

# **DRAFT ENVIRONMENTAL IMPACT STATEMENT**

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## **SPACEX STARSHIP-SUPER HEAVY LAUNCH VEHICLE AT LAUNCH COMPLEX 39A**

at the Kennedy Space Center, Merritt Island, Florida

Volume I - Main EIS

**August 2025**



**Federal Aviation  
Administration**



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## Environmental Impact Statement for the SpaceX Starship-Super Heavy Launch Vehicle at Launch Complex 39A at the Kennedy Space Center, Merritt Island, Florida

**AGENCIES: Lead Federal Agency:** Federal Aviation Administration (FAA) (Office of Commercial Space Transportation). **Cooperating Agencies:** National Aeronautics and Space Administration (Kennedy Space Center), Department of the Air Force (United States [U.S.] Space Force), National Park Service (Canaveral National Seashore), U.S. Fish and Wildlife Service (Merritt Island National Wildlife Refuge), and U.S. Coast Guard.

**DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION ADMINISTRATION:** The FAA is preparing this EIS to inform and support the decision on whether to issue Space Exploration Technologies Corporation (SpaceX) a new, or modify their existing, vehicle operator license for Starship-Super Heavy at Launch Complex (LC)-39A. This EIS analyzes the potential environmental effects associated with (1) the development of infrastructure at LC-39A to support Starship-Super Heavy operations, including testing, launches and Starship and booster landings at KSC, and (2) the FAA's issuance to SpaceX of a new, or modification of their existing vehicle operator license for Starship-Super Heavy operations at LC-39A and approval of related airspace closures. The Proposed Action would result in temporary closures of airspace to ensure public safety. The FAA is responsible for creating these temporary closures in accordance with FAA Order 7400.2R, Procedures for Handling Airspace Matters. The EIS addresses potential effects to 17 resource areas, to include noise and compatible land use; land use; socioeconomics; historical architectural, archaeological, and cultural resources; Department of Transportation Act Section 4(f) resources; biological resources, water resources, and transportation.

**PUBLIC REVIEW PROCESS:** This Draft Environmental Impact Statement (EIS) is submitted for review pursuant to the following public law requirements and lists those that are applicable, such as Section 102(2)(C) of the National Environmental Policy Act of 1969 and Section 4(f) of the Department of Transportation. Comments on the Draft EIS must be submitted by September 22, 2025, identified with the Docket Number **FAA-2024-1395**, and may be provided to the FAA as follows:

- Federal E-Rulemaking Portal: <http://www.regulations.gov>. Retrieve the docket by conducting a search for "FAA-2024-1395" and follow the online instructions for submitting comments. Please note that the FAA will post all comments on the Internet without changes, including any personal information provided.

**CONTACT INFORMATION:** Questions regarding this EIS may be directed to Ms. Eva Long, FAA Environmental Protection Specialist at [SpaceXStarship39AEIS@icf.com](mailto:SpaceXStarship39AEIS@icf.com).

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# Executive Summary

## ES.1 Introduction

The Federal Aviation Administration (FAA) is preparing this Environmental Impact Statement (EIS) to inform and support the decision on whether to issue Space Exploration Technologies Corp. (SpaceX) a new, or modify their existing, vehicle operator license for Starship-Super Heavy at Launch Complex (LC)-39A (Figure ES-1). This EIS analyzes the potential environmental effects associated with (1) the development of infrastructure at LC-39A to support Starship-Super Heavy operations, including testing, launches and Starship and booster landings at Kennedy Space Center (KSC), and (2) the FAA's issuance to SpaceX of a new, or modification of their existing, vehicle operator license for Starship-Super Heavy operations at LC-39A and approval of related airspace closures. The FAA considers the issuance or modification of a vehicle operator license and associated airspace closures to be major Federal actions that require environmental review consistent with the National Environmental Policy Act (NEPA) of 1969, §§ 4321-4336, as amended through Public Law 118–5 (June 3, 2023)<sup>1</sup> and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures (July 16, 2015)<sup>2</sup>.

## ES.2 Background (EIS Section 1.1)

LC-39A at KSC was previously sited for Starship-Super Heavy activities through the National Aeronautics and Space Administration's (NASA's) *Final Environmental Assessment [EA] for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC)*<sup>3</sup> (referred to as "2019 NASA EA" throughout this document) and resultant Finding of No Significant Impact (FONSI). This Proposed Action incorporates that environmental analysis by reference and addresses modifications to the SpaceX concept of operations for Starship-Super Heavy. The Department of the Air Force (DAF) is also considering a proposed action to support Starship-Super Heavy at Cape Canaveral Space Force Station (CCSFS). This action is separate from the Proposed Action at LC-39A in that the CCSFS action will provide separate utility for the DAF and SpaceX within the overall Starship-Super Heavy program. As a result, there are two separate EISs.

In September 2019, NASA completed the 2019 NASA Environmental Assessment (EA) to evaluate the potential environmental impacts resulting from construction and operations associated with the proposed SpaceX Starship-Super Heavy launch vehicle at LC-39A. The resulting FONSI concluded that the environmental impacts associated with the Proposed Action would not have a significant effect on the quality of the biological or physical environment.

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<sup>1</sup> On January 20, 2025, President Trump issued Executive Order (E.O.) 14154, *Unleashing American Energy*, which revoked E.O. 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. In response, the CEQ issued an interim final rule to remove the existing implementing regulations for NEPA (90 Federal Register 10610 [February 25, 2025], effective April 11, 2025).

<sup>2</sup> FAA Order 1050.1G was issued on June 30, 2025, over a year after this EIS was initiated. This EIS was prepared in accordance with FAA Order 1050.1F and CEQ's NEPA Implementing Regulations Revision Phase 1, 87 Federal Register 23453 (April 20, 2022) (Phase 1 final rule).

<sup>3</sup> NASA, 2019. Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC).



Figure ES-1. Location of LC-39A

While the FAA was a cooperating agency on the 2019 NASA EA, the EA was not adopted by the FAA because SpaceX did not apply to the FAA for a commercial launch vehicle operator license at that time and the FAA had no corresponding Federal action requiring evaluation. Since the 2019 NASA EA, SpaceX has undertaken infrastructure improvements at LC-39A (e.g., construction of a launch mount) (NASA, 2019a, pp. 9-14). However, the Starship-Super Heavy concept of operations has been updated, which includes additional launch infrastructure, evolved launch vehicle design, higher launch tempo, and return to launch site (RTLS) booster recovery. In consideration of SpaceX's proposal, NASA as the lead land management agency and the FAA as the licensing agency have determined that an EIS is the appropriate level of NEPA analysis to address the potential environmental effects of Starship-Super Heavy operations at LC-39A. This Proposed Action incorporates the 2019 NASA EA analysis by reference (where appropriate) and addresses modifications to the SpaceX concept of operations for Starship-Super Heavy. SpaceX will apply for a new license or modification of their existing vehicle operator license for LC-39A that would identify a proposed launch cadence consistent with that analyzed in this EIS. Any future proposed launch cadence increases would be reevaluated by the FAA through the same process.

### **ES.3 Federal Agency Roles (EIS Section 1.2)**

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 United States (U.S.) Code §§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 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 to encourage, facilitate, and promote commercial space launches and reentries by the private sector. As codified at 49 Code of Federal Regulations (CFR) §1.83(b), the Secretary has delegated authority to carry out these functions to the FAA Administrator.

The regulatory requirements pertaining to commercial launches and individual launch operators are described in 14 CFR Chapter III, Parts 400–600. SpaceX would apply for a new license or modification of their existing vehicle operator license, which would authorize a licensee to conduct one or more launches or reentries using the same vehicle or family of vehicles (14 CFR §450.3(a)). The FAA is also responsible for approving airspace closures in accordance with FAA Order 7400.2P, *Procedures for Handling Airspace Matters*, to ensure public safety.

The following Federal agencies accepted the FAA's request to participate in the NEPA process as cooperating agencies due to their special expertise concerning environmental effect of rocket launch operations or jurisdiction by law over launch facility or maritime environment: NASA, the U.S. Coast Guard (USCG), the DAF, the U.S. Fish and Wildlife Service (USFWS) Merritt Island National Wildlife Refuge (MINWR), and the National Park Service (NPS) Canaveral National Seashore (CANA). An agency has "special expertise" if it has statutory responsibility, agency mission, or related program experience.

### **ES.4 Purpose and Need (EIS Section 1.3)**

The FAA's NEPA-implementing procedures state that the purpose and need statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including



the Proposed Action. The FAA's authority with respect to SpaceX's license application or license modification and airspace closures is stated above in Section ES.3, Federal Agency Roles.

As established in the 2019 NASA EA, the purpose of Starship-Super Heavy at LC-39A is to provide greater mission capability to NASA and other SpaceX customers. SpaceX's activities would continue to fulfill the United States' expectation that increased capabilities and reduced space transportation costs will enhance exploration (including within the Artemis and Human Landing System programs), support U.S. leadership in space, and make space access more affordable. The Space Transportation section of the National Space Transportation Policy of 1994 addressed the commercial launch sector, stating that "assuring reliable and affordable access to space through U.S. space transportation capabilities is a fundamental goal of the U.S. space program."

Starship-Super Heavy at LC-39A is needed to increase operational efficiency, capabilities, and cost effectiveness of the Starship-Super Heavy program. Satisfaction of these needs benefit government and public interests and reduces operational costs. Demand for launch services has continued to increase over the past 20 years, and the space industry growth projections indicate this will continue into the foreseeable future. By providing a reusable launch vehicle with increased lift capability that returns to its launch site, the Proposed Action would reduce the cost of launch and increase efficiency, delivering greater access to space and enabling cost-effective delivery of cargo and people to the moon and Mars. SpaceX's Proposed Action would satisfy requirements for more efficient and effective space transportation methods and continue the United States' goal of encouraging activities by the private sector to strengthen and expand U.S. space transportation infrastructure.

#### **ES.5 Public Involvement (EIS Section 1.4)**

The FAA used multiple methods of stakeholder engagement and public outreach to solicit comments and feedback regarding the proposal. The following provides a summary of public involvement throughout the NEPA process; detailed information is provided in Appendix A, *Public and Agency Involvement*, of the EIS.

##### ***Scoping***

Scoping provides an opportunity for the public, Federal, state, tribal, and local governments and government agencies and other interested parties to learn about a proposed project and provide input. The FAA published the Notice of Intent to prepare an EIS in the Federal Register on May 10, 2024 (89 Federal Register 40526). Notices were also published in the *Orlando Sentinel*, *Florida Today*, and *Al Dia Today* to inform the public and government agencies of the EIS and announce the scoping comment period and scoping meetings. Notices were provided in English and Spanish. The scoping period lasted 45 days (May 10, 2024, through June 24, 2024). The FAA held three in-person public scoping meetings on June 12 and June 13, 2024, and one virtual public scoping meeting on June 17, 2024.

A summary of public scoping activities and comments received is provided in Section 1.4, *Public Involvement*, of the EIS, while Appendix A.1, *Public Scoping*, of the EIS provides greater detail, along with all scoping submittals received from the public and agencies.

##### ***Draft EIS Review***

In conjunction with the Draft EIS, the FAA will hold public meetings and will afford the public opportunity for review and comment during a 45-day review period. This public involvement process will be summarized in the Final EIS.

## **ES.6 Licenses, Permits, and Approvals (EIS Section 1.5)**

### ***FAA License***

Under 14 CFR Part 450, SpaceX would be required to obtain a new license or modification of their existing vehicle operator license for the Starship-Super Heavy launch vehicle at KSC's LC-39A. A vehicle operator license may authorize launch, reentry, or both. To comply with the FAA's licensing requirements, SpaceX will enter into a Letter of Agreement with appropriate air traffic control centers to accommodate flight parameters of Starship-Super Heavy. SpaceX may also enter into a Letter of Agreement with appropriate USCG Districts to safely operate the Starship-Super Heavy launch vehicle over open ocean.

### ***Other Licenses, Permits, and Approvals***

While not comprehensive, this list identifies the significant applicable environmental regulatory requirements associated with implementing the Proposed Action that are addressed in the EIS. Section 1.5.2, *Other Licenses, Permits, and Approvals*, of the EIS provides more detail regarding these regulatory requirements, which are addressed in the EIS analyses of the applicable resource sections: Bald and Gold Eagle Protection Act; Clean Air Act; Endangered Species Act; Magnuson-Stevens Fishery Conservation and Management Act; Marine Mammal Protection Act; Migratory Bird Treaty Act; U.S. Department of Transportation (DOT) Act Section 4(f); Coastal Zone Management Act; National Historic Preservation Act (NHPA); Clean Water Act; Industrial Wastewater Permitting; Florida Environmental Resources Permit Program; and liquefaction plant siting and permitting.

## **ES.7 Proposed Action and Alternatives (EIS Chapter 2)**

The FAA's Federal action is to issue a new vehicle operator license to SpaceX or modify their existing license to allow Starship-Super Heavy operations at LC-39A (see Figure ES-1) and any subsequent license modifications and renewals under 14 CFR Part 400 that are within scope of the EIS. The FAA's Federal action also includes the FAA's issuance of temporary airspace closures. LC-39A is a NASA-owned, SpaceX-leased launch site located on KSC property, approximately 3 miles (4.8 kilometers) east of NASA's Vehicle Assembly Building (Figure ES-2). LC-39A currently supports Falcon 9 and Falcon Heavy launches.

Following completion of the 2019 NASA EA (NASA, 2019a), SpaceX began developing a site within the perimeter of LC-39A for Starship-Super Heavy launch operations intended for future Starship-Super Heavy missions. SpaceX would continue to launch Falcon missions at LC-39A while Starship-Super Heavy is operational.

SpaceX's Proposed Action includes Starship-Super Heavy launch and landing operations (up to 44 launches and 88 landings—44 for each stage [Starship and Super Heavy] of the launch vehicle—per year) at LC-39A, to include ocean landings of Super Heavy in the Atlantic Ocean and Starship in the Atlantic, Pacific, and Indian Oceans. Starship and Super Heavy could land on floating platforms (referred to as "droneships") in the ocean. Infrastructure improvements at LC-39A are proposed to support launch and landing operations. A detailed discussion of the Proposed Action is provided in subsequent subsections.



Figure ES-2. Proposed Action Location



Starship-Super Heavy is composed of two stages: Super Heavy is the first stage (or booster), and Starship is the second stage (Figure ES-3). The fully integrated Starship-Super Heavy launch vehicle is expected to be up to 492 feet (150 meters) tall depending on configuration and approximately 30 feet (9 meters) in diameter. As designed, both stages are reusable, with any potential refurbishment actions taking place at SpaceX facilities at KSC (e.g., HangarX, Roberts Road<sup>4</sup>, LC-39A, etc.). Both stages are expected to have minimal post-flight refurbishment requirements; however, they may require periodic maintenance and upgrades (Figure ES-3).

#### ES.7.1 Proposed Action (EIS Section 2.1)

##### ***Starship-Super Heavy Operations (EIS Section 2.1.3)***

###### Pre-Launch Operations

Preflight operations could include ground testing activities, tanks testing, spin-prime tests, mission rehearsals (i.e., dry and wet dress rehearsals), and static fire engine tests. A dry dress rehearsal simulates launch day conditions where a full launch countdown is conducted but the vehicle is not fueled. A wet dress rehearsal is like a dry dress rehearsal, but the vehicle is fueled. This test allows the launch team to practice timelines and procedures used for launch, and to identify potential issues. The goal of these operations is to verify that all vehicle and ground systems are functioning properly, as well as to verify that all procedures are properly written.

###### *Static Fire Testing*

Prior to launch operations, SpaceX could conduct static fire engine tests of both Starship and Super Heavy (Starship static fire tests would be conducted before integration with Super Heavy). The goal of a static fire engine test is to verify engine control and performance. During a static fire engine test, the launch

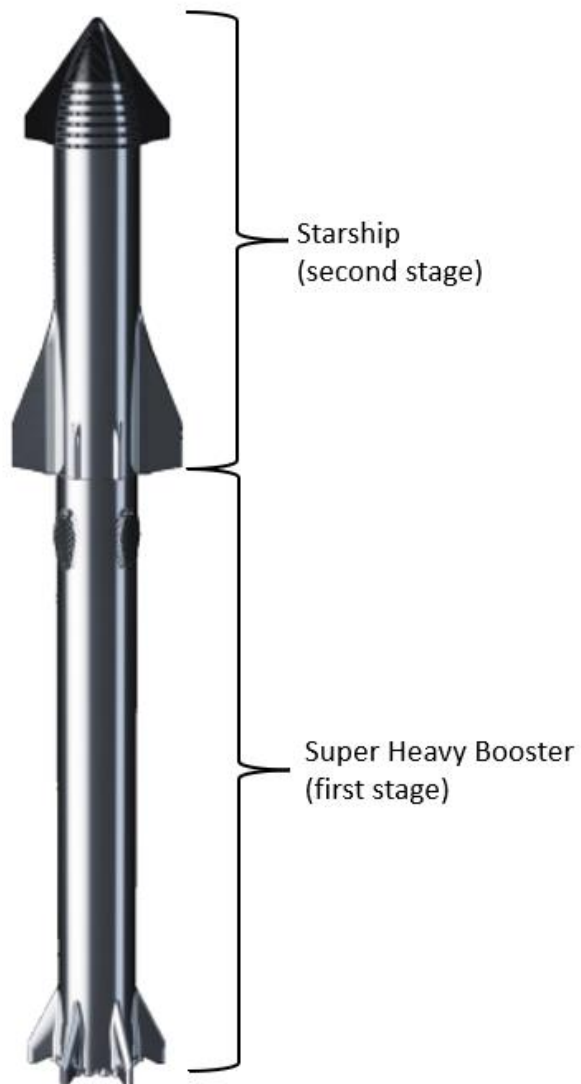


Figure ES-3. Starship-Super Heavy Launch Vehicle Design

<sup>4</sup> Both HangarX and the Roberts Road facility support SpaceX's payload fairing processes; current improvements underway (which are not part of this Proposed Action) would support Starship development plus integration and support of future Starship missions at KSC (NASA, 2024b).

vehicle engines are ignited for a short duration, generating noise and a heat plume, then shut down. SpaceX estimates that Starship and the Super Heavy booster would each conduct one static fire engine test per launch, respectively (i.e., 44 total static fire tests per stage for a total of 88 per year). SpaceX may also reduce the cadence of the static fires of the Starship or Super Heavy vehicles, not requiring a static fire of each engine test per launch operation. Static fires would be up to 15 seconds in duration and would only be conducted during the daytime. Airspace closures are not required for static fire testing. For booster static fires, an access restricted area<sup>5</sup> could extend into the ocean. SpaceX would surveil the area prior to commencing propellant loading and delay the operation if a vessel was actively inside or heading toward the access restricted area during the operation. For static fires, access restricted areas are cleared and roadblocks established around 2 hours prior to the test and dropped after propellant is offloaded, approximately 1 hour. Cleared areas and roadblocks therefore last about 3 hours per static fire event.

#### *Airspace Coordination/Closures*

All launch and reentry operations would comply with necessary notification requirements, including issuance of Notices to Airmen (NOTAMs), as defined in agreements required for a vehicle operator license issued by the FAA. A NOTAM provides notice of unanticipated or temporary future closures to components of, or hazards in, the National Airspace System (FAA Order 7930.2U, *Notice to Airmen (NOTAM)*). The FAA issues a NOTAM at least 48 hours prior to a launch or reentry activity in the airspace to notify pilots and other interested parties of temporary conditions. NOTAMs are similarly used by foreign Air Navigation Service Providers to provide notice of temporary airspace closures in their airspace. Advance notice via NOTAMs and the identification of Aircraft Hazard Areas (AHAs)<sup>6</sup> assist pilots in scheduling around any temporary disruption of flight activities in the area of operation.

The location and size of airspace closures for commercial space operations also vary with each mission type and are influenced by multiple factors, including prior flight history. The size of airspace closures can grow or shrink as reliability is either decreased or increased with results and analysis from each launch. The FAA worked with SpaceX to develop notional launch and reentry trajectories and associated AHAs for this EIS. These AHAs define the temporarily closed airspace that would be established and published through a NOTAM prior to the launch/reentry.

#### *Launches and Super Heavy Reentries*

Starship-Super Heavy launches and Super Heavy booster reentries<sup>7</sup> would impact air routes extending eastward from the launch site over portions of the Atlantic Ocean, covering approximately 1,600 nautical miles. AHAs may necessitate the closure of dozens of coastal and deep-water oceanic airways over the Atlantic Ocean, requiring substantial aircraft rerouting to avoid the AHAs. The northernmost and southernmost launch and Super Heavy booster reentry trajectory could impact the airspace of Canada and the Bahamas, respectively. The Bahamas would be expected to close its airspace up to

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<sup>5</sup> The access restricted area is the safety zone associated with the potential for an anomaly on the launch pad. Within the access restricted area, no personnel are allowed. The closure area represents a bounding case, using the highest possible fuel volume as well as the highest possible liquid oxygen (LOX)/methane yield.

<sup>6</sup> Hazard areas are any region of land, sea, or air that must be surveyed, publicized, controlled, or evacuated to control the risk to the public. It includes regions of land, sea, and air potentially exposed to hazardous debris generated during normal flight events and all reasonably foreseeable failure modes.

<sup>7</sup> Super Heavy booster landings at the launch site are included in the launch AHAs and are assumed to occur within approximately 10 minutes of a Starship-Super Heavy launch.

6,000 feet (1,829 meters), and the FAA would close the airspace above that level. See Figure ES-4 for a depiction of the range of notional launch and Super Heavy landing trajectories and associated AHAs.

### *Starship Reentries*

Starship reentries would impact air routes extending westward from KSC LC-39A over portions of the Pacific Ocean, Central America, Gulf of America, Caribbean Sea, Florida Peninsula, and Atlantic Ocean. AHAs may necessitate the closure of dozens of coastal and deep-water oceanic airways over the Pacific Ocean, Gulf of America, Caribbean Sea, and Atlantic Ocean, requiring significant aircraft rerouting to avoid the AHAs. Multiple airports may require departure stops due to the overlying AHA. See Figure ES-5 for a depiction of the notional range of Starship reentry AHAs.

### *Maritime Coordination*

All launch and reentry operations would comply with necessary notification requirements, including issuance of a Notice to Mariners (NOTMAR), as defined in agreements required for a vehicle operator license issued by the 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.

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

All landing operations would comply with necessary notification requirements, including issuance of NOTMARs by the USCG, as defined in agreements required for a vehicle operator license issued by the FAA. The USCG maintains authority to establish and enforce Limited Access Areas and RNAs as needed to support public health and safety during these events. A NOTMAR provides a notification regarding a temporary hazard and any additional safety measures within a defined area (an SHA) to ensure public safety during proposed operations.

Launches (up to 44 per year) and landings (a total of 88, up to 44 per vehicle, per year) would be of short duration, and scheduled in advance to minimize interruption to ship traffic.

### *Land-Side Coordination*

Static fire tests, launches, and landings (both booster and Starship) would require land-based access restrictions. Figure ES-6 provides a graphical representation of notional access-restricted areas. Any required CANA or MINWR closures would be coordinated between SpaceX and the respective agency, NPS and the USFWS, as appropriate. CANA and MINWR closures might also occur due to the volume of visitor traffic, because launch activity on KSC has historically attracted people to the area including MINWR and CANA, enhancing the visitor experience and public enjoyment. Such closures are coordinated between KSC Security Police, Spaceport Integration and Services, the USFWS, and NPS by monitoring to ensure parking lot thresholds are not exceeded and roadways allow for emergency egress for any form of emergency associated with large crowds.



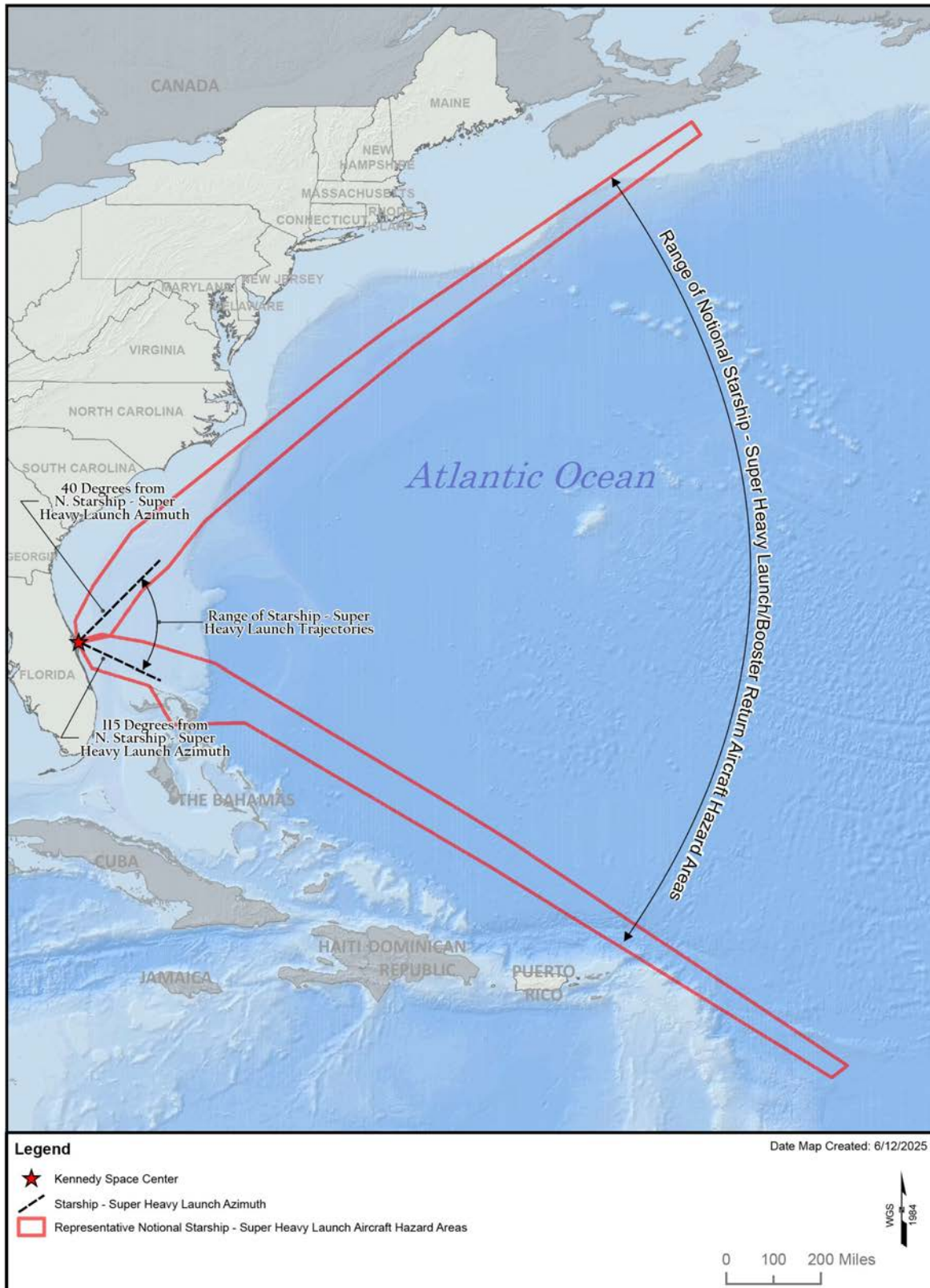


Figure ES-4. Range of Notional Launch and Super Heavy Landing Trajectories and Associated AHAs

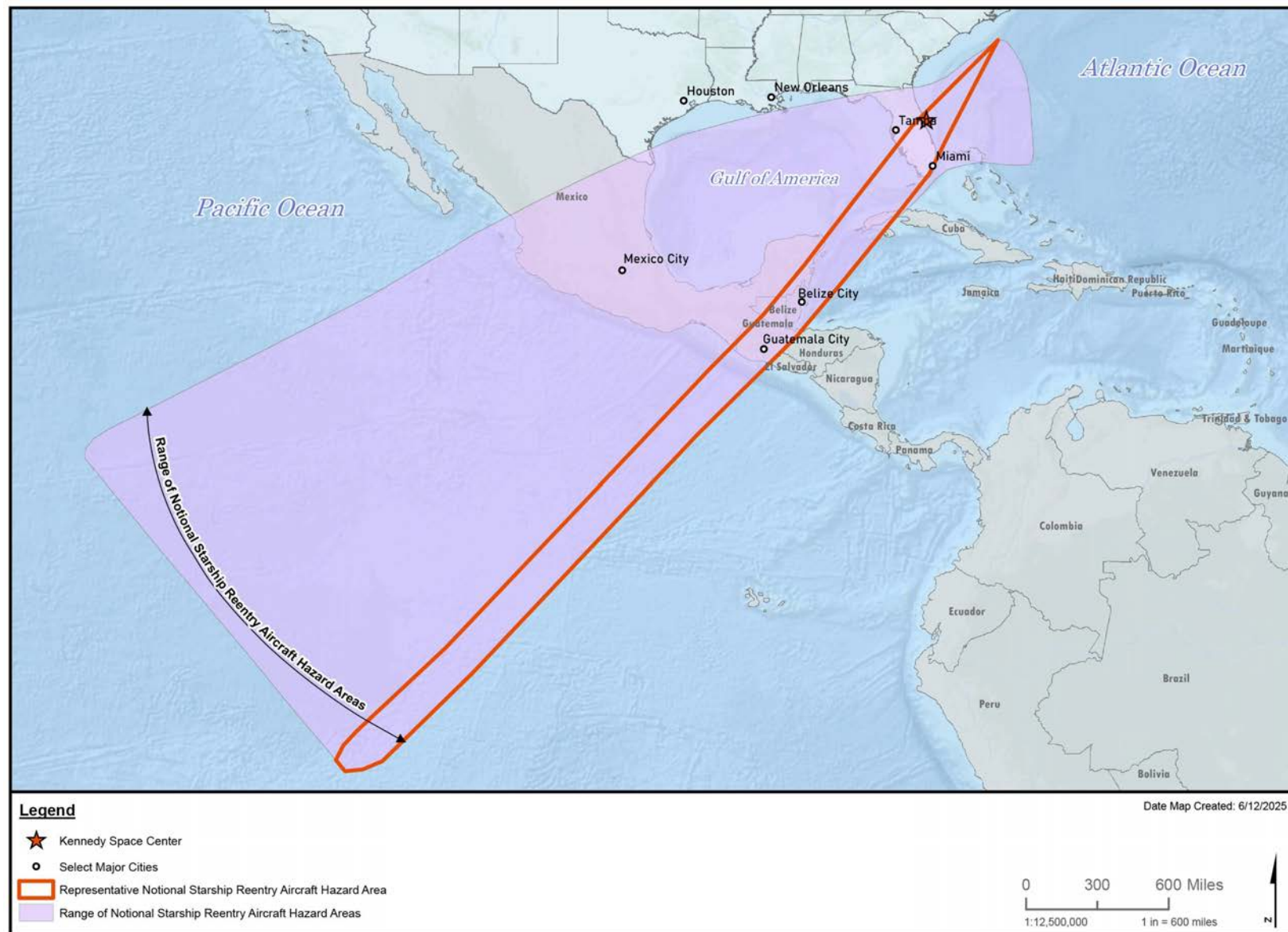


Figure ES-5. Notional Range of Starship Reentry AHAs



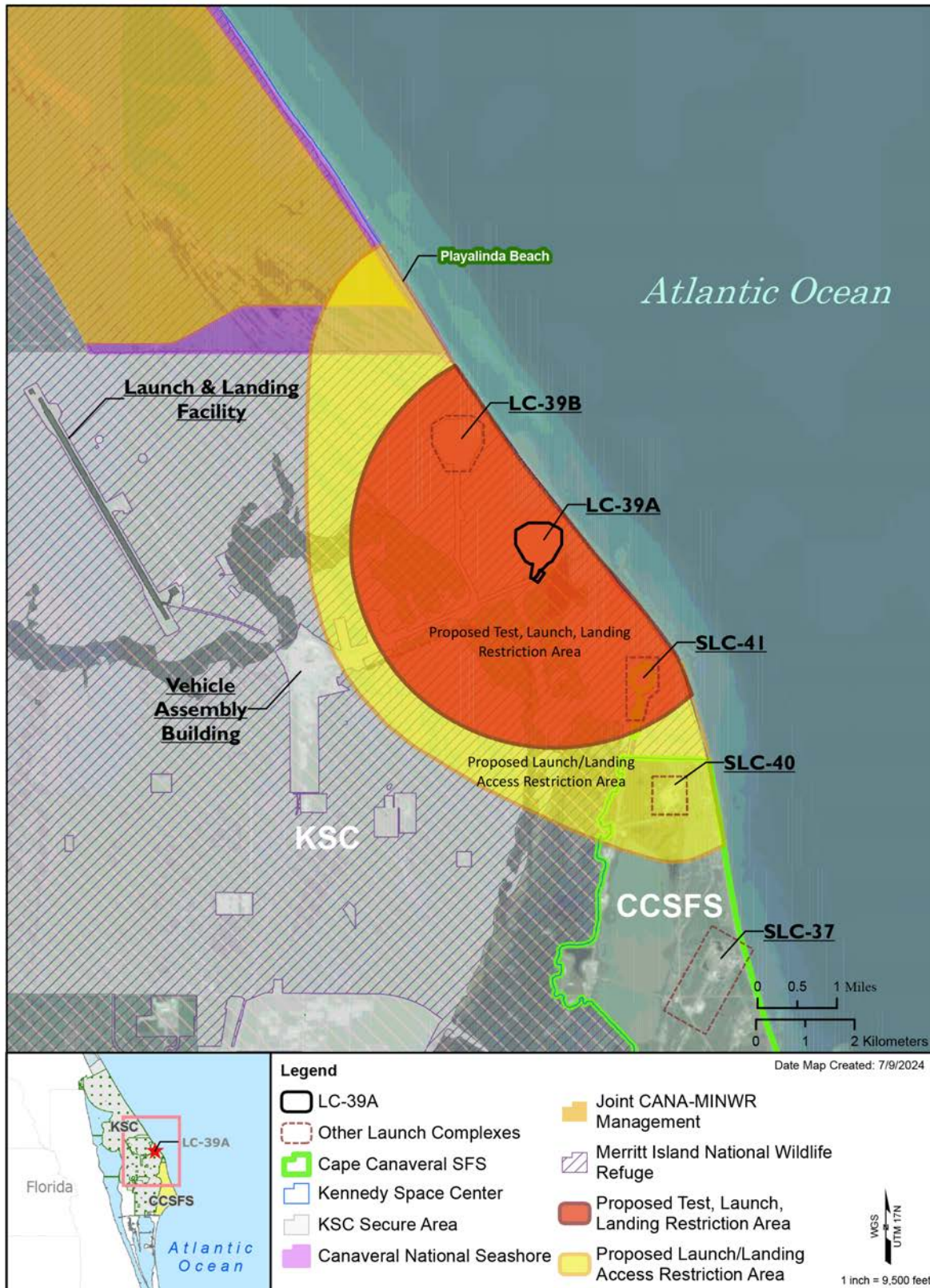


Figure ES-6. Potential Notional Access Restriction Areas For Pre-Launch, Launch, and Landing Activities



Access restricted areas are cleared and any necessary roadblocks are established around 3 hours prior to launch/landing and dropped after the event concludes. In the event of a scrub, cleared areas and roadblocks remain until propellant is offloaded, with the duration variable depending on the percentage of propellant loaded; however, the maximum duration would be about 1 hour. Not all attempts load propellant before scrubbing and roadblocks are often dropped early.

The restricted areas shown are estimated and provide only a representative depiction; exact restricted areas would be determined prior to pre-launch activities and launch/landing. For planning purposes to support this EIS, SpaceX and NASA used conservative assumptions to develop these restricted areas. Ultimately, each restricted area is mission specific and will be determined by Range Safety and the FAA through the FAA license or license modification process.

After receiving license or license modification materials, the FAA will determine the appropriate restricted areas to protect public safety and compare those areas to the assumptions provided in the EIS. The FAA would address any discrepancies or gaps, if found, in the environmental analysis.

Static fire tests would result in restricted access to areas not currently accessible to the public and would last approximately 3 hours each time; these would mostly affect land management and mission-related activities on MINWR and KSC. Restricted access associated with launches and landings would be expanded to also affect the northern portion of CCSFS, which would include Space Launch Complex (SLC)-41 (leased to United Launch Alliance) and SLC-40, and publicly accessible areas in the southern portion of MINWR and CANA that includes Playalinda Beach. Restricted areas in areas accessible to the public would be closed to the public during the identified operations due to safety concerns. All closures, whether dictated by public safety concerns (i.e., the Range or the FAA require the closure) or by the NPS due to visitor volumes exceeding capacity, would be temporary.

While restricted access requirements are limited to the duration that the access restricted area is in effect (i.e., between 3 and 3.5 hours), the actual duration of a closure associated with publicly accessible areas may be longer due to logistical aspects. Based on information provided by the NPS, duration of closures for portions of CANA and Playalinda Beach is affected by the time of day/night that the test or launch occurs. Due to logistics of closures (e.g., NPS personnel clearing the park of visitors, etc.), midday (or later) launches or tests could result in the need to close portions of the park for the entire day; tests or launches occurring very early in the morning may result in the park being closed for a portion of the day.

Based on information provided by NPS, it is estimated that there could be between 33 and 44 (using the most conservative estimate) full-day closures and up to 33 half-day closures, which equates to up to 60.5 total “closure days” per year (44 full days + 33 half days = 60.5 “full days”). Launch scrubs and weather delays could affect the length and/or number of closures; however, the extent of these occurrences cannot be quantified at this time. Table ES-1 provides a summary of pre-launch and closure-related activities and notional closure times/durations. As mentioned previously, it is anticipated that, similar to other launch vehicles like Falcon, associated closure areas would reduce in size and duration as the program matures, more data is available, and the reliability of the vehicle improves.

**Table ES-1. Summary of Pre-Launch Starship/Super Heavy and Pre-Reentry of Starship Closure-Related Activities**

| Action                                                                                                                                                                                                                                                                                                                                           | Purpose                                                                                                                                                                                                                                                           | Start Time                                                                                                                                            | End Time <sup>1</sup> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Establish check points and take down check points                                                                                                                                                                                                                                                                                                | Set up for launch and remove after launch. Commence monitoring of traffic flow.                                                                                                                                                                                   | T <sup>2</sup> – 6 to 12 hours                                                                                                                        | T + 5 to 30 minutes   |
| Establish hard access control checkpoints                                                                                                                                                                                                                                                                                                        | Restrict public access to access restricted area and limit access within the USCG LAA (same for static fire).                                                                                                                                                     | T – 3 hours                                                                                                                                           | T + 5 to 30 minutes   |
| USCG/other waterborne law enforcement on station                                                                                                                                                                                                                                                                                                 | USCG and/or other local waterborne law enforcement sweep areas and restrict/limit (LAA) boating access (same for static fire).                                                                                                                                    | T – 3 hours                                                                                                                                           | T + 5 to 30 minutes   |
| Security sweeps                                                                                                                                                                                                                                                                                                                                  | Security sweeps responsible areas (e.g., beach, roads near launch site, rivers and creeks). Verify by video, UAV, or ATV as needed.                                                                                                                               | T – 2 hours                                                                                                                                           | T – 1 hour 40 minutes |
| Trajectory sweeps                                                                                                                                                                                                                                                                                                                                | Verify with radar sweep.                                                                                                                                                                                                                                          | T – 1 hour                                                                                                                                            | T – 40 minutes        |
| Close airspace                                                                                                                                                                                                                                                                                                                                   | In accordance with agreed procedure, FAA Air Traffic Control closes appropriate commercial airspace. Airspace closures potentially affecting Special Use Airspace would be coordinated with the appropriate using agency (e.g., CCSFS, Patrick Space Force Base). | T – 15 minutes                                                                                                                                        | T + 5 to 30 minutes   |
|                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                   | Approximate minimum 40-minute, and up to 2-hour closure for launches. Approximate minimum 40-minute, and up to 1-hour closure for Starship reentries. |                       |
| Estimated Restricted Access Time per Static Fire Engine Test (88/year) and Wet Dress Rehearsal (44/year) within access restricted area and LAA (up to approximately 13,550 feet/2.6 miles from the center of LC-39A)                                                                                                                             |                                                                                                                                                                                                                                                                   | Approximately 3 hours                                                                                                                                 |                       |
| Estimated Total Annual Restricted Access Time within access restricted area and LAA for Static Fire Engine Tests and Wet Dress Rehearsals                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   | Approximately 396 hours                                                                                                                               |                       |
| Estimated Closure and Limited Access Time per Launch/Booster Landing (44/year) or Starship Landing (44/year) within the access restricted area/LAA (up to approximately 22,965 feet/4.4 miles [7 kilometers] from the center of LC-39A). Note: Booster landings would not be considered an “additional event” for closure length determinations. |                                                                                                                                                                                                                                                                   | Up to 3.5 hours                                                                                                                                       |                       |
| Estimated Total Annual Closure and Limited Access Time for Launches/Booster Landings and Starship Landings within the access restricted area/LAA (50% between 7:00 a.m. and 10:00 p.m. and 50% between 10:00 p.m. and 7:00 a.m.)                                                                                                                 |                                                                                                                                                                                                                                                                   | Approximately 308 hours                                                                                                                               |                       |
| Estimated Total Annual Closure and Limited Access Time within access restricted area and LAA (44 launches/booster landings + 44 Starship landings + 88 static fire engine tests + 44 wet dress rehearsals)                                                                                                                                       |                                                                                                                                                                                                                                                                   | Approximately 704 hours                                                                                                                               |                       |

Notes: % = percent; ATV = all-terrain vehicle; CCSFS = Cape Canaveral Space Force Station; FAA = Federal Aviation Administration; LAA = Limited Access Area; LC = Launch Complex; UAV = unmanned aerial vehicle; USCG = United States Coast Guard.

<sup>1</sup> Does not apply to static fire or wet dress—all times assume nominal launch/landing sequence.

<sup>2</sup> “T” implies the anticipated time of engine firing, with start and end times measured before (minus x hours or minutes) or after (plus x hours or minutes).

### Launch Operations

Starship-Super Heavy would launch from LC-39A up to 44 times per year and could occur at any time of day or night; for purposes of noise analysis, it is assumed that 22 launches would occur during the day (7:00 a.m. to 10:00 p.m.) and 22 launches would occur at night (10:00 p.m. to 7:00 a.m.). During a launch, ignition of the Super Heavy booster Raptor engines would generate a heat plume. The plume would appear clear and consist of water vapor, carbon dioxide (CO<sub>2</sub>), carbon monoxide, hydrogen, methane, nitrogen oxides (NO<sub>x</sub>), and oxygen. The heat plumes and increased temperatures in this area would be

temporary and would only occur during engine ignition and dissipate within minutes. A flame diverter or similar infrastructure (e.g., a water-cooled diverter) would be constructed to reduce potential effects due to the plume (a diverter can direct the plume upward, away from the ground). Launches would result in noise and vibration, and nighttime launches would require lighting.

### Super Heavy and Starship Landing Operations

SpaceX plans to land the reusable Super Heavy and Starship back on land at LC-39A or on floating platforms in the ocean. As SpaceX continues to develop the capability to perform an RTLS landing of Super Heavy and the Starship, some vehicles may not be reused and instead may be expended in the ocean in the following three conditions depending on the stage of development of the program:

1. Hard water landing at terminal velocity and break up on impact, resulting in an explosive event at the surface of the water
2. Soft water landing and tip over and sink or explode on impact at the surface of the water<sup>8</sup>
3. In-flight breakup—breakup during reentry, resulting in debris falling into the ocean (up to 25 times per year of each vehicle stage)

Of the above scenarios, SpaceX anticipates no more than 20 explosive events at the surface of the water (Scenario Number 1) for each vehicle for the life of the program. These three scenarios are only anticipated to occur within the first 5-6 years of the program.

For Super Heavy ocean landings, Super Heavy would land on a droneship or be expended in the Atlantic Ocean (Figure ES-7). Starship could land on a droneship (floating platform) or be expended in any of the following landing areas shown in Figure ES-8, Figure ES-9, and Figure ES-10. The landing area in the Pacific Ocean is outside the U.S. Exclusive Economic Zone. The droneship operations and specifications were assessed in the 2025 National Marine Fisheries Service consultations (NMFS, 2025a; NMFS, 2025b). Additionally, a Starship near-shore contingency landing zone is located in the Atlantic Ocean, beginning 1 nautical mile or more from the coast and covering a distance of up to 50 miles (80 kilometers) north of KSC LC-39A and up to 50 miles (80 kilometers) south of CCSFS SLC-37 (Figure ES-7). Landings that occur downrange on a floating platform would continue to be delivered by barge to the Port Canaveral and transported the remaining distance to the launch site through the Turn Basin and then over established roadways.

### Trajectories

Starship-Super Heavy launch and RTLS trajectories would be specific to each particular mission. Flight trajectories vary based on mission specifics such as desired payload orbit. Starship-Super Heavy launch azimuths would range from 40 degrees to 115 degrees, from a reference of due north at 0 degrees and due east at 90 degrees (see Figure ES-4); RTLS trajectories would be the same for the Super Heavy booster. RTLS trajectories for Starship would likely be in a range from the southwest/northwest eastward toward LC-39A; reentry trajectories and landing headings are shown in Figure ES-5 and Figure ES-7, respectively. Restricted airspace parameters would need to be modified for Starship-Super Heavy operations based on individual launch and RTLS trajectories.

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<sup>8</sup> A soft water landing is when the launch vehicle intentionally slows its speed to land in the water.



