Noise and general disturbance would likely cause any individuals present to react behaviorally (e.g., startle) and leave the area. Behavioral effects would be temporary, ceasing with completion of construction activities. Mobile animals would not be expected to remain within the area while construction activities were occurring, and physical effects would be unlikely, although possible. Nests could be disturbed or crushed by construction equipment. Florida scrub-jay and eastern indigo snake surveys would be conducted prior to construction activities, reducing the potential for direct effects to these species. In addition, seasonal restrictions on

vegetation removal would be implemented for the tricolored bat and Florida scrub-jay to reduce the potential for physical harm. As described in the associated BA, land clearing would remove about 2 acres of scrub habitat occupied by the Florida scrub-jay and potentially used by the eastern indigo snake, and would modify about 7.5 acres of potential southeastern beach mouse habitat.

Only USFWS-approved sea turtle lighting would be used at the construction site.

Falcon Launch and Booster Landing

As discussed for non-listed species, the increased tempo of launches and landings would increase the frequency at which listed and proposed species and migratory birds could respond behaviorally and physiologically to noise and vibration. There could potentially be a corresponding increase in effects such as long-term habitat avoidance and decreased reproductive success. Some individuals may become habituated to increased noise events and vibration and exhibit diminishing responses over time. It is not feasible to predict the number of exposures that would correspond to these types of effects. Given the lack of quantitative thresholds, species monitoring may be used to evaluate long-term effects. Monitoring of sea turtle nesting occurs currently at CCSFS and KSC and is expected to continue.

The increase in launches could decrease the frequency of prescribed burning on and adjacent to CCSFS due to safety restrictions. Fire is particularly important for Florida scrub-jay habitat. As discussed for non-listed species, significant impacts on current fire management program activities would not be expected. However, increased coordination between SpaceX, CCSFS, MINWR, and KSC personnel would be implemented if necessary to maintain an adequate burn schedule.

Increased launch and booster landing tempo would also increase the occurrence of nighttime lighting at SLC-40 and, potentially, associated effects on wildlife. Information in the 2016 USFWS ESA consultation indicated that lighting was expected to result in take of up to 3 percent of sea turtle hatchlings and nesting adult females under the launch tempo in place at that time. SpaceX would decrease the potential for lighting effects on sea turtles by installing USFWS-approved lighting. Exterior lighting measures have been identified previously in the CCSFS INRMP (USSF, 2023b), SLD 45 Instruction 32-7001 (*Exterior Lighting Management*) (SLD 45, 2012), 2016 Biological Opinion (see Appendix B of the 2020 EA), and a 2008 Biological Opinion that addressed lighting effects at CCSFS (USFWS, 2008a). However, SpaceX would prepare an update to the existing light management plan at SLC-40, which would be shared with the USFWS for approval. The plan would also potentially benefit species other than sea turtles. Continued sea turtle nesting monitoring would help to detect any lighting effects.

Effects Summary

LZ construction and Falcon launch and booster landings could affect protected species and their habitats, including migratory birds, bald eagles, and ESA-listed, proposed, and candidate species. Land clearing would cause long-term removal of about 2 acres of native scrub habitat and additional grassy habitat. Although the actions would reduce habitat available to migratory birds and ESA-listed species such as Florida scrub-jay and eastern indigo snake, the reduction would be small relative to the total habitat available in the vicinity. Substantial habitat fragmentation effects would not be expected. Noise, vibration, and lighting associated with launches and landings could deter some species from using habitats near SLC-40. The number of individuals affected would likely be small relative to population numbers. Physical strikes by construction equipment, vehicles, rockets, and rocket fallback would be possible but unlikely.

Overall, the Proposed Action would not result in significant adverse effects on protected species or migratory bird populations.

Bald eagle nests are not known to occur in areas near SLC-40 that would be substantially affected by noise. Vegetation removal would not affect nesting or foraging activities. As described for migratory birds, physical strikes would be possible but very unlikely. The Proposed Action would not result in significant impacts on the bald eagle.

3.7.4.1.3.2 Marine Species

The FAA has previously consulted with NMFS on the effects of launch and landing operations on ESA-listed marine species, as described in the following paragraphs. Conclusions are summarized in **Table 3-6**. The FAA is currently undergoing an updated programmatic consultation with NMFS for all launch activities at CCSFS and KSC.

Table 3-6. Effects Conclusions for Endangered Species Act-Listed Species under NMFS Jurisdiction

Common Name	Scientific Name	Effects Determination
Mammals		
North Atlantic right whale	*Eubalaena glacialis*	May affect, not likely to adversely affect
Blue whale	*Balaenoptera musculus*	May affect, not likely to adversely affect
Fin whale	*Balaenoptera physalus*	May affect, not likely to adversely affect
Sei whale	*Balaenoptera borealis*	May affect, not likely to adversely affect
Sperm whale	*Physeter macrocephalus*	May affect, not likely to adversely affect
Reptiles		
Green sea turtle (North and South Atlantic DPSs)	*Chelonia mydas*	May affect, not likely to adversely affect
Hawksbill sea turtle	*Eretmochelys imbricata*	May affect, not likely to adversely affect
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	*Caretta caretta*	May affect, not likely to adversely affect
Kemp's ridley sea turtle	*Lepidochelys kempii*	May affect, not likely to adversely affect
Leatherback sea turtle	*Dermochelys coriacea*	May affect, not likely to adversely affect
Fish		
Smalltooth sawfish	*Pristis pectinata*	May affect, not likely to adversely affect
Shortnose sturgeon	*Acipenser brevirostrum*	May affect, not likely to adversely affect
Atlantic sturgeon (Carolina, South Atlantic DPS)	*Acipenser oxyrinchus oxyrinchus*	May affect, not likely to adversely affect
Nassau grouper	*Epinephelus striatus*	May affect, not likely to adversely affect
Scalloped hammerhead shark (Central and Southwest Atlantic DPS)	*Sphyrna lewini*	May affect, not likely to adversely affect
Giant manta ray	*Mobula birostris*	May affect, not likely to adversely affect
Oceanic whitetip shark	*Carcharhinus longimanus*	May affect, not likely to adversely affect

Notes: DPS = distinct population segment; NMFS = National Marine Fisheries Service.

Analyses in previous assessments of the Falcon 9 and similar programs concluded that no adverse effects are expected for protected marine species or critical habitats. The FAA consulted with NMFS under Section 7 of the ESA for SpaceX landing and recovery operations. The consultations resulted in letters of concurrence in 2017 and 2018, in which NMFS concurred that SpaceX landing and recovery operations in the Atlantic Ocean are not likely to adversely affect threatened or endangered species or adversely modify designated critical habitat. The FAA reinitiated consultation with NMFS for SpaceX landing and recovery operations after the giant manta ray (*Mobula birostris*) and oceanic whitetip shark (*Carcharhinus longimanus*) were listed under the ESA. NMFS concurred with the FAA's determinations that SpaceX's landing and recovery operations would not likely adversely affect these species (see Appendix B of the 2020 EA). The FAA consulted with NMFS in 2020 regarding the expanded action area associated with polar missions. The resulting description of effects to federally listed marine species is provided in Appendix B of the 2020 EA. NMFS concurred with the FAA's determination that the proposed actions would not adversely affect ESA-listed species. While the previous consultation evaluated the effects of launch and landing operations on ESA-listed marine species using the same vehicle configuration and similar action area, the consultation did not specifically address an increase in the number of launches.