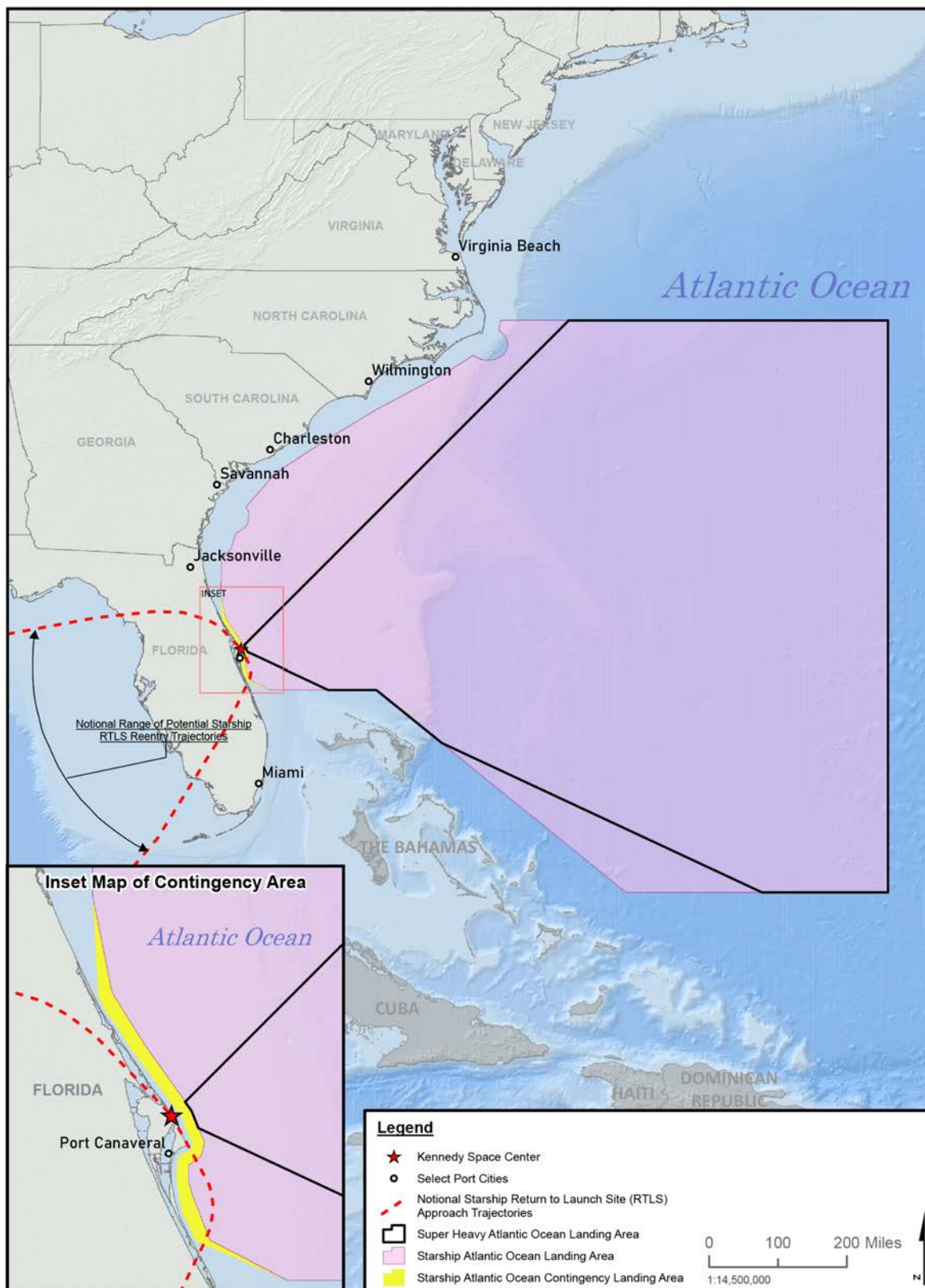


Figure ES-7. Starship and Super Heavy Atlantic Ocean Landing Areas and Notional Range of Starship RTLs Headings

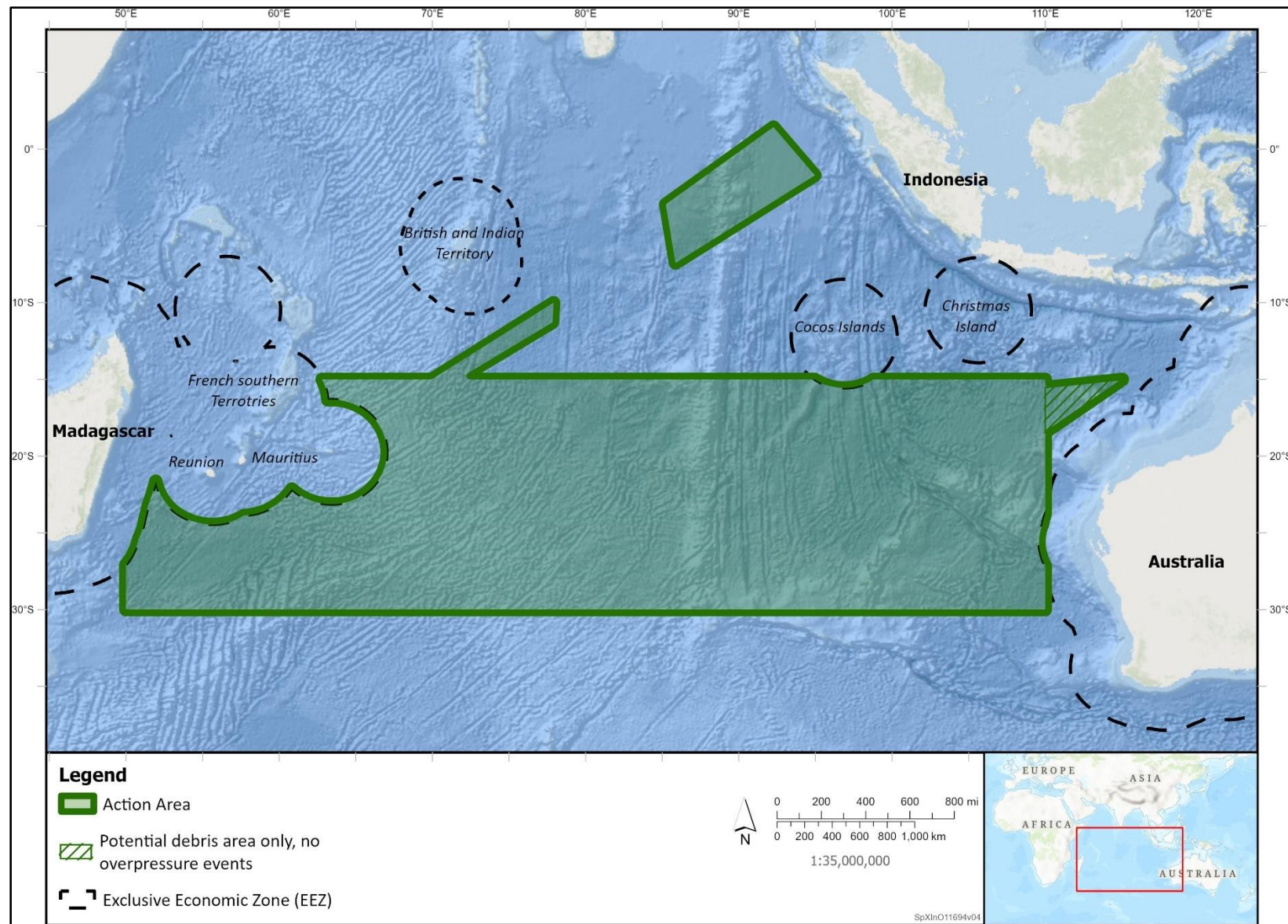


Figure ES-8. Indian Ocean Starship Landing Area



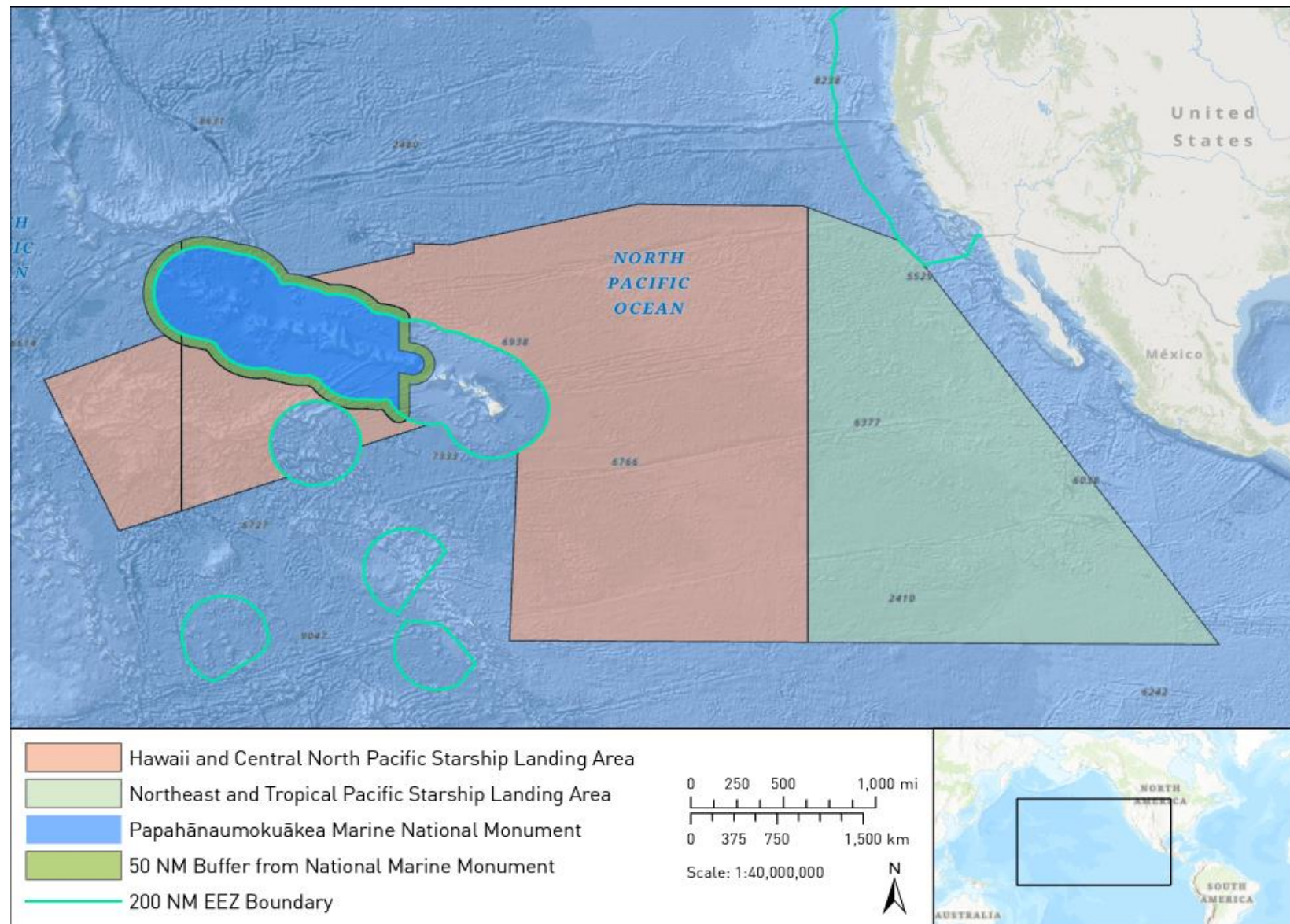


Figure ES-9. North Pacific Starship Landing Area (Hawaii and Central North Pacific Landing Area and Northeast and Tropical Pacific Ocean Landing Area)



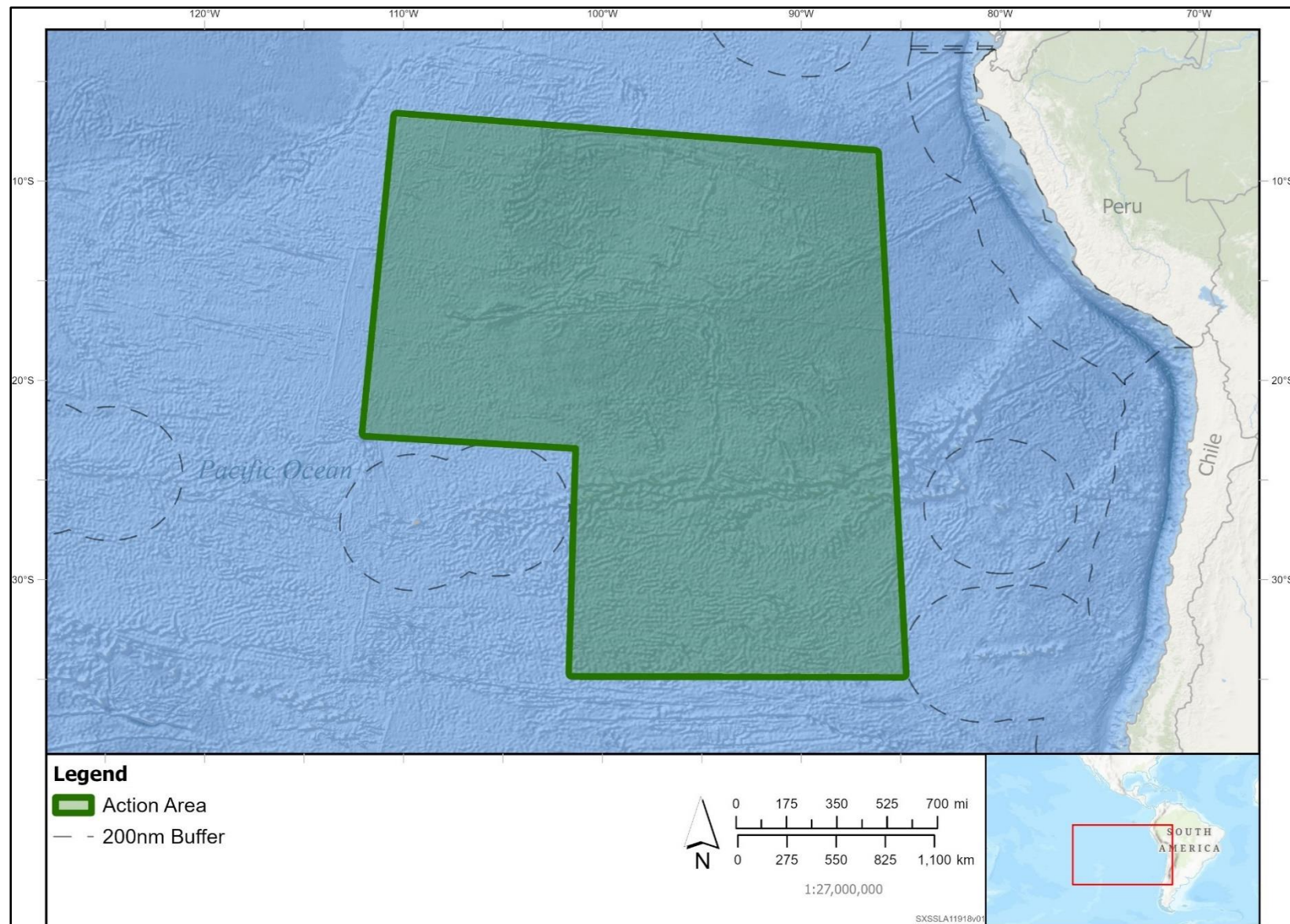


Figure ES-10. Southeast Pacific Starship Landing Area

## Anomalies

A Starship-Super Heavy operation could result in a deviation from what is expected (referred to as an anomaly). An anomaly on the launch pad could cause a fire on the launch pad and/or an explosion onsite or elsewhere that spreads debris. While anomalies are unexpected, as part of evaluating a vehicle operator license, the FAA evaluates SpaceX's debris analysis to ensure the hazard area is of sufficient size to ensure public safety. In the event of an anomaly, SpaceX would evaluate the level of response based on the situation and notify the appropriate emergency personnel and land-managing agencies according to the requirements in a site-specific anomaly [or emergency] response plan.

### ***LC-39A Infrastructure (EIS Section 2.1.4)***

A conceptual plan of proposed infrastructure improvements at LC-39A are shown in Figure ES-11 and described in the following sections. The figure shows facilities that were previously approved for construction (and currently under development) under the 2019 NASA EA, as well as those associated with this Proposed Action. It is estimated that remaining construction would last up to 2 years. Table ES-2 provides a summary of the proposed infrastructure.

**Table ES-2. Proposed Starship-Super Heavy Infrastructure Summary**

| Facility                      | Approximate Square Footage | Previously Approved (2019 EA) | Newly Proposed (2025 EIS) |
|-------------------------------|----------------------------|-------------------------------|---------------------------|
| <b>Propellant Generation</b>  |                            |                               |                           |
| Liquid Oxygen Farm            | 65,454                     | x                             |                           |
| Methane Farm                  | 78,876                     | x                             |                           |
| Vaporization Farm             | 9,650                      | x                             |                           |
| Liquid Nitrogen Farm          | 13,342                     | x                             |                           |
| Air Separation Unit           | 222,071                    |                               | x                         |
| Liquefaction Plant            | 17,246                     |                               | x                         |
| <b>General Infrastructure</b> |                            |                               |                           |
| Water Farm                    | 17,955                     | x                             |                           |
| Catch Tower                   | 5,992                      |                               | x                         |
| Deluge Pond                   | 121,963                    |                               | x                         |
| Ponds                         | 68,799                     | x                             |                           |
| Launch Mount                  | 36,568                     | x                             |                           |
| Landing Zone                  | 72,672                     | x                             |                           |
| Integration Tower             | 6,184                      | x                             |                           |
| MegaPacks                     | 34,979                     |                               | x                         |
| Power Hub                     | 28,998                     |                               | x                         |
| <b>Total</b>                  | <b>800,647</b>             |                               |                           |

Notes: EA = Environmental Assessment; EIS = Environmental Impact Statement.

## Propellant Generation

The Starship-Super Heavy Raptor engines are powered by LOX and liquid methane (LCH<sub>4</sub>). SpaceX is proposing to construct onsite facilities for propellant generation and propellant storage, and storage tanks for LOX and LCH<sub>4</sub> are under construction as approved under the 2019 NASA EA.



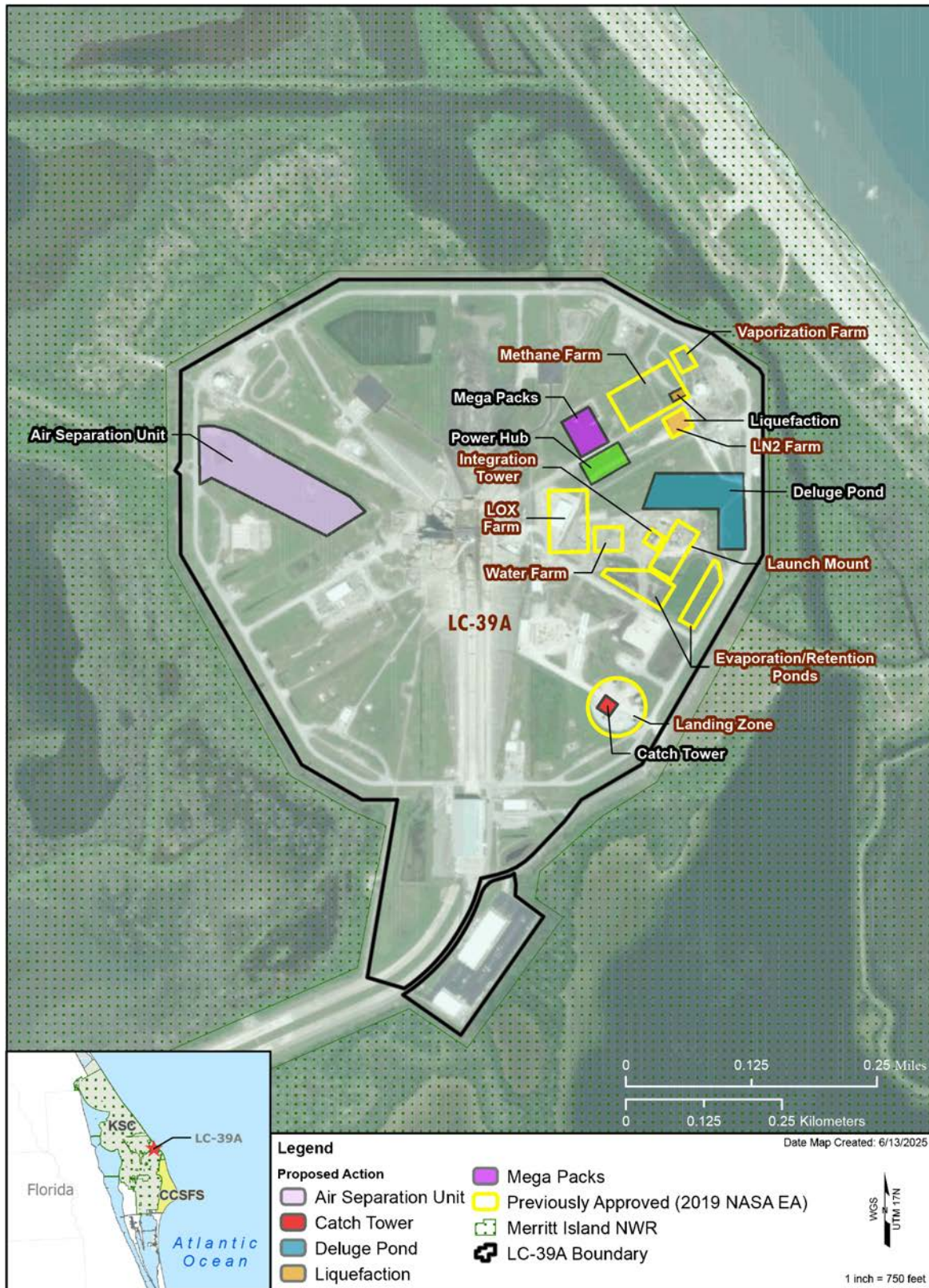


Figure ES-11. Proposed LC-39A Infrastructure



Propellant generation facilities would be operated using natural gas and/or existing electrical power lines and “MegaPacks” (a large-scale rechargeable lithium-ion battery stationary energy storage product that can store up to 3.9 megawatt (MW)-hours of electricity). The current concept of operations is that, until the liquefaction plant and air separation unit (ASU) are constructed (this is due to the extensive lead time necessary for final design, construction, and onboarding of these facilities), commodities would be trucked to LC-39A to generate propellant. For the purposes of a “maximum use” analysis in this EIS, current estimates of the number of trucks per launch for commodities include 270 for LOX, 80 for liquid nitrogen (LN<sub>2</sub>), and 90 for LCH<sub>4</sub>. At 44 launches per year, this equates to a total of 19,356 trucks per year. During a 12-hour period for operations occurring 365 days per year, this approximates to 53 trucks per day (or 4-5 trucks per hour).

SpaceX would process natural gas brought to the site for propellant generation. A natural gas pretreatment system would remove impurities such as mercury, sulfur, water, CO<sub>2</sub>, and hydrocarbons heavier than methane from the natural gas to produce a stream of higher purity gaseous methane; impurities would be captured through a filtration system and managed according to KSC solid and hazardous waste requirements. Surplus natural gas would be used for process work, power generation, or would boil off like a natural gas line venting. The natural gas pretreatment system would include a small amine treating unit for CO<sub>2</sub> removal, a scrub column to remove heavy hydrocarbons that would be up to 100 feet (30 meters) tall and 10 feet (3 meters) in diameter, and four to six smaller vessels approximately 6 feet (2 meters) in diameter and up to 30 feet (9 meters) tall.

As part of the liquefaction process, SpaceX proposes to construct a methane liquefier to supercool pretreated natural gas into a liquid state for storage and transportation to the launch vehicle. The natural gas pretreatment and liquefier together would be comprised of several structures each up to 65 feet (20 meters) tall. The methane liquefier would be cooled by a typical evaporative cooling tower requiring up to 30 cubic meters per hour (approximately 8,000 gallons per hour) of water (acquired through existing water pipelines) and producing up to 3 cubic meters per hour (approximately 800 gallons per hour) of wastewater, which would be captured by evaporation/retention ponds as identified in Figure ES-11.

SpaceX proposes to construct an ASU within the LC-39A fence line to generate LN<sub>2</sub> and LOX to support launch activities. An ASU dehumidifies, liquefies, and separates air into its major components (oxygen and nitrogen). The liquid would then be transferred via pipeline to storage tanks at LC-39A. The ASU would be cooled by a typical evaporative cooling tower requiring approximately 75 cubic meters per hour (approximately 20,000 gallons per hour) of water and producing approximately 7 cubic meters per hour (approximately 2,000 gallons per hour) of wastewater. Water/wastewater would be managed in the same way as identified for the evaporative cooling tower as discussed previously. The ASU would be up to approximately 180 feet (55 meters) tall with supporting infrastructure up to approximately 60 feet (18 meters) tall. An onsite ASU reduces the need to transport nitrogen and oxygen to LC-39A from offsite via trucks as discussed previously.

Wastewater generated by the ASU and stormwater would be treated onsite via evaporation and retention ponds. Any residuals may be treated onsite, hauled off, or conveyed in a wastewater system that has capacity. Onsite treatment could include, but is not limited to, methods such as membrane aerated biofilm reactors or other processes. Reclaimed wastewater could then be discharged onsite via a stormwater pond, exfiltration trenches, infiltration basins, Class V group 6 drainage wells, percolation/evaporation ponds, or industrial evaporators or used for irrigation purposes or some other permitted method. If discharge would occur,

SpaceX would acquire all necessary permits from the St. Johns River Water Management District and/or the Florida Department of Environmental Protection. Utility work within LC-39A would occur to provide power and water to the system, with any new utility lines placed underground. As mentioned previously, up to 12 MegaPacks would be installed to support 24 MW/48 MW hours of power generation. Existing commodity tanks would be used where practicable and a 10,000-gallon (40,000-liter) aboveground storage tank would be constructed to store LN<sub>2</sub> for system purges. Propellant generation infrastructure location is shown in Figure ES-11.

#### Stormwater Evaporation/Retention and Deluge Ponds

SpaceX proposes to construct additional stormwater evaporation/retention and deluge ponds, if needed, to manage water associated with deluge and stormwater within LC-39A. Preliminary pond locations are shown in Figure ES-11. In general, the deluge system would apply a large amount of water to rapidly cool and create a barrier between the steel plate of the launch mount and rocket exhaust that will help to absorb sound energy and heat produced by the rocket engines and would allow the steel plate to be reused. It is expected that approximately 92 percent of the water would be vaporized by the heat of the rocket engines (FAA, 2023a). Water delivery to the site would be by truck or pipeline, as previously described, and stored in tanks.

The deluge and diverter system and associated operational parameters are still in the design phase, and specific details are currently unknown. The deluge system would be activated during each ignition event on the orbital launch pad, including engine ignition tests and launches, and during landings. Each launch is associated with an estimated two static fire engine tests (one each for Starship and Super Heavy). Therefore, the deluge system may operate up to 220 times per year (88 static fires, 44 launches, and 44 landings each for Starship and Super Heavy).

The deluge system would be activated immediately prior to an engine ignition or landing event, allowing water to flow from the storage tanks, through the piping network, to the spray nozzles at the launch pad. Five seconds prior to ignition/landing, water would begin discharging. Most of this pre-ignition water would be captured by the containment structures. SpaceX estimates that up to 50 million gallons (190 million liters) of water per year would be utilized for launch/landing deluge operations at the site (approximately 137,000 gallons [518,601 liters] per day). SpaceX plans to reuse deluge water that is retained onsite (i.e., not evaporated). In the event SpaceX is unable to reuse the deluge water, it may be hauled offsite, discharged, or land applied. Prior to any discharge or land application, SpaceX would apply for any applicable Florida Department of Environmental Protection permits. All ponds would be lined to prevent percolation of contaminants into the groundwater and would be maintained and monitored by SpaceX. Berms would be built around the ponds to eliminate additional stormwater/rainwater inflow/outflow. No deluge water would enter the Banana River or adjacent waterbodies or wetlands.

During engine ignition of the Starship-Super Heavy, the surface of the pad flame diverter could experience a small amount of ablation (erosion of steel from the metal surface resulting from heat and force, considered common on metal launch infrastructure). The ablated steel would quickly recondense near the launch mount when exposed to the deluge water. The metal components of the steel could remain localized to the launch pad, captured in the deluge water and retained onsite, or dispersed in vapor. SpaceX would implement sampling protocols in accordance with an amended Multi-Sector General Permit for industrial stormwater from the Florida Department of Environmental Protection and would remove water containing contaminants that exceed the water quality criteria and haul it to an approved industrial

stormwater treatment facility. SpaceX would pump all other water not within permitting standards back to the water storage tanks for the deluge system.

### ***Launch Vehicle Transport and Refurbishment***

Fabrication, assembly, delivery, and integration of components would occur at existing SpaceX facilities located on KSC and CCSFS (NASA, 2019a, p. 12). Most manufacturing would occur at the SpaceX facility in Boca Chica, Texas. Starship or Super Heavy components would be delivered over roadways on a mobile transporter like the transports performed for Falcon. Large vehicle components would be transported by barge from the Port of Brownsville, Texas, utilizing the KSC Turn Basin to the Vehicle Assembly Building location, then via Crawlerway to LC-39A (Figure ES-12). These are the same locations and processes utilized for current large vehicle transport (i.e., Falcon) and that were used during the Shuttle Program.

No improvements to transportation routes are anticipated at this time. Future transportation improvements to support SpaceX and other KSC operations that are not covered under the scope of this EIS would require additional NEPA review. Transport of Starship-Super Heavy and related components to and across KSC would generally occur as transport of rocket components currently does at KSC. This could include transport via barge or overland from SpaceX production sites, including Boca Chica, Texas, and Hawthorne, California. Any potential refurbishment actions would take place at SpaceX's facilities at KSC. Starship-Super Heavy would be transported to and from LC-39A to a SpaceX facility via SpaceX transporter over KSC roadways. At this time no improvements to KSC infrastructure outside those previously identified for LC-39A are proposed. Current and potential future improvements to KSC infrastructure that would support general SpaceX and other KSC operations were previously analyzed and approved under NEPA (NASA, 2020a; NASA, 2024b).

### ***Launch Site Selection (EIS Section 2.1.6)***

SpaceX's purpose and need was established in the 2019 NASA EA (NASA, 2019b) and is identified in this EIS at Section 1.3, *Purpose and Need*. FAA Order 1050.1F Section 7-1.1(e) defines "reasonable alternatives" as those that meet the purpose and need for the proposed action. Through an alternative screening process based on Starship-Super Heavy requirements and the purpose and need, the 2019 EA established LC-39A as the approved location for Starship-Super Heavy operations, and infrastructure development based on NASA's 2019 FONSI is already underway. LC-39A provides time-critical mission capability to NASA and commercial pursuits via the Starship-Super Heavy. In addition to existing launch infrastructure, LC-39A provides launch site diversity for Starship-Super Heavy to meet the purpose and need for near-term lunar exploration under the NASA Artemis and Human Landing System programs. Given the above, no other launch sites were considered for this Proposed Action.





Figure ES-12. Starship-Super Heavy Transport Routes

### **ES.7.2 No Action Alternative (EIS Section 2.2)**

Under the No Action Alternative, NASA would not develop, implement, or approve agreements with SpaceX associated with Starship-Super Heavy operations at LC-39A. The FAA would not issue a new license to SpaceX or modify their existing vehicle operator license for Starship-Super Heavy operations at LC-39A and would not close any associated airspace. SpaceX would not launch Starship-Super Heavy from LC-39A. The No Action Alternative would not meet the purpose and need. The No Action Alternative includes reasonably foreseeable actions that would still occur regardless of the Proposed Action, such as planned launch activity at both KSC and CCSFS. No Action analyses therefore focus on reasonably foreseeable actions within each respective resource study area. Projects are identified as reasonably foreseeable if they are in published planning documents, are in the process of NEPA evaluation, or have completed NEPA evaluation but the project has not yet been implemented.

Reasonably foreseeable actions are actions that may affect projected effects of a proposal and are not remote or speculative. An action may be reasonably foreseeable even in the absence of a specific proposal. Actions not grounded in publicly available planning documents, projected development trends, or regional or local plans would typically be considered remote and speculative and are not considered. In addition, actions may be considered improbable or remote even though they have been mentioned in planning documents (e.g., general statements about future growth opportunities and unrefined lists of potential projects). This includes planned future operations and aggregate rocket noise levels from all approved actions that have completed their environmental review. Section 2.2, No Action Alternative, of the EIS provides greater detail on the activities included in the No Action analysis.

### **ES.7.3 Alternatives Considered but Eliminated from Further Analysis (EIS Section 2.3)**

As discussed previously, through an alternative screening process based on Starship-Super Heavy requirements and the purpose and need, the 2019 EA established LC-39A as the approved location for Starship-Super Heavy operations; SLC-40 within CCSFS and SLC-4 within Vandenberg Air Force Base were considered as alternatives but were not carried forward (NASA, 2019a). Currently, infrastructure development in support of Starship-Super Heavy at LC-39A based on NASA's 2019 FONSI is already underway. As a result, because LC-39A is already the approved location for Starship-Super Heavy operations alternative locations are not considered within the context of this EIS.

## **ES.8 Summary of Environmental Consequences**

Effects analyses in the EIS found no substantive or significant effects to the following resources under the Proposed Action and No Action alternatives: Visual Effects (EIS Section 3.6); Water Resources (EIS Section 3.9); Coastal Resources (EIS Section 3.10); Climate (EIS Section 3.12); Hazardous Materials, Solid Waste, and Pollution Prevention (EIS Section 3.13); Natural Resources and Energy Supply (EIS Section 3.14); Farmlands (EIS Section 3.15); and Health and Safety (EIS Section 3.18). As a result, these are not discussed further in this Executive Summary – more detail on these resource area analyses and associated best management practices (BMPs), mitigations, and monitoring actions can be found in the respective EIS sections.

### ES.8.1 Noise and Noise-Compatible Land Use (EIS Section 3.2)

#### *Proposed Action*

Increased supersonic noise levels would result in significant noise effects based on criteria in FAA Order 1050.1F Desk Reference, Section 11.5.4.2, *Noise Prediction Modeling*, and other effect criteria described in Section 3.2.1, *Definition of Resource and Regulatory Setting*. Interruptions of activities in nearby communities during the 44 proposed annual Starship-Super Heavy launch and 88 landing events per year would be relatively brief. At representative locations outside KSC/CCSFS, outdoor noise levels would exceed 97 maximum A-weighted decibels. The likelihood of people exposed to noise being awakened indoors would be as high 82 percent during late-night operations, which would make up approximately half of total annual events at sensitive locations outside KSC/CCSFS. Noise levels would remain below 65 A-weighted decibels day-night average sound level at all locations outside the boundaries of KSC/CCSFS under the Proposed Action (Figure ES-13); all land uses would remain compatible in accordance with guidelines at 14 CFR Part 150 with propulsion noise levels. Sonic boom noise levels would exceed 60 decibels C-weighted day-night average sound level, a level at which noise-sensitive land uses are not considered compatible, in 28,595 acres (11,572 hectares) of off-KSC/CCSFS land (Figure ES-14). Propulsion noise levels would remain below hearing conservation criteria at all locations outside of KSC/CCSFS boundaries. Sonic booms exceeding 4 pounds per square foot (psf) in portions of Merritt Island would be relatively infrequent, and sonic boom noise energy would be primarily at frequencies that do not interact strongly with hearing mechanisms (Figures ES-15 and Figure ES-16). People in known high-noise areas on KSC would be provided hearing protection where appropriate, and the risk of hearing damage would remain minimal. Mitigations described in Section 3.2.5, *Best Management Practices, Mitigation, and Monitoring*, would reduce effects somewhat, but significant effects associated with the Proposed Action are unavoidable. Details regarding associated BMPs, mitigations, and monitoring actions can be found in EIS Section 3.2.5.

#### *No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. Depending on the launch vehicle and location of launch/landing areas around KSC and CCSFS, the local area would continue to experience noise-related effects associated with activity interference, sleep disturbance, and in areas near launch sites minor structural damage to older and less robust structures (depending on the launch vehicle).

### ES.8.2 Land Use (EIS Section 3.3)

#### *Proposed Action*

Under the Proposed Action, land use designations at KSC would remain unchanged. Construction and operations at LC-39A would occur within areas previously approved for construction (and currently under development) as described in the NASA 2019 EA (NASA, 2019a). The Proposed Action would be consistent with the current land uses at and in the vicinity of KSC and would continue to function to support space transportation operations and associated support requirements.



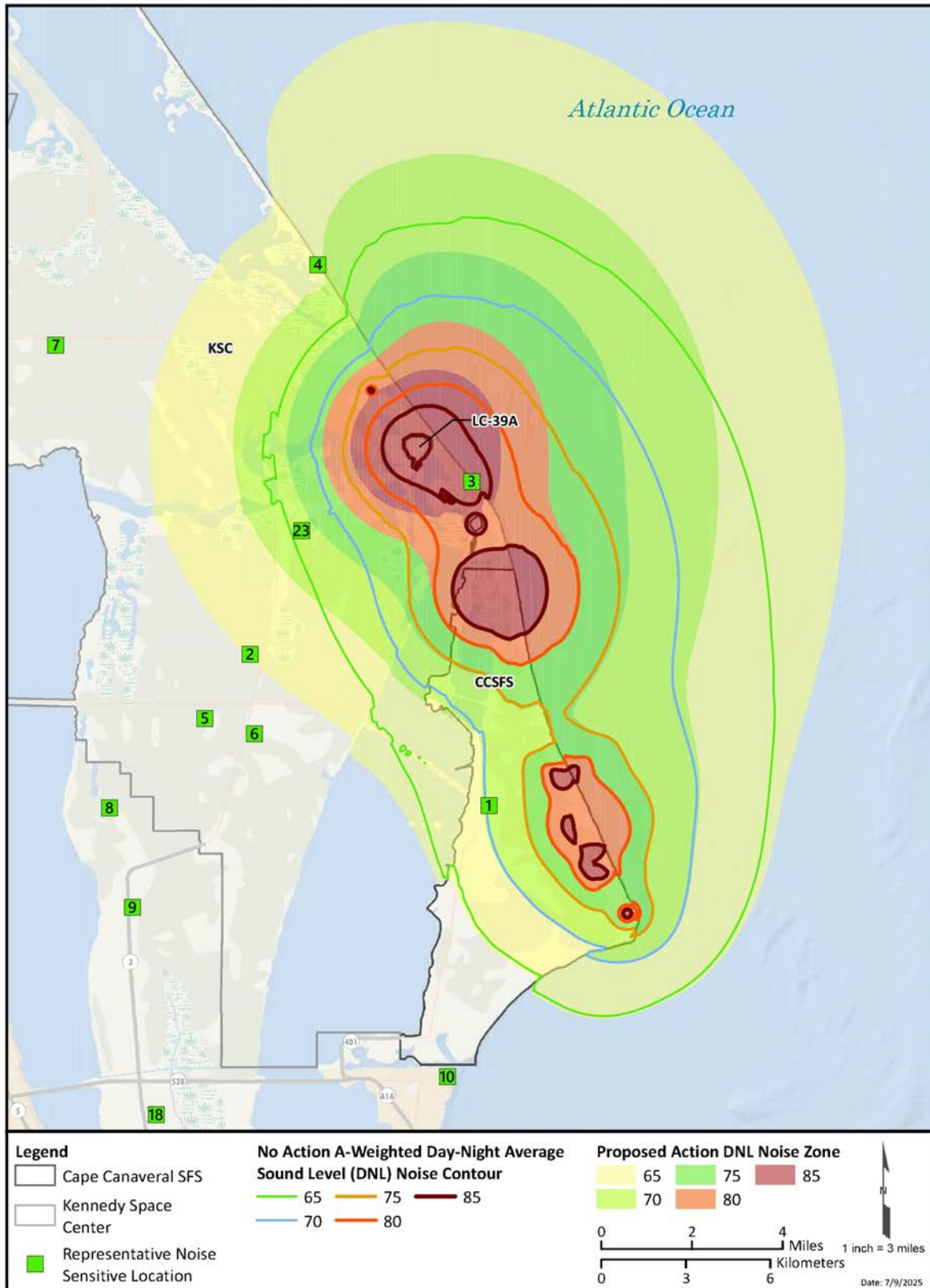
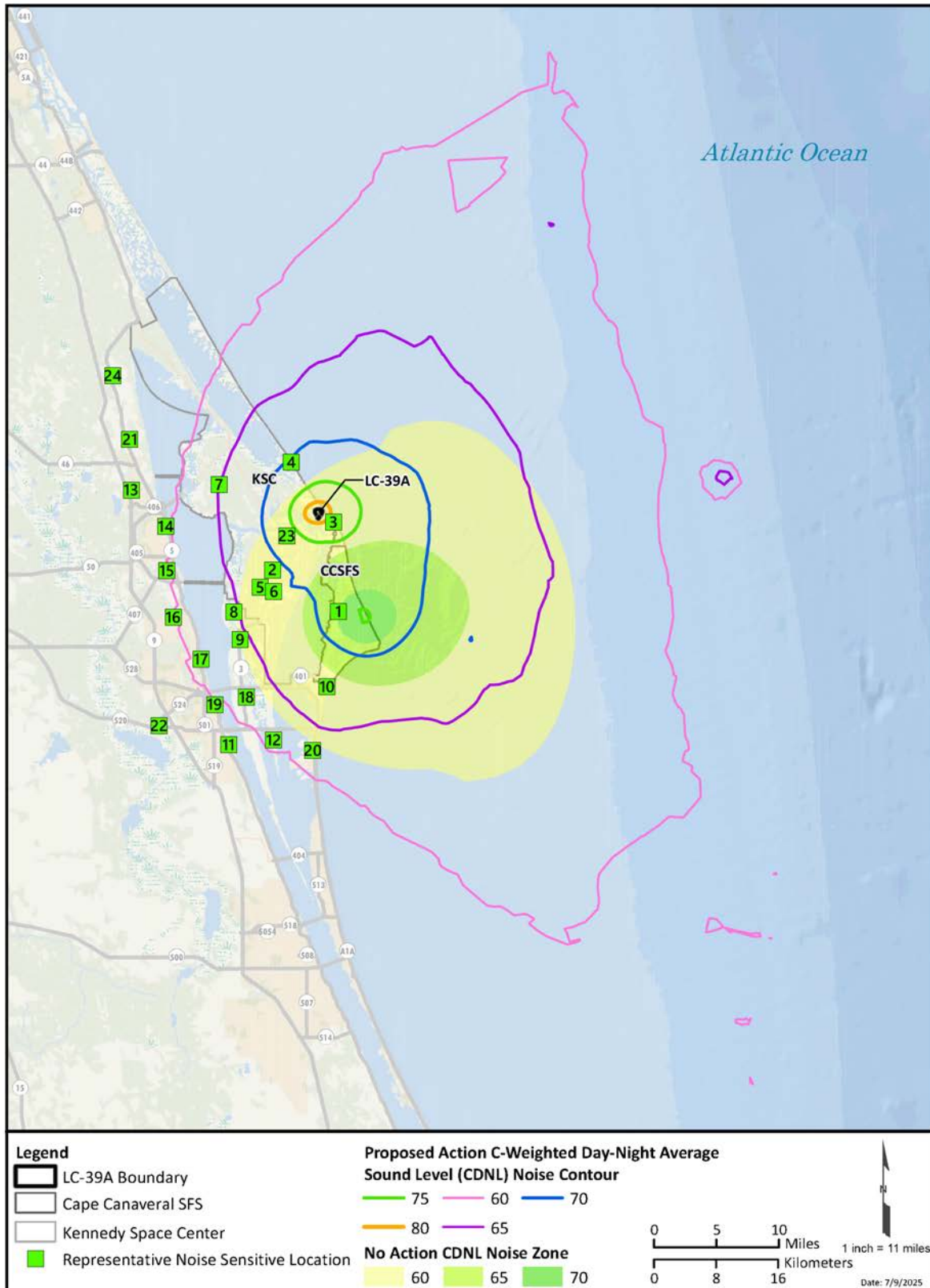


Figure ES-13. Proposed and No Action DNL



Sources: (FGDL, 2017; FGDL, 2018; FGDL, 2023a; FGDL, 2023b)

Figure ES-14. Proposed and No Action CDNL

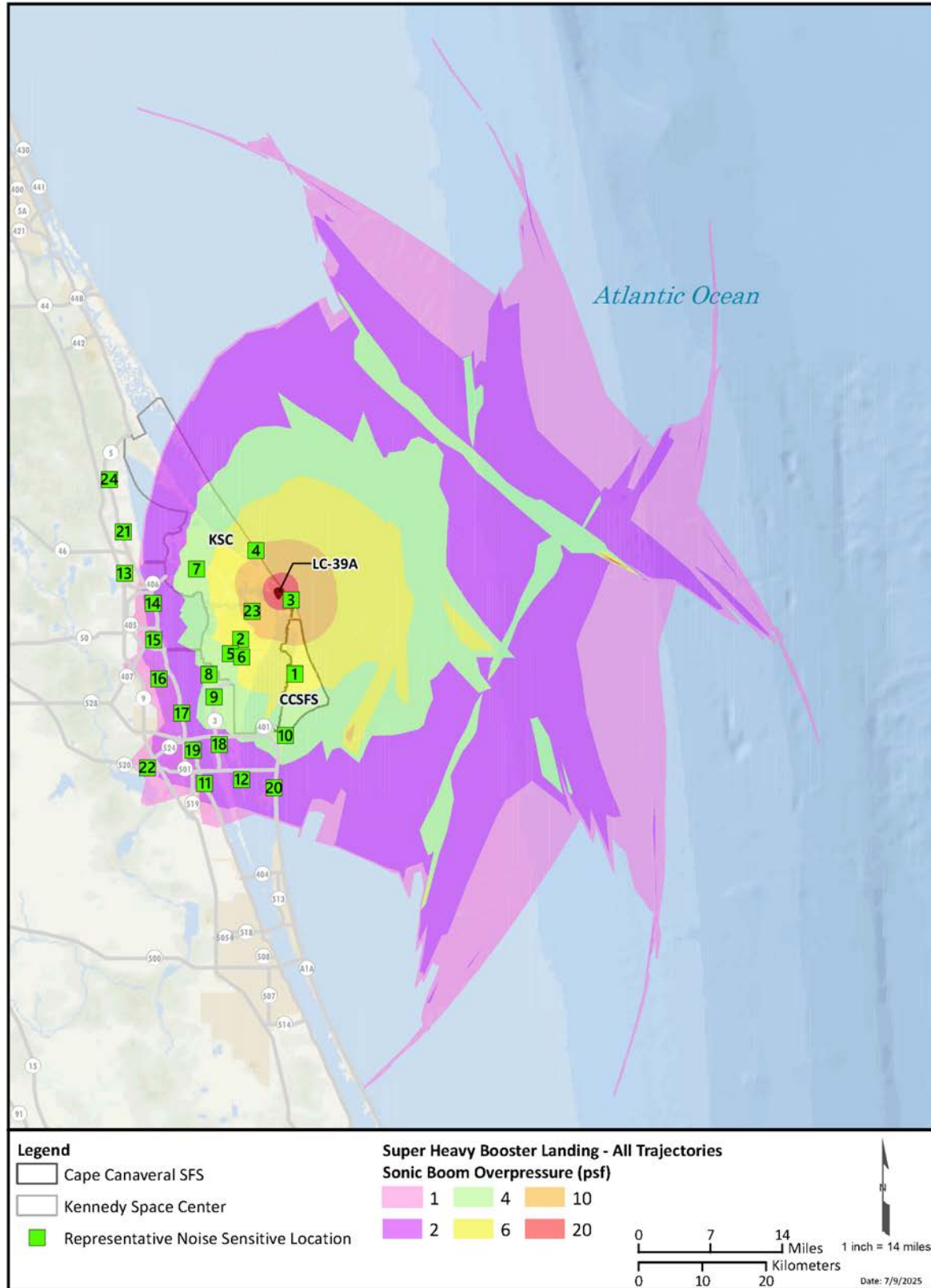


Figure ES-15. Super Heavy Booster Landing Sonic Boom Overpressure (psf)



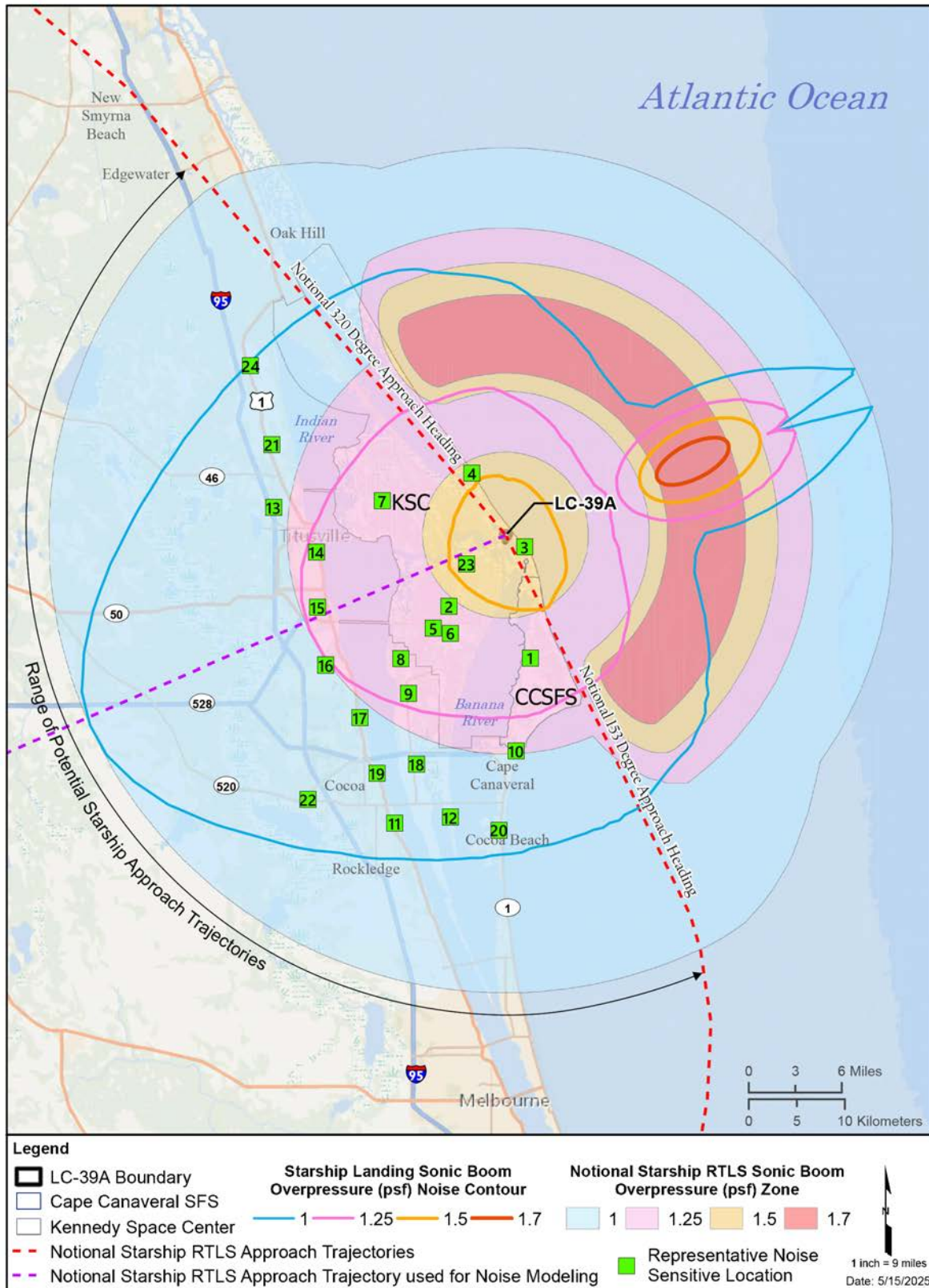


Figure ES-16. Notional Starship RTLS Sonic Boom Overpressure (psf) Zone

Impaired use (i.e., “Constructive Use”) of recreation areas such as parks, trails, water access, golf courses, campgrounds, and wildlife/waterfowl refuges due to the Proposed Action is discussed in EIS Section 3.7, *Department of Transportation Act, Section 4(f)*. In general, effects to recreational land use in the surrounding study area would occur due to increased noise events/public exposure, as well as increased access restrictions, closures, and the associated changes to USFWS and NPS staff management priorities altered by launches. However, the FAA has not determined a constructive use of these areas and does not consider these effects significant, as the noise and closure events would be temporary and would not permanently preclude the viability or use of the areas, as shown by their current exposure to frequent launch-related noise from both KSC and CCSFS. Land uses would not be affected to the extent that public health or safety was threatened. Additionally, it is not anticipated that fire management program activities would significantly change in the area surrounding KSC due to continued enforcement of the Memorandum of Understanding for Prescribed Burning (SLD 45, USFWS, and KSC, 2025). Before any closures are enacted, the closure activities must be reviewed and approved by the NPS Director and the Assistant Secretary for Fish and Wildlife and Parks under Secretarial Order 3426. This will be coordinated between the FAA, SpaceX, and the Department of the Interior.

Noise-compatible land use outside of KSC and CCSFS would remain compatible with guidelines published at 14 CFR Part 150, except for those areas exposed to sonic booms exceeding 60 decibels C-weighted day-night average sound level (Figure ES-15 and Figure ES-16). In these areas projected noise levels from sonic booms would exceed levels at which noise-sensitive land uses are not considered compatible (see EIS Section 3.2.4, *Noise and Noise-Compatible Land Use, Environmental Consequences*). Details regarding associated BMPs, mitigations and monitoring actions can be found in EIS Section 3.3.5, *BMPs, Mitigation, and Monitoring*.

#### *No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. Depending on the launch vehicle and location of launch/landing areas around KSC and CCSFS, the local area would continue to experience land use-related effects associated with increased access restrictions, closures, and the associated changes to USFWS and NPS staff management priorities altered by launches.

### **ES.8.3 Socioeconomics and Children’s Environmental Health and Safety Risks (EIS Section 3.4)<sup>9</sup>**

#### *Proposed Action*

Based on the analysis provided in EIS Section 3.4.4.2, *Proposed Action*, and consideration for the Proposed Action to affect factors outlined in EIS Section 3.4.4, *Environmental Consequences*, significant effects to socioeconomic resources would not be anticipated because there would not be a large change in

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<sup>9</sup> FAA Order 1050.1F includes environmental justice as a component of this impact category. On January 20, 2025, President Trump issued E.O. 14148, *Initial Rescissions of Harmful Executive Orders and Actions*, rescinding E.O. 14096, *Revitalizing Our Nation’s Commitment to Environmental Justice for All* (2023). E.O. 14096 supplemented E.O. 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994), establishing a government-wide mandate to advance environmental justice. As a result, the FAA no longer evaluates environmental justice as a part of its NEPA reviews. Thus, this EIS does not include any discussion of environmental justice, and environmental justice will not be considered by the FAA in its decision-making.

personnel that would induce substantial economic growth, disrupt or divide the physical arrangement of an established community, cause extensive relocation of residents and community businesses, substantially reduce the levels of service of roads, or produce a substantial change in the community tax base. However, construction and operational activities would have positive and short-term direct, indirect, and induced employment and income effects. These effects would last for the duration of the construction activities and/or during the up to 220 static fire, launch, and landing events. During the 44 launches/booster landings and 44 Starship reentries/landings, restricted access to airspace, maritime activities, and effects to MINWR and CANA (e.g., commercial and recreational boating and fishing) may create delays from rescheduling or rerouting, annoyance, and potential losses of income and economic value. NOTAMs and NOTMARs would be issued in advance to allow airspace and maritime participants to plan accordingly.

Launches/booster landings and reentries would occur 88 times per year and scheduled in advance to minimize interruption to commercial and recreational participants that may be affected by temporary closures or restricted access to certain areas. NPS could experience a range of annual fee loss due to closures potentially between \$239,000 and \$259,000, which equates to a potential annual average revenue loss of between approximately 17 percent and 18 percent. This would adversely affect the NPS's ability to fund projects, staff, and maintain the park; NPS may consider this a significant adverse effect to their operations. Persons visiting the park that are turned away due to closures would experience a loss of time spent and related travel costs. A robust notification and awareness system would serve to minimize this potential.

SpaceX is required to carry insurance to cover claims by third parties that result from licensed activities, including structural damage; claims would be subject to the insurance policy terms and Commercial Space Launch Act.

Implementation of Occupational Safety and Health Administration regulations, other recognized standards, applicable NASA regulations or instructions, and SpaceX internal procedures associated with existing launches and landings minimize potential environmental health and safety risks to the general public, including children. These regulations would continue under the Proposed Action. As stated in EIS Section 3.11.6, *Air Quality, Summary*, the FAA anticipates that launching and landing activities would result in NO<sub>x</sub> emissions above indicator thresholds and would be considered potentially significant unless localized air-dispersion modeling could demonstrate that the emissions would not cause or contribute substantially to a projected air quality violation of an ambient air quality standard. Significant levels of NO<sub>x</sub> emissions could result in a disproportionate health and safety risk to children. Details regarding associated BMPs, mitigations, and monitoring actions can be found in EIS Section 3.4.5, *BMPs, Mitigation, and Monitoring*.

#### *No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. Depending on the launch vehicle and location of launch/landing areas around KSC and CCSFS, the local area would continue to experience induced socioeconomic effects associated with increased access restrictions, closures, noise, air quality, and health and safety similar to those described under the Proposed Action.



#### **ES.8.4 Historical, Architectural, Archaeological, and Cultural Resources (EIS Section 3.5.3)**

##### *Proposed Action*

Based on the information provided in EIS Section 3.5.3, *Existing Conditions*, and EIS Section 3.5.4, *Environmental Consequences*, while effects to historical, architectural, archaeological, and cultural resources are possible, significant impacts to these resources are unlikely because of the infrequency of damage to these kinds of resources when exposed to sonic boom overpressure events and vibratory effects expected within the APE as the result of the Proposed Action. However, poorly maintained structures or previously damaged structures may be more susceptible to damage. The long-term effects of repeated sonic boom overpressure events on subsurface archaeological sites, if any, are poorly understood. Any effects potentially resulting from such events have not been systematically documented in the past.

NASA, as the lead agency for NHPA consultation and in coordination with the FAA, intends to continue NHPA Section 106 consultation with the State Historic Preservation Officer, federally recognized tribes, and other consulting parties to develop and execute a Programmatic Agreement pursuant to 36 CFR §800.14(b). The Programmatic Agreement will include ongoing consultation and monitoring efforts and mitigation strategies to resolve any potential adverse effects resulting from the Proposed Action. Details regarding associated BMPs, mitigations, and monitoring actions can be found in EIS Section 3.5.5.

##### *No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. While effects to historical, architectural, archaeological, and cultural resources resulting from reasonably foreseeable actions are possible, significant impacts to these resources are unlikely because of the infrequency of damage to these kinds of resources when exposed to sonic boom overpressure events and vibratory effects expected within the Area of Potential Effects. However, poorly maintained structures or previously damaged structures may be more susceptible to damage from repeated exposure to auditory and sonic boom overpressure events.

#### **ES.8.5 Department of Transportation Act, Section 4(f) (EIS Section 3.7)**

##### *Proposed Action*

Based on the information provided in EIS Section 3.6.3, *Visual Effects, Existing Conditions*, and EIS Section 3.7.4, *Department of Transportation Act, Section 4(f), Environmental Consequences*, there will be no use of Section 4(f) resources resulting from the Proposed Action or No Action Alternative. There are 392 Section 4(f) resources in the proposed project area. DOT Section 4(f) resources evaluated are shown in Figure ES-17 and Figure ES-18. The FAA determined that the MINWR and CANA are subject to the Joint Development Exemption of 23 CFR §774.11(i) and thus not subject to Section 4(f) evaluation. The FAA determined the proposed project does not require the permanent incorporation or temporary occupancy of Section 4(f) resources. Additionally, the FAA determined and detailed in the Section 4(f) Use Determination Report located in Appendix B.4, *Department of Transportation Act Section 4(f) Consultation*, of the EIS, that the proposed project does not significantly impair historic sites, public parks and recreation areas, or wildlife and waterfowl refuges; thus, the project would not use Section 4(f) resources. Details regarding associated BMPs, mitigations and monitoring actions can be found in EIS Section 3.7.5, *BMPs, Mitigation, and Monitoring*.

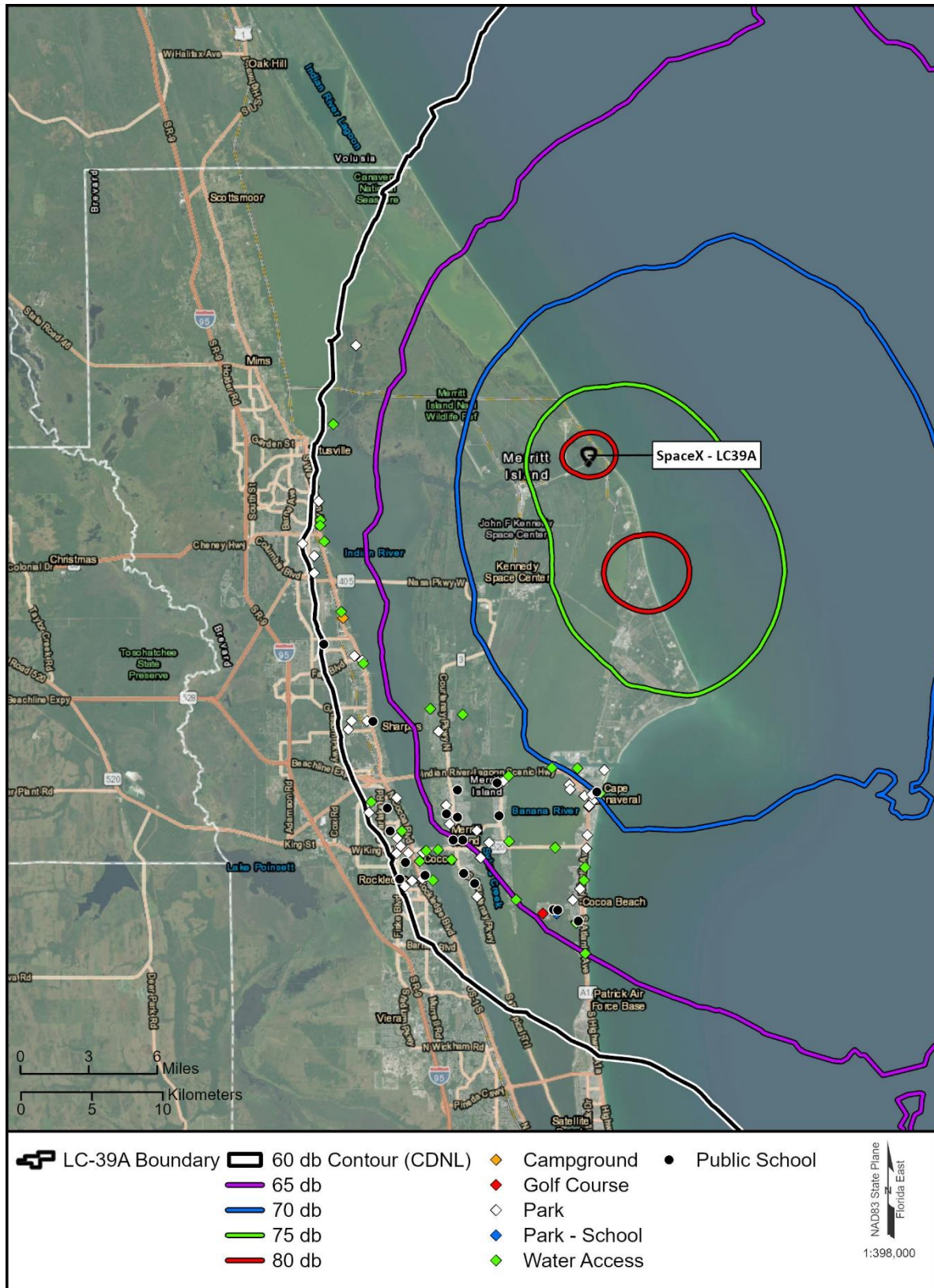


Figure ES-17. Public Parks and Recreation Areas



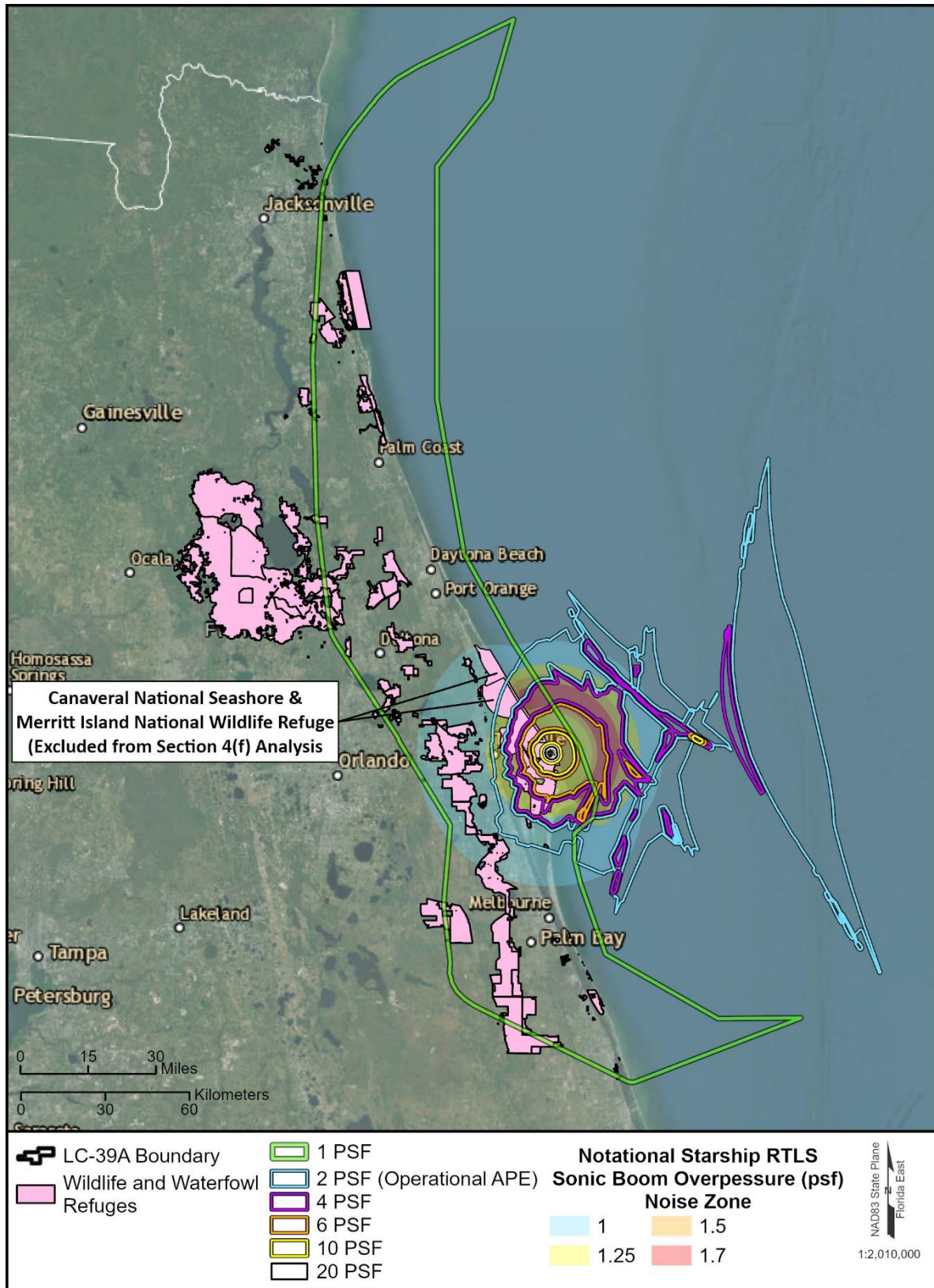


Figure ES-18. Wildlife and Waterfowl Refuges



### *No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. NASA and CCSFS actions that do not require FAA licenses are not subject to DOT Section 4(f) requirements. Any future actions requiring FAA licensing actions would necessarily address this issue.

### **ES.8.6 Biological Resources (EIS Section 3.8)**

#### *Proposed Action/No Action*

Figure ES-19 shows the area evaluated for potential effect from the Proposed Action. Table ES-3 provides a summary of the significance determinations for Biological Resources under the Proposed Action and the No Action Alternative. Under the No Action Alternative, Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. As described in the 2020 Falcon EA (FAA, 2020) and associated Endangered Species Act consultation, under the No Action Alternative SpaceX would continue to conduct Falcon operations at LC-39A and at ocean landing areas, and effects on terrestrial, estuarine, and marine habitats and species would remain below significant levels. Details regarding associated BMPs, mitigations, and monitoring actions can be found in EIS Section 3.8.5.

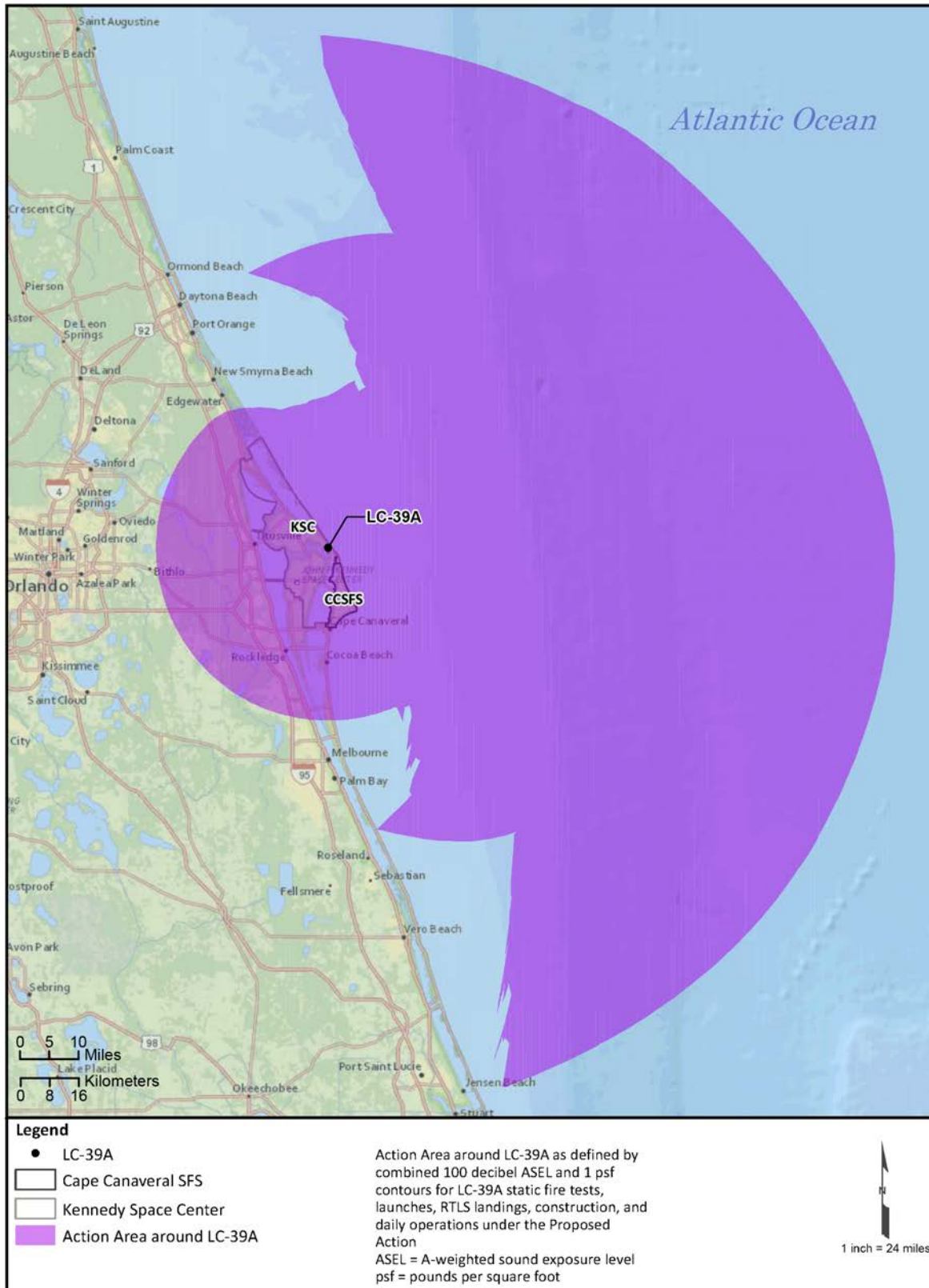


Figure ES-19. Biological Resources Study Area Around LC-39A

**Table ES-3. Significance Determinations for Biological Resources**

| <b>Resource</b>                                 | <b>Proposed Action</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No Action Alternative</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Terrestrial and Estuarine Wildlife and Habitats | Terrestrial and estuarine wildlife may alter behaviors or suffer injury or death, and their habitats may be degraded or destroyed by noise and visual disturbance, vibrations, sonic booms, strikes and collisions, artificial lighting, vapor plumes, hazardous materials, invasive species, and restricted access associated with construction and Starship-Super Heavy operations. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, effects would still be less than significant because the Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects. | Terrestrial and estuarine wildlife may alter behaviors, or suffer injury or death, and their habitats may be degraded or destroyed by noise and visual disturbance, vibrations, sonic booms (from landings at other sites), strikes and collisions, artificial lighting, vapor plumes, hazardous materials, invasive species, and restricted access associated with Falcon operations. However, effects would be less than significant because the No Action Alternative would not result in any species extirpations, substantial habitat effects, or adverse population-level effects. |
| Marine Wildlife and Habitats                    | Marine wildlife may alter behaviors, or suffer injury or death, and their habitats may be degraded by noise and visual disturbance, sonic booms, strikes and collisions, artificial lighting, hazardous materials, and restricted access associated with Starship-Super Heavy launches, expended boosters and landings, and vessel operations. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, effects would still be less than significant because the Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects.                                        | Marine wildlife may alter behaviors, or suffer injury or death, and their habitats may be degraded by Falcon noise and visual disturbance, sonic booms, strikes and collisions, entanglement in and ingestion of parachutes and parafoils, hazardous materials, and restricted access associated with expended boosters and landings, and vessel operations. However, effects would be less than significant because the No Action Alternative would not result in any species extirpations, substantial habitat effects, or adverse population-level effects.                           |
| Federally Protected Species                     | Federally protected species in the launch and ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, the effects would still be less than significant because the Proposed Action would not be likely to jeopardize the continued existence of a federally listed threatened or endangered species.                                                                                                                                                                                                     | Federally protected species in the Falcon launch and ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. However, the effects would be less than significant because the ongoing actions would not be likely to jeopardize the continued existence of a federally listed threatened or endangered species.                                                                                                                                                                                                           |
| Critical Habitat                                | Critical habitat in the launch and ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine habitats. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative, but effects to critical                                                                                                                                                                                                                                                                                                                                                                                                | Critical habitat in Falcon launch and ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine habitats, but effects would be less than significant because the ongoing actions would not likely result in the destruction                                                                                                                                                                                                                                                                                                          |



**Table ES-3. Significance Determinations for Biological Resources**

| <b>Resource</b>                 | <b>Proposed Action</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>No Action Alternative</b>                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | habitat would still be less than significant because the Proposed Action would not likely result in the destruction or adverse modification of federally designated critical habitat.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | or adverse modification of federally designated critical habitat.                                                                                                                                                                                                                                                                                                       |
| Essential Fish Habitat          | EFH could be affected by hazardous materials and debris strikes from Starship-Super Heavy construction and operations. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, effects would still be less than significant because there would be no adverse effects on estuarine EFH or water column or soft substrate EFH in the Atlantic Ocean landing area, and the potential to adversely affect hard bottom and deep-water corals in the Atlantic Ocean landing area would be decreased by their limited distribution in the overall study area, relatively low number and dispersed location of expended items, and number of debris items that would burn up in the atmosphere. | EFH in estuarine and marine waters could be affected by hazardous materials and debris strikes from Falcon operations, but effects would be less than significant because the effects would not measurably reduce the quantity or quality of EFH.                                                                                                                       |
| State-Listed Species            | State-listed species in the launch and ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, the effects would still be less than significant because the Proposed Action would not result in any species extirpations or adverse population-level effects.                                                                                                                                                                                                                                                                                              | State-listed species in the Falcon launch and ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. However, the effects would be less than significant because the No Action Alternative would not result in any species extirpations or adverse population-level effects.                           |
| Migratory Birds and Bald Eagles | Migratory birds and bald eagles in the launch and (for migratory birds) ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, the effects would still be less than significant because the No Action Alternative would not result in any species extirpations or adverse population-level effects.                                                                                                                                                                                                                                                       | Migratory birds and bald eagles in the launch and (for migratory birds) ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. However, the effects would be less than significant because the No Action Alternative would not result in any species extirpations or adverse population-level effects. |

Note: EFH = essential fish habitat.

**ES.8.7 Air Quality (EIS Section 3.11)***Proposed Action*

Based on the analysis provided in EIS Section 3.11.4.2.1, *Construction*, and EIS Section 3.11.4.2.2, *Operation*, effects to air quality would be insignificant for all criteria pollutants except NO<sub>x</sub>. Emissions from construction activities would be minor and temporary, lasting only the duration of the construction phase. These emissions would remain well below insignificance indicator thresholds established for NEPA analysis and would not contribute to an exceedance of any National Ambient Air Quality Standards. Emissions sources during construction would be mobile and intermittent and pollutant emissions would not be large enough in a localized area to cause any exceedance of an ambient air quality standard. For operational activities, emissions of all criteria pollutants except NO<sub>x</sub> are anticipated to remain below insignificance thresholds.

However, total NO<sub>x</sub> emissions—including both construction (11.11 tons per year) and operational (374.55 tons per year) sources—are estimated at 385.66 tons per year, exceeding the insignificance indicator threshold of 250 by approximately 54 percent. This level of NO<sub>x</sub> emissions represents 4.35 percent of the National Emissions Inventory total for Brevard County, which is 8,867.99 tons per year.

Additionally, the ground-level effect of launch vehicle emissions released above the atmospheric mixing layer would be negligible due to the inability of released pollutants to penetrate the mixing layer and mix downward to ground level. The FAA anticipates that launch and landing activities would result in NO<sub>x</sub> emissions above indicator thresholds and would be considered potentially significant unless localized air-dispersion modeling could demonstrate that the emissions would not cause or contribute substantially to a projected air quality violation of an ambient air quality standard.

*No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. As a result, implementation of the No Action Alternative would result in increased launch and development-related emissions within the region, the scope of which would be dependent on the number of launches and types of vehicles, and size of development projects. Development project emission would be considered short term and temporary. However, as launch licenses are approved or adjusted over time, air emissions analyses would be conducted by the FAA, NASA, or the DAF in associated NEPA documentation to identify any potentially significant effects. Details regarding associated BMPs, mitigations, and monitoring actions can be found in EIS Section 3.11.5.

**ES.8.8 Transportation (EIS Section 3.16)***Proposed Action*

While there could be temporary road closure and traffic effects associated with heavy and slow-moving construction vehicles at KSC and on the local roads, these effects would be temporary and typical for the local transportation system within and around an active spaceport. Therefore, the FAA does not anticipate significant effects to transportation systems during construction activities under the Proposed Action with

construction workers representing only a 0.02 percent increase in the number of employees and vehicles accessing LC-39A.

During operations, the number of employees could increase along with associated vehicle traffic; therefore, commuter traffic could increase under the Proposed Action compared to the No Action Alternative. These increases would be small compared to the number of employees located at KSC. Increases in the number of launches under the Proposed Action, however, would change the frequency of transport of rocket components, payloads, and commodities over roadways in and around KSC and CCSFS. In addition, more launches would result in more frequent road closures. As an active spaceport, road closures would be expected.

Visitors driving to KSC and surrounding areas to view launches would continue to generate traffic effects. It is unknown if more frequent launches would generate less tourist interest, but high-profile launches and reentries would likely still attract viewer interest and associated traffic congestion. Roadways are operating at an acceptable Level of service and current and planned improvement projects would result in better traffic flow. As a result, while traffic effects could occur due to more frequent road closures and launches, the FAA does not expect these effects to significantly affect current level of service.

Vessel transits to and from Port Canaveral are considered high as expected. The Port currently operates and is accustomed to periodic RNAs. The *State of the Port* (Port Canaveral, 2024) identifies a goal to work with SpaceX and other commercial space providers to assist with maritime assets. With proper coordination and scheduling, the Proposed Action would not significantly affect vessel traffic.

Air traffic would be impacted by launches, booster landings, and Starship RTLS. The average expected flight delay for launches would last approximately 40 minutes and could last up to 2 hours. General aviation operations would be similarly impacted by the launch and Super Heavy booster landing AHAs. The launch and Super Heavy booster landing AHA could also affect airways within the flight regions of Canada and the Bahamas. Due to the length of the Starship reentry AHAs, certain flights, especially international, may elect to delay the departure time due to the inability to accept a reroute caused by fuel constraints or the flight time of the reroute. The average expected flight delay for Starship reentries would be approximately 40 minutes and could be up to an hour. General aviation operations would be impacted similarly by the Starship reentry AHAs. The Starship reentry AHAs could also affect airways within the flight regions of Mexico, El Salvador, Belize, Guatemala, Honduras, and Cuba. The FAA would manage such operations in a way that minimizes disruption to existing aviation operations and ensures safety for all airspace users. Successful integration requires close collaboration between space operators, the FAA, commercial airlines, general aviation, and defense stakeholders. Key factors contributing to feasibility include enhanced real-time communication systems and well-defined scheduling and deconfliction procedures. Although temporary airspace closures may impact other stakeholders, mitigation strategies such as pre-coordinated reroutes, dynamic scheduling, and time-based traffic flow management could reduce operational burdens. Details regarding associated BMPs, mitigations, and monitoring actions can be found in EIS Section 3.16.5.

#### *No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS.



Local roadways and transportation corridors would continue to be affected by current traffic conditions and ongoing and planned roadway improvements. In addition, the Florida Department of Transportation has a Spaceport Office that developed and administers the Spaceport Improvement Program. The goal of the program is to improve aerospace transportation facilities. The program embraces Florida leading the growth and development of the aerospace industry. The Spaceport Improvement Program is designed to stimulate private sector investment and commercial spaceport development and acknowledges the importance of quality of life for Floridians continuing as a direct result of infrastructure improvements<sup>10</sup>. Vessel traffic is also projected to increase when considering the reasonably foreseeable actions along with NASA, other commercial space providers, and Port Canaveral goals.

### **ES.8.9 Utilities and Infrastructure (EIS Section 3.17)**

#### *Proposed Action*

There could be potential minor short-term effects during construction of the utility improvement projects, but those would likely be short-term and not significant. During operations, the Proposed Action would result in greater utility demands compared to the No Action Alternative; however, the Proposed Action includes construction projects to support the increased demand. Water use associated with Proposed Action operations at LC-39A would require approximately 297 million gallons per year; given the context of the City of Cocoa, this is a small percentage of current annual use and capacity. SpaceX would construct onsite bulk storage for water and commodities and would reuse or recycle as appropriate. Based on the analysis of potential effects presented above, the FAA does not anticipate significant effects to utilities and infrastructure distribution systems and service capacity from implementation of the Proposed Action. Details regarding associated BMPs, mitigations, and monitoring actions can be found in EIS Section 3.16.5.

#### *No Action Alternative*

Starship-Super Heavy would not launch from LC-39A. Launch activities currently occur on KSC and CCSFS, and this would continue, likely increasing over time based on current launch cadence projections and if Starship-Super Heavy were to be implemented at CCSFS. Reasonably foreseeable actions would all require an increase in utilities including drinking and industrial water use, domestic and industrial wastewater collection and treatment, emergency response, and communications enhancements. However, each project is analyzed separately to determine utility loads and typically includes infrastructure improvements to ensure that existing infrastructure availability and capacity would not be negatively affected. As an example, the EIS for Starship-Super-Heavy operations at SLC-37 on CCSFS estimates approximately 105 million gallons (397 million liters) per year of potable water use (USSF, 2025a). As a result, the FAA anticipates that the No Action Alternative, with consideration of new, more efficient utilities with an increased capacity would not pose significant adverse effects on utilities and infrastructure.

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<sup>10</sup> FDOT, 2023. Spaceport Improvement Program Project Handbook 2023-2024.

**ES.9 Other Environmental Considerations<sup>11</sup>*****Unavoidable Adverse Effects (EIS Section 4.1)***

For the Proposed Action analysis identified unavoidable adverse effects associated with soil disturbance, air quality, water quality, and biological resources within and adjacent to LC-39A from development activities (ground disturbance). However, these adverse effects have been shown to not be significant based on the context (already developed site) and intensity (short term and temporary) of these activities; furthermore, implementation of BMPs and permitting requirements for ground-disturbance activities would further minimize these effects. Unavoidable adverse effects from operational activities have been identified across multiple resource areas (e.g., land use and access restrictions, effects to biological resources), some of which have been identified as potentially significant (noise and air quality in particular). While some of these effects could be minimized through implementation of mitigations, or by reducing the scope of the Proposed Action, these effects are inherent to the Proposed Action and cannot be avoided (i.e., a rocket inherently produces noise and air emissions).

***Irreversible and Irretrievable Commitment of Resources (EIS Section 4.2)***

Implementing the Proposed Action requires a commitment of natural, physical, human, and fiscal resources. In all these categories, irreversible and irretrievable commitments of resources would occur, with these commitments similar in nature across the Proposed Action and No Action (given ongoing and reasonably foreseeable actions). However, these resources should generally be in sufficient supply during the Proposed Action; therefore, their commitment would not have an adverse effect on the resources' local, regional, or national continued or future availability.

***Short-Term Uses and Long-Term Productivity (EIS Section 4.3)***

Under the Proposed Action the only “short-term” uses would be associated with construction activities, given that the Proposed Action involves long-term use of LC-39A to support Starship-Super Heavy operations. Development of LC-39A would involve temporary, short-term effects associated with ground disturbance and vehicle air emissions, which would be minimized by implementation of best practices and permitting requirements identified in each respective section and would end once construction is complete. Therefore, there would be no effects associated with short-term uses (i.e., development activities) that would adversely affect maintenance and enhancement of the long-term productivity of KSC or the study area.

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<sup>11</sup> FAA Order 1050.1F provides for an evaluation of cumulative impacts. The term cumulative effects (impacts) was defined in CEQ's NEPA-implementing regulations in 40 CFR § 1508(i)(3) (2024). However, on February 25, 2025, the CEQ published an interim final rule to remove these regulations in accordance with E.O. 14154, *Unleashing American Energy*. See 90 Federal Register 10610 (February 25, 2025). The rule became effective on April 11, 2025. On February 19, 2025, the CEQ issued a memorandum titled *Implementation of the National Environmental Policy Act* that provided guidance to Federal agencies on how to implement NEPA. The memo provides, “Federal agencies should analyze the reasonably foreseeable effects of the proposed action consistent with section 102 of NEPA, which does not employ the term “cumulative effects;” NEPA instead requires consideration of “reasonably foreseeable” effects, regardless of whether or not those effects might be characterized as “cumulative.” Based on the CEQ memo and on the U.S. Supreme Court's recent decision in *Seven County Infrastructure Coalition v. Eagle County, Colorado*, 145 S. Ct. 1497 (2025), this EIS does not include a discussion of cumulative impacts, and cumulative impacts will not be considered by the FAA in its decision-making. Reasonably foreseeable effects are discussed within each resource area.

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## Acronyms and Abbreviations

| Acronym           | Definition                                         | Acronym           | Definition                                     |
|-------------------|----------------------------------------------------|-------------------|------------------------------------------------|
| #                 | Number                                             | ERD               | Environmental Resources Document               |
| §/§§              | Section/Sections                                   | ERP               | Environmental Resource Permit                  |
| ACAM              | Air Conformity Applicability Model                 | ESA               | Endangered Species Act                         |
| AHA               | Aircraft Hazard Area                               | FAA               | Federal Aviation Administration                |
| APE               | Area of Potential Effects                          | FDEP              | Florida Department of Environmental Protection |
| ASEL              | A-weighted sound exposure level                    | FHWA              | Federal Highway Administration                 |
| AST               | aboveground storage tank                           | FMC               | Fishery Management Council                     |
| ASU               | air separation unit                                | FMSF              | Florida Master Site File                       |
| BCA               | Biological and Conference Assessment               | FMU               | fire management unit                           |
| BGEPA             | Bald and Golden Eagle Protection Act               | FNAI              | Florida Natural Areas Inventory                |
| BMP               | best management practice                           | FONSI             | Finding of No Significant Impact               |
| C&D               | construction and demolition                        | FPL               | Florida Power and Light                        |
| CAA               | Clean Air Act                                      | FTA               | Federal Transit Administration                 |
| CANA              | Canaveral National Seashore                        | GHG               | greenhouse gas                                 |
| CCSFS             | Cape Canaveral Space Force Station                 | GMP               | General Management Plan                        |
| CDNL              | C-weighted day-night average sound level           | HAP               | hazardous air pollutant                        |
| CEQ               | Council on Environmental Quality                   | HAPC              | habitat areas of particular concern            |
| CFR               | Code of Federal Regulations                        | HLS               | Human Landing System                           |
| CMP               | coastal management program                         | HVAC              | heating, ventilation, and air conditioning     |
| CO                | carbon monoxide                                    | ICRMP             | Integrated Cultural Resource Management Plan   |
| CO <sub>2</sub>   | carbon dioxide                                     | IHA               | Incidental Harassment Authorization            |
| CO <sub>2</sub> e | carbon dioxide equivalent                          | IM                | Interim Measure                                |
| COC               | contaminant of concern                             | INRMP             | Integrated Natural Resources Management Plan   |
| CWA               | Clean Water Act                                    | IRL               | Indian River Lagoon                            |
| CZMA              | Coastal Zone Management Act                        | KCA               | Kennedy Contract Agreement                     |
| DAF               | Department of the Air Force                        | KNPR              | Kennedy NASA Procedural Requirements           |
| dB                | decibels                                           | KSC               | Kennedy Space Center                           |
| dba               | A-weighted decibels                                | LAA               | Limited Access Area                            |
| dbc               | C-weighted decibels                                | LA <sub>max</sub> | maximum A-weighted sound level                 |
| DNL               | day-night average sound level                      | LC                | Launch Complex                                 |
| DOD               | Department of Defense                              | LCH <sub>4</sub>  | liquid methane                                 |
| DOT               | Department of Transportation                       | L <sub>max</sub>  | maximum sound level                            |
| E.O.              | Executive Order                                    | LN <sub>2</sub>   | liquid nitrogen                                |
| EA                | Environmental Assessment                           | LNG               | liquified natural gas                          |
| EEZ               | Exclusive Economic Zone                            | LOA               | Letter of Agreement                            |
| EFH               | essential fish habitat                             | LOI               | Letter of Intent                               |
| EIS               | Environmental Impact Statement                     | LOS               | level of service                               |
| EPCRA             | Emergency Planning and Community Right-to-Know Act | LOX               | liquid oxygen                                  |
|                   |                                                    | LQG               | Large Quantity Generator                       |

| <b>Acronym</b>  | <b>Definition</b>                                                   | <b>Acronym</b> | <b>Definition</b>                             |
|-----------------|---------------------------------------------------------------------|----------------|-----------------------------------------------|
| LUC             | Land Use Control                                                    | PPV            | peak particle velocity                        |
| LZ              | Landing Zone                                                        | PRL            | Potential Release Location                    |
| MARPOL          | International Convention for the Prevention of Pollution from Ships | PSD            | prevention of significant deterioration       |
| MBTA            | Migratory Bird Treaty Act                                           | psf            | pounds per square foot                        |
| MINWR           | Merritt Island National Wildlife Refuge                             | RCRA           | Resource Conservation and Recovery Act        |
| MMPA            | Marine Mammal Protection Act                                        | Rev.           | Revision                                      |
| MOU             | Memorandum of Understanding                                         | RNA            | Regulated Navigation Area                     |
| MSFCMA          | Magnuson-Stevens Fishery Conservation and Management Act            | ROD            | Record of Decision                            |
| MSGP            | Multi-Sector General Permit                                         | RTLS           | return to launch site                         |
| MT              | metric tons                                                         | SEARCH         | SEARCH, LLC                                   |
| MW              | megawatt(s)                                                         | SEL            | sound exposure level                          |
| NAAQS           | National Ambient Air Quality Standards                              | SHA            | Ship Hazard Area                              |
| NAS             | National Airspace System                                            | SHPO           | State Historic Preservation Officer           |
| NASA            | National Aeronautics and Space Administration                       | SJNWR          | St. Johns National Wildlife Refuge            |
| NEI             | National Emissions Inventory                                        | SLC            | Space Launch Complex                          |
| NEPA            | National Environmental Policy Act                                   | SLD 45         | Space Launch Delta 45                         |
| NHL             | National Historic Landmark                                          | SO             | Secretarial Order                             |
| NHPA            | National Historic Preservation Act                                  | SpaceX         | Space Exploration Technologies Corp.          |
| NMFS            | National Marine Fisheries Service                                   | SPCC           | Spill Prevention, Control, and Countermeasure |
| No.             | Number                                                              | SR             | State Road                                    |
| NO <sub>2</sub> | nitrogen dioxide                                                    | SWMU           | Solid Waste Management Unit                   |
| NOTAM           | Notice to Airmen                                                    | SWPPP          | Stormwater Pollution Prevention Plan          |
| NOTMAR          | Notice to Mariners                                                  | TCP            | Traditional Cultural Place                    |
| NO <sub>x</sub> | nitrogen oxides                                                     | THPO           | Tribal Historic Preservation Officer          |
| NPDES           | National Pollutant Discharge Elimination System                     | TMDL           | total maximum daily load                      |
| NPS             | National Park Service                                               | TSDF           | treatment, storage, and disposal facility     |
| NRHP            | National Register of Historic Places                                | U.S.           | United States                                 |
| NWR             | National Wildlife Refuge                                            | U.S.C.         | United States Code                            |
| OSHA            | Occupational Safety and Health Administration                       | USACE          | United States Army Corps of Engineers         |
| PA              | Programmatic Agreement                                              | USCG           | United States Coast Guard                     |
| Pb              | lead                                                                | USEPA          | United States Environmental Protection Agency |
| PBF             | physical and biological feature                                     | USFWS          | United States Fish and Wildlife Service       |
| PCB             | polychlorinated biphenyl                                            | VAB            | Vehicle Assembly Building                     |
| PCE             | primary constituent element                                         |                |                                               |
| PEA             | Programmatic Environmental Assessment                               |                |                                               |
| PFAS            | perfluoroalkyl and polyfluoroalkyl substances                       |                |                                               |
| PIP             | preservation in place                                               |                |                                               |



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## Chapter 1. Purpose and Need

The Federal Aviation Administration (FAA) is evaluating Space Exploration Technologies Corp.'s (SpaceX's) proposal for operation of the Starship-Super Heavy at Launch Complex (LC)-39A within the National Aeronautics and Space Administration (NASA) Kennedy Space Center (KSC) (see Figure 1.1-1)<sup>1</sup>. SpaceX's proposed operations within the context of this Environmental Impact Statement (EIS) include construction of a launch pad and other launch support infrastructure at LC-39A, launching of the Starship-Super Heavy at LC-39A, landing of the Starship and the Super Heavy Booster at LC-39A, landing of the Starship and the Super Heavy Booster on droneships in the ocean, and expenditure of the vehicles and components in the ocean. For operations at LC-39A, SpaceX must obtain a new license or modification of their existing vehicle operator license from the FAA for Starship-Super Heavy launch and landing operations, and the FAA would need to close appropriate airspace for those launch and landing operations. The FAA considers the issuance or modification of a vehicle operator license and associated airspace closures to be major Federal actions that require environmental review consistent with the National Environmental Policy Act (NEPA) of 1969, §§ 4321-4336, as amended through Public Law 118–5 (June 3, 2023)<sup>2</sup> and FAA Order 1050.1F, Environmental Impacts: Policies and Procedures (July 16, 2015)<sup>3</sup>. SpaceX has prepared this EIS under the supervision of the FAA. This EIS assesses the potential direct, indirect, and reasonably foreseeable effects of the action and alternatives.

### EIS Basics

**Proposed Action:** SpaceX Starship-Super Heavy Launch/Landing Infrastructure and Operations at KSC LC-39A.

**Lead Agency:** FAA

**Need for EIS:** Issuance of vehicle operator license and approval of airspace closures is a major Federal action under NEPA.

The EIS is prepared according to FAA Order 1050.1F.

SpaceX is a commercial space transportation and services company headquartered in Hawthorne, California. SpaceX designs, manufactures, launches, and operates advanced rockets and spacecraft. SpaceX developed the Falcon 1 (no longer operational), Falcon 9, and Falcon Heavy vertical orbital launch vehicles, all of which were built with the goal of becoming reusable launch vehicles.

<sup>1</sup> SpaceX has not yet submitted a new vehicle operator license application or application for modification of their existing vehicle operator license to the FAA for operations at KSC.

<sup>2</sup> On January 20, 2025, President Trump issued Executive Order (E.O.) Number (No.) 14154, Unleashing American Energy, which revoked E.O. 11991, Relating to Protection and Enhancement of Environmental Quality (May 24, 1977), and instructed the Chair of the Council on Environmental Quality (CEQ) to rescind its NEPA-implementing regulations. In response, the CEQ issued an interim final rule to remove the existing implementing regulations for NEPA (90 Federal Register 10610 (Feb. 25, 2025), effective April 11, 2025).

<sup>3</sup> FAA Order 1050.1G was issued on June 30, 2025, over a year after this EIS was initiated, therefore this EIS was prepared in accordance with FAA Order 1050.1F and CEQ's NEPA Implementing Regulations Revision Phase 2, 89 Federal Register 35442 (May 1, 2024) (Phase 2 final rule).



Figure 1.1-1. Location of LC-39A

Falcon 9 and Falcon Heavy are the world’s only reusable orbital-class rockets and have successfully completed 504 missions, with 467 landings and 434 total reflights<sup>4</sup> since 2015. SpaceX supports and is under contract for the full spectrum of United States (U.S.) Government space mission requirements, including crew and cargo transportation for NASA to the International Space Station and spacecraft launches for NASA and the Department of Defense (DOD). SpaceX also conducts most of the world’s commercial satellite launches. The completion of the environmental review process does not guarantee that the FAA will issue SpaceX a new license or modify their existing vehicle operator license for Starship-Super Heavy at LC-39A or approve airspace closures. SpaceX’s license application must also meet FAA safety, risk, and financial responsibility requirements under 14 Code of Federal Regulations (CFR) Chapter III, *Commercial Space Transportation, Federal Aviation Administration, Department of Transportation* [DOT].

## 1.1 Background

LC-39A at KSC was previously sited for Starship-Super Heavy activities through NASA’s *Final Environmental Assessment [EA] for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC)* (NASA, 2019a) (referred to as “2019 NASA EA” throughout this document) and resultant Finding of No Significant Impact (FONSI). This Proposed Action incorporates the 2019 NASA EA analysis by reference (where appropriate) and addresses modifications to the SpaceX concept of operations for Starship-Super Heavy. The Department of the Air Force (DAF) is also considering a proposed action to support Starship-Super Heavy at Cape Canaveral Space Force Station (CCSFS). This action is separate from the Proposed Action at LC-39A in that the CCSFS action will provide separate utility for the DAF and SpaceX within the overall Starship-Super Heavy program. As a result, there are two separate EISs. The following provides additional background information regarding the SpaceX Starship-Super Heavy program.

### ***Starship-Super Heavy and NASA (KSC)***

In September 2019, NASA completed the 2019 NASA EA (NASA, 2019a) to evaluate the potential environmental impacts resulting from construction and operations associated with the proposed SpaceX Starship-Super Heavy launch vehicle at LC-39A. The resulting FONSI concluded that the environmental impacts associated with the Proposed Action would not have a significant effect on the quality of the biological or physical environment. While the FAA was a cooperating agency on the 2019 NASA EA, the EA was not adopted by the FAA because SpaceX did not apply to the FAA for a commercial launch vehicle operator license at that time and the FAA had no corresponding Federal action requiring evaluation.

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*Starship-Super Heavy at LC-39A was previously approved by NASA in a 2019 EA and FONSI.*

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The fully reusable Starship-Super Heavy launch vehicle system is planned to support cargo missions to space stations in low-Earth orbit, the moon and Mars, and satellite payload missions. From 2020 to 2022, NASA awarded SpaceX an Artemis Human Landing System (HLS) program contract and associated contract options to develop two Starship-based lunar landers and deliver them to the moon. The NASA-SpaceX

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<sup>4</sup> As of June 2025 – 493 Falcon 9 missions/448 landings/418 reflights; 11 Falcon Heavy missions/19 landings/16 reflights landings (<https://www.spacex.com/>).



contract also requires a series of Starship flight tests. These include a flight demonstration of the Starship lunar lander to the surface of the moon. These flight tests and missions require extensive use of the Starship-Super Heavy vehicle to launch the lunar lander, as well as numerous Starship-based propellant tanker vehicles. These missions can occur independently from different launch sites. However, in support of HLS, SpaceX is proposing to launch Starship-Super Heavy from LC-39A and to land the Super Heavy and Starship stages separately at LC-39A following launch (“return to launch site,” or RTLS). SpaceX’s proposal would provide an improved ability to reuse Super Heavy, which directly supports national space program priorities. By landing at the launch site, SpaceX can quickly begin post-flight vehicle processing.

Since the 2019 NASA EA, SpaceX has undertaken infrastructure improvements at LC-39A (e.g., construction of a launch mount) (NASA, 2019a, pp. 9-14). However, the Starship-Super Heavy concept of operations has been updated, which includes additional launch infrastructure, evolved launch vehicle design, higher launch tempo, and RTLS booster recovery. In consideration of SpaceX’s proposal, NASA as the lead land management agency and the FAA as the licensing agency have determined that an EIS is the appropriate level of NEPA analysis to address the potential environmental effects of Starship-Super Heavy operations at LC-39A. While the 2019 NASA EA is incorporated by reference, the environmental effects of these proposed changes to Starship-Super Heavy operations will be specifically analyzed in this EIS. SpaceX will apply for a new license or modification of their existing vehicle operator license for LC-39A that would identify a proposed launch cadence consistent with that analyzed in this EIS. Any future proposed launch cadence increases would be reevaluated by the FAA through the same process.

### ***Starship-Super Heavy and CCSFS***

The DAF is currently evaluating Starship-Super Heavy operations and related infrastructure improvements at CCSFS under separate NEPA analysis. The DAF has identified a Proposed Action Alternative and the No Action Alternative to be carried forward for analysis in an EIS.

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*Starship-Super Heavy at CCSFS is not connected to the Proposed Action addressed in this EIS.*

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Under the Proposed Action for CCSFS, SpaceX would redevelop Space Launch Complex (SLC)-37 at CCSFS to support Starship-Super Heavy launch and landing operations. The DAF is analyzing up to 76 launches/landings per year at CCSFS, to include preflight activities. Under the No Action Alternative, the DAF would not enter into a real property agreement with SpaceX, SpaceX would not develop a launch and landing site in support of Starship-Super Heavy launches, and SpaceX would not apply for a new license or modification of their existing vehicle operator license from the FAA for Starship-Super Heavy launches at SLC-37 (see <https://spaceforcestarshipeis.com/> for more information regarding the Starship-Super Heavy action at SLC-37 and CCSFS).

### ***Starship-Super Heavy and Boca Chica***

In 2022, the FAA prepared the *Final Programmatic Environmental Assessment [PEA] for the SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site in Cameron County, Texas* (FAA, 2022) to analyze the potential environmental impacts of constructing launch-related infrastructure and operating the Starship-Super Heavy launch vehicle at the Boca Chica launch site. The FAA issued a mitigated FONSI/Record of Decision (ROD) based on the 2022 PEA on June 13, 2022. Following issuance of the 2022 PEA and FONSI/ROD, SpaceX received a vehicle operator license from the FAA for the first orbital launch of the Starship-Super Heavy launch vehicle in April 2023. In April 2025, the FAA issued a Tiered EA and FONSI/ROD for cadence increase at Boca Chica (FAA, 2025a).

SpaceX operates the Starship-Super Heavy Boca Chica launch complex, which supports all aspects of Starship-Super Heavy research and development including vehicle flight testing and will continue to increase its iterative launch profile based on private and public sector interest in space.

### **Overall Starship-Super Heavy Program**

As proposed, the three possible launch sites (Boca Chica, CCSFS, and KSC) are not connected actions, and this EIS only discusses the Proposed Action at KSC. While there may be some commonality, each launch site operates independently of one another and supports unique requirements of NASA (KSC), the DAF (CCSFS), and SpaceX (Boca Chica), similar to how SpaceX's current Falcon launch pads operate independently of each other between KSC, CCSFS, and Vandenberg Space Force Base. Activities at each launch site can proceed without other actions taken previously or simultaneously at another site, and actions at one of the other locations are not dependent on actions at another. Launches from LC-39A are not expected to result in landings at CCSFS and vice versa, unless required due unavailability of the planned landing location<sup>5</sup>. Starship-Super Heavy operations at each launch site may be licensed under one vehicle operator license or separately. Each site would support SpaceX's identified purpose and need for a particular aspect of the Starship-Super Heavy program, including operational portfolio diversity, overall program redundancy, different flight opportunities, and cost reduction.

## **1.2 Federal Agency Roles**

### **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. Code (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 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 to encourage, facilitate, and promote commercial space launches and reentries by the private sector. As codified at 49 CFR §1.83(b), the Secretary has delegated authority to carry out these functions to the FAA Administrator.

The regulatory requirements pertaining to commercial launches and individual launch operators are described in 14 CFR Chapter III, Parts 400–600. SpaceX would apply for a new license or modification of their existing vehicle operator license, which would authorize a licensee to conduct one or more launches or reentries using the same vehicle or family of vehicles (14 CFR §450.3(a)). The FAA is also responsible for approving airspace closures in accordance with FAA Order 7400.2P, *Procedures for Handling Airspace Matters*, to ensure public safety.

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<sup>5</sup> FAA Order 1050.1F, Section 2-3.2(b)(1), *Scope of Proposed Action: Connected Actions*. The agency shall also consider whether there are connected actions, which are closely related Federal activities or decisions that should be considered in the same NEPA review that (1) automatically trigger other actions that may require NEPA review; (2) cannot or will not proceed unless other actions are taken previously or simultaneously; or (3) are interdependent parts of a larger action and depend on the larger action for their justification.

## 1.2.2 Cooperating and Participating Agencies

The following Federal agencies accepted the FAA’s request to participate in the NEPA process as cooperating agencies due to their special expertise concerning environmental effect of rocket launch operations or jurisdiction by law over launch facility or maritime environment: NASA, the U.S. Coast Guard (USCG), the DAF, the U.S. Fish and Wildlife Service (USFWS) Merritt Island National Wildlife Refuge (MINWR), and the National Park Service (NPS) Canaveral National Seashore (CANA). An agency has “special expertise” if it has statutory responsibility, agency mission, or related program experience.

NASA is a cooperating agency because it owns and operates KSC.

KSC is responsible for establishing and coordinating appropriate use agreements and operating procedures for those activities outlined in the Proposed Action. As the jurisdictional Federal agency, NASA is responsible for managing areas on KSC for space-related development and operations and provides oversight for non-NASA space and technology development activities that occur on KSC property. NASA has special expertise with respect to potential environmental effects from space launches and the operation of a launch site, as well as the operation of reusable launch system components (e.g., boosters).

The USCG is a cooperating agency because of its regulatory authority over waters subject to jurisdiction of the United States pursuant to the Ports and Waterways Safety Act, 46 U.S.C. Chapter 700; regulatory authority of U.S. and foreign flagged vessels as outlined in 33 and 46 CFR; and regulatory authority to review/advise KSC and the DAF on all launch and reentry site evaluation risk assessments with a focus on vessel navigation safety and security. All launch operations would comply with necessary notification requirements, including issuance of Notices to Mariners (NOTMARs), as defined in agreements required for a launch license issued by the FAA. The USCG issues NOTMARs to alert the maritime community of potential hazards or Ship Hazard Areas (SHAs) in navigable waterways. These notifications ensure that pilots and mariners can plan around temporary disruptions. A NOTMAR itself does not alter or close shipping lanes but serves as a notification of temporary hazards within a defined area to ensure public safety during the proposed operations. To comply with the FAA’s licensing requirements, SpaceX may enter into a Letter of Intent (LOI) with the USCG to safely operate the Starship-Super Heavy over open ocean. The LOI would describe the required responsibilities and procedures for both SpaceX and the USCG during a launch, which can include a landing or reentry operation resulting in the issuance of a NOTMAR. In accordance with 33 CFR Part 72, the USCG issues two types of NOTMARs to inform the maritime community of temporary changes in conditions or hazards in navigable waterways—Local Notices to Mariners and Broadcast Notices to Mariners. are published at least weekly but can be available to the public within 1 day of notifying the USCG. Marine Broadcast Notices to Mariners are issued as needed.

### Cooperating Agency Summary

**NASA** – owns and operates KSC.

**USCG** – has maritime safety authority over waters underneath launch/reentry trajectories.

**DAF** – provides special expertise associated with launch activities on the Eastern Range.

**USFWS** – manages MINWR, which includes property within the boundary of KSC.

**NPS** – manages CANA, a portion of which is located within KSC boundaries.

Notices in international areas are published by the National Geospatial Intelligence Agency. The Proposed Action would not require shipping lanes to be altered or closed. Launches and reentries would occur 88 times per year, would be of short duration, and scheduled in advance to minimize interruption to ship traffic.

The DAF is a cooperating agency because of its special expertise with regard to launch activities on the Eastern Range; the Eastern Range extends from the eastern U.S. mainland through the South Atlantic Ocean area eastward into the Indian Ocean. It includes all stations, sites, ocean areas, and air space necessary to conduct missile and space vehicle test and development. The DAF is responsible for overseeing the preparation and launch of U.S. Government, civil, and commercial payloads from CCSFS and operation of the Eastern Range. The DAF also provides facilities and services to support commercial space operations and provides coordination for activities that may be affected by proposed actions on the Eastern Range.

The USFWS is a cooperating agency due to its special expertise and management responsibilities for land potentially affected by the activities evaluated in this EIS. The USFWS manages over 135,000 acres (54,633 hectares) of lands and waters as MINWR and 128,569 acres (52,030 hectares) of the CANA (the NPS manages the Playalinda Beach entrance, parking lots, facilities, and Eddy Creek Boat Ramp and takes the lead in the overlap for cultural resources), including the non-operational areas of KSC, and owns and manages property off KSC on the mainland in the Turnbull Creek area. Through official agreement with NASA (Kennedy Contract Agreement [KCA]-1649 Revision [Rev.] B), the USFWS manages KSC lands not specifically used for space-related operations.

The NPS is a cooperating agency due to its special expertise and management responsibilities for land potentially affected by the activities evaluated in this EIS. The CANA provides approximately 24 miles (38.6 kilometers) of undeveloped seashore used by the public for a range of recreational opportunities, including viewing rocket launches and experiencing natural soundscapes and the night sky. The CANA was created by Public Law 93-626 “in order to preserve and protect the outstanding natural, scenic, scientific, ecologic, and historic values of certain lands, shoreline, and waters of the State of Florida, and to provide for public outdoor recreation use and enjoyment of the same...”. An agreement with the U.S. Department of the Interior was formed in 1975 due to a portion of the CANA being located within KSC boundaries. The NPS administers 6,655 acres (2,693 hectares) of the CANA.

## 1.3 Purpose and Need

The FAA’s NEPA-implementing procedures state that the purpose and need statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the Proposed Action. The FAA’s authority with respect to SpaceX’s license application or license modification and airspace closures is stated above in Section 1.2, *Federal Agency Roles*.

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**Purpose:** Provide greater mission capability to NASA and other SpaceX customers.

**Need:** To increase operational efficiency, capabilities, and cost effectiveness of the Starship-Super Heavy program.

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As established in the 2019 NASA EA (NASA, 2019a), the purpose of Starship-Super Heavy at LC-39A is to provide greater mission capability to NASA and other SpaceX customers. SpaceX’s activities would continue to fulfill the United States’ expectation that increased capabilities and reduced space transportation costs will enhance exploration (including within the Artemis and HLS programs), support



U.S. leadership in space, and make space access more affordable. The Space Transportation section of the National Space Transportation Policy of 1994 addressed the commercial launch sector, stating that “assuring reliable and affordable access to space through U.S. space transportation capabilities is a fundamental goal of the U.S. space program.”

Starship-Super Heavy at LC-39A is needed to increase operational efficiency, capabilities, and cost effectiveness of the Starship-Super Heavy program. Satisfaction of these needs benefit government and public interests and reduces operational costs. Demand for launch services has continued to increase over the past 20 years, and the space industry growth projections indicate this will continue into the foreseeable future. By providing a reusable launch vehicle with increased lift capability that returns to its launch site, the Proposed Action would reduce the cost of launch and increase efficiency, delivering greater access to space and enabling cost-effective delivery of cargo and people to the moon and Mars. SpaceX’s Proposed Action would satisfy requirements for more efficient and effective space transportation methods and continue the United States’ goal of encouraging activities by the private sector to strengthen and expand U.S. space transportation infrastructure.

## 1.4 Public Involvement

The FAA used multiple methods of stakeholder engagement and public outreach to solicit comments and feedback regarding the proposal. The following provides a summary of public involvement throughout the NEPA process; detailed information is provided in Appendix A, *Public and Agency Involvement*, of this EIS.

### 1.4.1 Notice of Intent and Public Scoping

Scoping provides an opportunity for the public, Federal, state, tribal, and local governments and government agencies and other interested parties to learn about a proposed project and provide input. Below is a summary of scoping activities for this EIS; Appendix A.1, *Public Scoping*, provides greater detail, along with all scoping submittals received from the public and agencies.