As described in Section 3.7.4.1, *Proposed Action*, the FAA consulted with NMFS in 2021 regarding all combined activities that could affect ESA-listed marine species and designated critical habitats. NMFS subsequently issued a programmatic letter of concurrence for launch, landing, and recovery operations in the marine environment, which provided discussion of the potential effects of direct strike by fallen objects; entanglement in unrecovered parachutes and parafoils; ingestion of materials; exposure to hazardous materials; exposure to sonic booms and impulse noise from spacecraft reentry and stage landings; ship strike; and aircraft overflight (NMFS, 2022). The letter of concurrence identified project design criteria, which include required measures intended to limit the effects of operations. Project design criteria consist of general measures and measures specific to education and observation; reporting of stranded, injured, or dead animals; vessel operations; aircraft procedures; and hazardous materials emergency response. NMFS concurred that, with implementation of project design criteria, operations may affect, but are not likely to adversely affect, ESA-listed species.

The Proposed Action would result in an increase in launches and related events including landings and recoveries. An increase in sonic booms would be associated with launches and first-stage booster landings at SLC-40 and on drone ships. There would be a corresponding increase in the potential for protected marine species to experience direct strikes, entanglement, and noise effects, and to ingest mission-related debris. However, the probability would likely remain small due to the dispersed distribution of marine species and size of the marine portion of the study area relative to the size of expended items. Encounter rates would likely be low.

All the ESA-listed whale species included in **Table 3-4** are also protected under the MMPA. Nearly 30 additional marine mammal species that are not listed under the ESA but are protected under the MMPA also occur in the western North Atlantic Ocean (NOAA Fisheries, 2024). Distribution of the various marine mammal species ranges from shallow coastal areas to deep offshore waters. Potential effects to marine mammals not listed under the ESA would generally be similar to those described in the 2021 consultation and 2022 letter of concurrence.

Acoustic energy from in-air noise does not effectively cross the air/water interface. Therefore, underwater noise effects from launches and landings would be minimal, and the effects would likely be discountable.

Marine mammals could be exposed to the overpressures from sonic booms in the air when they are at the surface. However, the chance of an individual or group of individuals surfacing at the same time a sonic boom occurred is extremely low, given that the duration of a sonic boom is less than 1 second. Any animals exposed to in-air noise would likely exhibit, at most, a brief behavioral response. The potential for vessel strikes or for fallen objects to strike a marine mammal at the surface or in the water column would be low. Entanglement in and ingestion of expended materials would not be likely. Parachutes and parafoils would be recovered during most operations. The potential for exposure to propellants or other hazardous materials would be extremely low. Given the preceding summary, the Proposed Action would not be expected to result in significant impacts on marine species or result in marine mammal take under the MMPA.

3.7.4.1.3.3 Critical Habitat

As described in Section 1.6, *Permits, Approvals, and Agreements*, critical habitat is not designated for ESA-listed species on CCSFS because the installation has an approved INRMP in place. Therefore, any effects to critical habitat resulting from the Proposed Action would occur outside the installation boundary.

In previous evaluations of SpaceX's launch and recovery operations, the USFWS and NMFS concurred with the FAA, DAF, and NASA determinations that the proposed actions are not likely to adversely affect the critical habitats that were designated at that time. The FAA also determined that polar launches would have no effect on critical habitats.

Analysis in the BA prepared in association with the Proposed Action (USSF, 2024) concluded that construction activities and operations would have no effect on critical habitat for the rufa red knot, loggerhead sea turtle, green sea turtle (proposed), or West Indian manatee.

Critical habitat for the Nassau grouper, which was designated in 2024, occurs near the shoreline in areas of the Florida Keys but does not extend into the study area. Therefore, debris would not be expended directly on critical habitat features. Some types of debris that fall to the ocean (e.g., parafoils and plastic pieces) could potentially drift into the habitat boundary and settle onto essential features, depending on local water currents. It is expected that the quantity of such debris would be small and would not cause detectable effects. The 2024 BA does not consider effects on critical habitat for this species. The Proposed Action would have no effect on Nassau grouper critical habitat.

3.7.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, *No Action Alternative*. The potential for effects related to noise, vibration, direct strikes, and, for marine species in downrange areas, entanglement in or ingestion of debris, would continue as under existing conditions. The No Action Alternative, analyzed as the Proposed Action in the 2020 EA, would not result in significant impacts to biological resources.

3.8 Coastal Resources

3.8.1 Definition of Resource and Regulatory Setting

Coastal resources include all natural resources occurring within coastal waters and their adjacent shorelands. Coastal resources include islands, transitional and intertidal areas, salt marshes, wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as fish and wildlife and their respective habitats within these areas.

The CZMA provides for management of our Nation's coastal uses and resources. Coastal states are encouraged to develop and implement comprehensive coastal management programs (CMPs) that balance the need for coastal resource protection with the need for economic growth and development in the coastal zone. Once a CMP is developed and approved by the National Oceanic and Atmospheric Administration (NOAA), the state is authorized to review certain Federal activities affecting the land, water uses, or natural resources of its coastal zone for consistency with the program. This authority is referred to as "Federal consistency." Federal activities that affect a state's coastal use or resource are subject to a determination of consistency with the state's CMP (15 CFR §930.30–46, §930.50–66).

Florida's statewide CMP, executed by the FDEP, oversees activities occurring in or affecting the coastal zone and is based on a network of agencies implementing the 24 statutes that make up the CMP's enforceable policies. Florida's coastal zone is the entire state and its territorial seas. Note that Federal lands, including CCSFS, are statutorily excluded from a state's coastal zone. However, any "spillover" impacts that affect any land or water use or natural resource of the coastal zone are subject to a determination of consistency.

3.8.2 Study Area

The study area for coastal resources is SLC-40 and the nearshore habitat that may be affected by the Proposed Action.

3.8.3 Existing Conditions

The existing conditions are described in applicable resource sections of this document (e.g., coastal water resources in Section 3.6, *Water Resources*; coastal fish and wildlife resources in Section 3.7, *Biological Resources*; and coastal land use in Section 3.9, *Land Use*, etc.).

3.8.4 Environmental Consequences

3.8.4.1 Proposed Action

The FAA has not established a significance threshold for coastal resources. However, the FAA has identified factors to consider when evaluating the context and intensity of potential environmental effects on coastal resources. Factors to consider include whether the action would have the potential to result in the following:

- Be inconsistent with the relevant state coastal zone management plan(s)

- Impact a coastal barrier resources system unit (and the degree to which the resource would be impacted)
- Pose an impact to coral reef ecosystems (and the degree to which the ecosystem would be affected)
- Cause an unacceptable risk to human safety or property
- Cause adverse impacts to the coastal environment that cannot be satisfactorily mitigated

While CCSFS is statutorily excluded from Florida's coastal zone, construction, operations, and launch and landing activities for the Falcon vehicles at SLC-40 would have direct and/or indirect effects on Florida coastal uses and resources. These include effects to air quality, noise, water quality, and biological resources as documented in applicable sections in this EA.

Falcon first-stage landings on the drone ship and fairing recovery would not occur in Florida's coastal zone (no closer than approximately 10 nautical miles from shore).

Landing and recovery operations would not take place in intertidal areas, salt marshes, estuaries, and coral reefs. National marine sanctuaries and national wildlife refuges would be avoided. Any coral reefs occurring in the study area would be avoided during planning of the landing location for each mission and operations.

Aside from the construction of the LZ at SLC-40, the Proposed Action does not include any coastal construction. Seafloor -disturbing activities within the coastal zone are not part of the Proposed Action. Spacecraft processing for the Falcon 9 and its payloads would be the same as currently performed. No effects are expected from Falcon payload processing operations. All materials and procedures would remain essentially the same.