The FAA published the Notice of Intent to prepare an EIS in the Federal Register on May 10, 2024 (89 Federal Register 40526). Notices were also published in the *Orlando Sentinel*, *Florida Today*, and *Al Dia Today* to inform the public and government agencies of the EIS and announce the scoping comment period and scoping meetings. Notices were provided in English and Spanish. The scoping period lasted 45 days (May 10, 2024, through June 24, 2024).

The FAA held three in-person public scoping meetings on June 12 and June 13, 2024, and one virtual public scoping meeting on June 17, 2024. The in-person public meetings were held in an open-house format. Participants were encouraged to review the displays, ask questions of project staff, and provide comments at their own pace. In the virtual public meeting format, a recorded presentation in English was provided, followed by an opportunity for formal comments. All public meeting materials, as well as the virtual presentation script and PowerPoint slides, were translated into Spanish and posted on the FAA website: ([https://www.faa.gov/space/stakeholder\\_engagement/spacex\\_starship\\_ksc](https://www.faa.gov/space/stakeholder_engagement/spacex_starship_ksc)). The meeting locations are listed in Table 1.4-1. The meeting sites include Cape Canaveral and Merritt Island.

**Table 1.4-1. Scoping Meeting Dates and Locations**

| Location                                | Date/Time                                       | Address                                                                                           |
|-----------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Radisson Cape Canaveral<br>Jamaica Room | June 12<br>2 p.m. to 4 p.m.<br>6 p.m. to 8 p.m. | 8701 Astronaut Boulevard<br>Cape Canaveral, Florida 32920                                         |
| Kennedy Space Center Visitor Complex    | June 13<br>6 p.m. to 8 p.m.                     | Space Commerce Way<br>Merritt Island, Florida 32953                                               |
| Virtual                                 | Meeting: June 17<br>6 p.m. to 8 p.m.            | Public: <a href="https://us06web.zoom.us/j/89402979916">https://us06web.zoom.us/j/89402979916</a> |

Table 1.4-2 shows the number of attendees at the meetings.

**Table 1.4-2. Scoping Meeting Attendance**

| Meeting                                                          | Attendance Number |
|------------------------------------------------------------------|-------------------|
| June 12, 2024, Radisson, 2 to 4 p.m.                             | 89                |
| June 12, 2024, Radisson, 6 to 8 p.m.                             | 48                |
| June 13, 2024, Kennedy Space Center Visitor Complex, 6 to 8 p.m. | 64                |
| June 17, 2024, Virtual                                           | 285               |
| <b>Total</b>                                                     | <b>486</b>        |

Scoping comments were submitted as follows: verbally at the in-person meetings via the court reporter, using a comment form handed out at the in-person meetings; the electronic docket (Docket Number [No.] FAA-2024-1395); U.S. Postal Service; verbally at the virtual public scoping meeting; or using the chat feature at the virtual public scoping meeting. Overall, the FAA received 155 scoping submittals, some of which contained multiple comments. Submittals were reviewed and comments were categorized by resource area. Table 1.4-3 provides a breakdown of scoping comments received by topic area and where those topics are addressed in the EIS. Scoping submittals in full are included in Appendix A.1, *Public Scoping*.

**Table 1.4-3. Scoping Comments by Topic**

| Topic Area           | # of Comments | Summary                                                                                                                                                                                                                                                                                                                                                                       | Addressed in the EIS              |
|----------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| Mitigations          | 57            | <ul style="list-style-type: none"> <li>▪ The need to identify mitigations for identified adverse effects.</li> </ul>                                                                                                                                                                                                                                                          | Throughout each resource section. |
| Biological Resources | 50            | <ul style="list-style-type: none"> <li>▪ Potential effects to the ability of the USFWS, NPS, NASA, and DAF to conduct habitat/species management activities.</li> <li>▪ Potential for general effects to wildlife and habitats.</li> <li>▪ Potential effects to essential fish habitat.</li> <li>▪ Potential effects to protected species and associated habitats.</li> </ul> | Section 3.8.                      |
| Noise                | 46            | <ul style="list-style-type: none"> <li>▪ Identification of noise metrics to be evaluated in the EIS.</li> <li>▪ Potential for vibration effects to structures.</li> <li>▪ General noise effects to the human and natural environment.</li> </ul>                                                                                                                              | Section 3.2.                      |

**Table 1.4-3. Scoping Comments by Topic**

| <b>Topic Area</b>  | <b># of Comments</b> | <b>Summary</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Addressed in the EIS</b>                                                                                                   |
|--------------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Socioeconomics     | 39                   | <ul style="list-style-type: none"> <li>Impacts to visitor access and economic output.</li> <li>Administrative burden of accommodating additional launch viewing opportunities.</li> <li>Economic impact of closures on businesses that are dependent upon customers using these Federal properties.</li> <li>Impacts to other launch providers.</li> <li>Impacts to commercial fisheries.</li> <li>Financial liability for damages.</li> <li>Impacts to insurance rates/home values.</li> </ul> | Section 3.4.                                                                                                                  |
| NEPA               | 36                   | <ul style="list-style-type: none"> <li>Concern regarding connected actions (CCSFS and LC-39A).</li> <li>Concern that the study area is sufficiently large enough.</li> <li>Concern that anomalies are analyzed in the EIS.</li> </ul>                                                                                                                                                                                                                                                           | Section 1.1/throughout resource sections.                                                                                     |
| Proposed Action    | 30                   | <p>Request for additional details on the Proposed Action:</p> <ul style="list-style-type: none"> <li>Deluge water.</li> <li>Clear Zones/Closure Areas/Flight Hazard Areas.</li> <li>Blast Danger Zone.</li> <li>Public notification processes.</li> <li>Stormwater management.</li> <li>Wastewater management.</li> <li>New roads/infrastructure.</li> </ul>                                                                                                                                    | Section 2.1.                                                                                                                  |
| Land Use           | 24                   | <ul style="list-style-type: none"> <li>Potential for restrictions and closures to affect USFWS and NPS management activities, visitor opportunities, and visitor experiences at MINWR and Canaveral National Seashore.</li> <li>Potential effects to other launch service providers.</li> </ul>                                                                                                                                                                                                 | Section 3.3.                                                                                                                  |
| Cumulative Effects | 22                   | <ul style="list-style-type: none"> <li>The scope of cumulative effects analysis to include the effects of the total number of approved and planned testing, launching, and landing activities at CCSFS and KSC.</li> <li>Identification of projects to consider as part of cumulative effects analysis.</li> <li>Potential cumulative effects for all resource areas addressed in the EIS.</li> <li>Potential cumulative effects to other launch providers.</li> </ul>                          | “Cumulative Effects” is no longer a NEPA requirement. Reasonably foreseeable effects are discussed within each resource area. |

**Table 1.4-3. Scoping Comments by Topic**

| <b>Topic Area</b>         | <b># of Comments</b> | <b>Summary</b>                                                                                                                                                                                                                                                                 | <b>Addressed in the EIS</b>                                                                                              |
|---------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Transportation            | 19                   | <ul style="list-style-type: none"> <li>▪ Potential impacts to local roadways.</li> <li>▪ Potential effects to maritime transportation.</li> <li>▪ Potential effects to airspace.</li> </ul>                                                                                    | Section 3.16.                                                                                                            |
| Water Resources           | 19                   | Potential for contamination of local waterways.                                                                                                                                                                                                                                | Section 3.9.                                                                                                             |
| Utilities                 | 9                    | Concern regarding the ability of local utility providers to accommodate water needs and wastewater.                                                                                                                                                                            | Section 3.17.                                                                                                            |
| Alternatives              | 8                    | <ul style="list-style-type: none"> <li>▪ Number of alternatives.</li> <li>▪ Suggestions for additional alternatives.</li> </ul>                                                                                                                                                | Section 2.3.                                                                                                             |
| Air Quality               | 6                    | Potential for adverse effects caused by the release of exhaust gases and material through exhaust plumes during rocket firings and after landings.                                                                                                                             | Section 3.11.                                                                                                            |
| Solid Waste               | 6                    | Potential effects from debris.                                                                                                                                                                                                                                                 | Section 3.13.                                                                                                            |
| Climate                   | 5                    | <ul style="list-style-type: none"> <li>▪ Potential effects from greenhouse gas emissions.</li> <li>▪ Potential effects on the stratospheric ozone layer.</li> </ul>                                                                                                            | Section 3.12.                                                                                                            |
| Cultural Resources        | 5                    | Potential effects to the structural integrity of historic properties.                                                                                                                                                                                                          | Section 3.5.                                                                                                             |
| Health and Safety         | 5                    | <ul style="list-style-type: none"> <li>▪ Potential health and safety effects to workers and the public from proposed operations at LC-39A.</li> <li>▪ Potential effects to emergency response, hospitals, and other key public support infrastructure and services.</li> </ul> | Section 3.18.                                                                                                            |
| Environmental Justice     | 4                    | Potential impacts to environmental justice communities.                                                                                                                                                                                                                        | The Executive Order requiring Environmental Justice considerations was rescinded by President Trump on January 21, 2025. |
| Section 4(f)              | 3                    | Potential constructive use of 4(f) properties.                                                                                                                                                                                                                                 | Section 3.7.                                                                                                             |
| Hazardous Materials/Waste | 2                    | Potential effects associated with storage and use of hazardous materials and handling of hazardous waste.                                                                                                                                                                      | Section 3.13.                                                                                                            |
| Infrastructure            | 2                    | The maintenance and long-term sustainability of common-use infrastructure used for or impacted by the Proposed Action or later operations.                                                                                                                                     | Section 3.17                                                                                                             |
| Visual                    | 2                    | Potential for light pollution.                                                                                                                                                                                                                                                 | Section 3.6.                                                                                                             |
| Farmlands                 | 1                    | Potential for effect to the agricultural industry.                                                                                                                                                                                                                             | Section 3.15.                                                                                                            |



**Table 1.4-3. Scoping Comments by Topic**

| Topic Area       | # of Comments | Summary                                                      | Addressed in the EIS                                               |
|------------------|---------------|--------------------------------------------------------------|--------------------------------------------------------------------|
| Public Relations | 1             | Suggestion for better notification during Draft EIS release. | Notifications have been provided for the release of the Draft EIS. |

Notes: # = number; CCSFS = Cape Canaveral Space Force Station; DAF = Department of the Air Force; EIS = Environmental Impact Statement; KSC = Kennedy Space Center; LC-39A = Launch Complex 39A; MINWR = Merritt Island National Wildlife Refuge; NASA = National Aeronautics and Space Administration; NEPA = National Environmental Policy Act; NPS = National Park Service; USFWS = United States Fish and Wildlife Service.

## 1.4.2 Draft EIS Public Involvement

In conjunction with the Draft EIS, the FAA will hold public meetings and will afford the public opportunity for review and comment during a 45-day review period. This public involvement process will be summarized in the Final EIS.

## 1.5 Licenses, Permits, and Approvals

To proceed with Starship-Super Heavy launch, Starship and Super Heavy landings, and associated construction identified in Chapter 2, *Proposed Action and Alternatives*, SpaceX would require several environmental and regulatory permits and approvals in addition to the FAA's license. The FAA has identified the following environmental permits and approvals for SpaceX's proposal, but others may be required as well. SpaceX is required to disclose permit violations of any kind to the FAA within 24 hours of notice.

### 1.5.1 FAA License

Under 14 CFR Part 450, SpaceX would be required to obtain a new license or modification of their existing vehicle operator license for the Starship-Super Heavy launch vehicle at KSC's LC-39A. A vehicle operator license may authorize launch, reentry, or both. To comply with the FAA's licensing requirements, SpaceX will enter into a Letter of Agreement (LOA) with appropriate air traffic control centers to accommodate flight parameters of Starship-Super Heavy. SpaceX may also enter into a LOA with appropriate USCG Districts to safely operate the Starship-Super Heavy launch vehicle over open ocean.

### 1.5.2 Other Licenses, Permits, and Approvals

- **Bald and Golden Eagle Protection Act (BGEPA)** — The BGEPA prohibits the take, possession, sale, purchase, barter, offer to sell, purchase or barter, transport, and export or import of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit. Coordination with the USFWS under the BGEPA is conducted as part of the NEPA process through EIS review (Section 3.8, *Biological Resources*).
- **Clean Air Act (CAA)** — Under Title V of the CAA, air emissions from the Proposed Action may require a Title V Air Operating Permit issued by the Florida Department of Environmental Protection (FDEP). Stationary sources operate under exemption thresholds established by the FDEP (Florida

Administrative Code Chapter 63-210). If required, SpaceX would obtain a Title V Air Operation Permit or coordinate with KSC for amendment of the KSC Title V Operation Permit to account for the Proposed Action (Section 3.11, *Air Quality*).

- Endangered Species Act (ESA)** — Section 7 of the ESA 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 result in destruction or adverse modification of designated critical habitat. In accordance with the ESA Section 7, the FAA is conducting consultation with the USFWS and has completed consultation with the National Marine Fisheries Service (NMFS). Information regarding these consultations is provided in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)* and Appendix B.6, *Endangered Species Act Section 7 Consultation (NMFS)*.
- Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)** — The MSFCMA requires the identification of the potential effects of, and conservation recommendations for, actions that may adversely affect essential fish habitat (EFH). In accordance with the MSFCMA, the FAA will consult with NMFS for potential effects to EFH. Information regarding this consultation is provided in Appendix B.2, *Essential Fish Habitat Assessment (NMFS)*.
- Marine Mammal Protection Act (MMPA)** — All marine mammals are protected under the provisions of the MMPA. The MMPA prohibits any person or vessel from “taking” marine mammals in the United States or the high seas without authorization. SpaceX has completed a programmatic consultation with NMFS for Starship-Super Heavy activities across multiple locations. Information regarding this consultation is provided in Appendix B.7, *Marine Mammal Protection Act Incidental Harassment Authorization (NMFS)*.
- Migratory Bird Treaty Act (MBTA)** — Birds, both migratory and most native-resident bird species, are protected under the MBTA. Under the MBTA, it is unlawful by any means or in any manner, to pursue, hunt, take, capture, kill; attempt to take, capture, or kill; or possess migratory birds or their nests or eggs at any time, unless permitted by regulation. Effects to migratory birds and compliance with the MBTA are addressed as part of the NEPA process; the FAA will consider measures to reduce effects as required by Executive Order (E.O.) 13186, which directs Federal agencies to act to further implement the MBTA (Section 3.8, *Biological Resources*).
- U.S. Department of Transportation (DOT) Act Section 4(f)** — 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, or the FAA may make a finding that the project has a de minimis impact on the Section 4(f) property. Section 4(f) pertains to impacts to subject properties from direct contact and public accessibility, as well as impacts from noise and airspace restrictions

#### APPLICABLE REGULATORY CONSULTATIONS

##### FAA consultations:

- USFWS for ESA Section 7 – Appendix B.1
- NMFS for MSFCMA and ESA Section 7– Appendix B.2 and B.4
- Florida SHPO for NHPA – Appendix B.3

##### SpaceX consultations:

- NMFS for MMPA – Appendix B.6

associated with the Proposed Action (Appendix B.4, *Department of Transportation Act Section 4(f) Consultation*).

- **Coastal Zone Management Act (CZMA)** — The CZMA (16 U.S.C. §1451, et seq.) establishes a policy to preserve, protect, develop, restore, and enhance the resources of the nation’s coastal zones. Federal actions that have reasonably foreseeable effects on natural resources or land or water uses in the coastal zone, regardless of the project’s location, are required to be consistent, to the maximum extent practicable, with the enforceable policies of federally approved state coastal management programs (CMPs) (16 U.S.C. §1456; 15 CFR Part 930). Federal agencies submit a Consistency Determination to the state CMP when an action could foreseeably affect coastal resources. If a Federal action would not foreseeably affect the coastal zone or coastal resources, then the Federal agency may prepare a negative determination for that action. For the Proposed Action, a Coastal Consistency Determination has been submitted to the FDEP as part of this EIS in accordance with 15 CFR Part 930, Subpart C (Appendix B.5, *Coastal Consistency Determination*). The FDEP shall inform the FAA of its concurrence with or objection to the Consistency Determination prior to the FAA issuing SpaceX a new license or modification of their existing vehicle operator license.
- **National Historic Preservation Act (NHPA)** — 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, NASA, on behalf of the FAA, is leading consultation with the Florida State Historic Preservation Officer (SHPO) and federally recognized tribes to help determine the potential effects of the Proposed Action (Appendix B.3, *National Historic Preservation Act Section 106 Consultation (Florida SHPO)*).
- **Clean Water Act (CWA)** – Through the National Pollutant Discharge Elimination System (NPDES) program, the CWA 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 sources (i.e., stormwater) of water pollution. The FDEP is authorized by the U.S. Environmental Protection Agency (USEPA) to issue permits for discharge to surface waters under the NPDES program.
  - *Construction Permitting:* The NPDES program requires construction site operators engaged in clearing, grading, and excavating activities that disturb 1 acre or more to obtain coverage under an NPDES Construction General Permit for stormwater discharges. Construction or demolition that necessitates an individual permit also requires preparation of a Notice of Intent to discharge stormwater and a Stormwater Pollution Prevention Plan (SWPPP) that is implemented during construction. Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredge or fill material into wetlands and other waters of the United States. Any discharge of dredge or fill material into waters of the United States requires a permit from the U.S. Army Corps of Engineers (USACE) (Section 3.9, *Water Resources*).
  - *Industrial Stormwater Permitting:* SpaceX currently operates LC-39A in accordance with an Environmental Resource Permit (ERP) from the St. Johns River Water Management District (Permit No. 81270-11) for operation of a stormwater management system.

SpaceX would be required to coordinate adjustments to their ERP and associated SWPPP with the St. Johns River Water Management District and FDEP regarding changes in industrial activity at LC-39A.

- **Industrial Wastewater Permitting** — The FDEP's Industrial Wastewater Program issues permits to facilities and activities that discharge to surface waters and groundwater of the State. Industrial wastewater that discharges to domestic wastewater treatment facilities, however, is regulated under the Industrial Pretreatment component of the FDEP's Domestic Wastewater Program. The FDEP is authorized by USEPA to issue permits for discharge to surface waters under the NPDES. Permits for discharge to groundwater are issued by the FDEP under state statutes and rules. Industrial wastewater permits are issued by the district offices. SpaceX would be required to either update the existing industrial wastewater permit or apply for a new one once facility design and wastewater requirements are finalized.
- **Florida Environmental Resources Permit Program** — The State of Florida operates the ERP Program, which regulates activities involving the alteration of surface water flows. This includes new activities in uplands that generate stormwater runoff from upland construction, as well as dredging and filling in wetlands and other surface waters. A modification to SpaceX's existing St. Johns River Water Management District ERP Permit No. 81270-13<sup>6</sup> at LC-39A may be required to construct the Proposed Action (Section 3.9, *Water Resources*).
- **Liquefaction Plant** — Final siting for the liquified natural gas (LNG) facility would be conducted in coordination with the KSC Fire Marshal and Safety Office to meet the requirements of National Fire Protection Association 59A (*Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)*), which applies to the siting, design, construction, maintenance, and operation of facilities that produce, store, and handle LNG, as well as the training of personnel involved with LNG. This standard provides minimum fire protection, safety, and related requirements for the location, design, construction, security, operation, and maintenance of LNG plants<sup>7</sup>. Additionally, the LNG facility would utilize 49 CFR Part 193 (*Liquefied Natural Gas Facilities: Federal Safety Standards*) as guidance (or as may otherwise be required by the Florida Public Safety Commission) to address facility resiliency, safety, and hazards for construction and operation of the plant. Such requirements may include a thermal exclusion zone, a flammable vapor-gas dispersion zone, design sufficient to withstand wind forces without loss of structural or functional integrity, and other structural and design requirements.<sup>8,9</sup> Until the LNG facility is constructed, commodities such as liquid oxygen (LOX) and liquid methane (LCH<sub>4</sub>) would be trucked in by contractors; all contractors transporting commodities to LC-39A would be required to comply with appropriate DOT Pipeline and Hazardous Materials Safety Administration regulations and NASA transportation requirements.

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<sup>6</sup> <https://permitting.sjrwmd.com/ep/#/prmtInfo?curlId=&hdr=1&usrId=0&offclId=81270&seqNo=13>.

<sup>7</sup> <https://www.nfpa.org/codes-and-standards/nfpa-59a-standard-development/59a>.

<sup>8</sup> <https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-D/part-193>.

<sup>9</sup> [https://www.epa.gov/sites/default/files/2015-08/documents/lng\\_regulatory\\_roadmap.pdf](https://www.epa.gov/sites/default/files/2015-08/documents/lng_regulatory_roadmap.pdf).



## 1.6 Scope of Environmental Analysis

This EIS addresses the potential environmental effects from the Proposed Action and No Action Alternative. As appropriate, the affected environment and environmental consequences of the Proposed Action and the No Action Alternative are discussed in context with resource area descriptions. The structure of the EIS is as follows: Chapter 2, *Proposed Action and Alternatives*, describes the Proposed Action and alternatives; Chapter 3, *Affected Environment and Environmental Consequences*, describes the existing conditions for each resource area and analyzes potential environmental effects of the Proposed Action and alternatives; Chapter 4, *Other Environmental Considerations*, addresses unavoidable adverse effects, irreversible and irretrievable commitment of resources, and short-term uses and long-term productivity analyzes cumulative effects; Chapter 5, *List of Preparers*, includes a list of preparers and independent evaluators; and Chapter 6, *List of Agencies, Organizations, and Persons With Which the FAA Coordinated*, contains a list of agencies and persons consulted.

## 1.7 Documents Incorporated by Reference

Within FAA Order 1050.1F Section 7-1, the FAA encourages incorporation of 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. Accordingly, Table 1.7-1 lists those documents incorporated by reference. Relevant portions of those documents are summarized where appropriate in this EIS.

**Table 1.7-1. Documents Incorporated by Reference**

| Document                                                                                                                                                                                       | Relevance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="#"><u>Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station</u></a> (FAA, 2020) | Analyzes similar operational activities (although a different launch vehicle) at the same location (LC-39A) as addressed in this document. Provides information regarding baseline/existing conditions and potential effects associated with development activities.                                                                                                                                                                                                                                                                                                                                                         |
| <a href="#"><u>Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC)</u></a> (NASA, 2019a)                                       | Analyzes construction of Starship-Super Heavy support infrastructure and launches at the same location (LC-39A) as addressed in this document. Provides information regarding baseline/existing conditions and potential effects associated with development activities.                                                                                                                                                                                                                                                                                                                                                     |
| <a href="#"><u>Kennedy Space Center Center-Wide Operations Final Programmatic Environmental Impact Statement</u></a> (NASA, 2016)                                                              | Analyzes center-wide operations at KSC in conjunction with an updated Center Master Plan to evaluate potential environmental impacts from proposed center-wide operations and activities for a 20-year planning horizon from 2012 to 2032. Considers a range of future scenarios, from repurposing existing facilities and recapitalizing infrastructure to reorganizing KSC management of its land resources with various types of commercial partnerships. Provides information regarding baseline/existing conditions and potential effects associated with development activities within the Proposed Action study area. |
| <a href="#"><u>Kennedy Space Center Master Plan</u></a> (NASA, 2024a)                                                                                                                          | Addresses future development activities throughout KSC. Provides information regarding baseline/existing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

Table 1.7-1. Documents Incorporated by Reference

| Document                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Relevance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | conditions and potential effects associated with development activities within the Proposed Action study area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <a href="#"><u>Kennedy Space Center Vision Plan and Programmatic Environmental Assessment</u></a> (NASA, 2020a)                                                                                                                                                                                                                                                                                                                                                             | Addresses future development activities throughout KSC. Provides information regarding baseline/existing conditions and potential effects associated with development activities within the Proposed Action study area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <a href="#"><u>Environmental Assessment for Launch of NASA Routine Payloads</u></a> (NASA, 2011a)                                                                                                                                                                                                                                                                                                                                                                           | Addresses operations of various expandable launch vehicles and conveyance of non-nuclear payloads throughout KSC. Provides information regarding baseline/existing conditions and potential effects associated with development activities within the Proposed Action study area.                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <a href="#"><u>Final Supplemental Environmental Assessment for the Roberts Road SpaceX Operations Area Expansion &amp; Supporting Infrastructure on Kennedy Space Center</u></a> (NASA, 2024b)                                                                                                                                                                                                                                                                              | Addresses SpaceX expansion of its Roberts Road Operations Area. SpaceX will expand the Roberts Road Operations Area by 100 acres (40 hectares) immediately north of the existing site and includes additional office space and industrial facilities and upgraded utilities in support of vehicle and payload processing, fabrication, storage, manufacturing, and shipping and receiving. SpaceX also intends to construct improvements to the intersection of Kennedy Parkway and Roberts Road and widen Saturn Causeway by approximately 8 feet (2.5 meters) from the Vehicle Assembly Building to LC-39A, improve drainage swales, and install a new electrical duct bank from the C5 substation to support operations at LC-39A. |
| <a href="#"><u>Final Tiered Environmental Assessment for SpaceX Starship/Super Heavy Vehicle Increased Cadence at the SpaceX Boca Chica Launch Site in Cameron County, Texas</u></a> (FAA, 2025a)                                                                                                                                                                                                                                                                           | While not directly comparable, these documents provide some surrogate information regarding Starship-Super Heavy facilities and operations and associated effects that may be used in effects analysis for this Proposed Action.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <a href="#"><u>Final Programmatic Environmental Assessment for the SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site in Cameron County, Texas</u></a> (FAA, 2022)                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <a href="#"><u>Written Re-evaluation of the 2022 Final Programmatic Environmental Assessment for the SpaceX Starship/Super Heavy Launch Vehicle Program at the Boca Chica Launch Site in Cameron County Texas</u></a> (FAA, 2023a) – Deluge System Operation, Addition of a Forward Heat Shield Interstage, and Expansion of the Area of Potential Effects for Cultural Resources; Starship/Super Heavy Vehicle Ocean Landings and Launch Pad Detonation Suppression System |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <a href="#"><u>Tiered Environmental Assessment for SpaceX Starship Indian Ocean Landings</u></a> (FAA, 2024a).                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

Notes: KSC = Kennedy Space Center; LC-39A = Launch Complex 39A.

## 1.8 Incomplete or Unavailable Information

As noted throughout this EIS, certain aspects of site and facility design remain in development. Wherever possible, this EIS identifies those areas where incomplete or unavailable information exists and how that may affect the analysis. Table 1.8-1 lists information currently unavailable.

**Table 1.8-1. Incomplete or Unavailable Information**

| Incomplete/Unavailable Information        | Relevance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Remedy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LC-39A Siting Plan                        | <p>The site plan presented in Figure 2.5-5 is notional; a detailed, validated site plan is unavailable. A validated site plan is relevant for producing safety restriction areas, which can inform the Land Use and Health and Safety sections of the EIS. For this EIS, the FAA recognizes safety regulations and requirements that prohibit actions that could feasibly jeopardize the public and allow for protections of workers, as well as an understanding that all Blast Danger Areas must stay on KSC/CCSFS and outside local communities, to inform its determination of a less than significant effect to health and safety.</p> <p>A site plan can also be used to ensure that facilities can fit within the LC-39A footprint given necessary setbacks, whether facilities such as deluge and stormwater ponds are of sufficient size, and to calculate the acreage of newly developed area or increased impervious area within the site. A detailed understanding of the developed area would allow for a more concise understanding of potential habitat loss.</p> | <p>Because the exact siting of facilities is still in process, the FAA has used the notional site plan and associated GIS data for identification of notional development footprints to analyze potential direct and indirect effects from ground disturbance and facility presence. The FAA further assumes that all development will occur within the fence line of LC-39A.</p> <p>If a validated site plan is confirmed prior to publication of the Final EIS, the EIS would be updated with that new information. If the confirmed site plan's environmental effects fall within the scope of those impacts already analyzed, no change in analysis would be required. If the confirmed site plan indicates analytical updates to the EIS are warranted, the EIS will be revised prior to publication of the Final EIS with appropriate notice given to the public. If a validated site plan is confirmed after publication of the Final EIS, the scope would be reviewed to determine the need for any additional NEPA analysis.</p> |
| Operational Aspects for LC-39A Facilities | <p>Operational aspects for facilities, such as the flame diverter and deluge system, are currently under development. These specifics drive analysis of amounts of water diversion, extent of heat plume, etc.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p>In lieu of specific facility operational information for LC-39A, the FAA has assumed that operational requirements for similar facilities at Boca Chica, Texas, would apply at LC-39A. While not directly comparable because of differing missions, this information provides some basis for analysis of potential effects.</p> <p>If this information is available prior to publication of the Final EIS, the information will be reviewed to determine if analytical updates to the EIS are warranted. If so, the EIS will be revised prior to publication of the Final EIS with appropriate notice given to the public.</p>                                                                                                                                                                                                                                                                                                                                                                                                         |

**Table 1.8-1. Incomplete or Unavailable Information**

| <b>Incomplete/Unavailable Information</b>                                  | <b>Relevance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Remedy</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Final Airspace Restricted Access for Starship Return to Launch Site (RTL5) | While notional airspace restrictions have been identified for Starship-Super launches and Super Heavy RTL5 to support potential impact analysis, final airspace restrictions have not yet been derived for Starship RTL5. The FAA issues a Notice to Airmen (NOTAM), which provides notice of temporary closures to components of, or hazards in, the National Airspace System at least 48 hours prior to a launch or reentry activity in the airspace to notify pilots and other interested parties of temporary conditions. Advance notice via NOTAMs and the identification of Aircraft Hazard Areas assists pilots in scheduling around any temporary disruption of flight activities in the area of operation. While Starship RTL5 would occur up to 44 times per year, these events would be of short duration and scheduled in advance to minimize interruption to air traffic. Temporary closures of existing airspace may be necessary to ensure public safety during the proposed operations. | <p>To comply with the FAA's licensing requirements, SpaceX may enter into an LOA with the appropriate Air Route Traffic Control Center(s), Terminal Radar Approach Control Facility(s), and Air Traffic Organization Space Operations, as applicable, to accommodate the flight parameters of the Starship-Super Heavy vehicle(s).</p> <p>SpaceX would submit a Flight Safety Data Package to the FAA in advance of the launch or reentry. The package would include the launch/reentry trajectory and associated Aircraft Hazard Areas. These Aircraft Hazard Areas consist of the temporarily closed airspace that would be defined and published through a NOTAM prior to the launch/reentry. The NOTAM would establish a closure window that is intended to warn aircraft to keep out of a specific region throughout the time that a hazard may exist. For a launch or reentry, typically, the keep-out must begin at the time of launch and end when the mission has been completed, terminated, or cancelled. Airspace closures are immediately released once the mission has successfully cleared the area and no longer imposes a risk to the public. More information on this process is provided in Section 2.1.3.1, <i>Pre-Launch</i>.</p> <p>If this information is available prior to publication of the Final EIS, the information will be reviewed to determine if analytical updates to the EIS are warranted. If so, the EIS will be revised prior to publication of the Final EIS with appropriate notice given to the public.</p> |

Notes: CCSFS = Cape Canaveral Space Force Station; FEIS = Environmental Impact Statement; FAA = Federal Aviation Administration; GIS = Geographic Information System; KSC = Kennedy Space Center; LC-39A = Launch Complex 39A; LOA = Letter of Agreement; NEPA = National Environmental Policy Act; NOI = Notice of Intent; NOTAM = Notice to Airmen.



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## Chapter 2. Proposed Action and Alternatives

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### 2.1 Proposed Action

The FAA's Federal action is to issue a new issue a new vehicle operator license to SpaceX or modify their existing license to allow Starship-Super Heavy operations at LC-39A (see Figure 1.1-1) and any subsequent license modifications and renewals under 14 CFR Part 400 that are within scope of the EIS. The FAA's Federal action also includes the FAA's issuance of temporary airspace closures.

SpaceX's Proposed Action includes Starship-Super Heavy launch and landing operations (up to 44 launches and 88 landings—44 for each stage [Starship and Super Heavy] of the launch vehicle—per year) at LC-39A, to include ocean landings of Super Heavy in the Atlantic Ocean and Starship in the Atlantic, Pacific and Indian Oceans. Starship and Super Heavy could land on floating platforms (referred to as "droneships") in the ocean. Infrastructure improvements at LC-39A are proposed to support launch and landing operations. A detailed discussion of the Proposed Action is provided in subsequent subsections.

#### 2.1.1 Proposed Location

LC-39A is a NASA-owned, SpaceX-leased launch site located on KSC property, approximately 3 miles east of NASA's Vehicle Assembly Building (VAB) (Figure 2.1-1). LC-39A currently supports Falcon 9 and Falcon Heavy launches. Following completion of the 2019 NASA EA (NASA, 2019a), SpaceX began developing a site within the perimeter of LC-39A for Starship-Super Heavy launch operations intended for future Starship-Super Heavy missions. SpaceX would continue to launch Falcon missions at LC-39A while Starship-Super Heavy is operational.

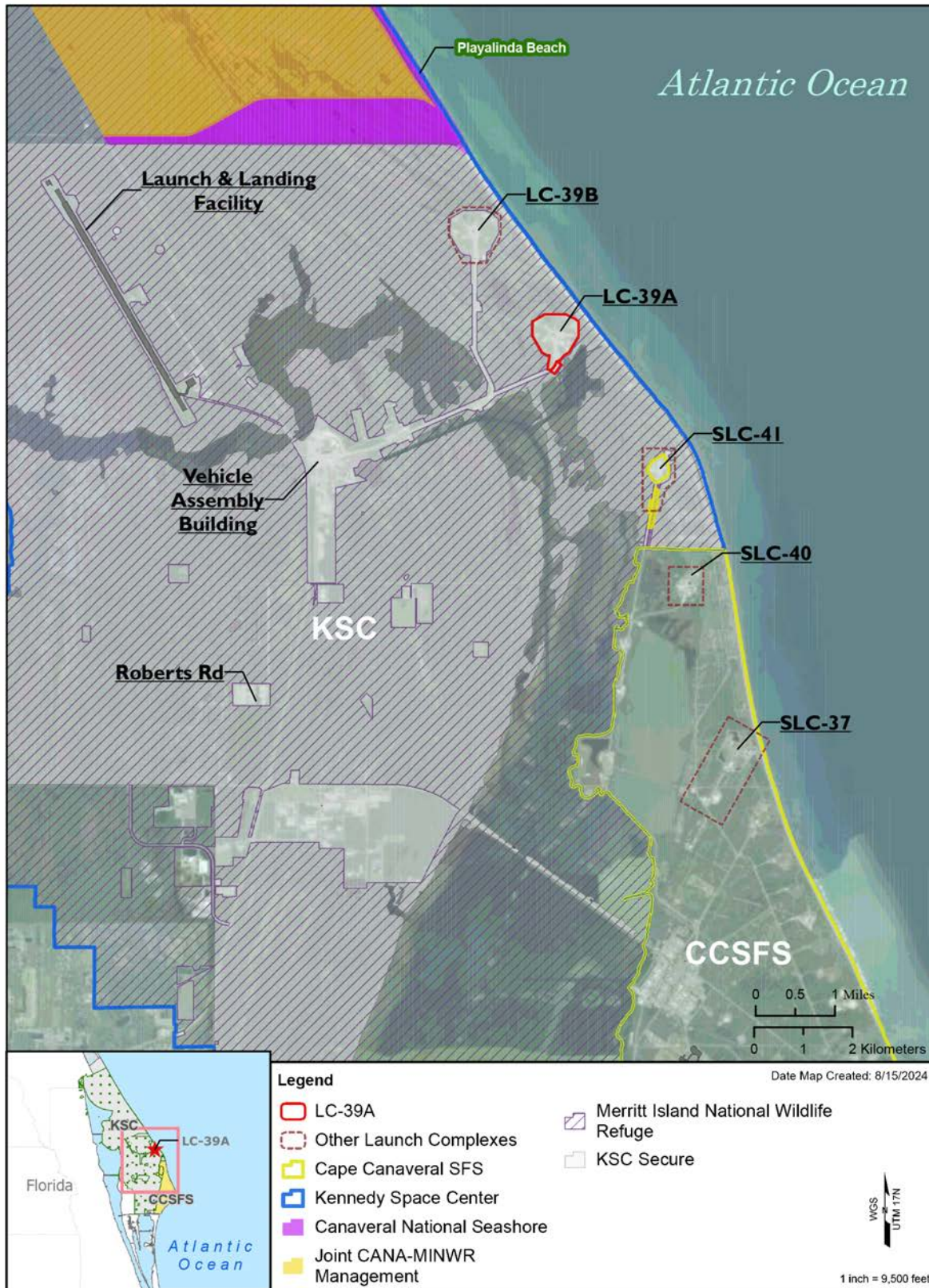


Figure 2.1-1. Proposed Action Location

## 2.1.2 Starship-Super Heavy Launch Vehicle

Starship-Super Heavy is composed of two stages: Super Heavy is the first stage (or booster), and Starship is the second stage (Figure 2.1-2). The fully integrated Starship-Super Heavy launch vehicle is expected to be up to 492 feet (150 meters) tall depending on configuration and approximately 30 feet (9 meters) in diameter. As designed, both stages are reusable, with any potential refurbishment actions taking place at SpaceX facilities at KSC (e.g., HangarX, Roberts Road<sup>21</sup>, LC-39A, etc.). Both stages are expected to have minimal post-flight refurbishment requirements; however, they may require periodic maintenance and upgrades.

As discussed in Section 1.1, *Background*, the Starship-Super Heavy launch vehicle has evolved since the 2019 NASA EA<sup>22</sup>. The proposed configuration consists of up to 35 Raptor engines for Super Heavy and nine Raptor engines for Starship. The Raptor engine is powered by LOX and LCH<sub>4</sub>. Super Heavy is expected to hold up to 4,100 metric tons (MT) of propellant and Starship up to 2,650 MT of propellant. Current maximum lift-off thrust of the launch vehicle is anticipated at 103 meganewtons<sup>23</sup>. Starship would have a maximum thrust of approximately 28 meganewtons. Launch propellant and commodities include liquid nitrogen (LN<sub>2</sub>), water, gaseous oxygen, gaseous methane, gaseous nitrogen, helium, hydraulic fluid, LOX, and LCH<sub>4</sub>.

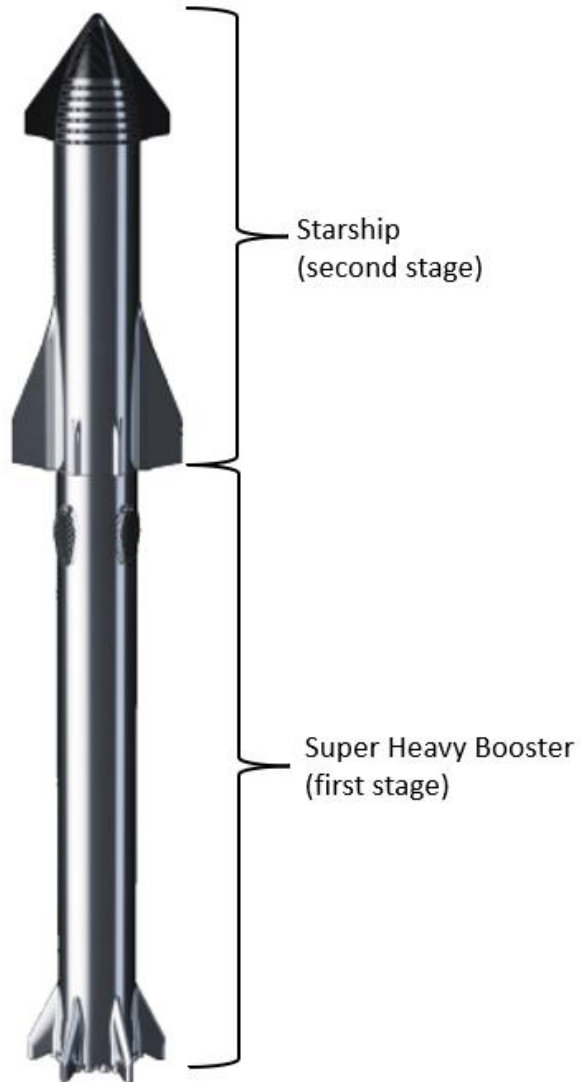


Figure 2.1-2. Starship-Super Heavy Launch Vehicle Design

<sup>21</sup> Both HangarX and the Roberts Road facility support SpaceX's payload fairing processes; current improvements underway (which are not part of this Proposed Action) would support Starship development plus integration and support of future Starship missions at KSC (NASA, 2024b).

<sup>22</sup> The configuration analyzed in the 2019 EA consisted of 31 Raptor engines for the booster (Super Heavy) and seven Raptor engines for Starship. The booster was proposed to hold up to 3,500 MT of propellant and Starship up to 1,500 MT of propellant. The maximum lift-off thrust was proposed at 62 meganewtons (NASA, 2019a).

<sup>23</sup> One newton is equal to the force needed to move one kilogram of mass at a rate of one meter per second squared. One meganewton is equal to 1,000,000 newtons.



## 2.1.3 Starship-Super Heavy Operations

### 2.1.3.1 Pre-Launch

Preflight operations could include ground testing activities, tanks testing, spin-prime tests, mission rehearsals (i.e., dry and wet dress rehearsals), and static fire engine tests. A dry dress rehearsal simulates launch day conditions where a full launch countdown is conducted but the vehicle is not fueled. A wet dress rehearsal is like a dry dress rehearsal, but the vehicle is fueled. This test allows the launch team to practice timelines and procedures used for launch, and to identify potential issues. The goal of these operations is to verify that all vehicle and ground systems are functioning properly, as well as to verify that all procedures are properly written.

SpaceX could conduct tank tests and spin-prime tests prior to static fire or launch. If needed, proof tests could be performed to confirm the structural integrity of the launch vehicle tanks. Proof pressure tests are broken into two main categories: (1) pneumatic and (2) cryogenic. Pneumatic proof pressure testing consists of pressurizing the launch vehicle's tank with gaseous media (either helium, nitrogen, oxygen, or methane) and holding pressure for an extended duration. Cryogenic proof pressure testing consists of loading the tank with a single propellant, typically LN<sub>2</sub> or LOX. The tanks are then pressurized to a predefined limit to confirm their structural integrity with appropriate factors of safety. These proof pressure tests do not release any propellant to the environment. Propellants are recycled back into the ground system tanks after the test is completed. Tank tests do not involve the mixing of explosive commodities and are designed to test an accepted safety limit; they are not expected to explode or spread debris. Spin-prime tests verify the engine system is operational prior to static fire tests. During a spin-prime test, the vehicle engines are chilled, and pumps are spun to operating speed but are stopped prior to engine ignition.

Prior to launch operations, SpaceX could conduct static fire engine tests of both Starship and Super Heavy (Starship static fire tests would be conducted before integration with Super Heavy). Static fire testing is a standard industry practice to provide greater confidence in vehicle reliability and is performed widely across launch and test sites at the Eastern Range and at other facilities across the United States. The goal of a static fire engine test is to verify engine control and performance. During a static fire engine test, the launch vehicle engines are ignited for a short duration, generating noise and a heat plume, then shut down. It is possible, but not expected, that a static fire engine test could be attempted but is unsuccessful. If an engine test is unsuccessful, SpaceX would

#### PRE-LAUNCH ACTIVITIES

##### Tank Tests –

- Pressure testing to confirm structural integrity with appropriate factors of safety; do not release any propellant to the environment.

##### Spin-Prime Tests –

- Testing to verify the engine system is operational prior to static fire tests; vehicle engines are chilled, and pumps are spun to operating speed but are stopped prior to engine ignition.

##### Static Fire Engine Test –

- Test to verify engine control and performance; the launch vehicle engines are ignited for a short duration, generating a heat plume, then shut down.
- Conducted for both Starship and Super Heavy booster.

##### Dry Rehearsal –

- Full launch countdown but the vehicle is not fueled.

##### Wet Rehearsal –

- Full launch countdown but the vehicle is fueled.

attempt another. A static fire test may be unsuccessful if one or more engine(s) fail to properly ignite or if other issues are identified with the vehicle or ground support equipment. SpaceX estimates that Starship and the Super Heavy booster would each conduct one static fire engine test per launch, respectively (i.e., 44 total static fire tests per stage for a total of 88 per year). SpaceX may also reduce the cadence of the static fires of the Starship or Super Heavy vehicles, not requiring a static fire of each engine test per launch operation. Static fires would utilize the deluge system, with each event utilizing approximately 300,000 gallons of water. Static fires would be up to 15 seconds in duration and would only be conducted during the daytime. Airspace closures are not required for static fire testing. For booster static fires, the access restricted area<sup>24</sup> could extend into the ocean. SpaceX would surveil the area prior to commencing propellant loading and delay the operation if a vessel was actively inside or heading toward the access restricted area during the operation. For static fires, access restricted areas are cleared and roadblocks established around 2 hours prior to the test and dropped after propellant is offloaded, approximately 1 hour. Cleared areas and roadblocks therefore last about 3 hours per static fire event.

During preflight operations, SpaceX would connect the launch vehicle to ground systems. After an operation involving propellant (i.e., wet dress rehearsal and static fire engine test), SpaceX would transfer the propellant back to the commodity tanks. During Starship fuel loading for a static fire engine test gaseous methane could be released to the atmosphere or combusted; however, SpaceX intends to recapture methane where practicable. This release would be minimal as the  $\text{LCH}_4$  would be released as gaseous methane vented from the stage to maintain pressure, and it would be a very small percentage of the vehicle tank's propellant vented. It is standard practice for all launch vehicles to vent cryogenics to maintain pressure.

### ***Airspace Coordination/Closures***

All launch and reentry operations would comply with necessary notification requirements, including issuance of Notices to Airmen (NOTAMs), as defined in agreements required for a vehicle operator license issued by the FAA. A NOTAM provides notice of unanticipated or temporary future closures to components of, or hazards in, the National Airspace System (NAS) (FAA Order 7930.2U, *Notice to Airmen (NOTAM)*). The FAA issues a NOTAM at least 48 hours prior to a launch or reentry activity in the airspace to notify pilots and other interested parties of temporary conditions. NOTAMs are similarly used by foreign Air Navigation Service Providers to provide notice of temporary airspace closures in their airspace. Advance notice via NOTAMs and the identification of Aircraft Hazard Areas (AHAs)<sup>25</sup> assist pilots in scheduling around any temporary disruption of flight activities in the area of operation.

The location and size of airspace closures for commercial space operations also vary with each mission type and are influenced by multiple factors, including prior flight history. The size of airspace closures can grow or shrink as reliability is either decreased or increased with results and analysis from each launch. The FAA worked with SpaceX to develop notional launch and reentry trajectories and associated AHAs for

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<sup>24</sup> The access restricted area is the safety zone associated with the potential for an anomaly on the launch pad. Within the access restricted area, no personnel are allowed. The closure area represents a bounding case, using the highest possible fuel volume as well as the highest possible LOX/methane yield.

<sup>25</sup> Hazard areas are any region of land, sea, or air that must be surveyed, publicized, controlled, or evacuated to control the risk to the public. It includes regions of land, sea, and air potentially exposed to hazardous debris generated during normal flight events and all reasonably foreseeable failure modes.

this EIS. These AHAs define the temporarily closed airspace that would be established and published through a NOTAM prior to the launch/reentry.

### ***Launches and Super Heavy Reentries***

Starship-Super Heavy launches and Super Heavy booster reentries<sup>26</sup> would impact air routes extending eastward from the launch site over portions of the Atlantic Ocean, covering approximately 1,600 nautical miles. AHAs may necessitate the closure of dozens of coastal and deep-water oceanic airways over the Atlantic Ocean, requiring substantial aircraft rerouting to avoid the AHAs. The northernmost and southernmost launch and Super Heavy booster reentry trajectories could impact the airspace of Canada and the Bahamas, respectively. The Bahamas would be expected to close its airspace up to 6,000 feet (1,829 meters), and the FAA would close the airspace above that level. See Figure 2.1-3 for a depiction of the range of notional launch and Super Heavy landing trajectories and associated AHAs.

### ***Starship Reentries***

Starship reentries would impact air routes extending westward from KSC LC-39A over portions of the Pacific Ocean, Central America, Gulf of America, Caribbean Sea, Florida Peninsula, and Atlantic Ocean. AHAs may necessitate the closure of dozens of coastal and deep-water oceanic airways over the Pacific Ocean, Gulf of America, Caribbean Sea, and Atlantic Ocean, requiring significant aircraft rerouting to avoid the AHAs. Multiple airports may require departure stops due to the overlying AHA. See Figure 2.1-4 for a depiction of the notional range of Starship reentry AHAs.

### ***Maritime Coordination***

All launch and reentry operations would comply with necessary notification requirements, including issuance of a NOTMAR, as defined in agreements required for a vehicle operator license issued by the FAA. A NOTMAR provides a notification regarding a temporary hazard within a defined area (an 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 the FAA's licensing requirements, SpaceX has agreed through a LOI with the 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 the USCG during the event, which may include a launch, landing, and/or reentry operation resulting in the issuance of a NOTMAR.

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

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<sup>26</sup> Super Heavy booster landings at the launch site are included in the launch AHAs and are assumed to occur within approximately 10 minutes of a Starship-Super Heavy launch.

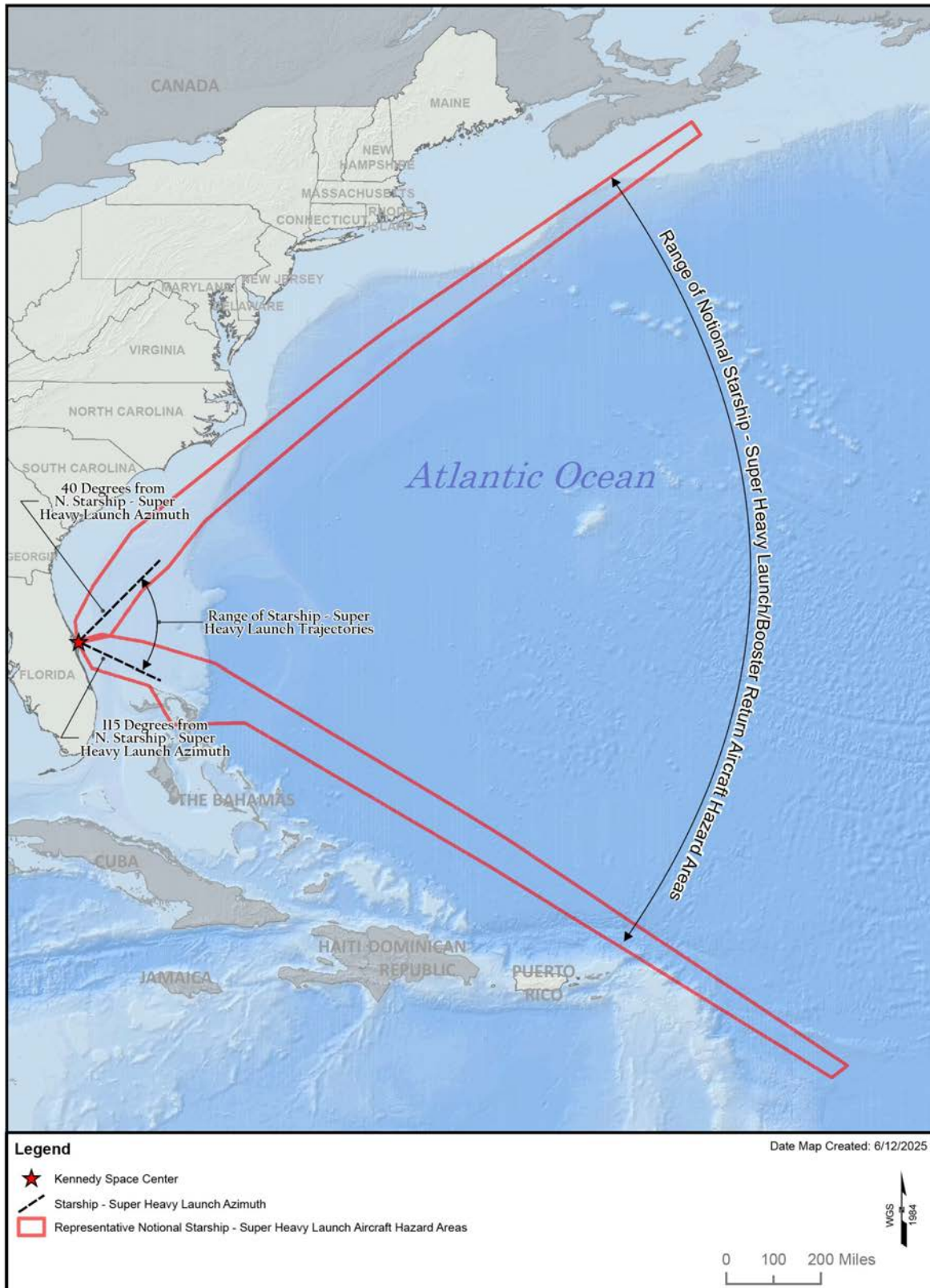


Figure 2.1-3. Range of Notional Launch and Super Heavy Landing Trajectories and Associated AHAs



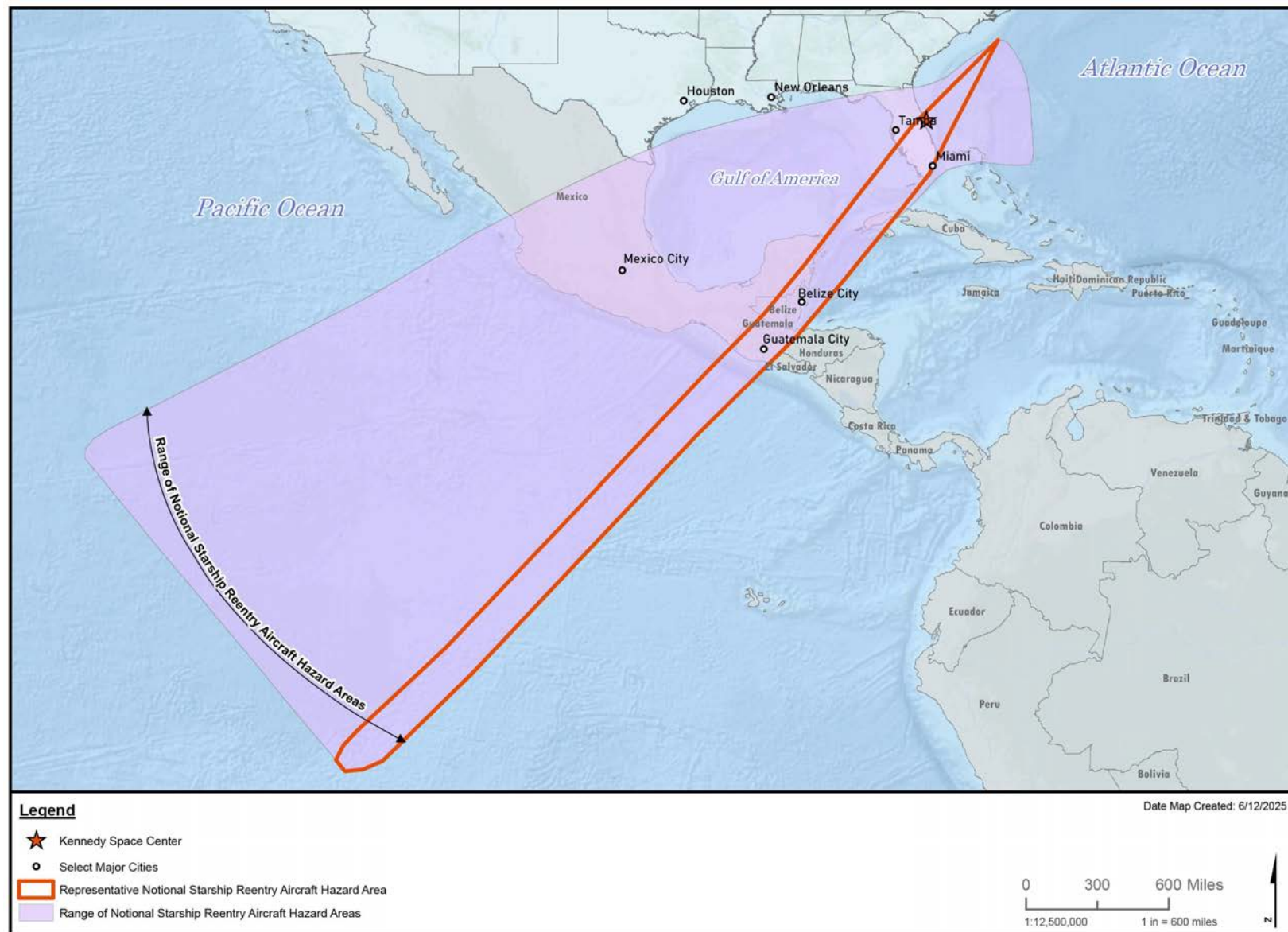


Figure 2.1-4. Notional Range of Starship Reentry AHAs

The USCG has broad authority to establish LAAs, 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. Launches (up to 44 per year) and landings (a total of 88, up to 44 per vehicle, per year) would be of short duration, and scheduled in advance to minimize interruption to ship traffic.

All landing operations would comply with necessary notification requirements, including issuance of NOTMARs by the USCG, as defined in agreements required for a vehicle operator license issued by the FAA. The USCG maintains authority to establish and enforce LAAs and RNAs as needed to support public health and safety during these events. A NOTMAR provides a notification regarding a temporary hazard and any additional safety measures within a defined area (an SHA) to ensure public safety during proposed operations.

A number of spotter aircraft, including drones, and surveillance vessels (or boats) are used during launch activities to ensure that designated hazard areas are clear of nonparticipating crafts. Combinations of radar, visual spotter aircraft, surface surveillance, and law enforcement vessels may be deployed prior to launch. Most fixed-wing aircraft operate at altitudes of 15,000 feet (4,572 meters) but may drop to 1,500 feet (457 meters) to obtain a call sign visually from a nonparticipating vessel.

### ***Land-Side Coordination***

As discussed in Section 2.1 of the 2019 NASA EA (NASA, 2019a), any required CANA or MINWR closures would be coordinated between SpaceX and the respective agency, NPS and the USFWS as appropriate.

CANA and MINWR closures might also occur due to the volume of visitor traffic, because launch activity on KSC has historically attracted people to the area including MINWR and CANA, enhancing the visitor experience and public enjoyment. Such closures are coordinated between KSC Security Police, Spaceport Integration and Services, the USFWS, and NPS by monitoring to ensure parking lot thresholds are not exceeded and roadways allow for emergency egress for any form of emergency associated with large crowds. KSC, the USFWS, and NPS established a process that allows KSC Security Police, and Brevard County Sheriff's Office support, when necessary, to extend badge checkpoints at the KSC boundary County Road 402, State Road (SR) 405, and SR 3–South. Additionally, the Base Operations Spaceport Services contractor raises the Haulover Canal Bridge, making access from SR 3 North impassable. Badge checkpoints are extended and the Haulover Canal Bridge is raised per guidelines as described in the 2019 NASA EA (NASA, 2019a, p. 14).

KSC Protective Services has the authority to implement the extended badge checkpoints only when necessary. When launches occur at times where visitor access management is not expected to be a challenge, KSC Protective Services may not implement the extension. Spaceport Integration and Services has had several quarterly meetings since implementation, where all parties have agreed that the closure process is effective at adequately managing the issue.

Access restricted areas are cleared and any necessary roadblocks are established around 3 hours prior to launch/landing and dropped after the event concludes. In the event of a scrub, cleared areas and roadblocks remain until propellant is offloaded, with the duration variable depending on the percentage of propellant loaded; however, the maximum duration would be about 1 hour. Not all attempts load propellant before scrubbing and roadblocks are often dropped early.

Figure 2.1-5 provides a graphical representation of notional access-restricted areas. The restricted areas shown are estimated and provide only a representative depiction; exact restricted areas would be determined prior to pre-launch activities and launch/landing. For planning purposes to support this EIS, SpaceX and NASA used conservative assumptions to develop these restricted areas. Ultimately, each restricted area is mission specific and will be determined by Range Safety and the FAA through the FAA license or license modification process. After receiving license or license modification materials, the FAA will determine the appropriate restricted areas to protect public safety and compare those areas to the assumptions provided in this EIS. The FAA would address any discrepancies or gaps, if found, in the environmental analysis.

To develop these notional restricted areas used in the EIS, SpaceX and NASA utilized a theoretical model considering a fully fueled vehicle stack as the bounding case because it is the highest possible propellant mass for both vehicles—this configuration is representative of launch and wet dress rehearsal operations. The explosive yield associated with the propellant mass is used to assess the risk from explosive blast; for purposes of this exercise, a conservative estimate of 134 percent yield above the actual mass is used. In the future, a theoretical model, testing data, and launch vehicle design can be used to generate a conservative, empirically derived LOX/methane yield curve for Starship-Super Heavy. The resultant empirically derived yield curve and resultant restricted areas could potentially reduce in size as more information is gained. Additionally, a flight hazard area utilized by the FAA for a Starship launch at the Boca Chica, Texas, launch site was used to further refine a representative restricted area for launch operations at LC-39A. SpaceX then added a conservative buffer (an increase of 89 percent longitudinally and an increase of 92 percent latitudinally) to account for a range of trajectories and a larger future vehicle. As a result of this theoretical yield model, SpaceX set the proposed launch/landing access restriction area to 4 miles (7 kilometers) north and south of LC-39A and 3 miles (5 kilometers) to the west of LC-39A (see yellow area in Figure 2.1-5). It is anticipated that the size of the restricted areas would shrink over time due to an increase in the reliability of the vehicle (as demonstrated by other launch vehicles over time) and the availability of empirical data.

Static fire tests would result in restricted access to areas not currently accessible to the public and would last approximately 3 hours each time; these would mostly affect land management and mission-related activities on MINWR and KSC. Restricted access associated with launches and landings would be expanded to also affect the northern portion of CCSFS, which would include SLC-41 (leased to United Launch Alliance) and SLC-40, and publicly accessible areas in the southern portion of MINWR and CANA that includes Playalinda Beach. Restricted areas in areas accessible to the public would be closed to the public during the identified operations due to safety concerns. All closures, whether dictated by public safety concerns (i.e., the Range or the FAA require the closure) or by the NPS due to visitor volumes exceeding capacity, would be temporary.

While restricted access requirements are limited to the duration that the access restricted area is in effect (i.e., between 3 and 3.5 hours), the actual duration of a closure associated with publicly accessible areas may be longer due to logistical aspects. Based on information provided by the NPS, duration of closures for portions of CANA and Playalinda Beach is affected by the time of day/night that the test or launch occurs. Due to logistics of closures (e.g., NPS personnel clearing the park of visitors, etc.), midday (or later) launches or tests could result in the need to close portions of the park for the entire day; tests or launches occurring very early in the morning may result in the park being closed for a portion of the day.



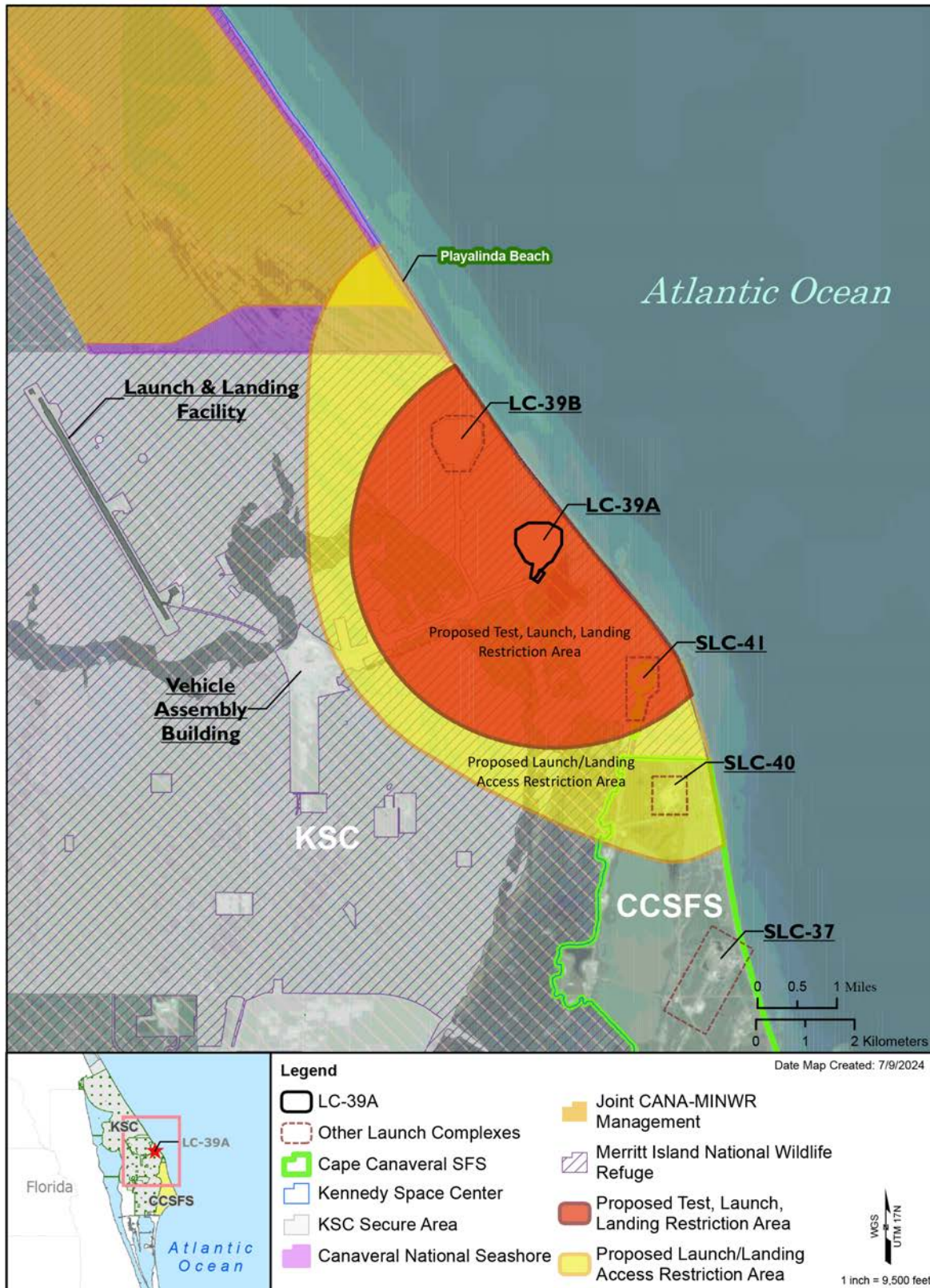


Figure 2.1-5. Potential Notional Access Restriction Areas For Pre-Launch, Launch, and Landing Activities



CANA is typically open from 6:00 a.m. to 8:00 p.m., 7 days a week. Launches/booster landings<sup>27</sup> and Starship RTLS (88 total) are the only events that would potentially result in closure. With 50 percent of the events occurring at night, that leaves 44 “daytime” events and 44 “nighttime” events. Conceivably, were all daytime launch/Super Heavy landing (22) and Starship landing (22) events to result in full-day closures, there could be up to 44 full-day closure events per year. This does not consider “early morning” events that result in half-day closures; this could reduce the amount of time CANA is closed (if more launch/landing events are scheduled early) or increase the closure times if more “nighttime launches/landings” are scheduled closer to 7:00 a.m.

However, it is unknown how many of the 44 “daytime” events might occur early in the day resulting in only half-day closures or might occur later resulting in full-day closures. Using 25 percent of the 44 “daytime” events that may occur early in the day as a conservative measure, approximately 11 “daytime” events may result in half-day closures, leaving 33 events resulting in full-day closures. It is also unknown how many “nighttime” events might occur in the early morning, thus affecting the park in the morning hours and resulting in half-day closures. Using 50 percent of the 44 nighttime events as a conservative measure, it is estimated that there could be 22 events occurring early in the morning that may result in a half-day closure, totaling a potential for 33 half-day closures in a year; the remaining “nighttime” events would not result in any closures. Using these figures, it is estimated that there could be between 33 and 44 (using the most conservative estimate) full-day closures and up to 33 half-day closures, which equates to up to 60.5 total “closure days” per year (44 full days + 33 half-days = 60.5 “full days”). Launch scrubs and weather delays could affect the length and/or number of closures; however, the extent of these occurrences cannot be quantified at this time.

Table 2.1-1 provides a summary of pre-launch and closure-related activities and notional closure times/durations. As mentioned previously, it is anticipated that, similar to other launch vehicles like Falcon, associated closure areas would reduce in size and duration as the program matures, more data is available, and the reliability of the vehicle improves.

**Table 2.1-1. Summary of Pre-Launch Starship/Super Heavy and Pre-Reentry of Starship Closure-Related Activities**

| Action                                            | Purpose                                                                                                                             | Start Time                     | End Time <sup>1</sup> |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------|
| Establish check points and take down check points | Set up for launch and remove after launch. Commence monitoring of traffic flow.                                                     | T <sup>2</sup> – 6 to 12 hours | T + 5 to 30 minutes   |
| Establish hard access control checkpoints         | Restrict public access to access restricted area and limit access within the USCG LAA (same for static fire).                       | T – 3 hours                    | T + 5 to 30 minutes   |
| USCG/other waterborne law enforcement on station  | USCG and/or other local waterborne law enforcement sweep areas and restrict/limit (LAA) boating access (same for static fire).      | T – 3 hours                    | T + 5 to 30 minutes   |
| Security sweeps                                   | Security sweeps responsible areas (e.g., beach, roads near launch site, rivers and creeks). Verify by video, UAV, or ATV as needed. | T – 2 hours                    | T – 1 hour 40 minutes |
| Trajectory sweeps                                 | Verify with radar sweep                                                                                                             | T – 1 hour                     | T – 40 minutes        |

<sup>27</sup> Integrated launches and Super Heavy booster landings would occur within approximately 10 minutes of each other; thus booster landings would not be considered an “additional event” for closure length determinations.

**Table 2.1-1. Summary of Pre-Launch Starship/Super Heavy and Pre-Reentry of Starship Closure-Related Activities**

| Action                                                                                                                                                                                                                                                                                                                                           | Purpose                                                                                                                                                                                                                                                           | Start Time                                                                                                                                               | End Time <sup>1</sup> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Close airspace                                                                                                                                                                                                                                                                                                                                   | In accordance with agreed procedure, FAA Air Traffic Control closes appropriate commercial airspace. Airspace closures potentially affecting Special Use Airspace would be coordinated with the appropriate using agency (e.g., CCSFS, Patrick Space Force Base). | T – 15 minutes                                                                                                                                           | T + 5 to 30 minutes   |
|                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                   | Approximate minimum 40-minute, and up to 2-hour closure for launches.<br>Approximate minimum 40-minute, and up to 1-hour closure for Starship reentries. |                       |
| Estimated Restricted Access Time per Static Fire Engine Test (88/year) and Wet Dress Rehearsal (44/year) within access restricted area and LAA (up to approximately 13,550 feet/2.6 miles from the center of LC-39A)                                                                                                                             |                                                                                                                                                                                                                                                                   | 3 hours                                                                                                                                                  |                       |
| Estimated Total Annual Restricted Access Time within access restricted area and LAA for Static Fire Engine Tests and Wet Dress Rehearsals                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                   | Approximately 396 hours                                                                                                                                  |                       |
| Estimated Closure and Limited Access Time per Launch/Booster Landing (44/year) or Starship Landing (44/year) within the access restricted area/LAA (up to approximately 22,965 feet/4.4 miles [7 kilometers] from the center of LC-39A). Note: Booster landings would not be considered an “additional event” for closure length determinations. |                                                                                                                                                                                                                                                                   | Up to 3.5 hours                                                                                                                                          |                       |
| Estimated Total Annual Closure and Limited Access Time for Launches/Booster Landings and Starship Landings within the access restricted area/LAA (50% between 7:00 a.m. and 10:00 p.m. and 50% between 10:00 p.m. and 7:00 a.m.)                                                                                                                 |                                                                                                                                                                                                                                                                   | Approximately 308 hours                                                                                                                                  |                       |
| Estimated Total Annual Closure and Limited Access Time within access restricted area and LAA (44 launches/booster landings + 44 Starship landings + 88 static fire engine tests + 44 wet dress rehearsals)                                                                                                                                       |                                                                                                                                                                                                                                                                   | Approximately 704 hours                                                                                                                                  |                       |

Notes: % = percent; ATV = all-terrain vehicle; CCSFS = Cape Canaveral Space Force Station; FAA = Federal Aviation Administration; LAA = Limited Access Area; UAV = unmanned aerial vehicle; USCG = United States Coast Guard.

<sup>1</sup> Does not apply to static fire or wet dress—all times assume nominal launch/landing sequence.

<sup>2</sup> “T” implies the anticipated time of engine firing, with start and end times measured before (minus x hours or minutes) or after (plus x hours or minutes).

### 2.1.3.2 Launch

Starship-Super Heavy would launch from LC-39A up to 44 times per year and could occur at any time of day or night; for purposes of noise analysis, it is assumed that 22 launches would occur during the day (7:00 a.m. to 10:00 p.m.) and 22 launches would occur at night (10:00 p.m. to 7:00 a.m.). During a launch, ignition of the Super Heavy booster, Raptor engines would generate a heat plume. The plume would appear clear and consist of water vapor, carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), hydrogen, methane, nitrogen oxides (NO<sub>x</sub>), and oxygen. The heat plumes and increased temperatures in this area would be temporary and would only occur during engine ignition and dissipate within minutes. A flame diverter or similar infrastructure (e.g., a water-cooled diverter) would be constructed to reduce potential effects due to the plume (a diverter can direct the plume upward, away from the ground). For LC-39A, SpaceX has only notional designs for a flame diverter; the notional design is a bifurcated diverter where the engines would be encased in the launch mount, which sits on top of the diverter. The two opposite sides of the rectangular diverter would be open and angled upwards. Deluge water (potable water) is released inside the launch mount to cool the mount and diverter as the launch occurs. SpaceX anticipates approximately 400,000 gallons of deluge water would be used during each integrated launch. Launches would result in noise and vibration, and nighttime launches would require lighting.

### 2.1.3.3 Super Heavy and Starship Landings

SpaceX plans to land the reusable Super Heavy and Starship back on land at LC-39A or on floating platforms in the ocean. As SpaceX continues to develop the capability to perform an RTLS landing of Super Heavy and the Starship, some vehicles may not be reused and instead may be expended in the ocean in the following three conditions depending on the stage of development of the program:

1. Hard water landing at terminal velocity and break up on impact, resulting in an explosive event at the surface of the water
2. Soft water landing and tip over and sink or explode on impact at the surface of the water<sup>28</sup>
3. In-flight breakup—breakup during reentry, resulting in debris falling into the ocean (up to 25 times per year of each vehicle stage)

Of the above scenarios, SpaceX anticipates no more than 20 explosive events at the surface of the water (Scenario Number [#] 1) for each vehicle for the life of the program. These three scenarios are only anticipated to occur within the first 5-6 years of the program.

Section 2.1.3.1, *Pre-Launch*, discusses the airspace, maritime, and land-based coordination and security/safety requirements (i.e., restricted access) associated with the trajectories for integrated launches, Super Heavy booster landings, and Starship reentry and landings.

For Super Heavy ocean landings, Super Heavy would land on a droneship or be expended in the Atlantic Ocean (Figure 2.1-6). Starship could land on a droneship (floating platform) or be expended in any of the following landing areas shown in Figure 2.1-6, Figure 2.1-7, Figure 2.1-8, or Figure 2.1-9. The landing area in the Pacific Ocean is outside the U.S. Exclusive Economic Zone (EEZ). The droneship operations and specifications were assessed in the 2025 NMFS consultations (NMFS, 2025a; NMFS, 2025b). Additionally, a Starship near-shore contingency landing zone is located in the Atlantic Ocean, beginning 1 nautical mile or more from the coast and covering a distance of up to 50 miles (80 kilometers) north of KSC LC-39A and up to 50 miles (80 kilometers) south of CCSFS SLC-37 (Figure 2.1-6). Landings that occur downrange on a floating platform would continue to be delivered by barge to the Port of Canaveral and transported the remaining distance to the launch site through the Turn Basin and then over established roadways.

#### STARSHIP-SUPER HEAVY LAUNCHES

- Up to 44 launches/year (22 day/22 night)

#### SUPER HEAVY LANDINGS

- Up to 44/landings year (22 day/22 night)
  - Return to LC-39A (results in sonic boom)
  - Droneship in Atlantic Ocean (results in sonic boom)
  - Expended in Atlantic Ocean greater than 5 miles (8 kilometers) off the coast (sonic boom not heard on land)

<sup>28</sup> A soft water landing is when the launch vehicle intentionally slows its speed to land in the water.

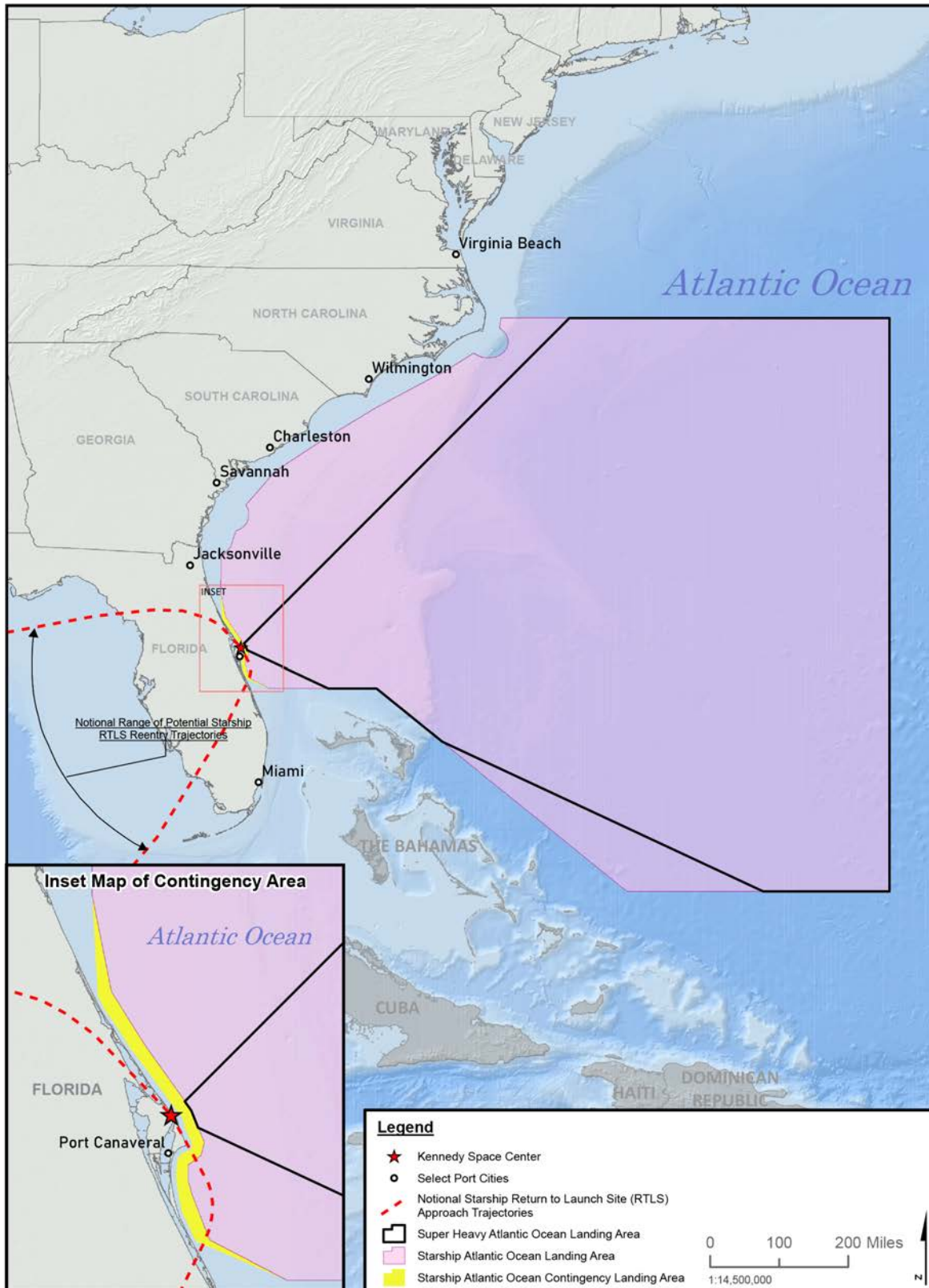


Figure 2.1-6. Starship and Super Heavy Atlantic Ocean Landing Areas and Notional Range of Starship RTLs Headings



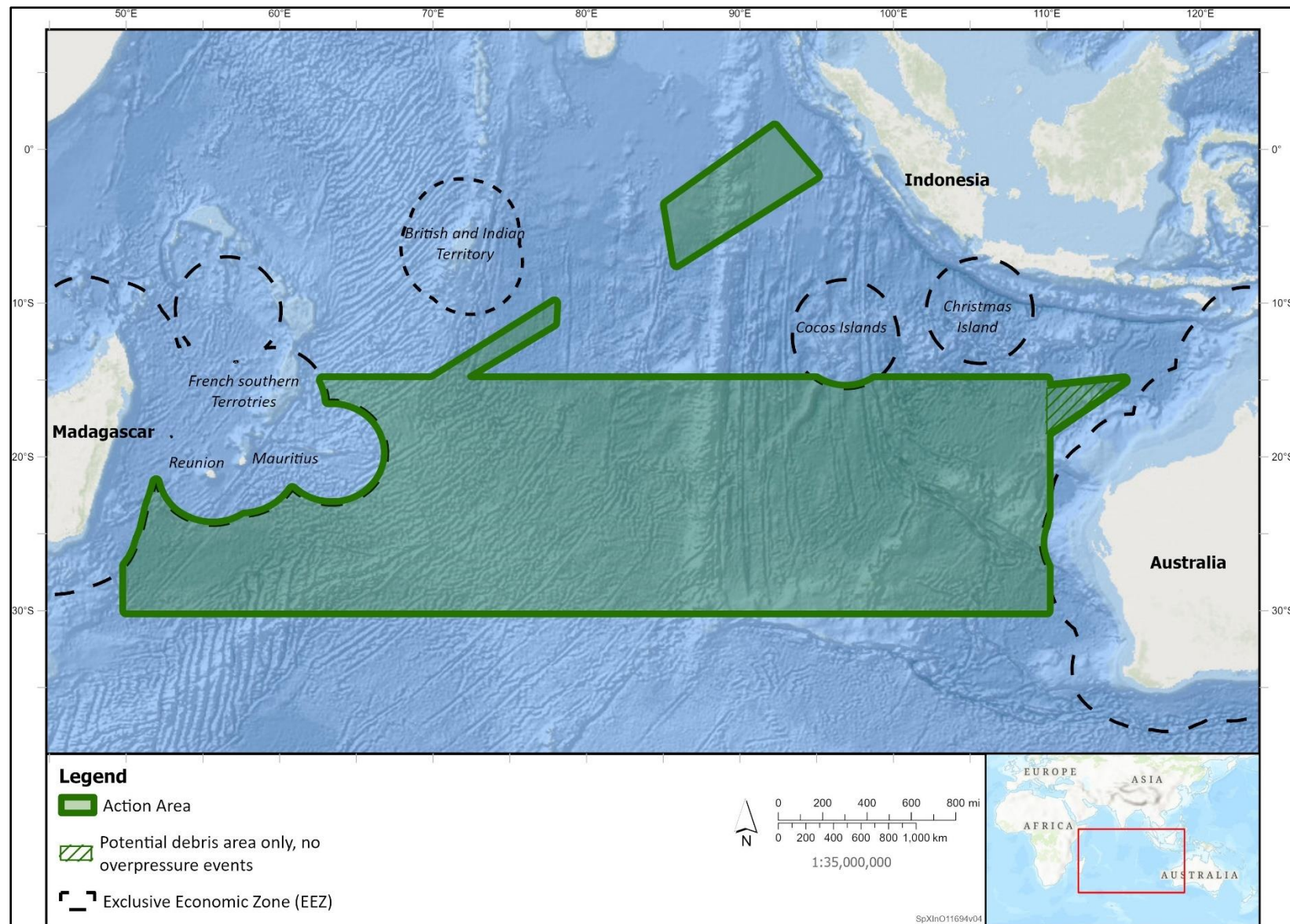


Figure 2.1-7. Indian Ocean Starship Landing Area

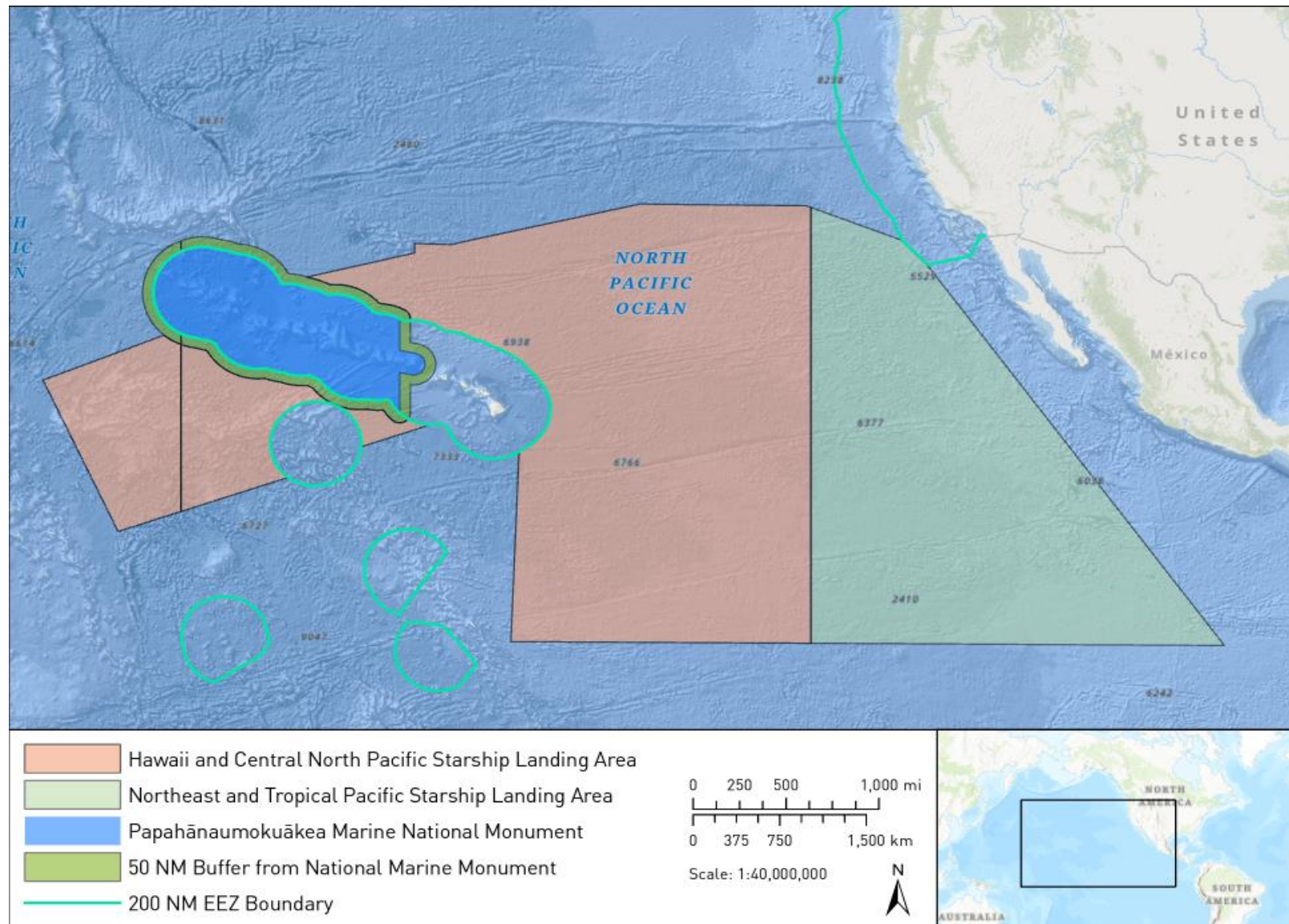


Figure 2.1-8. North Pacific Starship Landing Area (Hawaii and Central North Pacific Landing Area and Northeast and Tropical Pacific Ocean Landing Area)



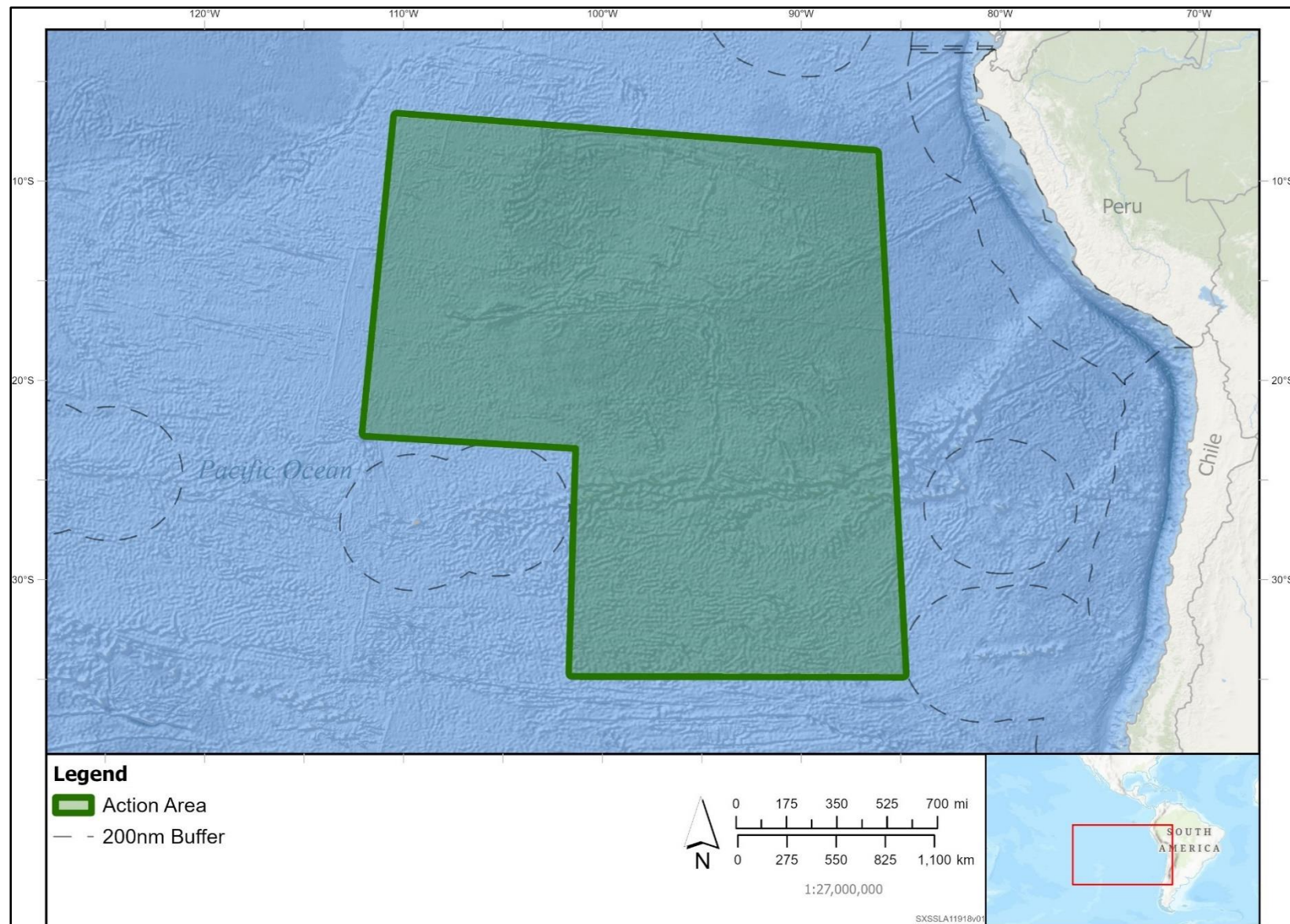


Figure 2.1-9. Southeast Pacific Starship Landing Area

Under the Proposed Action, there would be remaining propellant on both Starship and Super Heavy. Up to approximately 101 MT of residual propellant is projected to remain on the Starship launch vehicle for downrange landing, including expenditures. Up to approximately 74 MT of residual propellant is projected to remain on the Super Heavy vehicle for downrange landing, including expenditures, and would be vented following landing.

### ***Super Heavy Landings***

Each Starship-Super Heavy orbital launch would include landing Super Heavy at LC-39A, downrange in the Atlantic Ocean on a floating platform/barge, dronship (mobile vessel not attached to the sea floor), or expended in the Atlantic Ocean, no closer than approximately 5 nautical miles off the coast within the Super Heavy Atlantic Ocean Landing Area depicted in Figure 2.1-6. For purposes of analysis, it is assumed that 22 landings would occur during the day (7:00 a.m. to 10:00 p.m.) and 22 landings would occur at night (10:00 p.m. to 7:00 a.m.). While it is acknowledged that there may be landings occurring in the ocean, the goal is for all landings to occur at LC-39A.

During flight, Starship's engines would start, most of Super Heavy's engines would cut off, and the booster would separate from Starship<sup>29</sup>. Starship would continue to the desired orbit location and Super Heavy would rotate and ignite to conduct the retrograde burn, which would place it in the correct angle to move the vehicle impact point to approximately its final target. Once Super Heavy is in the correct position, the engines would cut off. Super Heavy would then perform a controlled descent using atmospheric resistance to slow it down and guide it for a precise return to the tower at LC-39A to be caught with the tower's arms. As Super Heavy slows down during its landing approach, a sonic boom would be generated. Once near the landing location, Super Heavy would ignite its engines to conduct a controlled landing. Super Heavy would land vertically at the catch tower or other landing location, such as a floating platform, and go into an automated safing sequence wherein the engines shut down and any remaining LOX and methane would be offloaded to ground storage or released to the atmosphere (LCH<sub>4</sub> converts to a gaseous form when it is released). If landing at the catch tower, another plume would be generated and the deluge system would be employed, utilizing approximately 68,000 gallons of water.

While SpaceX intends Super Heavy to be fully reusable and to RTLS following operational flights, expending (i.e., not recovering) vehicles may be required; SpaceX anticipates this to be an infrequent occurrence given the goals of the reusable concept. Super Heavy could be expended in the Atlantic Ocean (Figure 2.1-6) during the initial stages of launch operations at KSC if mission payload or desired orbit requirements would result in too little propellant remaining in Super Heavy to RTLS. This expenditure process would occur within several minutes after launch and Starship separating from the Super Heavy booster. An expended Super Heavy would break up above the ocean's surface or on impact with the ocean's surface, or it would sink. Some residual propellant would remain in an expended Super Heavy, and the impact would disperse settled remaining propellants and drive structural failure of the vehicle. The structural failure would allow the remaining propellant to mix, resulting in an explosive event upon impact with the ocean's surface. SpaceX has a requirement to surveil the splashdown area before committing to launch and will stand down if the area cannot be confirmed clear of vessel traffic.

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<sup>29</sup> There would be no interstage disposal.



Super Heavy could also conduct a soft water landing where the vehicle's engines would fire prior to impact with the ocean's surface, causing the vehicle to land vertically and intact. The vehicle would then take on water and sink on its own, be scuttled (purposefully sunk), or be transported back to land. If recovered in the open ocean, via water landing or on a dronship (dimensions are unknown at this time<sup>30</sup>; Starship-Super Heavy would employ a similar concept of operations as the Falcon offshore recovery model<sup>31</sup> but would likely require newer dronships), it would be delivered by vessel to Port Canaveral or the KSC Turn Basin and transported horizontally the remaining distance to the proposed launch site or other SpaceX facilities over the roadways. Following Super Heavy landings at the launch site, the vehicle may be transported from the landing pad to the adjacent launch mount or to one of SpaceX's production locations over the roadways for refurbishment. Any potential refurbishment actions would take place at SpaceX's facilities at the launch site or at other SpaceX facilities at KSC. No roadway improvements to support transportation are proposed as part of the Proposed Action. At this time, SpaceX does not anticipate a scenario where Super Heavy would launch from KSC and land at CCSFS, and this scenario is not addressed in this document. Should the Starship-Super Heavy operational concept evolve in the future to include such activities, additional NEPA review would be required.

### **Starship Landings**

A potential range of Starship reentry trajectories and landing headings are shown in Figure 2.1-4 and Figure 2.1-6 respectively. Starship could land at LC-39A, on a dronship in the Pacific or Indian Ocean (see Figure 2.1-7; Figure 2.1-8; Figure 2.1-9), or in the Atlantic Ocean (dimensions for the dronship are unknown at this time; Starship-Super Heavy would employ a similar concept of operations as the Falcon offshore recovery model<sup>32</sup> but would likely require newer dronships). In the Atlantic Ocean, SpaceX may land the Starship vehicle anywhere within the boundary of the "Starship Atlantic Ocean Action Area" depicted in Figure 2.1-6. However, part of the action area consists of an "Atlantic Ocean Contingency Landing Area," which is between one and 5 nautical

#### **STARSHIP LANDINGS**

- Controlled descent (all result in sonic boom)
  - Return to LC-39A
  - Return to dronship in Atlantic Ocean
  - Pacific, Atlantic, or Indian Ocean hard landing – terminal velocity impact with ocean surface; result in destruction of Starship
  - Pacific, Atlantic, or Indian Ocean soft landing – allows ocean surface landing where vehicle is intact; Starship sinks or is scuttled
  - Debris is recovered if possible
- Uncontrolled descent
  - Starship breaks up during reentry in broad open ocean areas of Pacific or Indian Oceans
  - Debris is recovered if possible

<sup>30</sup> FAA Order 1050.1F requires the identification of incomplete or unavailable information when that information is relevant to reasonably foreseeable significant adverse impacts.

<sup>31</sup> <https://newspaceconomy.ca/2024/07/12/spacexs-offshore-recovery-fleet-enabling-reusable-rocketry/#:~:text=To%20recover%20Falcon%209%20payload,halves%20out%20of%20the%20water.>

<sup>32</sup> <https://newspaceconomy.ca/2024/07/12/spacexs-offshore-recovery-fleet-enabling-reusable-rocketry/#:~:text=To%20recover%20Falcon%209%20payload,halves%20out%20of%20the%20water.>

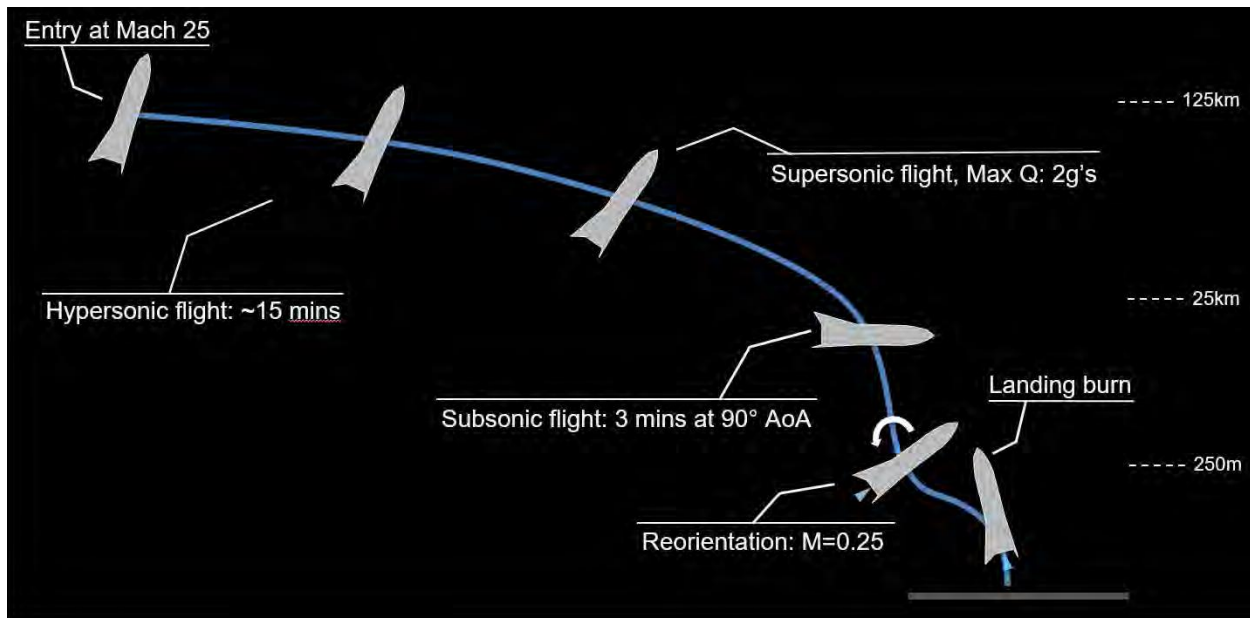
miles from shore and runs 50 miles north and south of LC-39A (Figure 2.1-6). The remainder of the action area begins 5 or more nautical miles from shore. Starship contingency landing operations could occur up to five times per year during the initial years of operation at KSC where something impedes use of the catch tower, there are issues with vehicle operating parameters, or other extenuating safety circumstances which prevent Starship RTLS landing operations at KSC. The timeframe for recovery of Starship within the Atlantic Ocean contingency landing area would be dependent on the location of occurrence and the rapidity of the SpaceX recovery team's mobilization. If SpaceX assets are in the vicinity, an attempt would be made to recover Starship. SpaceX has a requirement to surveil the splashdown area before committing to launch and will stand down in the event the area cannot be confirmed to be clear of vessel traffic. Should Starship land in shallow waters, SpaceX would coordinate with the USCG to mitigate any potential navigable hazard until recovery is accomplished. SpaceX recovery personnel would follow standard salvage procedures in compliance with applicable state and Federal requirements for the salvage activity and perform an assessment of structural stability required to tow and stabilize Starship as it is returned to the Port. Recovery operations typically consist of one barge and tug boat. The duration of vessel operations lasts approximately 5 days for each launch with a recovery. Vessel operations only apply to pre-launch surveillance and post-launch recovery (i.e., vessels are not active the entire day).

SpaceX anticipates this to be an infrequent occurrence given the goals of the reusable concept. Starship could be expended in two different ways: (1) a controlled descent that would result in Starship's intact impact with the ocean's surface (hard or soft landing) or (2) an uncontrolled descent resulting in breakup during atmospheric reentry<sup>33</sup>. The timeframe between launch and expenditure (as well as location of expenditure) would vary, depending on mission requirements (e.g., the length of the mission, associated trajectories, etc.).

As shown in Figure 2.1-10, Starship would perform a controlled descent using atmospheric resistance to slow the vehicle down and guide it to its landing location. Guidance systems are used to maneuver the vehicle, and trajectories determine flight paths. As Starship slows down during its landing approach, a sonic boom would be generated. If landing at the catch tower, another plume would be generated and the deluge system would be employed, utilizing approximately 68,000 gallons of water. Following a successful landing, Starship would go into an automatic safing sequence (i.e., put the vehicle in a safe state). After Starship is in a safe state, a mobile hydraulic lift would raise Starship onto a transporter. If a Starship landing occurred downrange in the broad ocean area, it would be delivered by vessel to Port Canaveral or the KSC Turn Basin and transported the remaining distance to the proposed launch site or other SpaceX facilities over the roadways. Following Starship landings at the launch site, it would be transported from the landing pad to the adjacent launch mount or to one of SpaceX's production locations over the roadways for refurbishment. Any potential refurbishment actions would take place at SpaceX's facilities at the launch site or at other SpaceX facilities at KSC.

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<sup>33</sup> When Starship is not configured to survive atmospheric reentry (e.g., lack of sufficient propellant), Starship would tumble as it descends through the atmosphere and break apart at greater than 31 miles (50 kilometers) above ground level (based on telemetry data).



Source: SpaceX

Figure 2.1-10. Proposed Starship Reentry and Landing

SpaceX expects most of the launch vehicle debris would sink because it is made of steel. Lighter items not made of steel, such as composite overwrapped pressure vessels, may float but are expected to eventually become waterlogged and sink. If large debris remains, SpaceX would coordinate with a party specialized in marine debris to survey the situation and sink or recover as necessary any large floating debris. SpaceX would coordinate with all land and water regulatory authorities, including the USCG and the State Department, prior to recovering debris to ensure it is recovered as expeditiously as possible. Following an orbital landing, Starship would have remaining LOX and LCH<sub>4</sub> in the vehicle. Remaining LOX would be released to the atmosphere, and remaining LCH<sub>4</sub> would likely be released to the atmosphere or safely combusted. Due to risks to personnel, SpaceX is unable to reconnect the vehicle to ground systems when LCH<sub>4</sub> remains on the vehicle. In the future, SpaceX may recycle LCH<sub>4</sub> back into tanks as technology and design develops.

At this time, SpaceX does not anticipate a scenario where Starship would launch from KSC and land at CCSFS, and this is not addressed in this document. Should the Starship-Super Heavy operational concept evolve in the future to include such activities additional NEPA review would be required.

#### 2.1.3.4 Trajectories

Starship-Super Heavy launch and RTLS trajectories would be specific to each particular mission. Flight trajectories vary based on mission specifics such as desired payload orbit. Starship-Super Heavy launch azimuths would range from 40 degrees to 115 degrees, from a reference of due north at 0 degrees and due east at 90 degrees (see Figure 2.1-3); RTLS trajectories would be the same for the Super Heavy booster. RTLS trajectories for Starship would likely be in a range from the southwest/northwest eastward towards LC-39A; reentry trajectories and landing headings are shown in Figure 2.1-4 and Figure 2.1-6, respectively. Restricted airspace parameters would need to be modified for Starship-Super Heavy operations based on individual launch and RTLS trajectories.

### 2.1.3.5 Payloads

In general, payloads and their associated materials/fuels/volumes are mission dependent but would be like current commercial and government payloads analyzed in the *Environmental Assessment for Launch of NASA Routine Payloads* (NASA, 2011a). Starship-Super Heavy Program payloads would be similar to, but larger than, current and planned payloads launched on Falcon 9 and Falcon Heavy and range from 100,000 to 150,000 kilograms. Missions could include cargo, and spacecraft flights to various orbits, the moon, Mars, and other destinations. SpaceX is also proposing to launch orbital propellant transfer missions, where Starship would carry propellant to refill orbital fuel depots. Payload volumes for Starship propellant tankers and depots could be as much as 2,650 MT. In such cases, no separate tank of propellant will be loaded into Starship as a true “payload or cargo.” Instead, the propellant depot is composed of the tanks already integrated into Starship, which would facilitate its return to Earth if it were not functioning as a depot. Crewed missions are not currently considered as part of the Proposed Action, although these may occur in the future.