The Florida State Clearinghouse, which administers the intergovernmental coordination and review of Federal activities in Florida, previously determined that SpaceX's Falcon launch operations in Florida are consistent with the state's CMP (NASA, 2013; DAF, 2013; FAA, 2020). To facilitate SpaceX's compliance with the state's CMP for the proposed increase in annual launch operations and addition of landing operations at the SLC-40 LZ, the FAA has submitted the Draft EA to the Florida State Clearinghouse for review. The FAA's preliminary determination is that the Proposed Action would not have significant impacts on coastal resources.

3.8.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, *No Action Alternative*. The No Action Alternative, analyzed as the Proposed Action in the 2020 EA, would not result in significant impacts to coastal resources.

3.9 Land Use

3.9.1 Definition of Resource and Regulatory Setting

Land use can be defined as the human use of land resources for various purposes including economic production, natural resources protection, or institutional uses. Land uses are frequently regulated by

mission objectives, program and project plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect designated or environmentally sensitive land.

3.9.2 Study Area

The study area for land use evaluated under this assessment includes SLC-40 at CCSFS and the surrounding land and water resources.

CCSFS is an installation of the USSF's SLD 45, located on Cape Canaveral in Brevard County, Florida. CCSFS is located south-southeast of NASA's KSC, on adjacent Merritt Island with the two linked by bridges and causeways. Refer to **Figure 2-1** and **Figure 2-2** for the regional location of CCSFS as well as location of SLC-40 at CCSFS.

Both KSC and CCSFS are located along Florida's east coast in Brevard and Volusia Counties roughly 50 miles east of Orlando. Land jurisdiction for both KSC and CCSFS is divided between NASA and the DAF.

Surrounding major landmarks include the CNS to the north, the Banana River and KSC to the west, the Atlantic Ocean to the east, and Port Canaveral, Cocoa Beach, and Banana River Aquatic Preserve to the south.

3.9.3 Existing Conditions

CCSFS designates its own land use and zoning regulations, with the primary function to support space transportation operations and associated support requirements. Land use at CCSFS is comprised of industrial areas that support launch operations, launch and range support, airfield operations, port operations, and station support areas. There are also open space areas dispersed throughout the station, but none of these areas are considered farmland. There are no public beaches located on CCSFS (Space Florida, 2017).

SLC-40 is located within a previously developed area, while the proposed LZ would be constructed within a partially developed and undeveloped area south of Rocket Road (**Figure 2-5**).

While neither Brevard County nor the City of Cape Canaveral have land use or zoning authority over CCSFS land, their general plans designate compatible land uses and zoning in the surrounding areas (COCC, 2021; Brevard County, 1988).

The MINWR and CNS surround CCSFS and are managed by the USFWS and NPS for conservation and conditional public access use. For more than 35 years, NASA and the USFWS have held interagency agreements for the use and USFWS management of property adjacent to CCSFS (Space Florida, 2017). The USFWS, SLD45, and the Air Force Wildland Fire Branch are responsible for conducting frequent prescribed burns on the lands under their management in accordance with the Prescribed Burn MOU, KCA4205 Rev B (45 SW, USFWS, and KSC, 2019).

3.9.4 Environmental Consequences

3.9.4.1 Proposed Action

The FAA has not established a significance threshold or identified factors to consider when evaluating the context and intensity of potential environmental impacts for land use (Exhibit 4-1 of FAA Order 1050.1). The determination that significant land use impacts exist is normally dependent on the significance of other impacts. Under the Proposed Action, land use at CCSFS would remain unchanged aside from the 4 acres of undeveloped land that would be converted to developed land for the construction of the LZ at SLC-40. Undeveloped areas would continue to make up much of the land that surrounds the north and west of the study area, currently designated as operational buffer/conservation managed areas.

Additionally, land use within the natural areas managed by MINWR and CNS would not be affected under the Proposed Action. Land use in these areas would remain as designated nonoperational areas by NASA and would continue to be subject to controlled burning operations.

The fire management program administered by MINWR controls vegetative fuel loads at KSC to reduce the potential of wildfires. Burn planning and operations would continue to adhere to a Prescribed Burn MOU, KCA4205 R. The MOU lays out conditions and constraints for conducting prescribed burns, both on KSC and CCSFS. The document states no prescribed burning would occur on CCSFS or KSC/MINWR within a 1-mile radius of a smoke-sensitive spaceflight hardware or payload transport route beginning 1 day prior to arrival and/or transport. SLC-40 is not considered a smoke-sensitive area.

While the Proposed Action could cause a loss of burn days due to an increased cadence of launch and landing operations, it is not anticipated that current fire management program activities would be significantly impacted as prescribed fire planning and interagency coordination activities would continue. Coordination as part of the MOU occurs to ensure that controlled burning of adjacent land and related issues are well communicated. When NASA KSC or CCSFS receive a USFWS or Air Force Wildland Fire Branch notification of a planned prescribed burn, NASA KSC or CCSFS shall notify SpaceX within 3 days to allow coordination of prescribed burns. NASA KSC management and CCSFS would assist the USFWS or Air Force Wildland Fire Branch in resolving any operational or other barriers to accomplish prescribed burns.

While operations at CCSFS would increase over existing conditions, the Proposed Action would not result in a change in the existing land use at or in the vicinity of CCSFS. The Proposed Action would be consistent with the current land uses at and in the vicinity of CCSFS and would continue to function to support space transportation operations and associated support requirements. As such, significant impacts to land use would not occur under implementation of the Proposed Action.

3.9.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, No Action Alternative. The No Action Alternative, analyzed as the Proposed Action in the 2020 EA, would not result in significant impacts to land use. It is anticipated that land use at the LZ would remain as a designated nonoperational area.

3.10 Socioeconomics

3.10.1 Definition of Resource and Regulatory Setting

Socioeconomics refers to the human environment such as population, employment and income, economic activity, housing, and public services that might be affected by the Proposed Action and alternative(s). Socioeconomic impacts are typically analyzed by stating that "*effects*" to be considered when preparing a NEPA document include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, and that through NEPA, the *Human Environment* shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment.

Therefore, the requirement to prepare socioeconomic analysis in an EA or EIS is project specific and is dependent upon the existence of a relationship between natural or physical environmental effects and socioeconomic effects. A socioeconomic analysis was prepared based on the potential economic impact of the Proposed Action, as well as its potential effects on adjacent industries such as commercial fishing.

3.10.2 Study Area

The study area for socioeconomics includes KSC, CCSFS, Brevard County, and Volusia County, in the state of Florida; and the recovery area off the Atlantic coast where most reentry sonic booms and some landings occur to assess the extent to which potential impacts to commercial and recreational fishing may occur (shown in **Figure 3-2**).

3.10.3 Existing Conditions

3.10.3.1 Population and Housing

As of the most recent U.S. Census Bureau population estimates, the population in Brevard County is 643,979, representing a 6.2 percent increase from the 2020 Census and a 9.1 percent increase from the population of Brevard County reported in the 2020 EA. Volusia County's population is estimated at 590,357, which represents a 6.7 percent increase from the 2020 Census (U.S. Census Bureau, 2020). As shown in **Table 3-7**, the population in the state of Florida grew slower than both counties during the same time period (U.S. Census Bureau, 2023).

Table 3-7. Population Change in Brevard County, Volusia County, and Florida

Location	2010 Census[1]	2020 Census[1]	2023 Estimate[1]	Percent Change 2020–2023	Projected 2030[2,3]
Brevard County	543,376	606,612	643,979	6.2%	678,300
Volusia County	494,593	553,543	590,357	6.7%	620,100
Florida	18,801,310	21,538,187	22,610,726	5.0%	24,471,100

[1] Census data as of April 1; population estimates as of July 1
[2] Projections for April 1, based on starting estimates of population on April 1, 2021
[3] Medium projections shown
Source: (BEBR, 2022; U.S. Census Bureau, 2023)

There are an estimated 290,314 housing units in Brevard County with a median value of $278,000 (see **Table 3-8**) (U.S. Census Bureau, 2022a). Volusia County has an estimated 273,835 housing units with a

median value of $251,400 (U.S. Census Bureau, 2022a). As of February 2024, the median home listing price in Brevard County was $384,000, trending up 3.8 percent from February 2023. The median listing price in Volusia County was $387,800, up 3.4 percent from February of the previous year. The median home sold price was $350,000 in Brevard County and $345,000 in Volusia County (Realtor.Com, 2024a; Realtor.Com, 2024b).

Table 3-8. Selected Housing Characteristics

Location	Total Housing Units	Occupied Housing Units	Owner-Occupied Housing Units	Home Ownership Rate (%)	Median Value of Owner-Occupied Housing Units
Brevard County	290,314	246,650	189,103	76.7	$278,000
Volusia County	273,835	232,673	167,784	72.1	$251,400
Florida	9,915,957	8,353,441	5,585,924	66.9	$292,200

Source: (U.S. Census Bureau, 2022a)

3.10.3.2 Employment and Income

The most recent estimates from the Bureau of Economic Analysis (BEA) report there are 339,006 total full-time and part-time jobs in Brevard County. The largest industries in the county in terms of employment include the health care and social assistance industry (11.18 percent of total employment), retail trade industry (10.48 percent of total employment), and manufacturing (9.67 percent of total employment). There are 22,442 jobs in the construction industry in Brevard County, which comprise 6.62 percent of total employment in the county (BEA, 2023).

In Volusia County, there are 282,141 full-time and part-time jobs. The largest industries in Volusia County in terms of employment include the health care and social assistance industry (12.65 percent of total employment), retail trade industry (12.34 percent of total employment), and the accommodation and food services industry (9.5 percent of total employment) (BEA, 2023). There are 18,406 jobs in the construction industry in Volusia County, which comprise 6.52 percent of total employment in the county (BEA, 2023).

The most recent annual average unemployment rates available from the Bureau of Labor Statistics for Brevard and Volusia Counties are 2.8 percent and 3.1 percent, respectively, compared to the state's average annual unemployment rate of 2.9 percent (BLS, 2024). Per capita income in Brevard County is $40,111, which is higher than Volusia County ($35,364) and the state ($38,850) (U.S. Census Bureau, 2022b). Similarly, the current median household income in Brevard County is higher than the median household income of $51,184 reported in Section 3.13 of the 2020 EA (FAA, 2020). The most recently reported median household income in Brevard County is higher ($71,308) than in Volusia County ($63,075) and the state of Florida ($67,917) (U.S. Census Bureau, 2022b).

3.10.3.3 Economic Activity

The aerospace industry is an important economic generator in Brevard County and throughout the state of Florida. In Brevard County, there are 14,828 jobs, approximately 4.4% of all jobs in Brevard County, in the aerospace and aviation industry. There are 122 establishments in the sector, and sector wages total $1.9 billion (Space Coast Economic Development Commission, 2024). In January 2023, Space Florida, the

aerospace economic development agency of the State of Florida, announced the economic impact of the state's aerospace finance and development authority has totaled $5.9 billion since 2007 (Space Commerce, 2023). Part of the $5.9 billion economic impact on the state includes $2.8 billion in gross domestic product and $1.7 billion in household income (Space Commerce, 2023). Over the next 5 years, Space Florida's total economic impact is expected to reach an average annual impact of $1.1 billion totaling more than $5.3 billion (Space Commerce, 2023).

Waterways have the potential to be temporarily closed during launch and landing events. Commercial and recreational fishing based out of Port Canaveral and other local access points are a substantial industry in the local economy. Economic contributions from commercial and recreational fishing to coastal communities are characterized in the form of jobs, income, value-added impacts, and sales impacts. The South Atlantic FMC manages fisheries for 66 species of finfish and crustaceans occurring in the U.S. Exclusive Economic Zone from the Florida Keys through North Carolina (with some exceptions). Commercial and recreational fishing for species managed by the South Atlantic FMC is a multi-billion-dollar industry that has been reported to support up to 21,000 jobs, $665 million in income, $1 billion in value-added impacts, and $2 billion (in 2016 dollars) to the U.S. economy each year (SAFMC, 2018).

3.10.4 Environmental Consequences

3.10.4.1 Proposed Action

The FAA has not established a significance threshold for socioeconomics but has identified factors to consider when evaluating potential impacts associated with the Proposed Action. These factors include whether the Proposed Action would have the potential to:

- Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area);
- Disrupt or divide the physical arrangement of an established community;
- Cause extensive relocation when sufficient replacement housing is unavailable;
- Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities;
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities; and/or
- Produce a substantial change in the community tax base.

Construction activities under the Proposed Action would result in economic benefits from the use of local labor and supplies. Benefits associated with construction would be local, minor, and temporary, lasting only for the duration of the construction activities, which is estimated to be three to four months. There would be no migration of construction workers as the labor would be filled from the existing local workforce. The local housing market would not be substantially affected, and no new social services or support facilities would be required during construction activities.

Launching and landing operations under the Proposed Action would result in moderate but positive economic benefits from increased demand in the existing workforce, higher revenues, and increased per

capita income. SpaceX would continue to use its existing workforce for launching and landing activities. Ongoing commercial space activities at KSC and CCSFS would continue to be an important economic generator for the local region and nearby counties. The Proposed Action would not significantly affect the local housing market or the need for new social services or support facilities and would not negatively affect the local economy.

Under the Proposed Action, the number of launches would increase by 70 annual launches. The increased tempo in launches would increase the frequency of temporary disruptions of flight activities and changes in conditions or hazards in navigable waterways, which may impact airspace and maritime activities in the region of influence (ROI) from rerouting or delays during operations. However, significant impacts to airspace and maritime activities in the ROI would not be expected due to implementation of numerous protocols and procedures described in Section 2.1.1.2, Launch Operations, including implementation of NOTAMs and NOTMARs, and airspace coordination and maritime coordination activities between SpaceX, the DAF, the FAA, and the USCG.

In summary, the Proposed Action would not result in significant socioeconomic impacts on the region.

3.10.4.2 No Action Alternative

Under the No Action Alternative, activities would occur as described in Section 2.3, No Action Alternative. SpaceX would lose the ability to land boosters at CCSFS. This would increase the costs and time required for each launch. The No Action Alternative would not have the potential to influence factors identified by the FAA and, therefore, would not result in significant impacts to socioeconomics. Activities in the region would continue as reflected in the existing conditions.

Chapter 4. Cumulative Effects

This chapter (1) defines cumulative effects, (2) describes past, present, and reasonably foreseeable future actions relevant to cumulative effects, (3) analyzes the incremental interaction the Proposed Action may have with other actions, and (4) evaluates cumulative effects potentially resulting from these interactions. The approach taken in the analysis of cumulative effects follows the objectives of NEPA, CEQ guidance on cumulative effects (CEQ, 1997), and CEQ guidance on past actions (CEQ, 2005).