### 2.1.3.6 Anomalies

A Starship-Super Heavy operation could result in a deviation from what is expected (referred to as an anomaly). An anomaly on the launch pad could cause a fire on the launch pad and/or an explosion onsite or elsewhere that spreads debris. While anomalies are unexpected, as part of evaluating a vehicle operator license, the FAA evaluates SpaceX’s debris analysis to ensure the hazard area is of sufficient size to ensure public safety. In the event of an anomaly, SpaceX would evaluate the level of response based on the situation and notify the appropriate emergency personnel and land-managing agencies according to the requirements in a site-specific anomaly [or emergency] response plan.

## 2.1.4 LC-39A Infrastructure

A conceptual plan of proposed infrastructure improvements at LC-39A are shown in Figure 2.1-11 and described in the following sections. The figure shows facilities that were previously approved for construction (and currently under development) under the 2019 NASA EA, as well as those associated with this Proposed Action. It is estimated that remaining construction would last up to 2 years.

### 2.1.4.1 Super Heavy Catch Tower

SpaceX would construct an additional tower within the LC-39A fence line to support landing operations. While the integration tower used for launch could support Super Heavy landings, an additional landing tower would reduce launch pad refurbishment needed between each launch, providing a shorter turnaround period between launches, and increase the efficiency of launch operations. The catch tower would be approximately 480 feet (146 meters) tall and be similar in appearance to the existing integration tower. No launches would occur from the catch tower. The proposed catch tower location is shown in Figure 2.1-11.



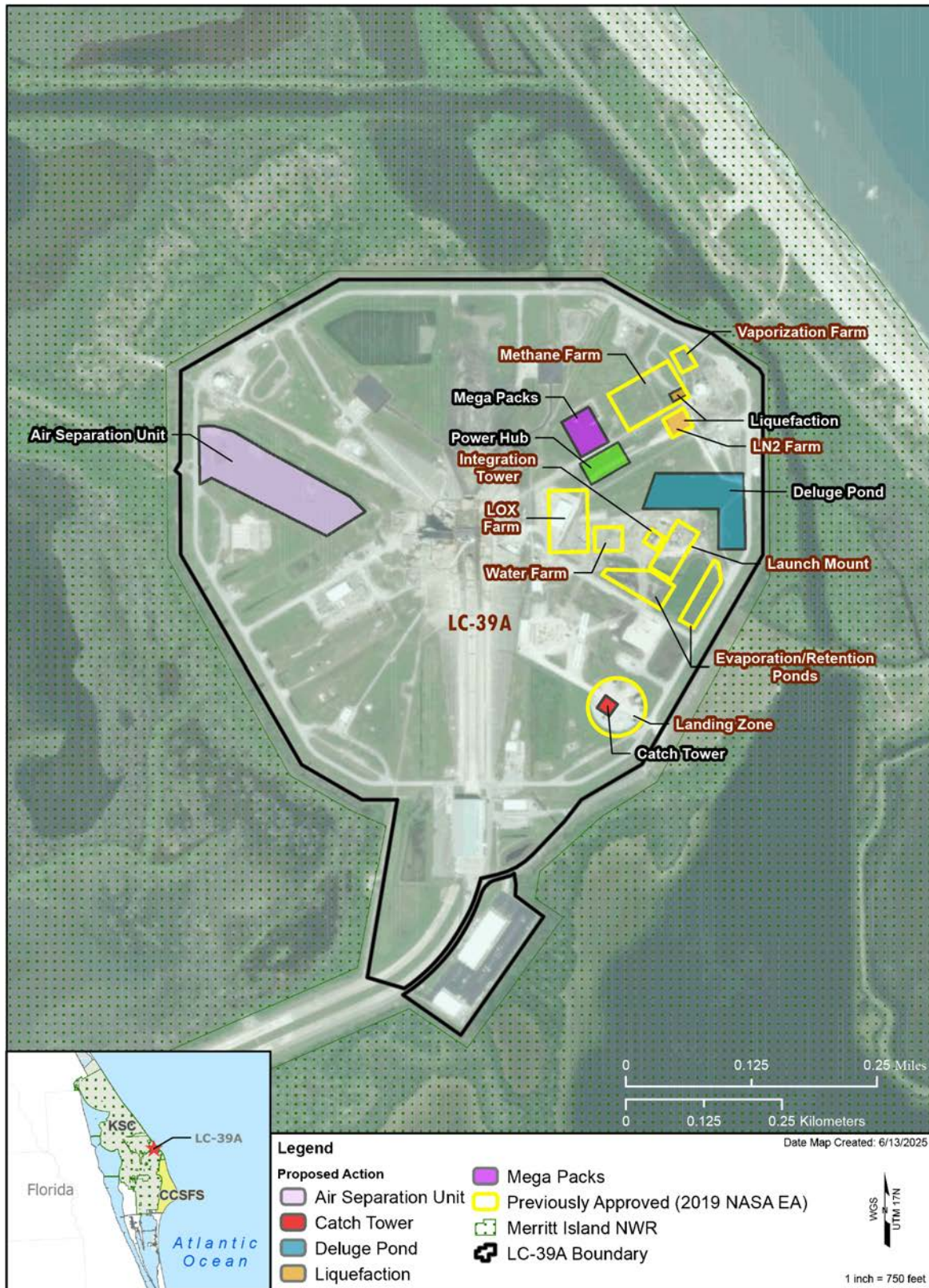


Figure 2.1-11. Proposed LC-39A Infrastructure

### 2.1.4.2 Propellant Generation

The Starship-Super Heavy Raptor engines are powered by LOX and LCH<sub>4</sub>. SpaceX is proposing to construct onsite facilities for propellant generation and propellant storage, and storage tanks for LOX and LCH<sub>4</sub> are under construction as approved under the 2019 NASA EA. Propellant generation facilities would be operated using natural gas and/or existing electrical power lines and “MegaPacks” (a large-scale rechargeable lithium-ion battery stationary energy storage product that can store up to 3.9 megawatt (MW)-hours of electricity). The current concept of operations is that, until the liquefaction plant and air separation unit (ASU) are constructed (this is due to the extensive lead time necessary for final design, construction, and onboarding of these facilities), commodities would be trucked to LC-39A to generate propellant. For the purposes of a “maximum use” analysis in this EIS, current estimates of the number of trucks per launch for commodities include 270 for LOX, 80 for LN<sub>2</sub>, and 90 for LCH<sub>4</sub>. At 44 launches per year, this equates to a total of 19,356 trucks per year. During a 12-hour period for operations occurring 365 days per year, this approximates to 53 trucks per day (or 4-5 trucks per hour).

However, there could be more or fewer trucks per hour depending on launch frequency and specific commodity needs. Bulk storage of commodities would serve to also minimize the need for trucks over time. SpaceX would process natural gas brought to the site for propellant generation. A natural gas pretreatment system would remove impurities such as mercury, sulfur, water, CO<sub>2</sub>, and hydrocarbons heavier than methane from the natural gas to produce a stream of higher purity gaseous methane; impurities would be captured through a filtration system and managed according to KSC solid and hazardous waste requirements. Surplus natural gas would be used for process work, power generation, or would boil off like a natural gas line venting. Natural gas systems typically have a venting mechanism (like in all propane tanks) to vent so they do not explode if under too much pressure; in industry this is called a relief valve.

In the future, natural gas would be supplied to LC-39A through a multiuser pipeline extending from the existing natural gas main line on KSC. Florida City Gas is in the process of planning an underground pipeline extension at KSC to provide additional service; no details are currently available regarding specific location or

#### Infrastructure Summary (size is approximate)

Previously approved in 2019 NASA EA  
(already developed/under development):

- LOX Farm (65,454 square feet [SF])
- Methane Farm (78,876 SF)
- Launch Mount (36,568 SF)
- Integration Tower (6,184 SF)
- Ponds (68,799 SF)
- Vaporization Farm (9,650 SF)
- LZ (72,672 SF)
- LN<sub>2</sub> Farm (13,342 SF)
- Water Farm (17,955 SF)

Included as part of this Proposed Action:

- ASU (222,071 SF)
- Catch Tower (5,992 SF)
- Deluge Pond (121,963 SF)
- Liquefaction – includes natural gas pretreatment and methane liquefier (17,246 SF)
- MegaPacks (34,979 SF)
- Power Hub (28,998 SF)

**Total Approximate Square Footage: 800,647**

timeframe. The extension of the pipeline would occur regardless of this Proposed Action and is only included as a component of reasonably foreseeable effects in this EIS. The natural gas pretreatment system would include a small amine treating unit for CO<sub>2</sub> removal, a scrub column to remove heavy hydrocarbons that would be up to 100 feet (30 meters) tall and 10 feet (3 meters) in diameter, and four to six smaller vessels approximately 6 feet (2 meters) in diameter and up to 30 feet (9 meters) tall.

As part of the liquefaction process, SpaceX proposes to construct a methane liquefier to supercool pretreated natural gas into a liquid state for storage and transportation to the launch vehicle. The liquefier would use a compressor and turboexpanders to operate a gas refrigeration cycle with nitrogen or air to liquefy the methane in a primary heat exchanger. The natural gas pretreatment and liquefier together would be comprised of several structures each up to 65 feet (20 meters) tall. The methane liquefier would be cooled by a typical evaporative cooling tower requiring up to 30 cubic meters per hour (approximately 8,000 gallons per hour) of water (acquired through existing water pipelines) and producing up to 3 cubic meters per hour (approximately 800 gallons per hour) of wastewater, which would be captured by evaporation/retention ponds as identified in Figure 2.1-11.

SpaceX proposes to construct an ASU within the LC-39A fence line to generate LN<sub>2</sub> and LOX to support launch activities. An ASU dehumidifies, liquefies, and separates air into its major components (oxygen and nitrogen). The liquid would then be transferred via pipeline to storage tanks at LC-39A. In addition to the primary oxygen and nitrogen liquid products, a waste nitrogen stream composed of rejected atmospheric gases would be produced, primarily nitrogen, oxygen, and argon, that would be vented back to the atmosphere; the amount that would be vented is unknown. However, an ASU primarily emits only the air gases already present in the atmosphere, meaning its primary emissions are essentially “clean air” with minimal impurities, as the process primarily separates air into its constituent components like nitrogen and oxygen, with minimal additional emissions (European Industrial Gases Association, 2017).

The ASU would be cooled by a typical evaporative cooling tower requiring approximately 75 cubic meters per hour (approximately 20,000 gallons per hour) of water and producing approximately 7 cubic meters per hour (approximately 2,000 gallons per hour) of wastewater. Water/wastewater would be managed in the same way as identified for the evaporative cooling tower as discussed previously. The ASU would be up to approximately 180 feet (55 meters) tall with supporting infrastructure up to approximately 60 feet (18 meters) tall. An onsite ASU reduces the need to transport nitrogen and oxygen to LC-39A from offsite via trucks as discussed previously.

Wastewater generated by the ASU and stormwater would be treated onsite via evaporation and retention ponds. Any residuals may be treated onsite, hauled off, or conveyed in a wastewater system that has capacity. Onsite treatment could include, but is not limited to, methods such as membrane aerated biofilm reactors or other processes. Reclaimed wastewater could then be discharged onsite via a stormwater pond, exfiltration trenches, infiltration basins, Class V group 6 drainage wells, percolation/evaporation ponds, or industrial evaporators or used for irrigation purposes or some other permitted method. If discharge would occur, SpaceX would acquire all necessary permits from the St. Johns River Water Management District and/or the FDEP. Utility work within LC-39A would occur to provide power and water to the system, with any new utility lines placed underground. As mentioned previously, up to 12 MegaPacks would be installed to support 24 MW/48 MW hours of power generation. Existing commodity tanks would be used where practicable and a 10,000-gallon (40,000-liter) aboveground storage tank (AST) would be constructed to store LN<sub>2</sub> for system purges. Propellant generation infrastructure location is shown in Figure 2.1-11.



### 2.1.4.3 Stormwater Evaporation/Retention and Deluge Ponds

SpaceX proposes to construct additional stormwater evaporation/retention and deluge ponds, if needed, to manage water associated with deluge and stormwater within LC-39A. Preliminary pond locations are shown in Figure 2.1-11. In general, the deluge system would apply a large amount of water to rapidly cool and create a barrier between the steel plate of the launch mount and rocket exhaust that will help to absorb sound energy and heat produced by the rocket engines and would allow the steel plate to be reused. It is expected that approximately 92 percent of the water would be vaporized by the heat of the rocket engines (FAA, 2023a). Water delivery to the site would be by truck or pipeline, as previously described, and stored in tanks.

The deluge and diverter system and associated operational parameters are still in the design phase, and specific details are currently unknown. However, the diverter is expected to be bifurcated and divert the heat plume and exhaust vertically to reduce the radial extent of the plume, and deluge system components and operational parameters would likely include water containment, water storage, press tank (to push water through the system), a pumping system and piping network, and a control system and valves. The deluge system would be activated during each ignition event on the orbital launch pad, including engine ignition tests and launches, and during landings. Each launch is associated with an estimated two static fire engine tests (one each for Starship and Super Heavy). Therefore, the deluge system may operate up to 220 times per year (88 static fires, 44 launches, and 44 landings each for Starship and Super Heavy).

The deluge system would be activated immediately prior to an engine ignition or landing event, allowing water to flow from the storage tanks, through the piping network, to the spray nozzles at the launch pad. Five seconds prior to ignition/landing, water would begin discharging. Most of this pre-ignition water would be captured by the containment structures. The amount of water applied during activation of the deluge system will differ depending on the type of ignition event. With estimates of 300,000 gallons per static fire event (88 total), 400,000 gallons per launch (44 total), and 68,000 gallons per landing (88 total), SpaceX estimates that up to 50 million gallons (190 million liters) of water per year would be utilized for launch/landing deluge operations at the site (approximately 137,000 gallons per day); approximately 92 percent of deluge water utilized is vaporized during operations. SpaceX plans to reuse deluge water that is retained onsite (i.e., not evaporated). The system would pump and filter water from the deluge pond into storage tanks for reuse. In the event SpaceX is unable to reuse the deluge water, it may be hauled offsite, discharged, or land applied. Prior to any discharge or land application, SpaceX would apply for any applicable FDEP permits. All ponds would be lined to prevent percolation of contaminants into the groundwater and would be maintained and monitored by SpaceX. Berms would be built around the ponds to eliminate additional stormwater/rainwater inflow/outflow. No deluge water would enter the Banana River or adjacent waterbodies or wetlands.

During engine ignition of the Starship-Super Heavy, the surface of the pad flame diverter could experience a small amount of ablation (erosion of steel from the metal surface resulting from heat and force, considered common on metal launch infrastructure). The ablated steel would quickly recondense near the launch mount when exposed to the deluge water. The metal components of the steel could remain localized to the launch pad, captured in the deluge water and retained onsite, or dispersed in vapor. SpaceX would implement sampling protocols in accordance with an amended Multi-Sector General Permit



(MSGP) for industrial stormwater from the FDEP and would remove water containing contaminants that exceed the water quality criteria and haul it to an approved industrial stormwater treatment facility. SpaceX would pump all other water not within permitting standards back to the water storage tanks for the deluge system.

## 2.1.5 Launch Vehicle Transport and Refurbishment

Fabrication, assembly, delivery, and integration of components would be as described in the 2019 EA and would occur at existing SpaceX facilities located on KSC and CCSFS (NASA, 2019a, p. 12). As stated in the 2019 EA (Section 2.1), most manufacturing would occur at the SpaceX facility in Boca Chica, Texas. Starship or Super Heavy components would be delivered over roadways on a mobile transporter like the transports performed for Falcon. Large vehicle components would be transported by barge from the Port of Brownsville, Texas, utilizing the KSC Turn Basin to the VAB location, then via Crawlerway to LC-39A (Figure 2.1-12). These are the same locations and processes utilized for current large vehicle transport (i.e., Falcon) and that were used during the Shuttle Program.

No improvements to transportation routes are anticipated at this time. Future transportation improvements to support SpaceX and other KSC operations that are not covered under the scope of this EIS would require additional NEPA review. Transport of Starship-Super Heavy and related components to and across KSC would generally occur as transport of rocket components currently does at KSC. This could include transport via barge or overland from SpaceX production sites, including Boca Chica, Texas, and Hawthorne, California. Any potential refurbishment actions would take place at SpaceX's facilities at KSC. Starship-Super Heavy would be transported to and from LC-39A to a SpaceX facility via SpaceX transporter over KSC roadways. At this time no improvements to KSC infrastructure outside those previously identified for LC-39A are proposed. Current and potential future improvements to KSC infrastructure that would support general SpaceX and other KSC operations were previously analyzed and approved under NEPA (NASA, 2020a; NASA, 2024b).

## 2.1.6 Launch Site Selection

SpaceX's purpose and need was established in the 2019 NASA EA (NASA, 2019b) and is identified in this EIS at Section 1.3, *Purpose and Need*. FAA Order 1050.1F Section 7-1.1(e) defines "reasonable alternatives" as those that meet the purpose and need for the proposed action. Through an alternative screening process based on Starship-Super Heavy requirements and the purpose and need, the 2019 EA established LC-39A as the approved location for Starship-Super Heavy operations, and infrastructure development based on NASA's 2019 FONSI is already underway. LC-39A provides time-critical mission capability to NASA and commercial pursuits via the Starship-Super Heavy. In addition to existing launch infrastructure, LC-39A provides launch site diversity for Starship-Super Heavy to meet the purpose and need for near-term lunar exploration under the NASA Artemis and HLS programs. Given the above, no other launch sites were considered for this Proposed Action.



Figure 2.1-12. Starship-Super Heavy Transport Routes

## 2.2 No Action Alternative

Under the No Action Alternative NASA would not develop, implement, or approve agreements with SpaceX associated with Starship-Super Heavy operations at LC-39A. The FAA would not issue a new license to SpaceX or modify their existing vehicle operator license for Starship-Super Heavy operations at LC-39A and would not close any associated airspace. SpaceX would not launch Starship-Super Heavy from LC-39A. The No Action Alternative would not meet the purpose and need. The No Action Alternative includes reasonably foreseeable actions that would still occur regardless of the Proposed Action, such as planned launch activity at both KSC and CCSFS. No Action analyses therefore focus on reasonably foreseeable actions within each respective resource study area. Projects are identified as reasonably foreseeable if they are in published planning documents, are in the process of NEPA evaluation, or have completed NEPA evaluation but the project has not yet been implemented.

Reasonably foreseeable actions are actions that may affect projected effects of a proposal and are not remote or speculative. An action may be reasonably foreseeable even in the absence of a specific proposal. Actions not grounded in publicly available planning documents, projected development trends, or regional or local plans would typically be considered remote and speculative and are not considered. In addition, actions may be considered improbable or remote even though they have been mentioned in planning documents (e.g., general statements about future growth opportunities and unrefined lists of potential projects). This includes planned future operations and aggregate rocket noise levels from all approved actions that have completed their environmental review. Table 2.2-1 shows the launch-related activities that have been previously approved under separate NEPA analysis considered in the No Action Alternative analysis (see Appendix C.1, *Noise Assessment and Noise Assessment Appendix*). The actions are relevant because they are in proximity to LC-39A, are planned to occur under the No Action, and could result in direct or indirect operational launch/landing or development-related effects within the Proposed Action study area for various resources.

**Table 2.2-1. No Action Launch, Landing, and Static Fire Test Operations at KSC and CCSFS**

| Event       | Facility | Complex | Vehicle/Program              | Day          | Night        | Total      |
|-------------|----------|---------|------------------------------|--------------|--------------|------------|
| Launch      | KSC      | LC-39A  | SpaceX Falcon 9              | 0            | 36           | 36         |
|             |          | LC-39A  | SpaceX Falcon Heavy          | 0            | 5            | 5          |
|             |          | LC-39B  | NASA Space Launch System     | 0.6          | 0.4          | 1          |
|             |          | LC-48N  | NASA SCLV                    | 32.5         | 19.5         | 52         |
|             |          | LC-48S  | NASA SCLV                    | 32.5         | 19.5         | 52         |
|             | CCSFS    | SLC-16  | Relativity Terran R          | 18           | 6            | 24         |
|             |          | SLC-36  | Blue Origin New Glenn Launch | 10           | 2            | 12         |
|             |          | SLC-40  | SpaceX Falcon 9 Launch       | 0            | 70           | 70         |
|             |          | SLC-41  | ULA Atlas V 551 (5 SRBs)     | 6.25         | 3.75         | 10         |
|             |          | SLC-41  | ULA Vulcan VC6S              | 13           | 7            | 20         |
|             |          | SLC-46  | Liquid Propellant Vehicle    | 7.5          | 4.5          | 12         |
|             |          | SLC-46  | Solid Propellant Vehicle     | 7.5          | 4.5          | 12         |
|             |          |         | <b>Total</b>                 | <b>127.8</b> | <b>178.2</b> | <b>306</b> |
| Landing     | CCSFS    | LZ-1/2  | SpaceX Falcon Booster        | 0            | 54           | 54         |
|             |          | LZ-1/2  | SpaceX Falcon Heavy Booster  | 0            | 10           | 10         |
|             |          |         | <b>Total</b>                 | <b>0</b>     | <b>64</b>    | <b>64</b>  |
| Static Fire | KSC      | LC-39A  | SpaceX Falcon 9              | 0            | 36           | 36         |

**Table 2.2-1. No Action Launch, Landing, and Static Fire Test Operations at KSC and CCSFS**

| Event | Facility | Complex | Vehicle/Program                        | Day        | Night      | Total      |
|-------|----------|---------|----------------------------------------|------------|------------|------------|
|       |          | LC-39A  | SpaceX Falcon Heavy                    | 0          | 5          | 5          |
|       |          | LC-48N  | NASA SCLV                              | 32.5       | 19.5       | 52         |
|       |          | LC-48S  | NASA SCLV                              | 32.5       | 19.5       | 52         |
|       | CCSFS    | SLC-11  | Blue Origin BE-4 Engine Testing        | 108        | 0          | 108        |
|       |          | SLC-16  | Relativity Terran R Static Fire        | 18         | 6          | 24         |
|       |          | SLC-16  | Relativity Terran R Stage MDC Hot Fire | 10         | 4          | 14         |
|       |          | SLC-36  | Blue Origin New Glenn Static Fire      | 10         | 2          | 12         |
|       |          | SLC-40  | SpaceX Falcon 9 Static Fire            | 0          | 70         | 70         |
|       |          |         | <b>Total</b>                           | <b>211</b> | <b>162</b> | <b>373</b> |

Notes: BE-4 = Blue Engine 4; CCSFS = Cape Canaveral Space Force Station; KSC = Kennedy Space Center; LC = Launch Complex; LZ = Landing Zone; MDC = Mission Duty Cycle; NASA = National Aeronautics and Space Administration; SLC = Space Launch Complex; SCLV = Spacecraft and Launch Vehicle; SpaceX = Space Exploration Technologies Corp.; SRB = solid rocket booster; ULA = United Launch Alliance.

Table 2.2-2 provides a list of approved NEPA and publicly available planning documentation for actions in and around KSC and CCSFS relevant to No Action effects analysis. The actions are relevant because they are in proximity to LC-39A, could be reasonably assumed to occur under the No Action, and could result in direct or indirect operational launch/landing or development-related effects within the Proposed Action study area for various resources.

**Table 2.2-2. Reasonably Foreseeable Actions\***

| Activity/Planning Document (if relevant)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Location |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Action: Construction and operations of a Landing Zone for Falcon operations at LC-39A. Location is outside and adjacent to the northern fence line.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | KSC      |
| Action: Expansion of 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 existing operations at LC-39A.<br><br><i>Supplemental Environmental Assessment for Roberts Road SpaceX Operations Area Expansion and Supporting Infrastructure on Kennedy Space Center. Draft. September. 2023. (NASA, 2024b)</i>                                                                           | KSC      |
| Action: Construction of new LC-49 and horizontal launch facilities north of LC-39A and LC-48 between LC-39A and LC-41 at KSC to support future launch operations. Construction at the Shuttle Landing Facility, also known as the Launch and Landing Facility, and on the KSC Main Campus to support commercial spaceflight and aviation testing, research, development, and training.<br><br><i>Kennedy Space Center Master Plan (<a href="https://public.ksc.nasa.gov/masterplan/">https://public.ksc.nasa.gov/masterplan/</a>) (NASA, 2024a)</i><br><i>Final Environmental Assessment for Launch Complex 48, Kennedy Space Center, FL. (NASA, 2019c)</i> | KSC      |
| Action: Development and improvements to the area around the Space Florida Shuttle Landing Facility, also known as the Launch and Landing Facility, to support commercial activities.<br><br><i>Draft Environmental Assessment for Space Florida Shuttle Landing Facility Construction of Developable Land at the John F. Kennedy Space Center, Kennedy Space Center, Florida. 2021. (NASA, 2021d)</i>                                                                                                                                                                                                                                                       | KSC      |
| Action: SpaceX to increase the annual cadence of Falcon 9 launches and construction and operation of a Falcon 9 LZ at SLC-40 on CCSFS.<br><br><i>Draft Environmental Assessment for SpaceX Falcon 9 Operations at Space Launch Complex 40, Cape Canaveral Space Force Station. March 2025. (FAA, 2025b)</i>                                                                                                                                                                                                                                                                                                                                                 | CCSFS    |



**Table 2.2-2. Reasonably Foreseeable Actions\***

| Activity/Planning Document (if relevant)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Location       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <p>Action: SpaceX construction of launch, landing, and other associated infrastructure at and in proximity to SLC-37 at CCSFS. This includes Starship-Super Heavy launches/landings.</p> <p><i>SpaceX Starship-Super Heavy Cape Canaveral Space Force Station Environmental Impact Statement. Draft. January 2025. (USSF, 2025a)</i></p>                                                                                                                                                                                                                                                                                                                                                                           | CCSFS          |
| <p>Action: Repairs and new construction at Skid Strip, including paved overruns, administrative facility, hangar, and apron for future DOD mission.</p> <p><i>Spaceports of the Future – Infrastructure: Society of American Military Engineers Presentation (USSF, 2024a)</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                 | CCSFS          |
| <p>Action: Various improvements to infrastructure including utility corridor expansion and increased utility resiliency and redundancy; consolidation of munitions storage areas; facilities to relocate non-essential personnel/equipment out of launch exclusionary safety zones; changes to reduce the risk of communication infrastructure failure; establish haul routes and improve traffic flow; improvements to CCSFS South Gate; and construction of new launch/landing support, research, and testing facilities.</p> <p><i>Environmental Assessment for Eastern Range Planning and Infrastructure Development, Cape Canaveral Space Force Station, Florida. Final. January. 2024. (USSF, 2024b)</i></p> | CCSFS          |
| <p>Action: Terran R Program to modify launch capabilities within Relativity's existing licensed property boundary at SLC-16 following the retirement of the Terran 1 Program. Includes launches of the Terran R.</p> <p><i>Supplemental Environmental Assessment (SEA) for the Relativity Space Terran R Launch Program Cape Canaveral Space Force Station (CCSFS), FL. 2024. (USSF, 2024c)</i></p>                                                                                                                                                                                                                                                                                                                | CCSFS          |
| <p>Action: Additional third pad build-out at SLC-20. Currently in pre-planning phase; environmental documentation not yet available.</p> <p><i>Supplemental EA for the Reconstitution and Enhancement of SLC-20 for Multi-User Launch Operations.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                          | CCSFS          |
| <p>Action: Reactivation of SLC-14 in support of Stoke's launch program, which includes the demolition of existing structures, the construction of new facilities, and improvements to existing infrastructure, ground support operations, and launch operations. New ground elements would include a launch mount/pad, propellant tank farm, engineering support facility, launch vehicle/payload processing/maintenance hangar, utilities, and roads and security.</p> <p><i>Environmental Assessment for Stoke's Nova Launch Program at Cape Canaveral Space Force Station, Florida (Draft). May. 2024. (USSF, 2024d)</i></p>                                                                                    | CCSFS          |
| <p>Action: NASA development of the Kennedy Visitor Complex and viewing gantry at LC-39 (includes various improvements as part of a 15-year Development Plan).</p> <p><i>Programmatic Environmental Assessment for the Implementation of a 15-Year Development Plan at the Kennedy Space Center Visitor Complex and Launch Complex 39 Viewing Gantry (Draft). August. 2024. (NASA, 2024c)</i></p>                                                                                                                                                                                                                                                                                                                   | NASA           |
| <p>Action: Replacement of the drawbridge on State Route 401 over the Canaveral Barge Canal.</p> <p><i>Florida Department of Transportation District 5 Five Year Work Program FY25-FY29 (FDOT, 2024d)</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Port Canaveral |
| <p>Action: Space Florida near-term wharf development in the Middle Turning Basin at CCSFS. Short-term improvements to existing infrastructure followed by later expansions of the Middle Turning Basin to the north for long-term capacity enhancement.</p> <p><i>Florida Spaceport System Maritime Intermodal Transportation Study Feasibility Phase, Port Canaveral, Florida (Space Florida, 2024)</i></p>                                                                                                                                                                                                                                                                                                       | CCSFS          |

**Table 2.2-2. Reasonably Foreseeable Actions\***

| Activity/Planning Document (if relevant)                                                                                                                                                                                                                                                                                                               | Location                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Action: Brightline train stop addition to Cocoa, Florida.<br><a href="https://www.floridatoday.com/story/news/local/2024/03/12/brightline-gives-green-light-to-cocoa-stop-for-its-rail-service/72940551007/">https://www.floridatoday.com/story/news/local/2024/03/12/brightline-gives-green-light-to-cocoa-stop-for-its-rail-service/72940551007/</a> | North<br>Cocoa<br>Brevard<br>Counties,<br>Florida |

Notes: CCSFS = Cape Canaveral Space Force Station; DOD = Department of Defense; FL = Florida; FY = fiscal year; KSC = Kennedy Space Center; LC = Launch Complex; LZ = Landing Zone; NASA = National Aeronautics and Space Administration; SLC = Space Launch Complex; SpaceX = Space Exploration Technologies Corp.

\* Reasonably foreseeable launch activities are discussed in Section 3.2.4.2.3, *Noise and Noise-Compatible Land Use, Reasonably Foreseeable Effects*, and listed in Appendix C.1.1, *Noise Assessment*, Section 7.

## 2.3 Alternatives Considered but Eliminated from Further Analysis

As discussed previously, through an alternative screening process based on Starship-Super Heavy requirements and the purpose and need, the 2019 EA established LC-39A as the approved location for Starship-Super Heavy operations; SLC-40 within CCSFS and SLC-4 within Vandenberg Air Force Base were considered as alternatives but were not carried forward (NASA, 2019a). Currently, infrastructure development in support of Starship-Super Heavy at LC-39A based on NASA's 2019 FONSI is already underway. As a result, because LC-39A is already the approved location for Starship-Super Heavy operations alternative locations are not considered within the context of this EIS.

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## Chapter 3. Affected Environment and Environmental Consequences

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### 3.1 Introduction

This chapter identifies the resources and defines the related regulatory setting for those potentially affected by development and operations under the Proposed Action and No Action Alternative. For each resource a description of the existing condition is provided, as well as an analysis of potential environmental consequences (i.e., effects) associated with Proposed Action activities and the No Action Alternative. Additionally, this chapter identifies any monitoring and mitigation actions that would be implemented to avoid, minimize, or compensate for identified effects. After a ROD is signed, a Mitigation Plan would be developed in coordination with the applicant, the FAA, and cooperating agencies to formulate direction for implementing the mitigations selected as part of the decision. Implementation of identified mitigations, such as monitoring, would utilize an “adaptive management” approach, wherein continuous data gathering and analyses would be utilized to improve future management strategies within the action area.

At the end of each resource subsection, a summary is provided that summarizes the analysis and associated conclusion(s). It should be noted that while it is acknowledged that there may be landings occurring in the ocean, the goal is for all landings to occur at LC-39A. Therefore, analysis addresses all landings occurring at LC-39A with the potential for some occurring in the ocean (as described in Section 2.1.3.3, *Super Heavy and Starship Landings*).

### 3.2 Noise and Noise-Compatible Land Use

#### 3.2.1 Definition of Resource and Regulatory Setting

Noise is defined as unwanted sound. 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.

Noise affects several resource areas, and it is discussed in several sections of this EIS. Per the FAA Order 1050.1F Desk Reference (FAA, 2023b), this section concentrates on general noise effects to humans and structures. Noise effects on socioeconomics and children’s [environmental health and safety risks](#) are discussed in Section 3.4, *Socioeconomics and Children’s Environmental Health and Safety Risks*, effects on historical, architectural, and cultural resources are discussed in Section 3.5, *Historical, Architectural, Archaeological, and Cultural Resources*, and effects on biological resources are discussed in Section 3.8, *Biological Resources*.

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. Noise metrics used in this EIS are described briefly below, and in greater detail in Appendix C.1, *Noise Assessment and Noise Assessment Appendix*.



**Decibel (dB).** Noise levels are expressed in logarithmic units of dB. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB; sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 to 140 dB are felt as pain. The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. The human ear perceives a doubling (or halving) of a sound's loudness when the sound level changes by 10 dB and a quadrupling (or quartering) of loudness when the sound level changes by 20 dB.

**Weighted Decibel (dB).** Sound levels that have been adjusted to account for frequencies heard best by the human ear are designated A-weighted dB (dBA) levels. Clapping or banging sounds (e.g., sonic booms), are sometimes described using C-weighted dB (dBC), which best account for the full experience of these impulsive sounds. Noise frequencies with potential to induce structural vibrations include frequencies that are inaudible to the human ear, and structural effects are often assessed using unweighted dB.

**Maximum Sound Level ( $L_{\max}$ ).** The  $L_{\max}$  is the highest sound level measured during a single event in which the sound level changes with time (e.g., a rocket launch). Maximum A-weighted sound level ( $LA_{\max}$ ) is useful for prediction of activity interference (e.g., speech interference), while unweighted  $L_{\max}$  is one metric used in assessment of potential effects to structures.

**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. The SEL metric is useful for prediction of sleep disturbance. For events such as rocket launches, SEL is higher than  $L_{\max}$  because SEL reflects noise energy accumulated over multiple seconds.

**Day-Night Average Sound Level (DNL).** The DNL noise metric is the dB-averaged sound level measured over a 24-hour period, with a 10 dB penalty assigned to noise events occurring between 10:00 p.m. and 7:00 a.m. to account for added intrusiveness of late-night noise. DNL is the primary noise metric of the FAA, DOD, and USEPA. Studies of community annoyance in response to numerous types of environmental noise show that there is a positive correlation between DNL and the percent of the population that can be expected to be highly annoyed by the noise.

**Sonic Boom Overpressure measured in Pounds per Square Foot (psf).** A sonic boom is a pressure wave created when an object moves through air faster than the speed of sound. The magnitude of the pressure change (i.e., the overpressure) is affected by several factors including the size, weight, shape, and speed of the object as well as atmospheric conditions. The psf metric is useful for describing listener experiences and assessing potential for structural damage.

**C-Weighted Day-Night Average Sound Level (CDNL).** The CDNL metric is a version of the DNL metric described above calculated based on dBC levels. Because C-weighted sound levels are different from A-weighted sound levels and are associated with different effects, CDNL cannot be added to A-weighted DNL to yield meaningful results and must be discussed separately.

**Peak Particle Velocity (PPV).** This metric can be used to describe the vibratory motion of objects. The PPV metric is used in assessments of the potential for effects to structures.

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 Part 150 establish that noise-sensitive land uses, such as residential areas, are generally not compatible with noise levels greater than 65 dBA DNL. For impulsive noises (i.e., banging sounds such as sonic booms), the FAA uses 60 dB CDNL as the threshold level above which not all land uses are considered compatible. In terms of the percentage of people highly annoyed, 60 dB CDNL is considered equivalent to 65 dBA DNL (National Research Council, 1981). The FAA has established environmental effects significance thresholds based on the DNL and CDNL metrics, which

are described in Section 3.2.4, *Environmental Consequences*. Land use noise compatibility analysis considers the effects of noise on special management areas, such as national parks, National Wildlife Refuges (NWRs), and other sensitive noise receptors, where a quiet setting is a generally recognized purpose and attribute.

FAA Order 1050.1F Desk Reference, Section 11.5.4.2, *Noise Prediction Modeling*, recommends that supplemental noise metrics be used in addition to the DNL metric to characterize specific effects, such as activity interference. Noise events exceeding background sound levels are likely to be noticed. Noise levels exceeding 90 dB LA<sub>max</sub> 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. The Federal Interagency Committee on Aviation Noise has recommended a conservative quantitative method for estimation of behavioral awakenings (which is indicated by the awakened test subject pushing a button) in residential settings associated with sounds that are new to an area (FICAN, 1997). According to the conservative method published by the Federal Interagency Committee on Aviation Noise, and assuming that structures provide at least 15 dB noise level reduction, less than 16 percent of people sleeping indoors are expected to be awakened by exterior noise levels of up to 110 dBA SEL, and less than 11 percent of people sleeping indoors are awakened by exterior noise levels up to 100 dBA SEL. People sleeping in transient lodgings (e.g., hotels) that have never experienced the noise source, as well as people sleeping in locations with no structural noise attenuation (e.g., camping in a tent), would be expected to have a higher probability of being awakened. Sonic booms with overpressures less than 1 psf may or may not be noticed depending on ambient sound levels, the activity of the listener at the time of the boom, and other factors. Booms with magnitudes higher than 1 psf are likely to be noticed and may startle listeners. The DOD Noise Working Group has published a preliminary relationship between sonic boom intensity and the percentage of people experiencing a behavioral awakening or sleep disturbance, which is recognized as being based on limited data available (DNWG, 2024). “Sleep disturbance” indicates that the test subject experienced a change in sleep stage, as shown by electroencephalogram readings. Additional details on the calculations used to estimate percent awakened are provided in Appendix C.1, *Noise Assessment and Noise Assessment Appendix*. In a residence with windows open, approximately 16 percent of people would be expected to be awakened by a sonic boom at 1 psf, 38 percent would be awakened at 3 psf, and 48 percent would be awakened by a sonic boom at 5 psf. The sensitivity of individuals to noise and sonic booms is highly variable. For example, older individuals are more likely to be awakened by loud sounds, such as sonic booms, than younger individuals (Smith & Hutto, 1972).

Hearing conservation recommendations published by the National Institute for Occupational Safety and Health and adopted in Kennedy NASA Procedural Requirements (KNPR) 1820.3, as well as DAF Instruction 48-127, *Occupational Noise and Hearing Conservation Program*, are applicable to workplace environments but are also referenced in this EIS as a conservative threshold for hearing conservation in non-workplace settings. The KNPR define a relationship between noise duration and noise level under which exposure to noise at 108 dB for 2 minutes (i.e., the approximate duration of elevated noise levels during a launch) is permissible. The KNPR also state that exposure to impulsive noise (i.e., 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 psf. However, the noise energy contained in sonic booms is primarily at frequencies too low to pose a risk to human hearing mechanisms (CHABA, 1992). Tests on subjects exposed to simulated air-bag noises at peak levels as high as 80 psf showed that small, temporary threshold shifts in hearing were mainly caused by high-frequency noise, rather than the low-frequency energy typical of sonic booms and sonic booms (Sommer & Nixon, 1973). Sonic booms ranging from 50 to 144 psf (generated by fighter aircraft overflights as low as 85 feet above ground level) caused no direct injury to exposed researchers (Nixon, Hille, Sommer, & Guild, 1968). The high-frequency noise energy in sonic booms of intensities associated with typical vehicle overflights is not sufficiently high to harm

hearing mechanisms (DNWG, 2024). The National Institute for Occupational Safety and Health recommendations 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 effect threshold when applied to people who experience rocket noise on an irregular basis. People that are indoors when an outdoor noise event, such as a rocket launch, occurs are exposed to substantially lower noise levels (Klepeis, et al., 2001).

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. The National Academy of Sciences' *Guidelines for Preparing Environmental Impact Statements on Noise* state that one may conservatively consider all sound lasting more than 1 second with levels exceeding 130 dB (unweighted) as potentially damaging to structures (National Academy of Sciences, 1977). A study of structural damage claims from rocket ground tests indicates that, based on unweighted  $L_{max}$ , approximately one damage claim will result per 100 households exposed at 120 dB and one damage claim per 1,000 households exposed at 111 dB, but the study did not characterize the nature of the damage that may result from these claims (Guest & Slone, 1972). That study was based on community responses to 45 ground tests of the first and second stages of the Saturn V rocket system conducted in Southern Mississippi over 5 years in the 1960s. It is important to note that the sound levels collected were for static ground tests from rocket engines, which were generally of greater durations than the exposure expected during a launch event. In addition, during ground tests, the engine remains in one position, which results in a longer exposure duration to continuous levels as opposed to the transient noise occurring from a moving vehicle during a launch event. Therefore, as noted by Guest and Slone (1972), the  $L_{max}$  values of 111 dB and 120 dB may be used as a very conservative threshold for potential risk of structural damage claims.

More recently, in 2016, the United Kingdom Ministry of Defense Land Ranges commissioned a study to ascertain whether test, evaluation, demilitarization, and training activities of items such as weapons systems, ordnance, and munitions (i.e., short duration, transient sound) would cause structural damage (Fenton & Methold, 2016). Unlike the Guest and Slone study, the Fenton and Methold study developed criteria to assess the likelihood of structural damage. To create the criteria, the study reviewed previous similar studies, relevant British Standards, and academic literature, and it ultimately relied on the U.S. Bureau of Mines and British Industry Standards as key information sources. There is consensus that damage becomes improbable below 140 dB. No glass or plaster damage is expected below 140 dB.

At sonic boom overpressures below 1 psf, no damage to structures is expected. At less than 2 psf, damage to structures is extremely unlikely (Haber & Nakaki, 1989). There is a 1/10,000 probability of breakage for a large window at approximately 2 psf and a 1/10,000 probability of breakage for a small window at approximately 4 psf (USACE, 1989). Windows that are pre-damaged or in poor condition could possibly exhibit progression of damage over multiple exposures to booms between 2 and 4 psf (Higgins, 1965). At 10 psf, superficial damage to brittle structural elements such as plaster and damage to windows becomes more likely but is generally still expected to be very low probability and predominantly due to poor existing conditions such as pre-cracked, prestressed, older and weakened, or poorly mounted windows (Maglieiri et al., 1966; White, 1972; Benson, 2013; Fenton & Methold, 2016). Damage associated with noise and sonic booms is typically limited to lightweight or brittle structural elements, such as windows and plaster. More massive structural elements (e.g., elements providing structural integrity) are affected by noise and sonic booms to much a lesser degree. The level of risk to structures is discussed in greater detail in Appendix C.1, *Noise Assessment and Noise Assessment Appendix*.

The Noise Control Act of 1972 (Public Law 92-574) directs Federal agencies to comply with applicable Federal, state, and local noise control regulations. Several Federal regulations governing noise are discussed above. The State of Florida, counties near KSC, and local jurisdictions near KSC have not

established maximum noise level limitations that apply to rocket operations, which are conducted in conformity with applicable Federal and state regulations. Brevard County Code of Ordinances §62-2271 exempts construction noise generated between 7:00 a.m. and 8:00 p.m. from noise disturbance standards.

The hazard area, which is evacuated prior to rocket operations, is designed to minimize risks to people—including potential effects associated with noise and vibration—in the event of an off-nominal event (e.g., rocket failure). Noise levels that could be generated by an off-nominal event would depend on the details of the event (e.g., location and type of rocket failure). In the event that a launch or landing results in structural damage, the FAA requires that SpaceX carry insurance in the amount of the “Maximum Probable Loss,” which is determined on a launch-by-launch basis by the FAA and is up to \$500 million per launch. The FAA requires SpaceX to maintain insurance in the unlikely event of claims of structural damage resulting from flight of the Starship/Super Heavy launch vehicle. Property owners may contact SpaceX directly ([insurance@spacex.com](mailto:insurance@spacex.com)) to submit claims and evidence in support of the damage claim.

### 3.2.2 Study Area

The study area for noise includes the area with the potential to be affected by noise from the proposed project. The analysis focuses on areas within which individual noise and sonic booms would be most likely to be disturbing or impactful (i.e., exceeding 90 dB  $LA_{max}$ , 90 dB SEL, 110 dB  $L_{max}$ , or 1 psf). It also includes the recovery area, which is located more than 5 nautical miles (8 kilometers) off the Atlantic coast, where most reentry sonic booms and some landings would occur.

The closest communities to LC-39A are Courtenay and the City of Titusville, which are approximately 12 miles (19 kilometers) southwest and west, respectively. Cape Canaveral and several other urban areas are located farther away or on Merritt Island, on the western shore of the Indian River, and along the Atlantic coast.

Noise-sensitive areas are areas where noise interferes with normal activities associated with its use. Normally, noise-sensitive areas include residential, educational, health, and religious structures and sites and parks, recreational areas, areas with wilderness characteristics, wildlife refuges, and cultural and historical sites. Representative noise-sensitive locations selected for detailed noise effects assessment are listed in Table 3.2-1 and are shown in Figure 3.2-1. The representative locations were selected because they are near many other sensitive locations (e.g., the parks listed are near residences, schools, daycares, etc.) and include a range of distances from LC-39A. In general terms, locations farther from LC-39A would experience lower noise levels associated with Starship-Super Heavy operations. Noise levels described for the representative sensitive locations would be like those experienced nearby or at the same distance from LC-39A.



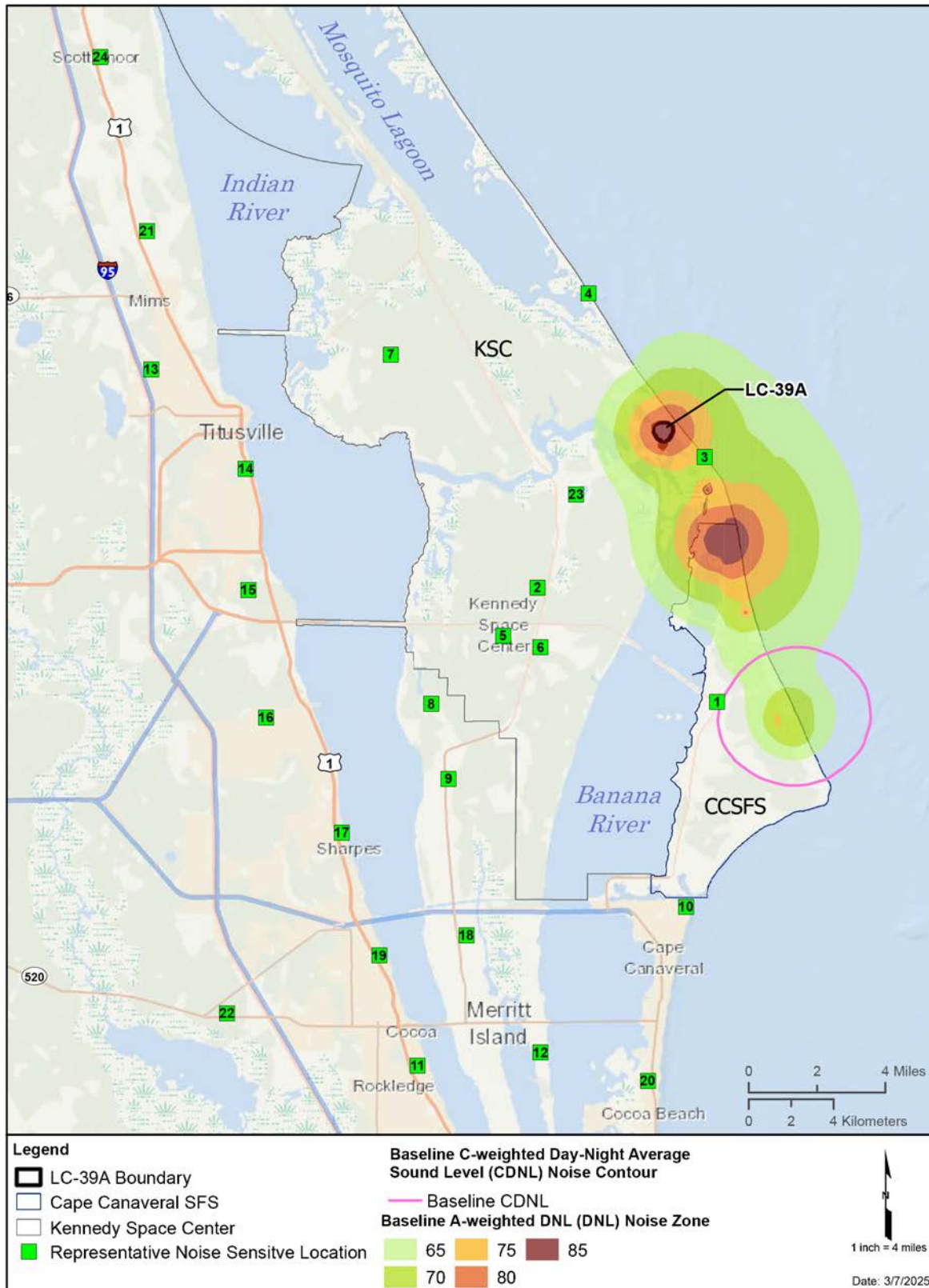


Figure 3.2-1. Baseline A-Weighted Day-Night Average Sound Level (DNL) and C-Weighted Day-Night Average Sound Level (CDNL) Noise Contours

**Table 3.2-1. Representative Noise-Sensitive Locations**

| ID | Location Description                                   | City/Community  | Category <sup>1</sup> | Latitude     | Longitude    |
|----|--------------------------------------------------------|-----------------|-----------------------|--------------|--------------|
| 1  | CCSFS Representative Location                          | CCSFS           | Various               | 28.493334 °N | 80.578592 °W |
| 2  | SpaceX Operations Area                                 | KSC             | Various               | 28.541982 °N | 80.665036 °W |
| 3  | Titusville Beach                                       | KSC             | Recreation            | 28.597248 °N | 80.584332 °W |
| 4  | Playalinda Beach                                       | KSC             | Recreation            | 28.666931 °N | 80.640046 °W |
| 5  | Kennedy Space Center Visitor Complex                   | KSC             | Recreation            | 28.521605 °N | 80.681668 °W |
| 6  | KSC Child Development Center                           | KSC             | School                | 28.516664 °N | 80.663637 °W |
| 7  | Merritt Island National Wildlife Refuge Visitor Center | KSC             | Recreation            | 28.641282 °N | 80.7355 °W   |
| 8  | Pine Island Conservation Area/Pine Island Estates      | Merritt Island  | Recreation            | 28.492903 °N | 80.716337 °W |
| 9  | Kings Park Estates - Courtenay                         | Courtenay       | Residential           | 28.460988 °N | 80.708112 °W |
| 10 | Jetty Park Campground                                  | Cape Canaveral  | Recreation            | 28.40639 °N  | 80.594016 °W |
| 11 | Rockledge High School                                  | Rockledge       | School                | 28.339163 °N | 80.723326 °W |
| 12 | Merritt Island                                         | Merritt Island  | Residential           | 28.344603 °N | 80.664185 °W |
| 13 | Oak Park Elementary School                             | Titusville      | School                | 28.63516 °N  | 80.851085 °W |
| 14 | Titusville High School                                 | Titusville      | School                | 28.592831 °N | 80.805446 °W |
| 15 | Summerwood Villas                                      | Titusville      | Residential           | 28.541226 °N | 80.804303 °W |
| 16 | Atlantis Elementary School                             | Port Saint John | School                | 28.487197 °N | 80.795901 °W |
| 17 | Fairglen Elementary School                             | Cocoa           | School                | 28.438281 °N | 80.759597 °W |
| 18 | Lewis Carroll Elementary School                        | Merritt Island  | School                | 28.394415 °N | 80.699706 °W |
| 19 | Cocoa                                                  | Cocoa           | Residential           | 28.385957 °N | 80.741665 °W |
| 20 | Cocoa Beach                                            | Cocoa Beach     | Residential           | 28.332381 °N | 80.612675 °W |
| 21 | Pinegrove Estates                                      | Mims            | Residential           | 28.693979 °N | 80.852874 °W |
| 22 | Fern Meadows                                           | West Cocoa      | Residential           | 28.361476 °N | 80.814906 °W |
| 23 | KSC Office                                             | KSC             | Administrative        | 28.581582 °N | 80.64623 °W  |
| 24 | The Rock Church                                        | Fontaine Grant  | Place of Worship      | 28.768077 °N | 80.875282 °W |

Notes: ° = degrees; - = minus; CCSFS = Cape Canaveral Space Force Station; ID = location identification number; KSC = Kennedy Space Center; N = North; SpaceX = Space Exploration Technologies Corp.; W = West.

<sup>1</sup> Land uses at each location include multiple activities, some of which may be disrupted by noise. For example, one of the recognized uses of Playalinda Beach is to provide visitors the opportunity to experience solitude and the sounds of nature. Locations were selected to be representative of locations with high sensitivity for human receptors. For example, the location chosen on Playalinda Beach is outside of the access restricted area and may host gatherings of onlookers during Starship-Super Heavy launches.

### 3.2.3 Existing Conditions

Rocket noise is a notable, occasional part of the acoustic environment in the study area. Noise levels in the study area when rocket operations are not underway vary by location depending primarily on the intensity and types of nearby human activities. Rural or remote areas typically have DNL less than 49 dB while urbanized commercial or industrial areas may have DNL 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).