Cumulative effects are most likely to arise when a relationship or synergism exists between a proposed action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or close to the Proposed Action would be expected to have more potential for a relationship than those more geographically separated. Similarly, relatively concurrent actions would tend to offer a higher potential for cumulative effects. To identify cumulative effects, the analysis needs to address the following three fundamental questions:

- Does a relationship exist such that affected resource areas of the Proposed Action might interact with the affected resource areas of past, present, or reasonably foreseeable actions?
- If one or more of the affected resource areas of the Proposed Action and another action could be expected to interact, would the Proposed Action affect or be affected by impacts of the other action?
- If such a relationship exists, then does an assessment reveal any potentially significant impacts not identified when the Proposed Action is considered alone?

Therefore, the scope of the cumulative effects analysis involves both the geographic extent and the timeframe in which the Proposed Action's effects could be expected to occur in relation to other relevant past, present, and reasonably foreseeable actions. For this EA, the geographic extent of Proposed Action effects (i.e., the study area) includes those areas previously identified in Chapter 3, *Affected Environment and Environmental Consequences*, for the respective resource areas. The timeframe for cumulative effects centers on the timing of the Proposed Action (both development actions and operations). Beyond determining that the geographic scope and timeframe of the Proposed Action interrelate with past and present actions within the study area, the analysis employs the measure of "reasonably foreseeable" to include or exclude other actions. For the purposes of this analysis, public documents prepared by Federal, state, and local government agencies form the primary sources of information regarding reasonably foreseeable actions.

4.1 Projects Considered for Potential Cumulative Effects

This section focuses on identifying past, present, and reasonably foreseeable projects at and near the Proposed Action locale and determining which projects to include in the cumulative effects analysis. If a relationship exists such that the affected resource areas of the Proposed Action might interact (geographically and/or temporally) with the affected resource area of a past, present, or reasonably foreseeable action, the action is included in the analyses. If no such potential relationship exists, the project was not carried forward into the cumulative effects analysis. These actions considered but

excluded from further cumulative effects analysis are not cataloged here as the intent is to focus the analysis on the meaningful actions relevant to informed decision-making. Projects in the region that posed temporary impacts only during construction but are now complete are listed in **Table 4-1**. In addition, the table includes projects scheduled for the near term that would only pose temporary construction impacts but would not contribute to any permanent increase in impacts. None of these projects are carried forward for cumulative analysis because:

- No additional permanent impact would be expected to occur; or
- The project impacts are already incorporated into the affected environment described for each resource area.

Table 4-1. Cumulative Actions with Temporary Construction Impacts

Location	Action Name	Description
Past Actions That Had Temporary Construction Impacts but Are Now Complete		
KSC	LC-39B Redevelopment for Space Launch System	LC-39B was redeveloped for the Space Launch System rocket and Orion spacecraft. The pad was returned to a clean design after removal of the Fixed Service Structure. Conceptually, this design allows multiple types of vehicles to launch from LC-39B arriving at the pad with service structures on the mobile launch platform rather than custom structures on the pad.
KSC	KSC Central Campus Redevelopment	The area was identified to support any nonhazardous new NASA development in support of NASA programming and/or as part of KSC's recapitalization process. Facilities were relocated here through recapitalization efforts.
CCSFS	Blue Origin Construction of SLC-36	Blue Origin constructed a launch site and supporting facilities necessary for Orbital Launch Vehicles (DOT, 2017).
KSC	Blue Origin Manufacturing and Production Campus in Exploration Park	Blue Origin built a manufacturing facility to support development of reusable launch vehicles utilizing rocket-powered Vertical Takeoff and Vertical Landing systems.
CCSFS	Relativity Redevelopment of SLC-16	To support the Terran 1 Program, modification of existing facilities and construction of new systems and facilities were conducted at SLC-16 (DAF, 2020).

Notes: CCSFS = Cape Canaveral Space Force Station; DAF = Department of the Air Force; DOT = United States Department of Transportation; KSC = Kennedy Space Center; LC = Launch Complex; NASA = National Aeronautics and Space Administration; SLC = Space Launch Complex.

If the projects pose ongoing impacts (e.g., air emissions or vessel traffic), then they are included in the cumulative effects analysis. All projects included in this cumulative effects analysis are listed in **Table 4-2** and briefly described in the following subsections.

Table 4-2. Cumulative Action Evaluation

Location	Action	Description	Potentially Impacted Resources
Past Actions			
KSC	KSC Transition to Multi-User Spaceport	KSC's transition to a multi-user spaceport, as addressed in the 2016 Master Plan Environmental Impact Statement, advocates compatible relationships between adjacent land uses. In addition, the 2020 Vision Plan and Programmatic EA supports KSC's mission to	Air Quality Climate Noise Cultural Resources Water Resources Biological Resources

Table 4-2. Cumulative Action Evaluation

Location	Action	Description	Potentially Impacted Resources
		function as a multi-user spaceport for launch operations by NASA and private partners. As such, development within KSC focuses on maintaining effective real property management through sustainable planning (NASA, 2016).	Coastal Resources Land Use DOT Section 4(f) Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
Present Actions			
KSC	SpaceX	SpaceX operates its Falcon family of launch vehicles at LC-39A and plans to expand operations to include launch of a Starship-Super Heavy vehicle from this complex (up to 24 times per year) (NASA, 2019). In support of this action, SpaceX is constructing a Starship-Super Heavy launch mount and integration tower and installing ground support equipment. Site improvements include an interior transport road and several new high-pressure gaseous commodity lines.	Air Quality Climate Noise Cultural Resources Water Resources Biological Resources Coastal Resources Land Use DOT Section 4(f) Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	SpaceX Roberts Road Operations Area	The ongoing construction associated with a 2018 EA includes site development of approximately 67 acres of land (NASA, 2018). Roberts Road and A Avenue were paved.	Air Quality Climate Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	Blue Origin Manufacturing and Production Campus in Exploration Park	Blue Origin operates a manufacturing facility to support development of reusable launch vehicles utilizing rocket-powered Vertical Takeoff and Vertical Landing systems.	Air Quality Climate Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
CCSFS	Space Florida Redevelopment of SLC-20	Space Florida is developing, refurbishing, enhancing, and using approximately 220 acres at CCSFS, including SLC-20 and all facilities at the site (Space Florida, 2020). Action includes	Air Quality Climate Cultural Resources Water Resources

Table 4-2. Cumulative Action Evaluation

Location	Action	Description	Potentially Impacted Resources
		construction/renovation activities and operation of small- and medium-lift launch vehicles.	Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
CCSFS	Redevelopment of SLC-16	Relativity is redeveloping SLC-16 to support the Terran R launch program.	Air Quality Climate Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	Space Florida Launch and Landing Facility Development	Space Florida is proposing to develop and make improvements to the area around the LLF to support commercial activities (NASA, 2021b).	Air Quality Climate Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	Space Commerce Way Widening	The FDOT is widening 2.7 miles of Space Commerce Way to four lanes to support future growth at KSC. The project began construction in July 2023.	Air Quality Climate Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
Reasonably Foreseeable Future Actions			
CCSFS	SpaceX Starship-Super Heavy Operations at CCSFS	The DAF is evaluating the potential environmental impacts associated with the execution of a real property agreement between the USSF and SpaceX, which would	Air Quality Climate Noise Cultural Resources