In the 12-month period between September 2023 and August 2024, 79 of the 88 total launches from KSC and CCSFS were Falcon 9, 3 were Falcon Heavy, and 6 were other rocket types (see Appendix C.1, *Noise Assessment and Noise Assessment Appendix*, for additional details). This tempo of operations is considered to be baseline conditions for the purposes of this analysis. The tempo of launch operations has been increasing steadily in recent years, resulting in an increased frequency of loud noise events.

**Activity interference.** As described in the *Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station* (hereafter referred to as the 2020 Falcon EA), Falcon rocket operation noise levels exceed 90 dB LA<sub>max</sub> (a noise level with a high likelihood of being disruptive) only within the boundaries of KSC/CCSFS (FAA, 2020). Falcon launches generate noise levels between 90 and 100 dBA SEL, which could awaken up to 11 percent of affected people, in parts of the cities of Titusville, Port Saint John, Cape Canaveral, and Cocoa Beach. Landings of a booster at Landing Zone (LZ)-1 and/or LZ-2 generate noise levels that exceed 90 dBA SEL in portions of the cities of Cape Canaveral and Cocoa Beach. Sonic booms generated during landings are typically approximately 1 psf or lower in areas adjacent to KSC/CCSFS, resulting in a low likelihood of activity interference or sleep disturbance.

**Noise-Compatible Land Use.** Noise levels associated with rocket propulsion are below 65 dB DNL and sonic boom noise levels are below 60 dB CDNL at all locations outside of the boundaries of KSC and CCSFS that are publicly accessible during launches, as shown in Figure 3.2-1. The noise levels shown in the figure reflect all ongoing rocket operations at KSC and CCSFS, not only those conducted by SpaceX. Beach area that is affected by levels exceeding 65 dB DNL and 60 dB CDNL that are not owned by KSC or CCSFS are not accessible to members of the public during rocket operations due to safety considerations. These areas are not considered noise-sensitive to humans, because no members of the public are present when loud events occur.

Table 3.2-2 lists DNL and CDNL at representative sensitive locations under existing (i.e., baseline) conditions. Noise levels less than 45 dB DNL are similar to typical ambient sound levels and are listed as “<45.” Sonic boom noise levels less than 45 dB CDNL are below relevant impact thresholds and are similarly listed as “<45” where values are below 45 dB.

**Table 3.2-2. Baseline A-Weighted Day-Night Average Sound Level (DNL) and C-Weighted Day-Night Average Sound Level (CDNL) at Representative Sensitive Locations**

| ID | Location Description                                   | DNL (dB) | CDNL (dB) |
|----|--------------------------------------------------------|----------|-----------|
| 1  | CCSFS Representative Location                          | 61.9     | 59.6      |
| 2  | SpaceX Operations Area                                 | 54.3     | 50.2      |
| 3  | Titusville Beach                                       | 75.0     | 52.1      |
| 4  | Playalinda Beach                                       | 53.7     | 45.2      |
| 5  | Kennedy Space Center Visitor Complex                   | 51.0     | 48.9      |
| 6  | KSC Child Development Center                           | 52.5     | 51.5      |
| 7  | Merritt Island National Wildlife Refuge Visitor Center | 46.2     | <45       |
| 8  | Pine Island Conservation Area/Pine Island Estates      | 46.2     | 46.6      |

**Table 3.2-2. Baseline A-Weighted Day-Night Average Sound Level (DNL) and C-Weighted Day-Night Average Sound Level (CDNL) at Representative Sensitive Locations**

| ID | Location Description            | DNL (dB) | CDNL (dB) |
|----|---------------------------------|----------|-----------|
| 9  | Kings Park Estates - Courtenay  | <45      | 46.8      |
| 10 | Jetty Park Campground           | 48.4     | 53.0      |
| 11 | Rockledge High School           | <45      | <45       |
| 12 | Merritt Island                  | <45      | 45.0      |
| 13 | Oak Park Elementary School      | <45      | <45       |
| 14 | Titusville High School          | <45      | <45       |
| 15 | Summerwood Villas               | <45      | <45       |
| 16 | Atlantis Elementary School      | <45      | <45       |
| 17 | Fairglen Elementary School      | <45      | <45       |
| 18 | Lewis Carroll Elementary School | <45      | 45.3      |
| 19 | Cocoa                           | <45      | <45       |
| 20 | Cocoa Beach                     | <45      | 46.0      |
| 21 | Pinegrove Estates               | <45      | <45       |
| 22 | Fern Meadows                    | <45      | <45       |
| 23 | KSC Office                      | 59.7     | 50.4      |
| 24 | The Rock Church                 | <45      | <45       |

Notes: < less than; CCSFS = Cape Canaveral Space Force Station; CDNL = C-weighted day-night average sound level; dB = decibels; DNL = day-night average sound level; ID = location identification number; KSC = Kennedy Space Center; SpaceX = Space Exploration Technologies Corp.

**Hearing Conservation.** As described in the 2020 Falcon EA, Falcon rocket engine noise exceeds 108 dB LA<sub>max</sub> (a conservative threshold for hearing conservation) only within the boundaries of KSC/CCSFS and offshore areas (FAA, 2020). During launch and landing operations, access to these areas is tightly restricted. Any people outdoors in the affected area while launch and landing operations are under way are equipped with protective equipment in accordance with applicable regulations. Most of the surface area affected by sonic booms generated by ongoing operations experience overpressures of 0.25 to 0.5 psf, which is like distant thunder. Launches toward the south (i.e., polar trajectories), which occur six times per year under baseline conditions, generate sonic booms that affect land areas approximately 60 miles (97 kilometers) south of KSC. Sonic boom intensities are less than 4 psf (conservative hearing conservation threshold) in all areas except about 0.01 square miles (0.03 square kilometers). The risk of damage to hearing associated with engine noise and sonic booms is minimal.

**Structural Damage Potential.** As discussed in the 2020 Falcon EA, Falcon rocket operations engine unweighted maximum noise levels exceed 111 dB (a noise level associated with a 1 in 1,000 chance of a structural damage claim) only within KSC/CCSFS boundaries and offshore areas. Noise levels outside the boundaries of KSC/CCSFS are well below 130 dB L<sub>max</sub>, a level at which minor structural damage associated with sounds lasting more than 1 second (as opposed to claims of damage) is more plausible. Most sonic booms generated by launches affect areas offshore (FAA, 2020). During relatively infrequent polar launches only very small land areas located approximately 60 miles (97 kilometers) south of KSC are exposed to booms exceeding 4 psf (FAA, 2020). In areas adjacent to KSC/CCSFS, sonic booms generated



during landings typically generate sonic booms of 1 psf or lower that are not expected to damage structures.

During scoping, commenters noted that rattle of structural elements during some rocket operations was a cause for concerns about potential for structural damage. Whether an object, such as a windowpane, will rattle depends on characteristics of the object (e.g., its mass, orientation relative to the sound source, and looseness-of-fit in a surrounding structure) as well as characteristics of the noise. In general, rattle of objects is potentially annoying, but is not necessarily associated with damage. The risk of damage to structures in areas outside the boundaries of KSC/CCSFS associated with ongoing operations is very low, as discussed in the previous paragraph. In general, non-historic structures on KSC are designed to withstand forces known to exist on KSC, which include storm force winds and vibrations associated with rocket operations. In the unlikely event that damage to a structure on KSC/CCSFS or outside the boundaries of KSC/CCSFS were to occur because of ongoing SpaceX operations, SpaceX would be responsible for resolving that damage. SpaceX is required by the FAA to maintain insurance in the event that their activities result in claims of structural damage. Property owners may contact SpaceX directly to submit claims and evidence in support of the damage claim.

### 3.2.4 Environmental Consequences

#### ***Analysis Methodology***

Potential noise effects could occur from the proposed construction or the proposed static fire tests, launches, and landings at LC-39A. 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 65 dBA DNL, or that will be exposed at or above the 65 dBA DNL level due to a 1.5 dBA DNL or greater increase, when compared to the No Action Alternative for the same timeframe. For supersonic noise levels, an increase of 1.5 dB to 60 dB CDNL (which has equivalent community reaction to 65 dBA DNL) would be considered significant. The FAA also considered activity interference, hearing conservation, and risk of structural damage in assessing whether impacts are expected to be significant.

Noise levels associated with static fire tests and subsonic portions of the launch/landing flight trajectories were estimated using the RNOISE model. Modeling in RNOISE considers factors including the differing effects of land and water on the transmission of sound, the atmospheric absorption of sound, and the trajectories of launch and landing operations. Use of the water deluge system currently installed at LC-39A during launches would reduce propulsion noise levels experienced at noise-sensitive locations relative to results presented in this section. Water deluge systems work by creating a curtain of water between the engines and the launch pad, absorbing and dissipating the sound energy. There is currently uncertainty regarding the amount of noise reduction provided by the deluge system. To ensure that effects are not underrepresented, noise levels presented in this EIS do not reflect reductions associated with use of the deluge system. This EIS presents noise levels associated with annual average atmospheric conditions (e.g., winds). Appendix C.1, *Noise Assessment and Noise Assessment Appendix*, includes assessment of time-varying effects of variable weather conditions on noise levels. The computer program PCBOOM, which is an FAA-approved model, was used to model sonic booms generated by supersonic segments of launch and landing operations. The noise modeling methodology (i.e., use of RNOISE) was reviewed

and is expected to be approved by the FAA Office of Environment and Energy prior to public release of the Final EIS.

### 3.2.4.1 No Action

Under the No Action Alternative, Starship-Super Heavy operations would not occur at LC-39A; however, other separate changes in operations at KSC and CCSFS would occur, which have been assessed for environmental effects pursuant to NEPA, resulting in changes to noise levels. The total number of launches per year at KSC and CCSFS would increase from 88 to 306, the number of landings is expected to increase from 13 to 64, and the number of static fire tests would increase from 87 to 373 under the No Action Alternative (see Section 2.2, *No Action Alternative*, for additional details). The increased tempo of rocket operations would result in increases in propulsion and sonic boom time-averaged noise levels on and near KSC and CCSFS. Rocket propulsion noise levels exceeding 65 dBA DNL would remain within the boundaries of KSC and CCSFS (Figure 3.2-2). However, if all of the launches involving landings at KSC/CCSFS included in the No Action Alternative occur in a given year, the sonic booms generated from those landings are expected to increase noise levels such that the CDNL 60 dB contour would extend into portions of the City of Cape Canaveral and parts of Merritt Island (Figure 3.2-3). As shown in Table 3.2-3, 9,152 acres of land outside KSC/CCSFS and an estimated 18,829 residents would be affected by sonic boom noise levels exceeding 60 dB CDNL. Propulsion noise levels at representative sensitive locations off of KSC and CCSFS would increase to as high as 56.8 dBA DNL, while sonic boom noise levels would increase to as high as 63.6 dB CDNL (Table 3.2-4).

**Table 3.2-3. Off-KSC/CCSFS Acres of Land and Estimated Number of Residents Affected by Greater than 60 dB CDNL Under the No Action Alternative**

| CDNL (dB)    | Off-KSC/CCSFS Land (acres) | Estimated Off-KSC/CCSFS Residents |
|--------------|----------------------------|-----------------------------------|
| 60-64        | 9,082                      | 18,824                            |
| 65-69        | 60                         | 3                                 |
| 70-74        | 10                         | 2                                 |
| 75-79        | 0                          | 0                                 |
| 80-84        | 0                          | 0                                 |
| ≥85          | 0                          | 0                                 |
| <b>Total</b> | <b>9,152</b>               | <b>18,829</b>                     |

Notes: - = minus; + = plus; ≥ = greater than or equal to; dB = decibels; CCSFS = Cape Canaveral Space Force Station; CDNL = C-weighted day-night average sound level; KSC = Kennedy Space Center.

Source: (U.S. Census Bureau, 2024a)

**Table 3.2-4. No Action Alternative A-Weighted and C-Weighted Day-Night Average Sound Level (DNL and CDNL) at Representative Sensitive Locations**

| ID | Location Description                 | On/Off-KSC/CCSFS | DNL (dBA) | CDNL (dB) |
|----|--------------------------------------|------------------|-----------|-----------|
| 1  | CCSFS Representative Location        | On               | 70.4      | 70.0      |
| 2  | SpaceX Operations Area               | On               | 60.1      | 61.6      |
| 3  | Titusville Beach                     | On               | 92.8      | 62.7      |
| 4  | Playalinda Beach                     | On               | 61.1      | 58.8      |
| 5  | Kennedy Space Center Visitor Complex | On               | 57.0      | 61.2      |

**Table 3.2-4. No Action Alternative A-Weighted and C-Weighted Day-Night Average Sound Level (DNL and CDNL) at Representative Sensitive Locations**

| ID | Location Description                                   | On/Off-KSC/CCSFS | DNL (dBA) | CDNL (dB) |
|----|--------------------------------------------------------|------------------|-----------|-----------|
| 6  | KSC Child Development Center                           | On               | 58.4      | 62.2      |
| 7  | Merritt Island National Wildlife Refuge Visitor Center | On               | 52.8      | 57.0      |
| 8  | Pine Island Conservation Area/Pine Island Estates      | Off              | 52.6      | 59.7      |
| 9  | Kings Park Estates - Courtenay                         | Off              | 51.5      | 60.0      |
| 10 | Jetty Park Campground                                  | Off              | 56.8      | 63.6      |
| 11 | Rockledge High School                                  | Off              | <45       | 56.4      |
| 12 | Merritt Island                                         | Off              | 46.9      | 58.8      |
| 13 | Oak Park Elementary School                             | Off              | <45       | <45       |
| 14 | Titusville High School                                 | Off              | 48.2      | <45       |
| 15 | Summerwood Villas                                      | Off              | 47.9      | 55.3      |
| 16 | Atlantis Elementary School                             | Off              | 47.2      | 55.5      |
| 17 | Fairglen Elementary School                             | Off              | 47.6      | 57.4      |
| 18 | Lewis Carroll Elementary School                        | Off              | 48.4      | 59.1      |
| 19 | Cocoa                                                  | Off              | 46.1      | 57.3      |
| 20 | Cocoa Beach                                            | Off              | 48.7      | 59.6      |
| 21 | Pinegrove Estates                                      | Off              | <45       | <45       |
| 22 | Fern Meadows                                           | Off              | <45       | <45       |
| 23 | KSC Office                                             | On               | 65.9      | 61.4      |
| 24 | The Rock Church                                        | Off              | <45       | <45       |

Notes: < = less than; CDNL = C-weighted day-night average sound level; DNL = day-night average sound level; ID = location identification number; CCSFS = Cape Canaveral Space Force Station; KSC = Kennedy Space Center; SpaceX = Space Exploration Technologies Corp.

### 3.2.4.2 Proposed Action

This section describes noise levels associated with proposed noise-generating activities (i.e., construction, facility operations, static fire tests, launches, and landings) and noise effects associated with the Proposed Action (e.g., activity interference, noise compatible land use, hearing conservation, and structural damage potential).

#### 3.2.4.2.1 Construction

Noise generated by heavy equipment during construction would be temporary and localized to the vicinity of the construction site. Construction noise levels at the closest community, approximately 12 miles (19 kilometers) from LC-39A, would not be audible. Construction workers and other people in known high-noise areas 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.

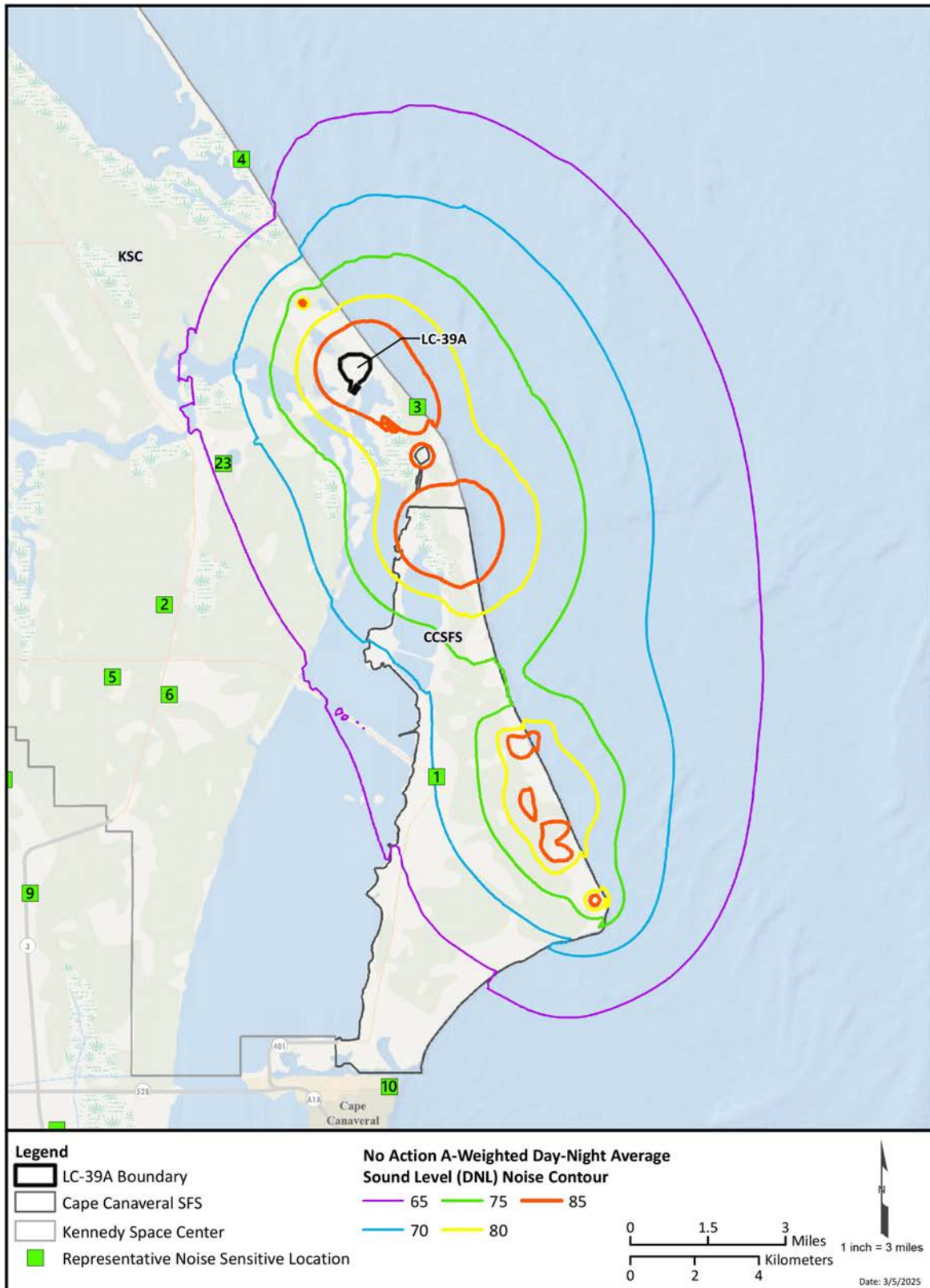


Figure 3.2-2. No Action A-Weighted Day-Night Average Sound Level (DNL) Noise Contours



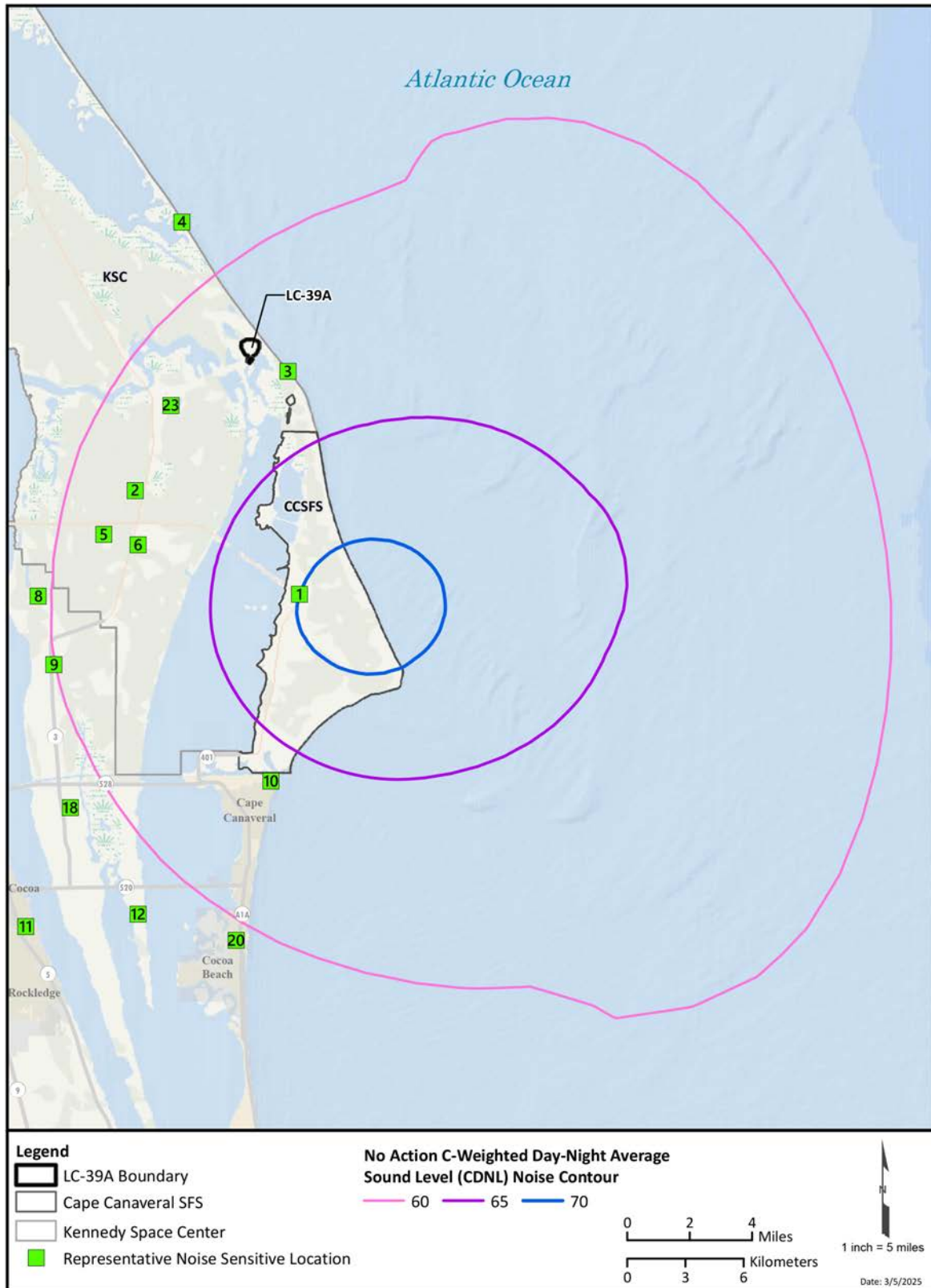


Figure 3.2-3. No Action C-Weighted Day-Night Average Sound Level (CDNL) Noise Contours

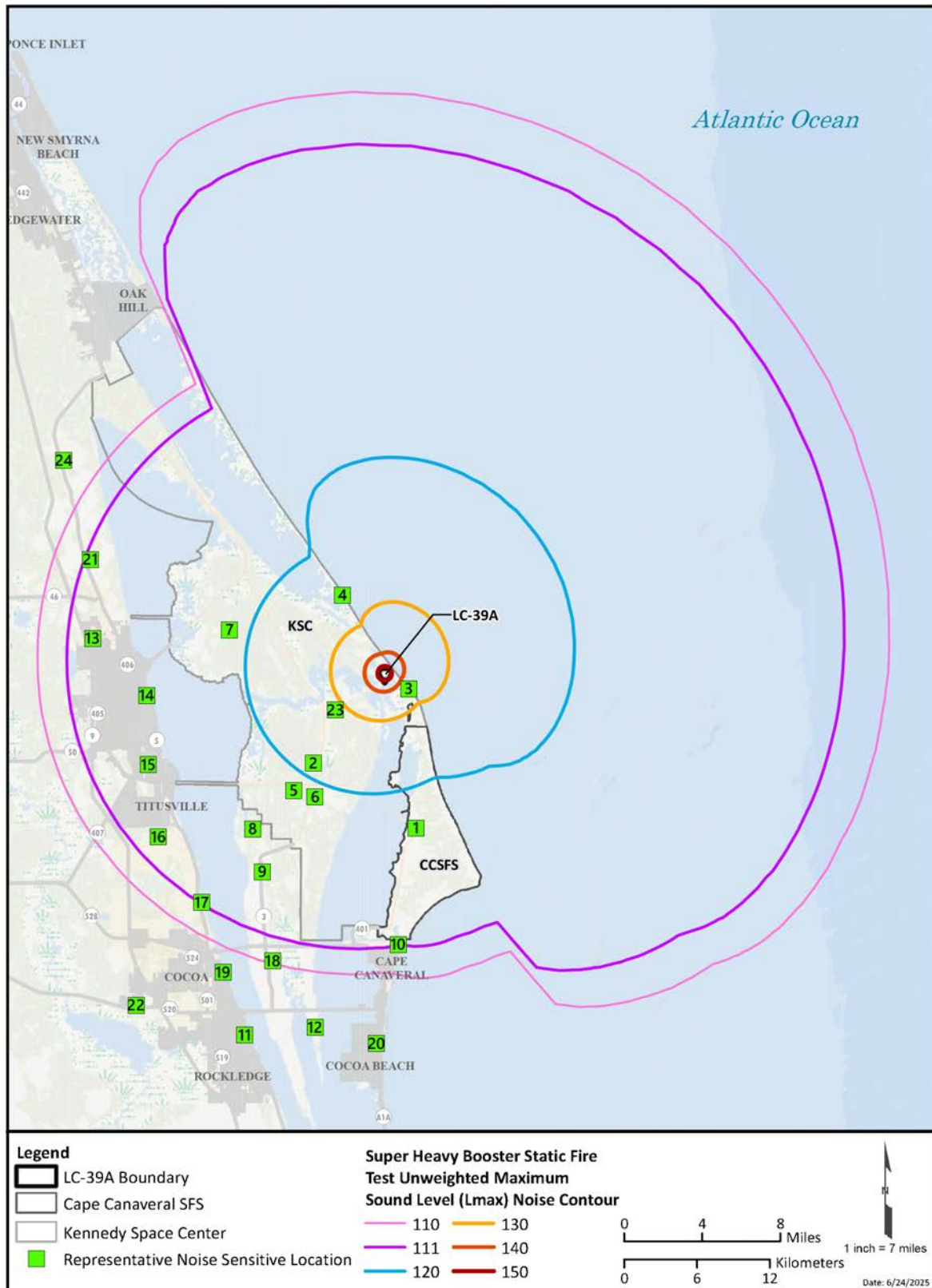
### 3.2.4.2.2 Operation

**Facility Operation.** Operation of new LC-39A infrastructure (i.e., propellant generation facilities, and Super Heavy Catch Tower) during tests or at other times when rocket operations are not under way simultaneously would add to the industrial acoustic environment that exists at LC-39A under existing conditions. Operation of the ASU and liquefaction facilities would generate noise with similar characteristics to noise generated by other industrial facilities at LC-39A (e.g., LOX farm) that were analyzed in the 2019 NASA EA (NASA, 2019a) and found to have no significant noise effects. Exact noise levels experienced outside the boundaries of LC-39A would depend on detailed ASU and liquefaction plant layout and equipment specifications, which are not known at this time. The loudest components of these facilities (e.g., compressors) are typically enclosed in structures, and air inlets/exhaust vents are equipped with silencers to reduce noise levels. Noise levels associated with similar facilities employing large compressors and other loud equipment generate noise levels of approximately 40 dBA at a distance of 1 mile (1.6 kilometers) (Stantec, 2023). Operations of proposed facilities in the context of similar noise generated by other industrial plant operations on LC-39A would not result in noise effects at noise-sensitive locations, which are located more than 1 mile (1.6 kilometers) away.

Loudspeakers are used at LC-39A and other launch complexes on KSC and CCSFS under existing conditions to communicate weather warnings and other important information. During launch events, loudspeakers are utilized for limited notifications, lasting a few seconds. The loudspeaker system is operated such that messages necessary for safety and operational purposes are clearly audible throughout the launch complex. Because areas close to the launch complex would typically be cleared of nonparticipants during rocket operations due to safety considerations, loudspeaker use associated with rocket operations would have limited potential to be disruptive to human activities. The proposed Starship-Super Heavy operations would moderately increase the amount of time per year in which loudspeakers would be audible in areas near LC-39A relative to baseline conditions.

**Static Fire Test.** SpaceX expects to conduct 44 booster and 44 Starship static fire tests per year, with each test planned to last for 15 seconds. Noise energy generated during the static fire tests would be directed primarily over the Atlantic Ocean. Super Heavy booster static fire tests would exceed 110 dB  $L_{max}$  in portions of Titusville, Mims, Port Saint John, Cocoa, Merritt Island, and the City of Cape Canaveral, as shown in Figure 3.2-4. Super Heavy booster static fire test noise levels exceeding 90 dB  $LA_{max}$  or 90 dB A-weighted SELs (ASELs) would not affect privately owned lands as shown in Figure 3.2-5 and Figure 3.2-6, respectively. Starship static fire tests have lower sound levels than Super Heavy booster static fire tests. Noise levels associated with Starship static fire tests would not exceed 90 dB  $LA_{max}$ , or 90 dB ASELs or 110 dB  $L_{max}$  in privately owned lands as discussed in Appendix C.1, *Noise Assessment and Noise Assessment Appendix*.

**Launch.** A water deluge system would be employed during each of the 44 proposed Starship-Super Heavy launches per year, dampening sound and vibration. As noted previously, launch noise levels presented in this EIS are conservative in that they do not account for the beneficial effects of the deluge system. Launches could occur at any time of day, and half of the proposed 44 launches per year would be assumed to occur between 10:00 p.m. and 7:00 a.m. As shown in Figure 3.2-7,  $LA_{max}$  would exceed 90 dB in portions of Titusville, Port Saint John, Cocoa, Merritt Island, and Cape Canaveral.

Figure 3.2-4. Super Heavy Booster Static Fire Test Unweighted Maximum Sound Level ( $L_{max}$ )

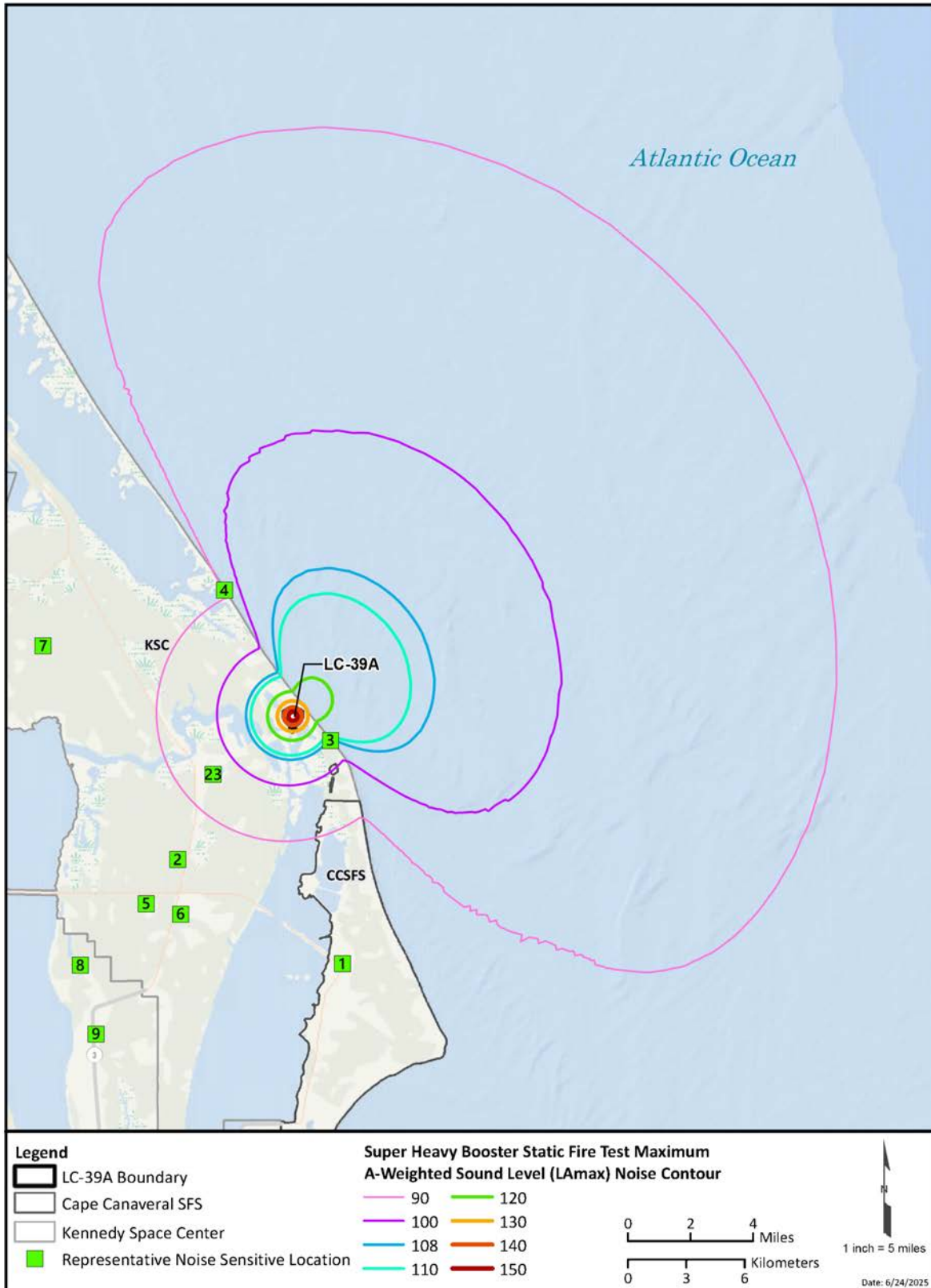


Figure 3.2-5. Super Heavy Booster Static Fire Test Maximum A-Weighted Sound Level ( $LA_{max}$ )



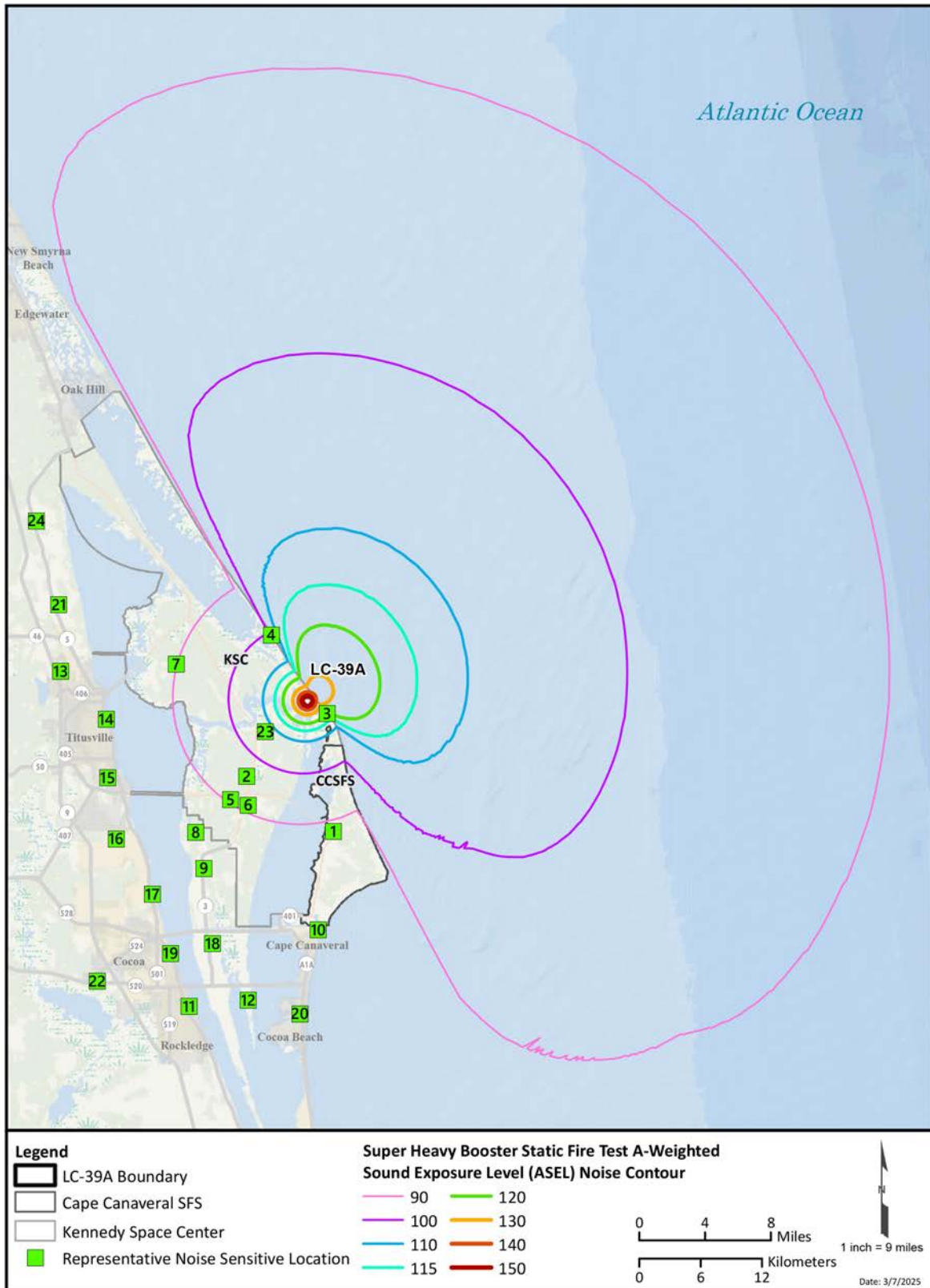
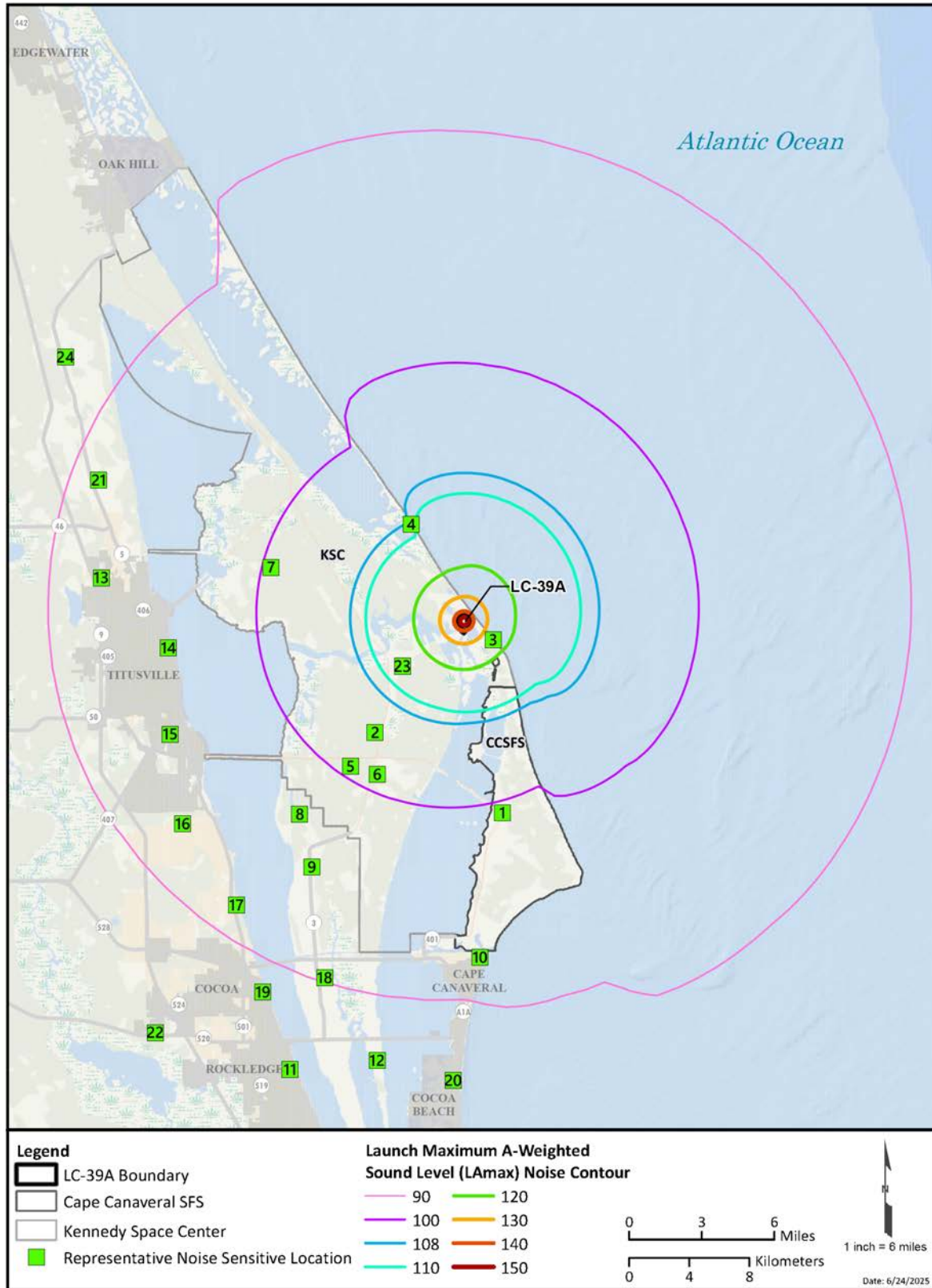


Figure 3.2-6. Super Heavy Booster Static Fire Test A-Weighted Sound Exposure Level (ASEL)

Figure 3.2-7. Launch Maximum A-Weighted Sound Level ( $LA_{max}$ )

Launch noise levels would exceed 90 dB ASEL in land areas within approximately 31 miles (50 kilometers) of LC-39A, which include the cities of Oak Hill, Mims, Titusville, Port Saint John, Cocoa, Rockledge, Cocoa Beach, Cape Canaveral, and Satellite Beach. Launches would exceed 100 dB ASELs in Titusville, Port Saint John, Merritt Island, and Cape Canaveral (Figure 3.2-8). Unweighted  $L_{\max}$  would exceed 110 dB in the cities of Oak Hill, Titusville, Cocoa, Rockledge, Cocoa Beach, Merritt Island, and Cape Canaveral (Figure 3.2-9).

Launch propulsion noise levels would be highest when Starship-Super Heavy is close to the ground and climbing along a nearly vertical flight path. As a result, propulsion noise levels are affected primarily by distance to the launch pad and whether the noise propagates over land or water. The heading of a launch has minimal effect on the propulsion noise levels represented in Figure 3.2-7, Figure 3.2-8, and Figure 3.2-9.

Sonic booms produced during vehicle ascent over the Atlantic Ocean are directed in front of the vehicle and do not affect land areas. Launch azimuths that would generate sonic booms over land areas (e.g., polar azimuth launches) are not included in the Proposed Action.

**Landing.** Landings of the Super Heavy booster would generate noise levels louder than those generated by Starship landings. Noise levels were considered for booster landings on the nominal trajectory (arriving from approximately due east) as well as the most northerly (40-degree) and southerly (115-degree) booster landing trajectories. Because the final portion of the landing—which is the loudest portion—is nearly vertical, areas affected by elevated propulsion noise levels are similar for all booster and Starship landing trajectories. Booster landings would generate an  $LA_{\max}$  of less than 90 dB outside the boundaries of KSC and CCSFS (Figure 3.2-10). ASEL would exceed 90 dB in the cities of Titusville and Merritt Island during booster landing, but noise levels exceeding 100 dB ASEL would not occur outside the boundaries of KSC and CCSFS (Figure 3.2-11). Unweighted  $L_{\max}$  would exceed 110 dB in portions of Merritt Island during landings of Super Heavy boosters (Figure 3.2-12). Noise levels associated with Starship landings would not exceed 90 dB  $LA_{\max}$ , 90 dB ASELs, or 110 dB  $L_{\max}$  in privately owned lands, as documented in Appendix C.1, Noise Assessment and Noise Assessment Appendix.

Sonic booms generated by Super Heavy booster and Starship landings would exceed 1 psf in portions of the cities of Oak Hill, Mims, Titusville, Port Saint John, Cocoa, Rockledge, Cocoa Beach, Satellite Beach, Melbourne, Merritt Island, and Cape Canaveral, as shown in Figure 3.2-13 and Figure 3.2-14, respectively. Ground areas affected by sonic booms differ widely between Starship and three representative booster landing trajectories reflecting widely varying locations and headings of the supersonic portions of these trajectories. Landings on variable trajectories would be similar to each other in terms of altitudes and airspeeds, generating sonic boom overpressure footprints with generally similar size and shape but different orientations relative to LC-39A. The sonic boom footprint associated with the modeled Starship RTLS trajectory was rotated clockwise and counterclockwise around LC-39A to identify areas in which booms could be expected to exceed overpressure thresholds during descents on notional LC-39A approach headings ranging from 153 to 310 degrees. As shown in Figure 3.2-14, Starship landings on any of the notional trajectories would be expected to exceed 1.7 psf only in offshore areas.

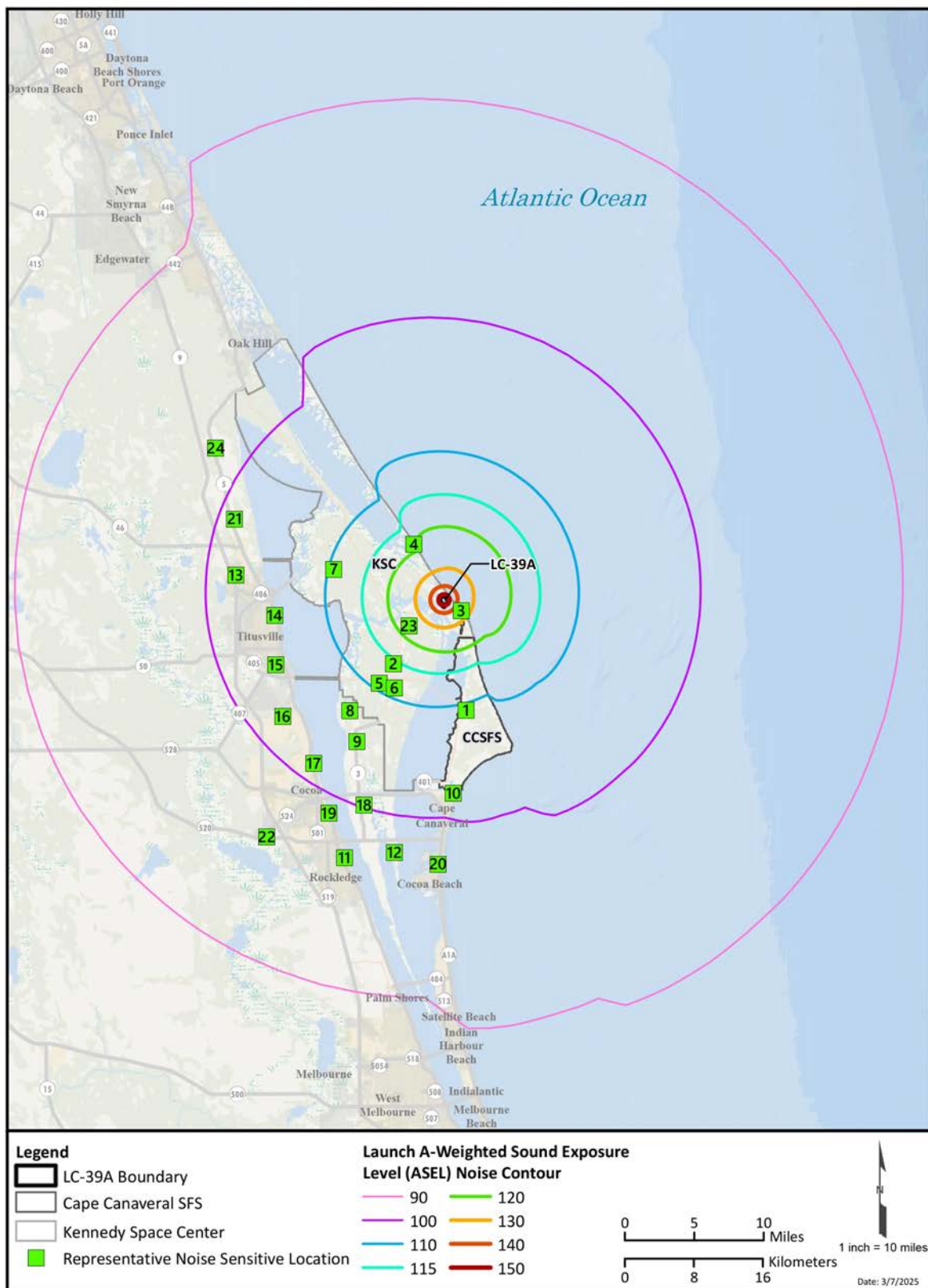
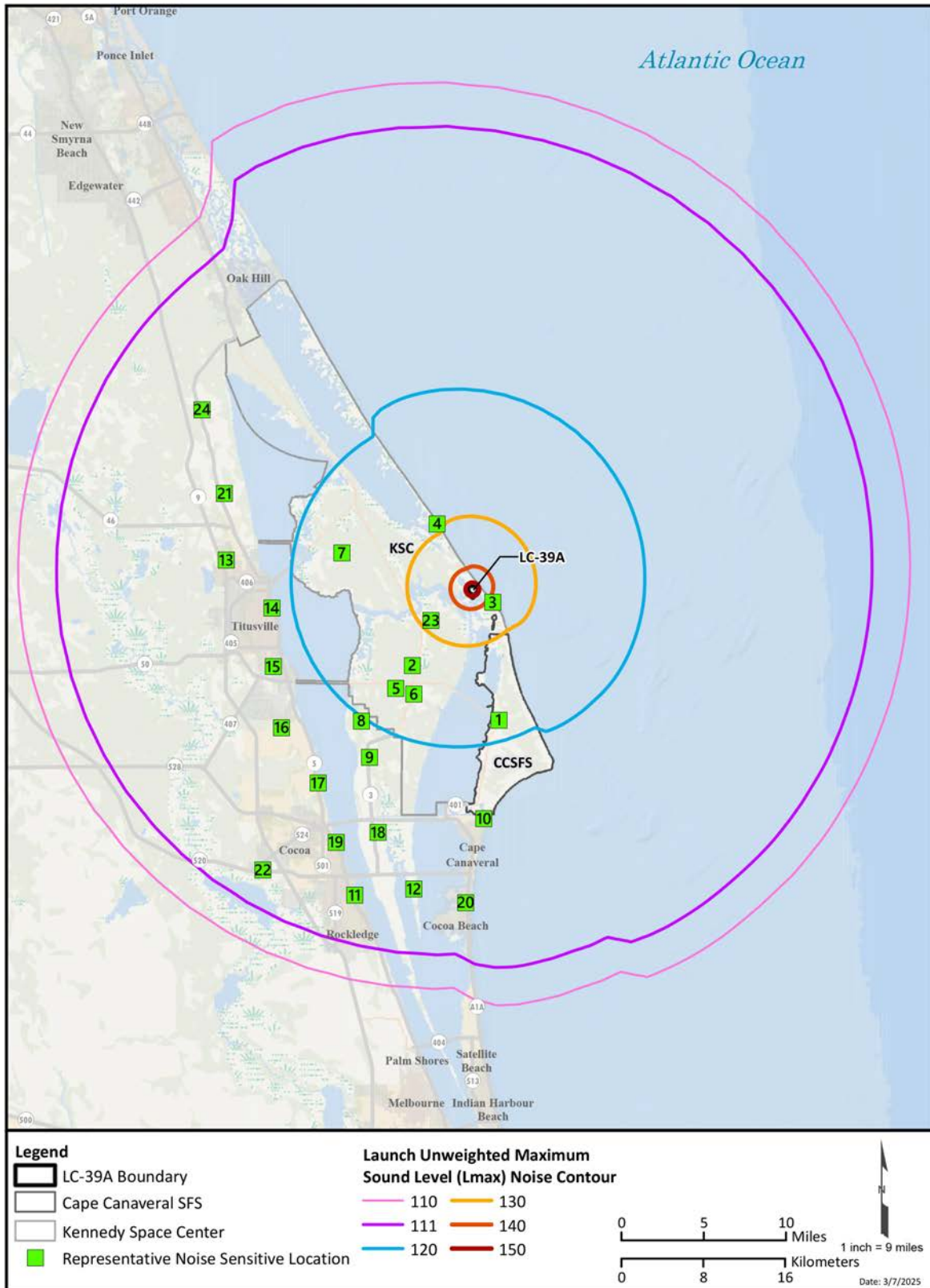
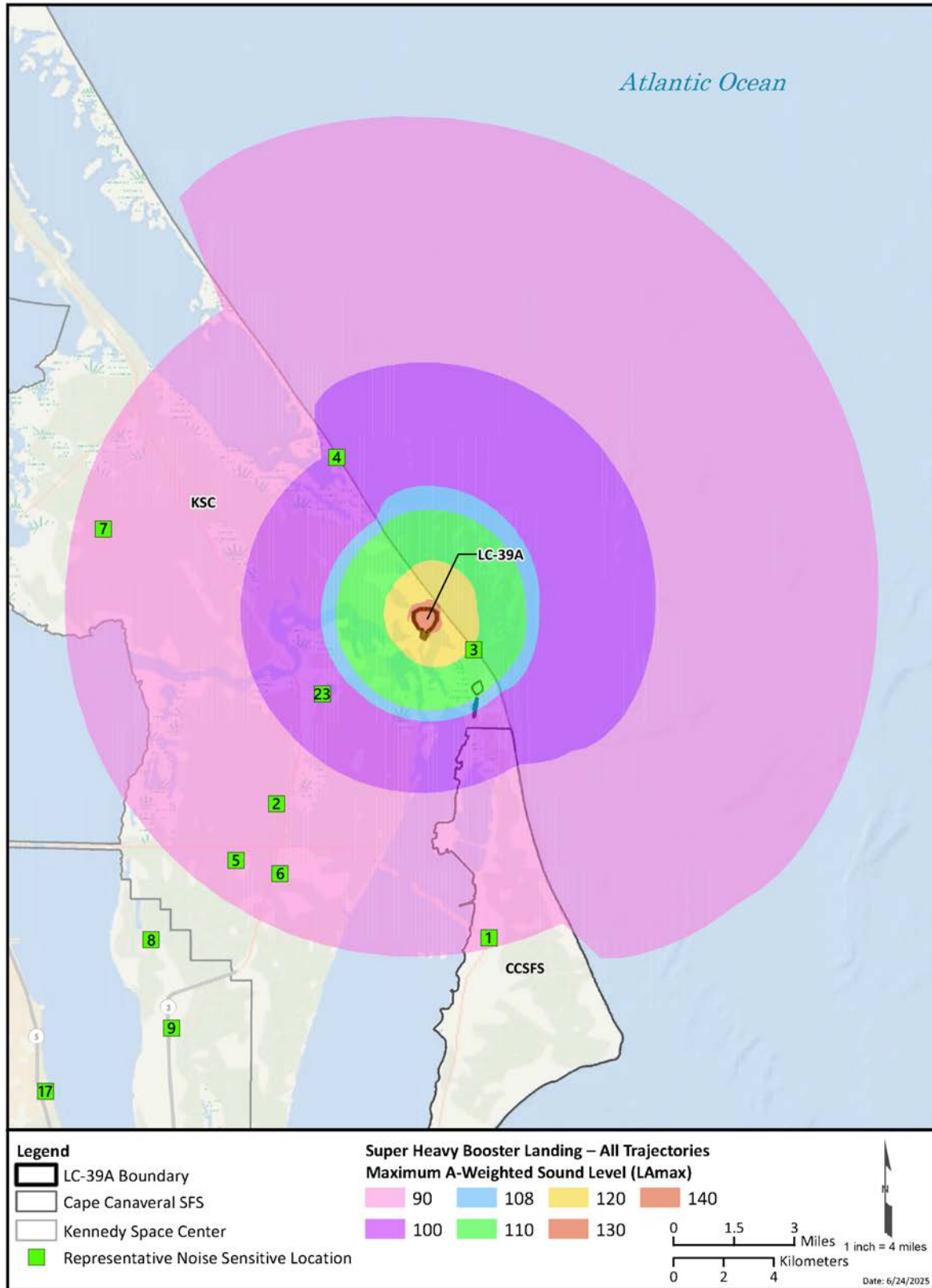