Table 4-2. Cumulative Action Evaluation

Location	Action	Description	Potentially Impacted Resources
		enable SpaceX to develop a launch site to support Starship-Super Heavy operations, including launch and landing at CCSFS and the FAA's issuance of a vehicle operator license at the selected launch site and approval of related airspace closures (DAF, 2024).	Water Resources Biological Resources Coastal Resources Land Use Socioeconomics DOT Section 4(f) Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
CCSFS	United States Space Force Range of the Future	The USSF plans to update Cape Canaveral in terms of infrastructure and processes over the next decade, clearing the way to accommodate potential daily launches for everything from manned spaceflight to military and commercial communications and surveillance payloads (Cohen, 2020). As part of this effort, SLD 45 is currently working on increasing its launch posture over the next 10 years through a collection of work called the Range of the Future, which includes improvements to infrastructure, operations, and policies, continuously developing and deploying new technology, and innovating at every level (USSF, 2021).	Air Quality Climate Noise Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Socioeconomics DOT Section 4(f) Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
CCSFS	Redevelopment of ICBM Road Launch Complexes	The USSF is considering the redevelopment of multiple launch complexes along ICBM Road to support new launch programs.	Air Quality Climate Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	Starship-Super Heavy Operations at LC-39A	As noted under present actions, SpaceX plans to expand operations to include launch of a Starship-Super Heavy vehicle from LC-39A (NASA, 2019). In addition, SpaceX is evaluating landing operations at LC-39A, downrange in the Atlantic Ocean on a floating platform, or expended in the Atlantic Ocean (FAA, 2024).	Air Quality Climate Noise Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Socioeconomics DOT Section 4(f)

Table 4-2. Cumulative Action Evaluation

Location	Action	Description	Potentially Impacted Resources
			Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	LC-39A Falcon Landing Zones and Increased Falcon Launches	Landing zones at LC-39A are proposed to support Falcon launches from LC-39A to replace LZ-1 and LZ-2. There would be up to 20 Falcon booster landings at LC-39A, so the total Falcon booster landings between the proposed LC-39A and SLC-40 LZs would be 54, which is the same number of total booster landings at LZ-1/LZ-2 that was analyzed in the 2020 EA.	Air Quality Climate Noise Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Socioeconomics DOT Section 4(f) Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC/CCSFS	Other launch and reentry operations	• Atlas V and Vulcan launches from SLC-41 • Relativity launches from SLC-16 • Blue Origin launches from SLC-36 • SLS launches from LC-39B • Sierra Space Dream Chaser landings at the LLF • Astra launches from SLC-46 • Firefly launches from LC-20 • Stoke Space launches from LC-14 • ABL Space Systems launches from LC-15 • Phantom and Vaya launches from LC-13	Air Quality Climate Noise Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Socioeconomics DOT Section 4(f) Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	Solar Development	A solar field and stormwater treatment are proposed at the intersection of Schwartz Road and A Avenue. The project began construction in 2023.	Air Quality Climate Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy

Table 4-2. Cumulative Action Evaluation

Location	Action	Description	Potentially Impacted Resources
KSC	Natural Gas Pipeline	A natural gas pipeline operated by Florida City Gas is proposed to provide natural gas to KSC. The project began construction in 2024.	Air Quality Climate Cultural Resources Water Resources Biological Resources Coastal Resources Land Use Socioeconomics Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy
KSC	SpaceX Roberts Road Operations Area Expansion and Supporting Infrastructure on Kennedy Space Center	SpaceX would expand the Roberts Road Operations Area by 100 acres immediately north of the existing site. Saturn Causeway would be widened from the Vehicle Assembly Building to Phillips Parkway and drainage swales would be improved. A new electrical duct bank from the C5 substation is proposed within the roadway footprint to support operations at LC-39A.	Air Quality Climate Water Resources Biological Resources Coastal Resources Land Use Hazardous Materials, Solid Waste, and Pollution Prevention Natural Resources and Energy

Notes: CCSFS = Cape Canaveral Space Force Station; DAF = Department of the Air Force; DOT = United States Department of Transportation; EA = Environmental Assessment; FAA = Federal Aviation Administration; FDOT = Florida Department of Transportation; KSC = Kennedy Space Center; LC = Launch Complex; LLF = Launch and Landing Facility; LZ = landing zone; NASA = National Aeronautics and Space Administration; NEPA = National Environmental Policy Act; SLC = Space Launch Complex; SLD = Space Launch Delta; SLS = Space Launch System; SpaceX = Space Exploration Technologies Corporation; USSF = United States Space Force.

4.2 Cumulative Effects Analysis

Cumulative effects result from the incremental effect of an action when added to other past, present, and reasonably foreseeable actions, regardless of the proponent (Federal or non-Federal) undertaking these actions. Minimal or negligible impacts from individual projects may, over a period of time, become collectively significant. Where feasible, the cumulative effects were assessed using quantifiable data; however, for many of the resources included for analysis, quantifiable data are not available, and a qualitative analysis was undertaken. In addition, where an analysis of potential environmental effects for future actions has not been completed, assumptions were made regarding cumulative effects related to this EA where possible. The analytical methodology presented in Chapter 3, *Affected Environment and Environmental Consequences*, which was used to determine potential impacts to the various resources analyzed in this document, was also used to determine cumulative effects.

4.2.1 Air Quality

The study area for assessing cumulative air quality impacts from criteria pollutants includes Brevard County. Brevard County is currently in attainment for all NAAQS. The immediate area surrounding the project site at CCSFS is the focus of localized cumulative effects, as this area would experience the highest ambient impacts from project emissions. The nearest locations of substantial cumulative project emissions (as identified in Section 4.1, *Projects Considered for Potential Cumulative Effects*) that could combine with project emissions and produce cumulative effects within CCSFS and KSC were reviewed. In general, air emissions associated with construction activities are short-term and temporary. Similarly, air emissions during launch operations are temporary.

As described in Section 3.2.4, *Air Quality, Environmental Consequences*, emissions from project construction or operational activities would not cause or contribute to an exceedance of a NAAQS. Contributions from cumulative sources to localized project impacts would be limited by the geographical separation of the cumulative projects. Transport of these emissions to the locality surrounding the project site would result in ambient impacts below levels of concern, as demonstrated by the attainment status of all NAAQS within the study area. As a result, emissions from the Proposed Action, in combination with emissions from cumulative projects, would not cause or contribute to an exceedance of a NAAQS. Therefore, criteria pollutant impacts from project construction or operational activities would not result in significant cumulative effects.

4.2.2 Climate

The potential effects of proposed GHG emissions are by nature global and cumulative effects, as worldwide sources of GHGs contribute to climate change. As identified in Section 3.3.4, *Climate, Environmental Consequences*, GHG emissions estimated for project construction and operational activities would incrementally contribute to future climate change, some effects of which are identified in Section 3.3, *Climate*. Essentially, project GHG emissions, in combination with GHG emissions from past, present, and reasonably foreseeable future sources, would result in incremental cumulative effects to climate change. To minimize GHG emissions from the Proposed Action, project emission sources would comply with applicable regulations and GHG policies.

As identified in Section 3.3.4, *Climate, Environmental Consequences*, climate change could impact implementation of the Proposed Action at CCSFS and the adaptation strategies needed to respond to future conditions. Operations at CCSFS have adapted to their changing climate. However, exacerbation of these conditions in the future could impede proposed activities during extreme events. The FAA, NASA, and the DAF have developed measures to adapt to future climatic events and, therefore, to make facilities more resilient to future climate impacts. Implementation of these measures would mitigate the effects of climate change to the Proposed Action.

4.2.3 Noise and Noise-Compatible Land Use

Over time, the same areas would experience noise generated by operations at both SLC-40 and LC-39A. Noise from future Falcon landing events at LC-39A would occur but would be balanced by the removal of that landing noise at LZ-1 and LZ-2 at CCSFS. Starship-Super Heavy noise levels for proposed operations at KSC and CCSFS will be analyzed in two EISs (DAF, 2024; FAA, 2024). At the time of that analysis, Falcon 9

operations at SLC-40 would be accounted for as part of baseline conditions. If significant noise impacts are found to be associated with the combined noise levels, then appropriate mitigations would be developed, where practicable to minimize or avoid impacts. As approved and proposed launch programs begin to launch or increase their flight rate, additional noise associated with these events would occur. However, it is unclear when or if these programs will launch, thus cumulative noise levels cannot be predicted with a reasonable certainty.

Other projects that involve construction on CCSFS/KSC, such as the Roberts Road SpaceX Operations Area Expansion, would also generate temporary and localized noise increases. These activities would not occur in the same locations at the same time, and there would not be cumulative effects.

4.2.4 Cultural Resources

The past, present, and reasonably foreseeable actions with the potential to affect cultural resources are presented in Table 4-1 and Table 4-2. Under the Proposed Action, there would be no impact to cultural resources from site development at SLC-40; however, launch frequencies are anticipated to increase as compared to those previously analyzed. In general, past and future launches contribute to short-term and temporary increases in noise levels throughout the APE. Analysis has shown that launches and landings do not result in significant impacts to historic properties within the APE, and taken into context, the overall cumulative effect of noise to cultural resources within the APE from other past, present, and reasonably foreseeable actions would not result in significant effects based on evaluation criteria. As noted in Section 4.2.3, *Noise and Noise-Compatible Land Use*, the same areas would experience noise generated by operations at both SLC-40 and LC-39A. Starship-Super Heavy noise levels and any associated impacts on cultural resources for proposed operations at KSC and CCSFS will be analyzed in two EISs (DAF, 2024; FAA, 2024).

4.2.5 Water Resources

Cumulative effects to water resources could occur if projects identified in Table 4-1 and Table 4-2 were to inadequately address water resources in the study area. Cumulative effects to water resources would not be expected because projects that contained ground disturbance would have construction requirements for managing stormwater runoff, such as implementation of a SWPPP and related BMPs (e.g., installing silt fences, covering soil stockpiles, using secondary containment for hazardous materials, and revegetating the site in a timely manner). Cumulative increased impervious surfaces at KSC and CCSFS could increase stormwater runoff; however, post-construction BMPs (e.g., swales and retention ponds) would be employed to control stormwater runoff.

Compliance with all state and Federal regulations and implementation of proper management of materials and wastes would minimize impacts to water resources. Therefore, implementation of the Proposed Action in conjunction with other past, present, or reasonably foreseeable projects would not result in significant cumulative effects to water resources.

4.2.6 Biological Resources

Several of the projects listed in Table 4-2 include construction and development in both undisturbed and previously disturbed areas. Disturbance to existing launch areas or other developed and semi-developed

sites would have little effect on wildlife because these areas have limited habitat value. The Proposed Action and some of the actions in Table 4-2 involve clearing of native upland habitat. Some of the actions in Table 4-2 could also potentially involve clearing and/or filling of a limited amount of wetland habitat. The Proposed Action would not directly affect wetlands; potential impacts would consist of construction -related sedimentation from runoff. Cumulative loss and fragmentation of native upland and wetland habitats may cause long-term effects on wildlife breeding, roosting, or foraging, particularly of individuals with limited mobility and those without corridors to another suitable habitat. Construction noise and general disturbance could cause similar impacts, but the effects would be temporary. As described in the Cape Canaveral Spaceport Master Plan (Space Florida, 2017), KSC Vision Plan (NASA, 2020), and USSF Range of the Future initiative (DAF, 2023c), to the greatest extent possible development is consistent with sustainable planning and is focused in areas that minimize impacts to wetlands and protected species. Compensatory mitigation would be required for any activities in scrub habitat and wetlands, and all construction projects would follow BMPs and permit requirements to prevent excess sedimentation and runoff into surrounding habitats. CCSFS, KSC, and MINWR have large areas of intact wetlands where some displaced wetland-dependent species may establish new territories, although the survival rate of displaced individuals is unknown. ESA Section 7 requirements from the USFWS and the requirement to avoid nests of bald eagles, migratory birds, and other protected bird species until they have fledged, which are in place for some past and present actions, reduce the potential for major cumulative effects to these species. Similar requirements are likely for reasonably foreseeable actions that involve substantial habitat disturbance.

For wildlife species with populations that are currently well-distributed and not stressed by other factors, cumulative habitat loss and disturbance impacts are expected to be minimal. However, for protected species, the potential for negative impacts is greater due to the rarity of these animals and their habitats. For example, if restrictions on prescribed burning at CCSFS, KSC, and MINWR from the actions listed in Table 4-2 were to occur such that fire-dependent habitats were not burned frequently enough to maintain quality conditions in large areas of connected habitat, there would likely be decreases in the health of species that frequently use fire-dependent habitats (e.g., Florida scrub-jay and eastern indigo snake). Due to the importance of the Florida scrub-jay population at CCSFS and KSC, such impacts could be considered significant. CCSFS, KSC, and MINWR are committed to ensuring habitat is burned such that the long-term health of this species is maintained and improved, as detailed in the Prescribed Fire MOU (45 SW, USFWS, and KSC, 2019), MINWR Comprehensive Conservation Plan (USFWS, 2008b), and CCSFS INRMP (USSF, 2023b). Additionally, if impacts could not be avoided, compensatory mitigation for the Florida scrub-jay likely would be required through Section 7 consultation with the USFWS.

The number of annual launch operations on CCSFS and KSC for all current and prospective operators could increase substantially, potentially up to daily, with implementation of the Proposed Action and other actions listed in Table 4-2. Some actions would also include static fire tests and booster landings. The increased launch tempo could result in long-term vegetation scorching and potentially conversion to heat -tolerant vegetation near launch sites. The area of effects for any given launch site would be relatively small and would not be expected to cause detectable impacts on wildlife populations. The total affected area for all combined launch sites would be greater. Most of the vegetation within launch sites at CCSFS and KSC is maintained under existing conditions and, therefore, has reduced habitat value. The use of more powerful rocket engines associated with some future actions would affect a larger area but would not likely cause detectable impacts on wildlife. Acid and particulate deposition in surrounding areas has

been noted during operation of some launch vehicles, but the Proposed Action would not contribute substantially to such effects because of the type of fuels used in Falcon vehicles.

The increased number of launches and landings would correspondingly increase the frequency at which wildlife would be exposed to noise and ground vibration. Behavioral and physiological stress reactions would be expected in some individuals, although habituation could also potentially occur. There is potential for individuals to avoid areas associated with repeated disturbance long term or to experience chronic stress responses, which could affect health and reproductive success. Such impacts would be of particular concern for protected species. Population-level impacts, and the significance of such impacts, are difficult to predict, but monitoring of representative species may be used to help assess long-term effects. Monitoring is currently conducted for some species on and near CCSFS and KSC. Additional monitoring or other management requirements could potentially be identified during consultations with the USFWS for the Proposed Action and other future actions listed in Table 4-2.

Increased development and launch tempo would also increase the incidence of nighttime lighting. Lighting may disorient birds and affect the behavior of nesting sea turtles and hatchlings. As all facilities at CCSFS and KSC are required to develop and follow a Lighting Management Plan, the Proposed Action and other development actions in Table 4-2 would contribute a minimal amount of artificial lighting to the region. Lighting associated with increased launches and landings would have greater potential to affect sea turtles. It is expected that exterior lighting measures would be identified during consultations with the USFWS and would be incorporated into applicable Lighting Management Plans. CCSFS currently implements requirements of the 45 Space Wing Instruction 32-7001 (*Exterior Lighting Management*), and KSC operates under a programmatic Biological Opinion for artificial lighting. Continued sea turtle nesting monitoring would help to detect any impacts due to lighting.

Increased launches, landings, and splashdowns associated with the Proposed Action and other actions in Table 4-2 would increase the frequency of impacts on marine species and habitats, including potential noise disturbance, physical strikes, entanglement in or ingestion of mission-related items or debris, and habitat alteration. Sonic booms would affect a small area of ocean surface. Most of the affected area would be exposed to pressure levels of 1 psf or less. Sonic booms would not substantially affect marine species beneath the surface. Although frequent launches and landings would increase the potential for an animal at the surface to be within the small area of highest noise levels, the probability would remain low overall. Animals experiencing a sonic boom could exhibit a startle response. Due to the dispersed distribution of marine species and the size of mission-related items and debris relative to the study area, physical strikes would likely be unusual and would not cause detectable impacts on populations. Similarly, entanglement in and ingestion of items such as parachutes, parafoils, and other debris is possible, but the number of animals affected would not likely be detectable at the population level. Increased launch operations would generate more debris that would sink to the ocean floor and impact benthic habitats, including EFH. Because of the small number of unrecovered items relative to the area of available seafloor, impacts on benthic habitats would not affect marine populations.

Overall impacts to vegetation, habitats, wildlife, and protected species would be moderated by the implementation of CCSFS and KSC requirements, mitigations, and USFWS and NMFS Section 7 consultation terms and conditions. Increased noise and potential disruption of prescribed burn schedules could cause potentially significant impacts on terrestrial wildlife and protected species (e.g., habitat abandonment and decreased reproductive success). It is expected that requirements developed during

Section 7 consultations, which could include actions such as mitigation development based on the results of increased species monitoring, would decrease the potential for effects and that the continued existence of federally listed species would not be jeopardized. It is also expected that burn schedules would be coordinated such that significant habitat impacts would not occur. Impacts on marine species and habitats would likely be minor. With implementation of required management and project design criteria, the Proposed Action in combination with the actions in Table 4-2 would not reach a cumulatively significant level.

4.2.7 Coastal Resources

The projects listed in Table 4-1 and Table 4-2 have or would undergo a coastal consistency determination and concurrent or other applicable permitting process and would be subject to the same enforceable policies and regulations as the Proposed Action that protect coastal resources. Therefore, there would be no significant cumulative effects to coastal resources.

4.2.8 Land Use

The Proposed Action would not result in significant adverse cumulative land use impacts. The Proposed Action would not change the existing use of the launch facilities or significantly change the fire management program activities in the area surrounding SLC-40. Although the Proposed Action could cause a loss of burn days due to the increase in operations over existing conditions, it is not anticipated that current fire management program activities would be significantly impacted. Prescribed fire planning and interagency coordination activities would continue and adhere to the Prescribed Burn MOU, KCA4205 Rev B (45 SW, USFWS, and KSC, 2019) as new launch operators become active to reduce or avoid impacts to the prescribed burn programs at CCSFS and KSC.

The Proposed Action would be consistent with the current land uses at and in the vicinity of CCSFS and would continue to function to support space transportation operations and associated support requirements. Therefore, the Proposed Action, when combined with other past, present, and reasonably foreseeable future actions, would not result in cumulative effects on land use.

4.2.9 Socioeconomics

Additional economic activity associated with the Proposed Action would result in minor to moderate but positive socioeconomics impacts. Employers such as KSC and CCSFS have provided positive direct, indirect, and induced contributions to the local economy through employment, income, and tax revenues.

The increased tempo in launches under the Proposed Action in combination with past, present, and reasonably foreseeable future actions that could temporarily disrupt flight activities and cause changes in conditions or hazards in navigable waterways in the ROI may further impact airspace and maritime activities from rerouting or delays during operations. While the combined impacts could be significant if unmitigated, the uncertainty surrounding the timing and specific location of activities makes it infeasible to quantify the cumulative socioeconomic impact of all projects identified in Table 4-2. SpaceX, the DAF, the FAA, and the USCG would continue to implement numerous protocols and procedures to assess, avoid, mitigate, and minimize potential risks to airspace and maritime participants.

As a result, the overall cumulative effect of the Proposed Action when combined with other past, present, and reasonably foreseeable future actions on socioeconomics would not result in significant impacts to socioeconomics.

4.2.10 DOT Section 4(f) Properties

The Proposed Action would not result in significant adverse cumulative effects on Section 4(f) resources. Section 4(f) resources within the vicinity of CCSFS and in the broader region have experienced noise and temporary closures related to crowd control and access for emergency services for decades. These effects have not led to substantial diminishment of the protected activities, features, or attributes of these properties. .

Falcon launches at LC-39A currently restrict access to Section 4(f) resources due to safety; thus, any future increase in cadence from LC-39A in combination with the proposed increases at SLC-40 would not be expected to result in substantial access restrictions. Reasonably foreseeable future actions in the area, such as SLS launches at LC-39B, may require temporary closures of both the refuge and the seashore by USFWS and NPS. These temporary closures are related to crowd control and access for emergency services and are not related to a public safety hazard from a launch. If any such closures were to occur, they would be both infrequent and temporary in nature. As a result, the cumulative effects of other past, present, and reasonably foreseeable future actions with the Proposed Action are not expected to result in a significant impact to Section 4(f) resources.

4.2.11 Hazardous Materials, Solid Waste, and Pollution Prevention

Falcon launch operations would use products containing hazardous materials, such as paints, solvents, oils, lubricants, acids, batteries, surface coating, cleaning compounds, propellants, chemicals, and other hazardous material payload components. In addition, numerous hazardous materials are used and hazardous wastes generated in association with support to missions and general maintenance activities at CCSFS and KSC. However, as noted in Section 4.11 of the 2020 EA, continued implementation of existing handling and management procedures for hazardous materials, hazardous wastes, and solid wastes generated during the operation of the vehicles would limit the potential for effects. As a result, the cumulative effects of other past, present, and reasonably foreseeable future actions with the Proposed Action would not contribute a noticeable incremental effect from hazardous materials and waste.

4.2.12 Natural Resources and Energy Supply

Other launch operators and projects considered in Table 4-1 and Table 4-2 will result in cumulative consumption of resources. However, the Proposed Action is not expected to contribute in any substantive manner to adverse cumulative effects to supplies of natural resources or energy use. As noted in Section 5.2.12 of the 2020 EA, the Proposed Action would involve the consumption of fuel, oil, and lubricants for launch, landing, and recovery operations. Effects to electrical service would occur within CCSFS and result in relatively small cumulative effects to regional service providers. Water supply may become more limited; however, future operations and personnel are anticipated to implement water conservation measures and evaluate alternative water sources to minimize effects on this resource.

Energy and natural resources needed to implement the Proposed Action in conjunction with past, present, and reasonably foreseeable future actions are not anticipated to exceed regional capacity, and as a result, cumulative effects to natural resources and energy supply would not be significant.

Chapter 5. Conclusion

The FAA has prepared this EA to evaluate the potential environmental effects of an annual launch cadence of 120 launches per year at SLC-40 and the construction and operation of a new Falcon 9 LZ. The environmental effect categories assessed in detail in this EA include air quality; climate; noise and noise-compatible land use; cultural resources; Department of Transportation Act Section 4(f); water resources; biological resources; coastal resources; land use; socioeconomics; hazardous materials, solid waste, and pollution prevention; and natural resources and energy supply.

Based on the above review and in conformity with FAA Order 1050.1F, the FAA has preliminarily concluded that the Proposed Action would not significantly affect the quality of the human environment.

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Chapter 6. List of Preparers, Independent Evaluators, and Agencies and Persons Consulted

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6.3 List of Agencies and Persons Consulted

Federal Agencies

National Aeronautics and Space Administration
United States Coast Guard
United States Space Force

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