Figure 3.2-8. Launch A-Weighted Sound Exposure Level (ASEL)



Figure 3.2-9. Launch Unweighted Maximum Sound Level ( $L_{max}$ )

Figure 3.2-10. Super Heavy Booster Landing Maximum A-Weighted Sound Level (LA<sub>max</sub>)

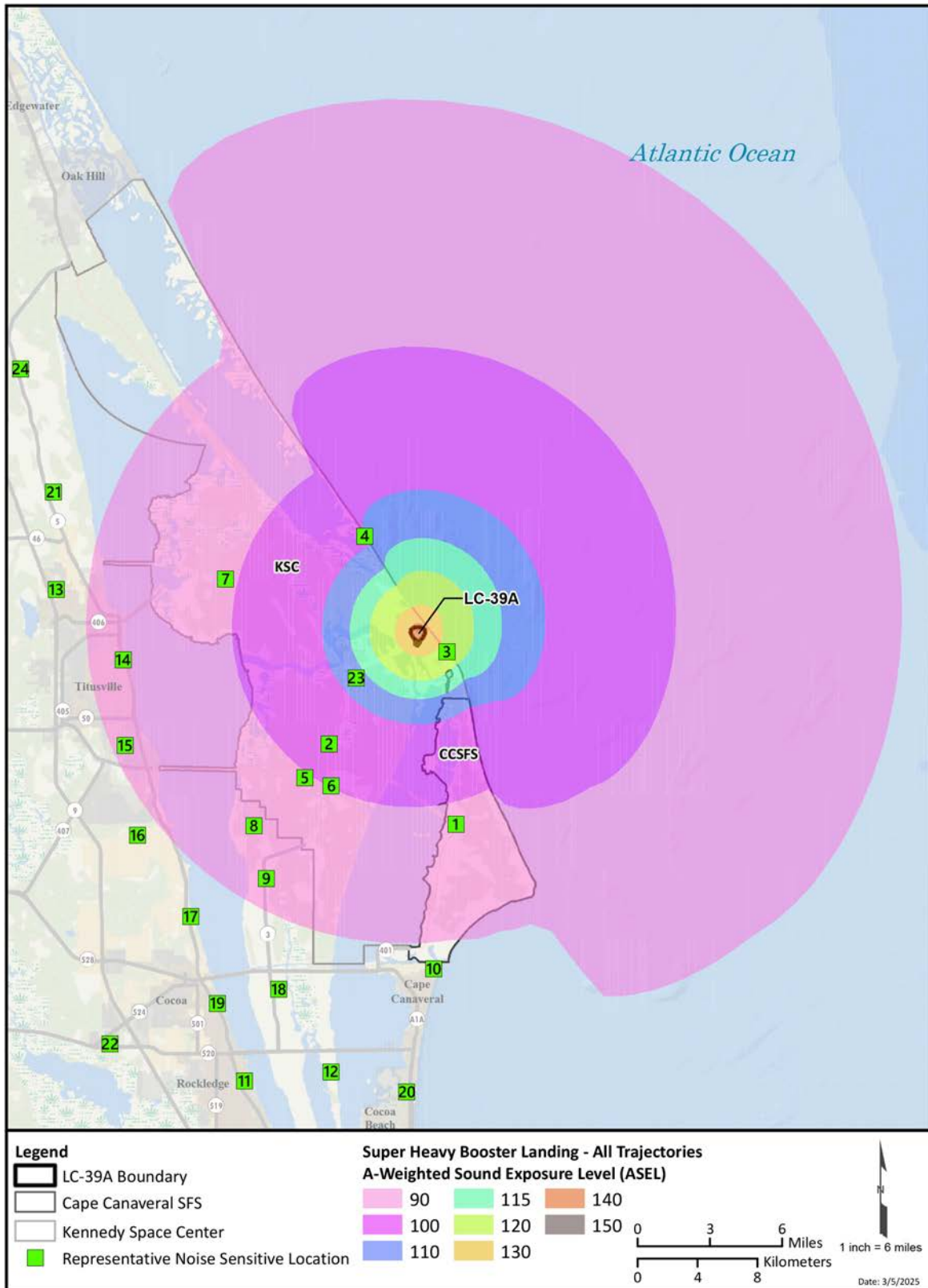
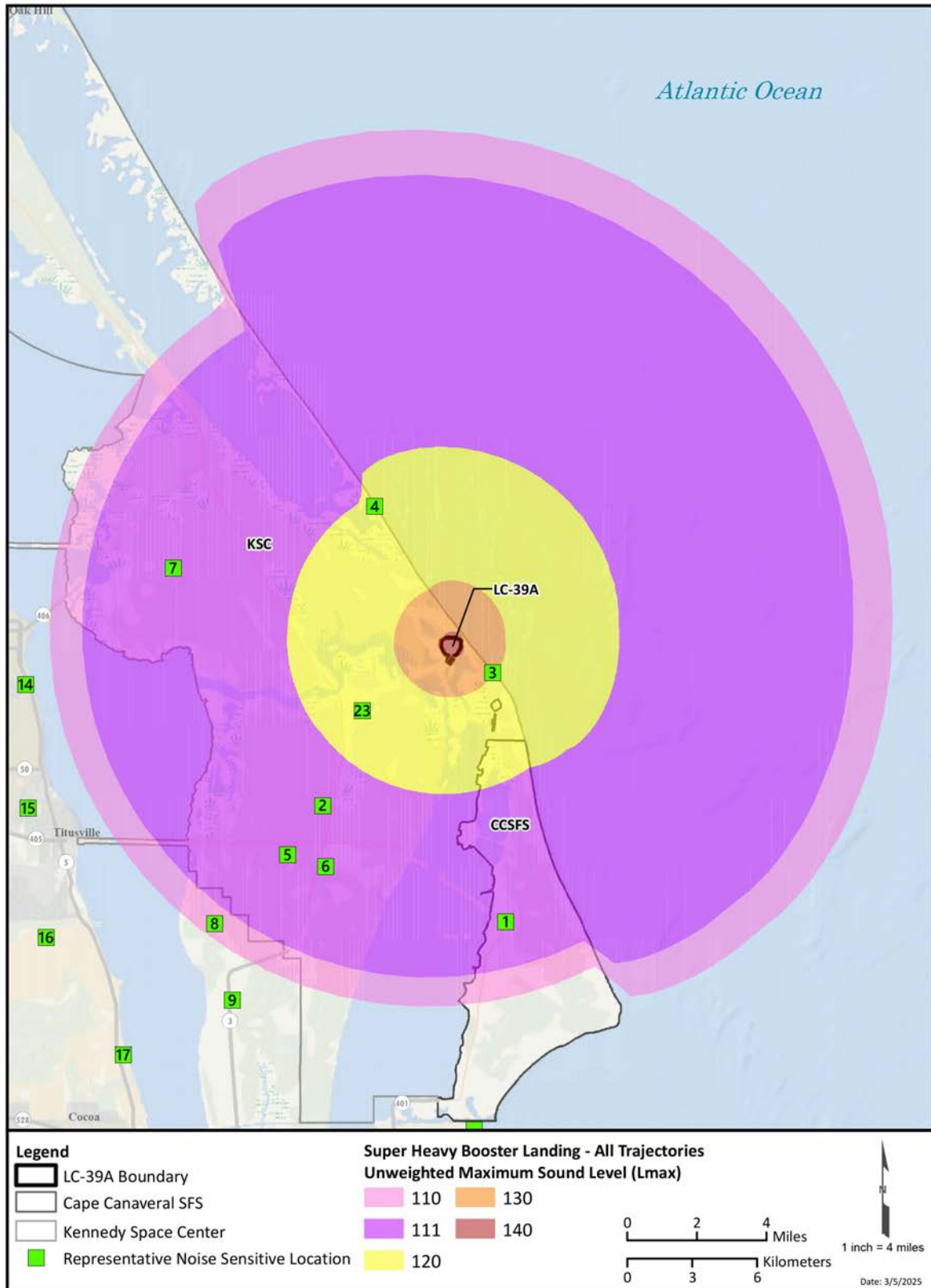


Figure 3.2-11. Super Heavy Booster Landing A-Weighted Sound Exposure Level (ASEL)

Figure 3.2-12. Super Heavy Booster Landing Unweighted Maximum Sound Level ( $L_{max}$ )



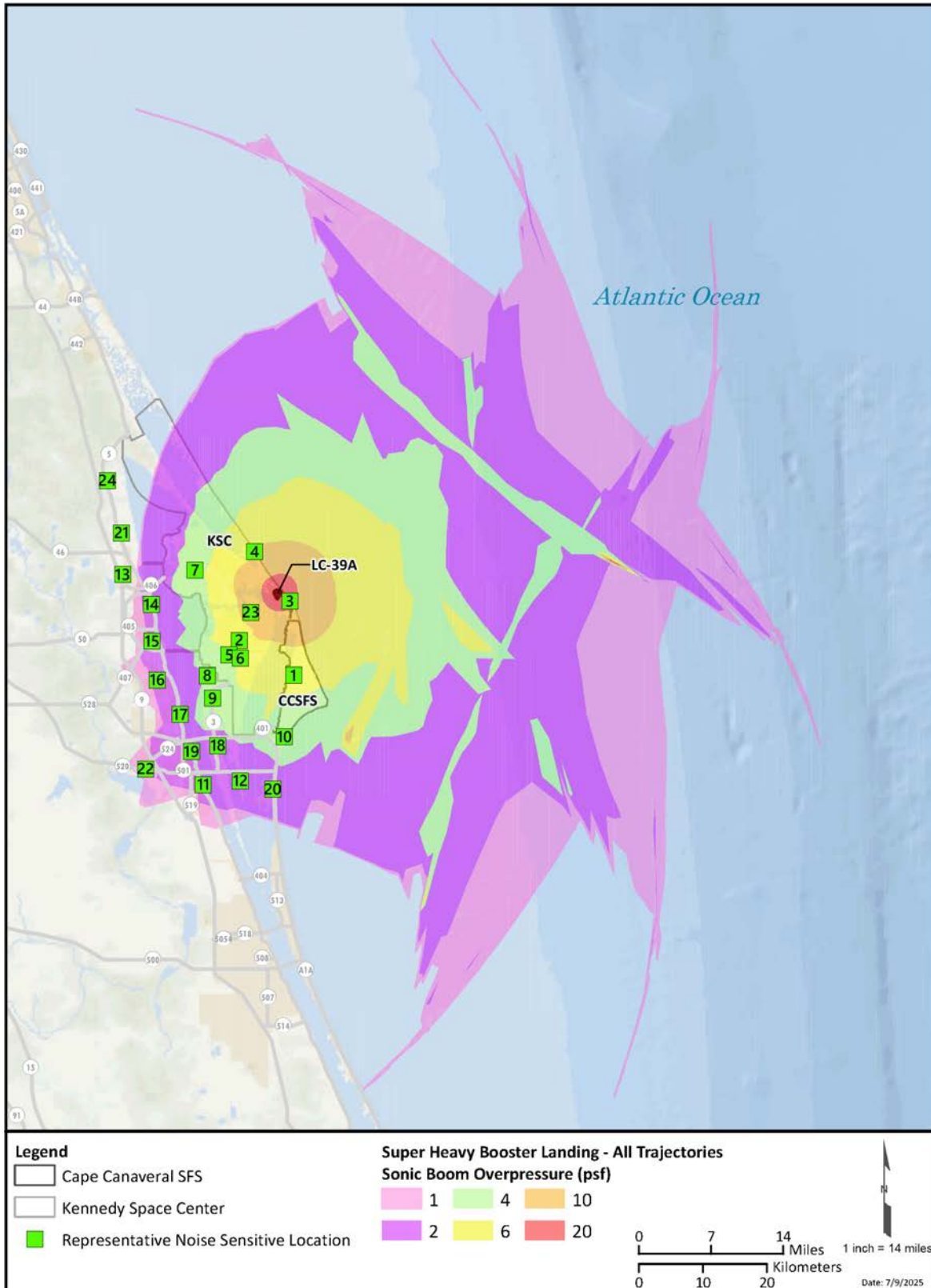


Figure 3.2-13. Super Heavy Booster Landing Sonic Boom Overpressure (psf)

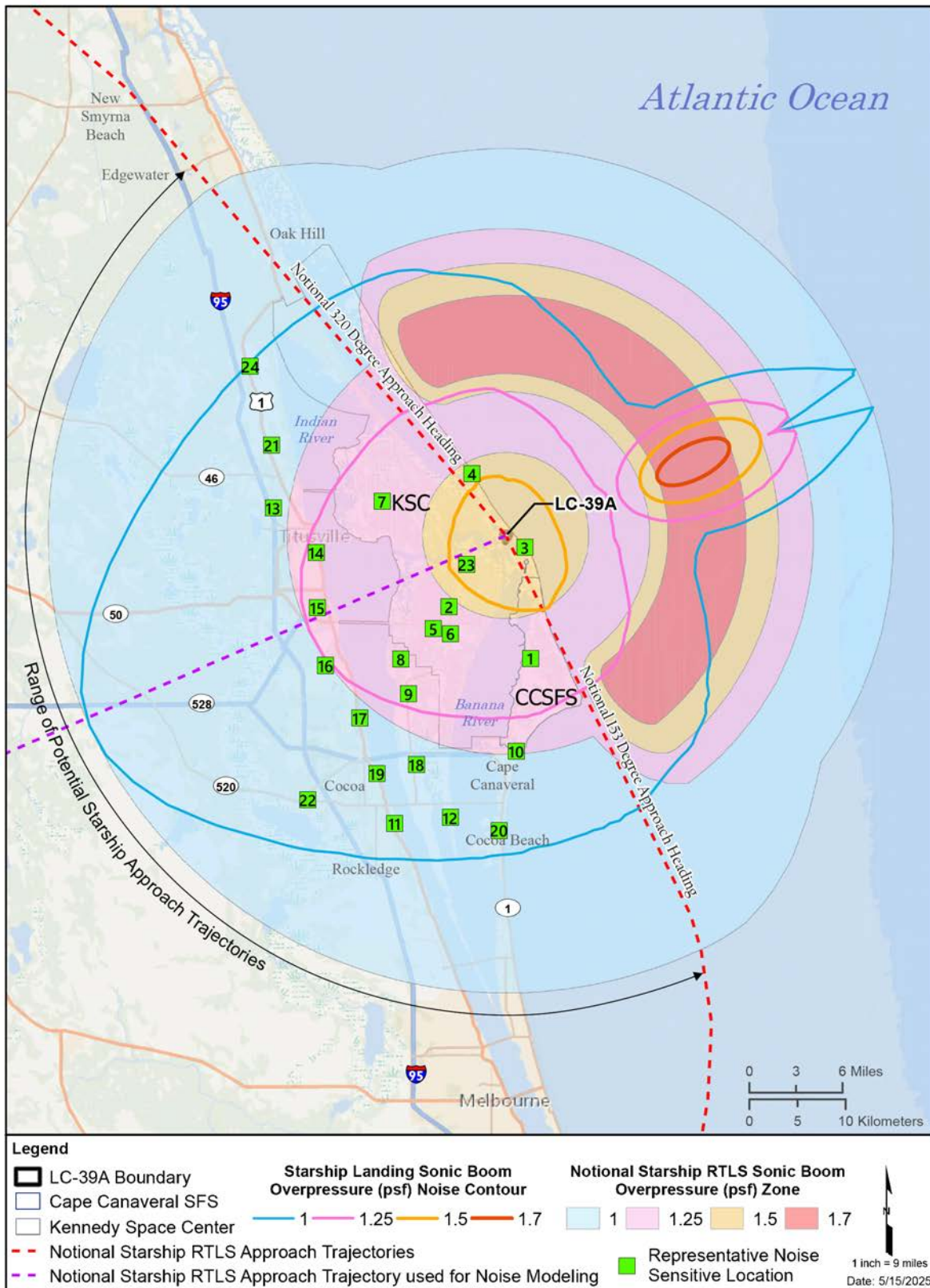


Figure 3.2-14. Notional Starship RTLS Sonic Boom Overpressure (psf) Zone

Noise and sonic booms generated during descents to portions of ocean landing areas that are far from shore would not be audible on land. Super Heavy booster landings in the Super Heavy Atlantic Ocean Landing Area, which is shown in Figure 2.1-6, would generate noise levels and sonic booms that are generally less intense on land areas than those generated by booster landings at LC-39A. Starship landings in the Starship Atlantic Contingency Landing Area, which is also shown in Figure 2.1-6, could potentially exceed 1 psf but would not exceed 1.7 psf in the land areas shown in Figure 3.2-15 (the Starship RTLS range of trajectories shown are representative only). Because contingency landings would be assumed to make up less than 10 percent of Starship landings (i.e., less than five per year) and because landings in the majority of the Super Heavy Atlantic Ocean Landing Area would not be audible on shore, booms exceeding 1 psf in the area shown in Figure 3.2-15 would be extremely rare. For a near-shore landing of Starship in the contingency or ocean landing area shown in Figure 2.1-6, inland areas up to 5.5 miles (8.9 kilometers) from the coast may experience sound events between 90 and 115 dBA. Exposures from coastal landings would be brief (less than 1 minute), infrequent, and would not exceed Occupational Safety and Health Administration (OSHA) hearing conservation thresholds.

**Airspace Closures.** Airspace closures associated with the Proposed Action could result in the FAA temporarily grounding aircraft at affected airports and rerouting en route flights on established alternate flight paths. Aircraft could be grounded temporarily if airspace above or around the airport is closed. The FAA may use ground delays under some circumstances to avoid airborne reroutes. If aircraft were grounded, noise levels at the airport could temporarily increase if the planes sit idle; some aircraft would likely shut down engines altogether until the closure was lifted. Also, depending on the altitude at which aircraft approach an airport, there could be temporary increases in noise levels in communities around the airports. Aircraft would travel on existing routes and flight paths that are used on a daily basis to account for weather and other temporary restrictions. Any incremental increases in noise levels at individual airports would only last for the duration of the airspace closure and are not expected to meaningfully change existing DNLs at the affected airports and surrounding areas. Therefore, airspace closures associated with the Proposed Action are not expected to result in significant noise impacts.

**Activity Interference.** Launches, but not static fire tests or landings, would exceed 90 dB  $LA_{max}$ , a noise level considered likely to interfere with activities, in communities outside the boundaries of KSC and CCSFS. Launches would occur 44 times per year (1 per 8 days on average). At the off-KSC/CCSFS representative noise-sensitive locations studied, noise levels associated with launch operations would be as high as 97 dB  $LA_{max}$  (Table 3.2-5). As noted previously, noise levels described for representative noise-sensitive locations would be like noise levels experienced at other locations nearby. The 44 Super Heavy booster landings and 44 Starship landings per year (i.e., 1 per 8 days on average for each) would have lower sound levels than launch events but would generate a sonic boom on land. At off-KSC/CCSFS representative locations studied, boom overpressure during Super Heavy booster landings would be as high as 4.8 psf. During Starship landings, sonic booms would be less intense, not exceeding 1.3 psf at the locations studied. Representative noise-sensitive locations that are farther away from LC-39A would experience less intense sonic booms (Table 3.2-6). Locations on KSC/CCSFS (including MINWR and CANA) would experience elevated noise levels and sonic booms during proposed rocket operations, which would be expected to be disturbing for those unaware of pending rocket operations.



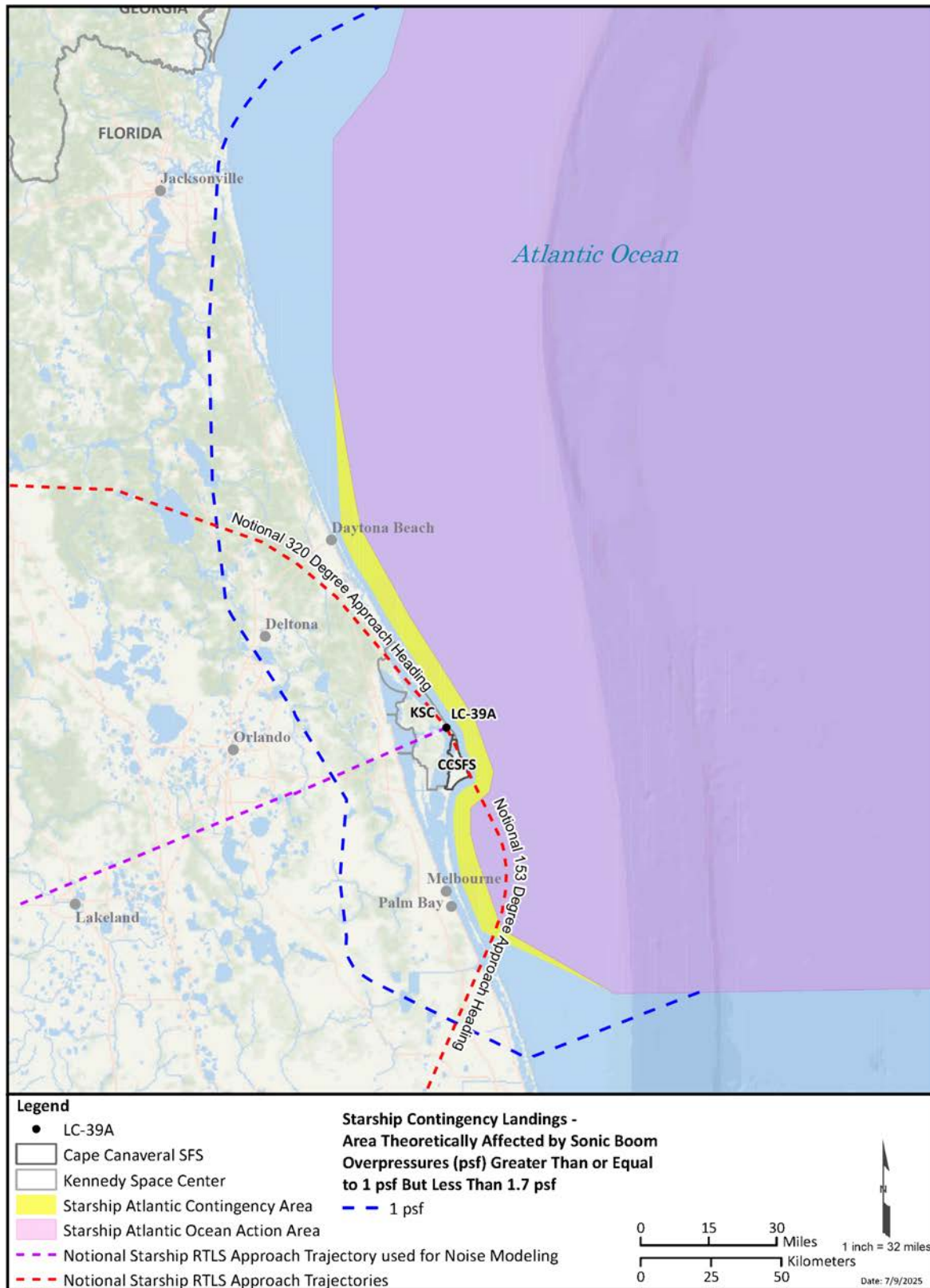


Figure 3.2-15. Land Areas Potentially Affected by Levels Between 1 psf and 1.7 psf under the Starship Contingency Scenario



**Table 3.2-5. LA<sub>max</sub> at Representative Locations**

| ID | Location Description                                   | On/Off<br>KSC/CCSFS | Super Heavy<br>Booster<br>Static Fire<br>Test <sup>1</sup> | Launch | Super<br>Heavy<br>Booster<br>Landing <sup>2</sup> | Starship<br>Landing |
|----|--------------------------------------------------------|---------------------|------------------------------------------------------------|--------|---------------------------------------------------|---------------------|
| 1  | CCSFS Representative Location                          | On                  | 77                                                         | 99     | 91                                                | 80                  |
| 2  | SpaceX Operations Area                                 | On                  | 84                                                         | 104    | 96                                                | 87                  |
| 3  | Titusville Beach                                       | On                  | 107                                                        | 125    | 119                                               | 109                 |
| 4  | Playalinda Beach                                       | On                  | 92                                                         | 109    | 102                                               | 92                  |
| 5  | Kennedy Space Center Visitor Complex                   | On                  | 79                                                         | 101    | 92                                                | 82                  |
| 6  | KSC Child Development Center                           | On                  | 79                                                         | 101    | 93                                                | 83                  |
| 7  | Merritt Island National Wildlife Refuge Visitor Center | On                  | 78                                                         | 101    | 91                                                | 81                  |
| 8  | Pine Island Conservation Area/Pine Island Estates      | Off                 | 73                                                         | 97     | 87                                                | 76                  |
| 9  | Kings Park Estates - Courtenay                         | Off                 | 71                                                         | 95     | 84                                                | 73                  |
| 10 | Jetty Park Campground                                  | Off                 | 68                                                         | 92     | 81                                                | 70                  |
| 11 | Rockledge High School                                  | Off                 | 62                                                         | 87     | 75                                                | 63                  |
| 12 | Merritt Island                                         | Off                 | 63                                                         | 88     | 76                                                | 64                  |
| 13 | Oak Park Elementary School                             | Off                 | 68                                                         | 92     | 81                                                | 69                  |
| 14 | Titusville High School                                 | Off                 | 71                                                         | 95     | 85                                                | 74                  |
| 15 | Summerwood Villas                                      | Off                 | 70                                                         | 94     | 83                                                | 72                  |
| 16 | Atlantis Elementary School                             | Off                 | 68                                                         | 92     | 82                                                | 70                  |
| 17 | Fairglen Elementary School                             | Off                 | 67                                                         | 91     | 80                                                | 69                  |
| 18 | Lewis Carroll Elementary School                        | Off                 | 66                                                         | 90     | 79                                                | 67                  |
| 19 | Cocoa                                                  | Off                 | 64                                                         | 89     | 78                                                | 66                  |
| 20 | Cocoa Beach                                            | Off                 | 63                                                         | 87     | 76                                                | 64                  |
| 21 | Pinegrove Estates                                      | Off                 | 67                                                         | 91     | 80                                                | 68                  |
| 22 | Fern Meadows                                           | Off                 | 61                                                         | 86     | 74                                                | 61                  |
| 23 | KSC Office                                             | On                  | 95                                                         | 113    | 105                                               | 98                  |
| 24 | The Rock Church                                        | Off                 | 63                                                         | 88     | 76                                                | 64                  |

Notes: CCSFS = Cape Canaveral Space Force Station; ID = location identification number; KSC = Kennedy Space Center; LA<sub>max</sub> = maximum A-weighted sound level; SpaceX = Space Exploration Technologies Corp.

<sup>1</sup> Starship static fire tests, which would be 44 of 88 total tests per year, have lower sound levels than Super Heavy booster static fire tests.

<sup>2</sup> Reflects the representative descent trajectory with highest noise level.

**Table 3.2-6. Sonic Boom Overpressure (psf) at Representative Locations**

| ID | Location Description          | On/Off<br>KSC/CCSFS | Booster<br>Landing <sup>1</sup> | Starship Landing |
|----|-------------------------------|---------------------|---------------------------------|------------------|
| 1  | CCSFS Representative Location | On                  | 7.4                             | 1.4              |
| 2  | SpaceX Operations Area        | On                  | 7.9                             | 1.5              |
| 3  | Titusville Beach              | On                  | 24.4                            | 1.6              |

**Table 3.2-6. Sonic Boom Overpressure (psf) at Representative Locations**

| ID | Location Description                                   | On/Off KSC/CCSFS | Booster Landing <sup>1</sup> | Starship Landing |
|----|--------------------------------------------------------|------------------|------------------------------|------------------|
| 4  | Playalinda Beach                                       | On               | 10.1                         | 1.5              |
| 5  | Kennedy Space Center Visitor Complex                   | On               | 5.9                          | 1.4              |
| 6  | KSC Child Development Center                           | On               | 6.1                          | 1.4              |
| 7  | Merritt Island National Wildlife Refuge Visitor Center | On               | 5.3                          | 1.4              |
| 8  | Pine Island Conservation Area/Pine Island Estates      | Off              | 4.2                          | 1.3              |
| 9  | Kings Park Estates - Courtenay                         | Off              | 4.8                          | 1.3              |
| 10 | Jetty Park Campground                                  | Off              | 4.5                          | 1.2              |
| 11 | Rockledge High School                                  | Off              | 2.8                          | 1.1              |
| 12 | Merritt Island                                         | Off              | 2.9                          | 1.1              |
| 13 | Oak Park Elementary School                             | Off              | -                            | 1.2              |
| 14 | Titusville High School                                 | Off              | 2.7                          | 1.3              |
| 15 | Summerwood Villas                                      | Off              | 2.2                          | 1.3              |
| 16 | Atlantis Elementary School                             | Off              | 1.7                          | 1.2              |
| 17 | Fairglen Elementary School                             | Off              | 3.3                          | 1.2              |
| 18 | Lewis Carroll Elementary School                        | Off              | 3.7                          | 1.2              |
| 19 | Cocoa                                                  | Off              | 3.3                          | 1.1              |
| 20 | Cocoa Beach                                            | Off              | 2.8                          | 1.0              |
| 21 | Pinegrove Estates                                      | Off              | -                            | 1.1              |
| 22 | Fern Meadows                                           | Off              | 1.4                          | 1.1              |
| 23 | KSC Office                                             | On               | 12.5                         | 1.5              |
| 24 | The Rock Church                                        | Off              | -                            | 1.0              |

Notes: CCSFS = Cape Canaveral Space Force Station; ID = location identification number KSC = Kennedy Space Center; psf = pounds per square foot; SpaceX = Space Exploration Technologies Corp.; “-” indicates that the location is outside of the sonic boom footprint.

<sup>1</sup> Reflects the representative descent trajectory with highest psf value.

Half of launch operations (22 per year) and landing operations (44 per year) are expected to occur late at night between 10:00 p.m. and 7:00 a.m. and would have an increased likelihood of disturbing sleep. Probabilities of awakening were estimated using conservative estimation methods, which are described in Section 3.2.1, *Definition of Resource and Regulatory Setting*. Launch propulsion noise levels (i.e., rocket engines rather than sonic booms) at off-KSC/CCSFS sensitive locations would be associated with up to 14 percent of people exposed being awakened if windows are open and 10 percent if windows are closed. During landings noise levels would be lower, resulting in a smaller percentage of people being awakened (Table 3.2-7). Sonic booms generated during late-night Super Heavy booster landings (22 per year) and Starship landings (22 per year) would generate noise levels associated with up to 81 percent of people exposed being awakened at representative locations off KSC/CCSFS (Table 3.2-8). Most of the acoustic energy in a sonic boom occurs at low frequencies (below 100 hertz), which is only minimally attenuated by typical structures. The likelihood of awakening was estimated for structures providing 0 dB and 15 dB noise level reduction, which reflects a likely range of reductions provided by typical structures.

**Table 3.2-7. Likelihood of Behavioral Awakening Associated with Propulsion Noise at Representative Locations<sup>1</sup>**

| ID | Location Description                                      | On/Off<br>KSC/CCSFS | Super Heavy Booster<br>Static Fire Test <sup>2</sup> |                                | Launch                       |                                | Super Heavy Booster<br>Landing <sup>3</sup> |                                | Starship Landing             |                                |
|----|-----------------------------------------------------------|---------------------|------------------------------------------------------|--------------------------------|------------------------------|--------------------------------|---------------------------------------------|--------------------------------|------------------------------|--------------------------------|
|    |                                                           |                     | Windows<br>Open <sup>4</sup>                         | Windows<br>Closed <sup>4</sup> | Windows<br>Open <sup>4</sup> | Windows<br>Closed <sup>4</sup> | Windows<br>Open <sup>4</sup>                | Windows<br>Closed <sup>4</sup> | Windows<br>Open <sup>4</sup> | Windows<br>Closed <sup>4</sup> |
| 1  | CCSFS Representative Location                             | On                  | 7%                                                   | 5%                             | 15%                          | 11%                            | 11%                                         | 7%                             | 6%                           | 4%                             |
| 2  | SpaceX Operations Area                                    | On                  | 10%                                                  | 7%                             | 17%                          | 13%                            | 13%                                         | 9%                             | 8%                           | 5%                             |
| 3  | Titusville Beach                                          | On                  | 19%                                                  | 15%                            | 27%                          | 22%                            | 23%                                         | 18%                            | 18%                          | 13%                            |
| 4  | Playalinda Beach                                          | On                  | 13%                                                  | 9%                             | 19%                          | 15%                            | 15%                                         | 11%                            | 10%                          | 7%                             |
| 5  | Kennedy Space Center Visitor<br>Complex                   | On                  | 8%                                                   | 5%                             | 16%                          | 12%                            | 11%                                         | 8%                             | 7%                           | 4%                             |
| 6  | KSC Child Development Center                              | On                  | 8%                                                   | 5%                             | 16%                          | 12%                            | 11%                                         | 8%                             | 7%                           | 4%                             |
| 7  | Merritt Island National Wildlife<br>Refuge Visitor Center | On                  | 8%                                                   | 5%                             | 16%                          | 12%                            | 11%                                         | 8%                             | 7%                           | 4%                             |
| 8  | Pine Island Conservation<br>Area/Pine Island Estates      | Off                 | 6%                                                   | 4%                             | 14%                          | 10%                            | 9%                                          | 6%                             | 5%                           | 3%                             |
| 9  | Kings Park Estates - Courtenay                            | Off                 | 6%                                                   | 3%                             | 13%                          | 9%                             | 8%                                          | 6%                             | 5%                           | 2%                             |
| 10 | Jetty Park Campground <sup>5</sup>                        | Off                 | 5%                                                   | 3%                             | 12%                          | 8%                             | 7%                                          | 5%                             | 4%                           | 2%                             |
| 11 | Rockledge High School                                     | Off                 | 4%                                                   | 2%                             | 10%                          | 7%                             | 6%                                          | 3%                             | 2%                           | 1%                             |
| 12 | Merritt Island                                            | Off                 | 4%                                                   | 2%                             | 10%                          | 7%                             | 6%                                          | 3%                             | 2%                           | 1%                             |
| 13 | Oak Park Elementary School                                | Off                 | 5%                                                   | 3%                             | 12%                          | 9%                             | 7%                                          | 5%                             | 4%                           | 2%                             |
| 14 | Titusville High School                                    | Off                 | 6%                                                   | 3%                             | 13%                          | 10%                            | 9%                                          | 6%                             | 5%                           | 2%                             |
| 15 | Summerwood Villas                                         | Off                 | 6%                                                   | 3%                             | 13%                          | 9%                             | 8%                                          | 5%                             | 4%                           | 2%                             |
| 16 | Atlantis Elementary School                                | Off                 | 5%                                                   | 3%                             | 12%                          | 9%                             | 8%                                          | 5%                             | 4%                           | 2%                             |
| 17 | Fairglen Elementary School                                | Off                 | 5%                                                   | 3%                             | 12%                          | 8%                             | 7%                                          | 4%                             | 3%                           | 2%                             |
| 18 | Lewis Carroll Elementary School                           | Off                 | 4%                                                   | 2%                             | 11%                          | 8%                             | 7%                                          | 4%                             | 3%                           | 1%                             |
| 19 | Cocoa                                                     | Off                 | 4%                                                   | 2%                             | 11%                          | 8%                             | 6%                                          | 4%                             | 3%                           | 1%                             |
| 20 | Cocoa Beach                                               | Off                 | 4%                                                   | 2%                             | 10%                          | 7%                             | 6%                                          | 3%                             | 2%                           | 1%                             |
| 21 | Pinegrove Estates                                         | Off                 | 5%                                                   | 3%                             | 12%                          | 8%                             | 7%                                          | 4%                             | 3%                           | 1%                             |
| 22 | Fern Meadows                                              | Off                 | 3%                                                   | 2%                             | 10%                          | 7%                             | 5%                                          | 3%                             | 2%                           | 1%                             |
| 23 | KSC Office                                                | On                  | 14%                                                  | 10%                            | 21%                          | 17%                            | 17%                                         | 12%                            | 12%                          | 9%                             |

**Table 3.2-7. Likelihood of Behavioral Awakening Associated with Propulsion Noise at Representative Locations<sup>1</sup>**

| ID | Location Description | On/Off<br>KSC/CCSFS | Super Heavy Booster<br>Static Fire Test <sup>2</sup> |                                | Launch                       |                                | Super Heavy Booster<br>Landing <sup>3</sup> |                                | Starship Landing             |                                |
|----|----------------------|---------------------|------------------------------------------------------|--------------------------------|------------------------------|--------------------------------|---------------------------------------------|--------------------------------|------------------------------|--------------------------------|
|    |                      |                     | Windows<br>Open <sup>4</sup>                         | Windows<br>Closed <sup>4</sup> | Windows<br>Open <sup>4</sup> | Windows<br>Closed <sup>4</sup> | Windows<br>Open <sup>4</sup>                | Windows<br>Closed <sup>4</sup> | Windows<br>Open <sup>4</sup> | Windows<br>Closed <sup>4</sup> |
| 24 | The Rock Church      | Off                 | 4%                                                   | 2%                             | 11%                          | 7%                             | 6%                                          | 3%                             | 2%                           | 1%                             |

Notes: % = percent; CCSFS = Cape Canaveral Space Force Station; dB = decibels; ID = location identification number; KSC = Kennedy Space Center; SpaceX = Space Exploration Technologies Corp.

<sup>1</sup> “Behavioral awakenings” were recorded during sleep testing when the awakened test subject pushed a button. “Sleep disturbance” is a broader term including any induced change in sleep stage.

<sup>2</sup> Starship static fire tests, which would be 44 of 88 total tests per year, have lower sound levels than Super Heavy booster static fire tests.

<sup>3</sup> A Super Heavy booster landing reflects the representative descent trajectory with highest noise level.

<sup>4</sup> Structures are assumed to provide 15 dB outdoor-to-indoor noise attenuation with windows open and 25 dB with windows closed. Results reflect people sleeping in a residential setting. People sleeping in transient lodgings (e.g., hotels) are more likely to have never experienced the noise source and would be expected to have a higher likelihood of being awakened.

<sup>5</sup> People sleeping outdoors or in structures providing negligible noise attenuation (e.g., tents) would experience higher propulsion noise levels, and would be approximately 8% more likely to be awakened than people sleeping indoors with windows open at the same location. At Jetty Park Campground, for example, an estimated 18% of people sleeping in structures with minimal noise attenuation would be awakened by launch propulsion noise.

**Table 3.2-8. Likelihood of Awakening or Sleep Disturbance Associated with Sonic Booms at Representative Locations<sup>1</sup>**

| ID | Location Description                                   | On KSC/<br>CCSFS | Super Heavy Booster Landing <sup>2</sup> |                              | Starship Landing            |                              |
|----|--------------------------------------------------------|------------------|------------------------------------------|------------------------------|-----------------------------|------------------------------|
|    |                                                        |                  | 0 dB Reduction <sup>3</sup>              | 15 dB Reduction <sup>3</sup> | 0 dB Reduction <sup>3</sup> | 15 dB Reduction <sup>3</sup> |
| 1  | CCSFS Representative Location                          | On               | 89%                                      | 54%                          | 57%                         | 22%                          |
| 2  | SpaceX Operations Area                                 | On               | 92%                                      | 58%                          | 58%                         | 24%                          |
| 3  | Titusville Beach                                       | On               | 100%                                     | 80%                          | 60%                         | 25%                          |
| 4  | Playalinda Beach                                       | On               | 97%                                      | 63%                          | 58%                         | 24%                          |
| 5  | Kennedy Space Center Visitor Complex                   | On               | 86%                                      | 52%                          | 58%                         | 23%                          |
| 6  | KSC Child Development Center                           | On               | 87%                                      | 53%                          | 58%                         | 23%                          |
| 7  | Merritt Island National Wildlife Refuge Visitor Center | On               | 84%                                      | 49%                          | 57%                         | 22%                          |
| 8  | Pine Island Conservation Area/Pine Island Estates      | Off              | 80%                                      | 45%                          | 56%                         | 22%                          |
| 9  | Kings Park Estates - Courtenay                         | Off              | 82%                                      | 48%                          | 56%                         | 21%                          |
| 10 | Jetty Park Campground <sup>4</sup>                     | Off              | 81%                                      | 46%                          | 54%                         | 19%                          |



**Table 3.2-8. Likelihood of Awakening or Sleep Disturbance Associated with Sonic Booms at Representative Locations<sup>1</sup>**

| ID | Location Description            | On KSC/<br>CCSFS | Super Heavy Booster Landing <sup>2</sup> |                              | Starship Landing            |                              |
|----|---------------------------------|------------------|------------------------------------------|------------------------------|-----------------------------|------------------------------|
|    |                                 |                  | 0 dB Reduction <sup>3</sup>              | 15 dB Reduction <sup>3</sup> | 0 dB Reduction <sup>3</sup> | 15 dB Reduction <sup>3</sup> |
| 11 | Rockledge High School           | Off              | 71%                                      | 37%                          | 52%                         | 17%                          |
| 12 | Merritt Island                  | Off              | 72%                                      | 37%                          | 52%                         | 17%                          |
| 13 | Oak Park Elementary School      | Off              | -                                        | -                            | 54%                         | 19%                          |
| 14 | Titusville High School          | Off              | 71%                                      | 36%                          | 56%                         | 21%                          |
| 15 | Summerwood Villas               | Off              | 67%                                      | 32%                          | 56%                         | 21%                          |
| 16 | Atlantis Elementary School      | Off              | 62%                                      | 27%                          | 55%                         | 20%                          |
| 17 | Fairglen Elementary School      | Off              | 75%                                      | 40%                          | 55%                         | 20%                          |
| 18 | Lewis Carroll Elementary School | Off              | 77%                                      | 42%                          | 54%                         | 19%                          |
| 19 | Cocoa                           | Off              | 75%                                      | 40%                          | 53%                         | 18%                          |
| 20 | Cocoa Beach                     | Off              | 72%                                      | 37%                          | 52%                         | 17%                          |
| 21 | Pinegrove Estates               | Off              | -                                        | -                            | 53%                         | 18%                          |
| 22 | Fern Meadows                    | Off              | 58%                                      | 23%                          | 52%                         | 17%                          |
| 23 | KSC Office                      | On               | 100%                                     | 67%                          | 59%                         | 24%                          |
| 24 | The Rock Church                 | Off              | -                                        | -                            | 51%                         | 16%                          |

Notes: % = percent; CCSFS = Cape Canaveral Space Force Station; dB = decibels; ID = location identification number; KSC = Kennedy Space Center; SpaceX = Space Exploration Technologies Corp.

<sup>1</sup> “Sleep disturbance” includes any induced change in sleep stage. This term differs from “behavioral awakenings,” which were recorded during sleep testing when the awakened test subject pushed a button.

<sup>2</sup> Reflects the representative descent trajectory with highest sonic boom overpressure. “-” indicates that the location is outside of the sonic boom footprint.

<sup>3</sup> Most of the acoustic energy in a sonic boom occurs at low frequencies (below 100 hertz), which is only minimally attenuated by typical structures. The likelihood of awakening was estimated for structures providing 0 dB and 15 dB noise level reduction, which reflects a likely range of reductions provided by typical structures; the 15 dB reduction does not apply to mobile homes, which are included in some of the representative locations.

<sup>4</sup> People sleeping outdoors or in structures providing negligible noise attenuation (e.g., tents) would experience higher noise sonic boom noise levels, and would be 35% more likely to be awakened than people sleeping indoors at the same location. At Jetty Park Campground, for example, an estimated 81% of people sleeping in structures with minimal noise attenuation would be awakened by booster landings.

During scoping, concern was expressed about car alarms being triggered by noise-induced vibrations. Car alarm sensitivity is variable between manufacturers and according to settings input by the owner. Car alarms are often set off by events other than theft of the vehicle, and it is plausible that noise-induced vibrations could increase the number of false alarms. Therefore, lowering the sensitivity settings on car alarms would minimize false alarms.

In summary, interference with activities, such as conversation, watching television, or sleeping may occur because of proposed annual Starship-Super Heavy operations, booster static fire tests, and Starship static fire tests with maximum noise levels as high as 97 dBA and sonic boom overpressures as high as 4.8 psf at locations studied outside of KSC/CCSFS. These events would occur during the 44 launches, booster landings, and Starship landings, half of which would be assumed to occur between 10:00 p.m. and 7:00 a.m. Sleep disturbance, which would be expected to be as high as 82 percent of affected persons off KSC/CCSFS during booster landings, is expected to be significant.

**Noise-Compatible Land Use.** Noise levels would remain below 65 dBA DNL at all locations outside the boundaries of KSC and CCSFS (Figure 3.2-16). All land uses outside of KSC and CCSFS would remain compatible with guidelines published at 14 CFR Part 150. The FAA recognizes that there are settings where the 65 dB DNL standard does not apply. In these locations, DNL land use guidelines should be considered in conjunction with other criteria when assessing compatibility of specific uses, such as the MINWR Visitor Center. The total annual duration of noise would be relatively brief, limited to 44 launches, 88 static fire tests, and 88 landings. The relatively short duration of potentially disturbing noise levels supports consideration of sensitive land uses in MINWR and CANA (e.g., the MINWR Visitor Center) as being compatible.

Sonic boom time-averaged noise levels would increase such that additional land area in Titusville, Merritt Island, Cape Canaveral, Cocoa, and Cocoa Beach would be exposed to greater than 60 dB CDNL (Figure 3.2-17). Portions of Cape Canaveral, Cocoa Beach, and Merritt Island would be exposed to levels between 65 and 70 dB CDNL. Residential land uses and schools are considered incompatible at these levels, and sensitive public uses (e.g., hospitals and places of worship) are considered compatible only if sound attenuation provided by the structure exceeds minimum values. Certain other land uses, such as offices and commercial, are compatible at greater than 65 dB CDNL only if attenuation minimums are met.

Even if all Starship landings were to occur on a single descent trajectory that is different from the modeled trajectory, the net effect would be to shift the 60 dB CDNL contour line by less than 0.2 miles (0.3 kilometers) relative to the contour shown in Figure 3.2-17. Sonic booms generated by Starship landings would be less intense than booms generated by Super Heavy boosters and, therefore, contribute proportionally less to overall CDNL. In the context of booster landing sonic boom noise, the effects of continuously variable Starship descent trajectories would not result in substantial differences relative to the CDNL values calculated for the nominal RTLS trajectory.

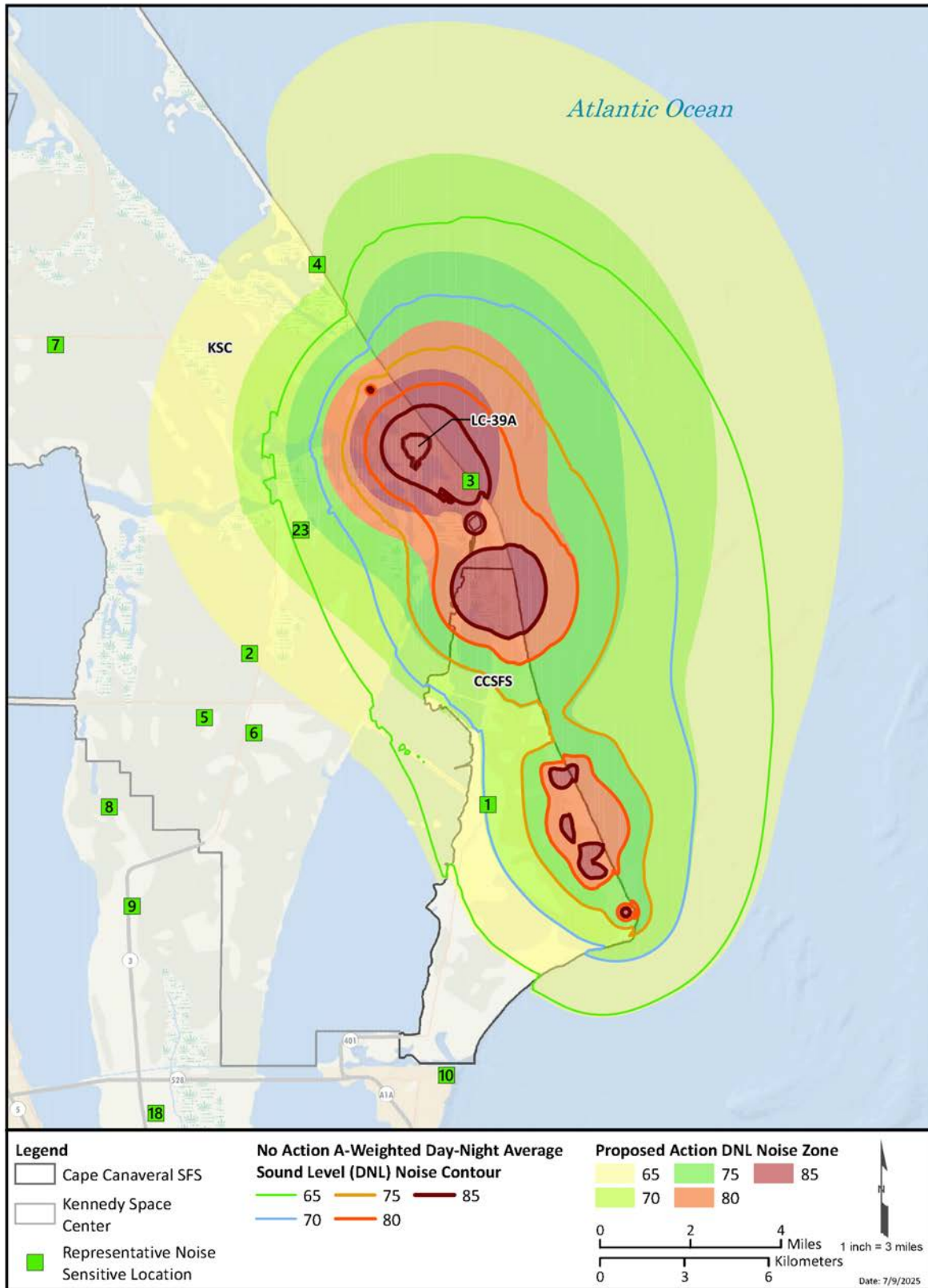
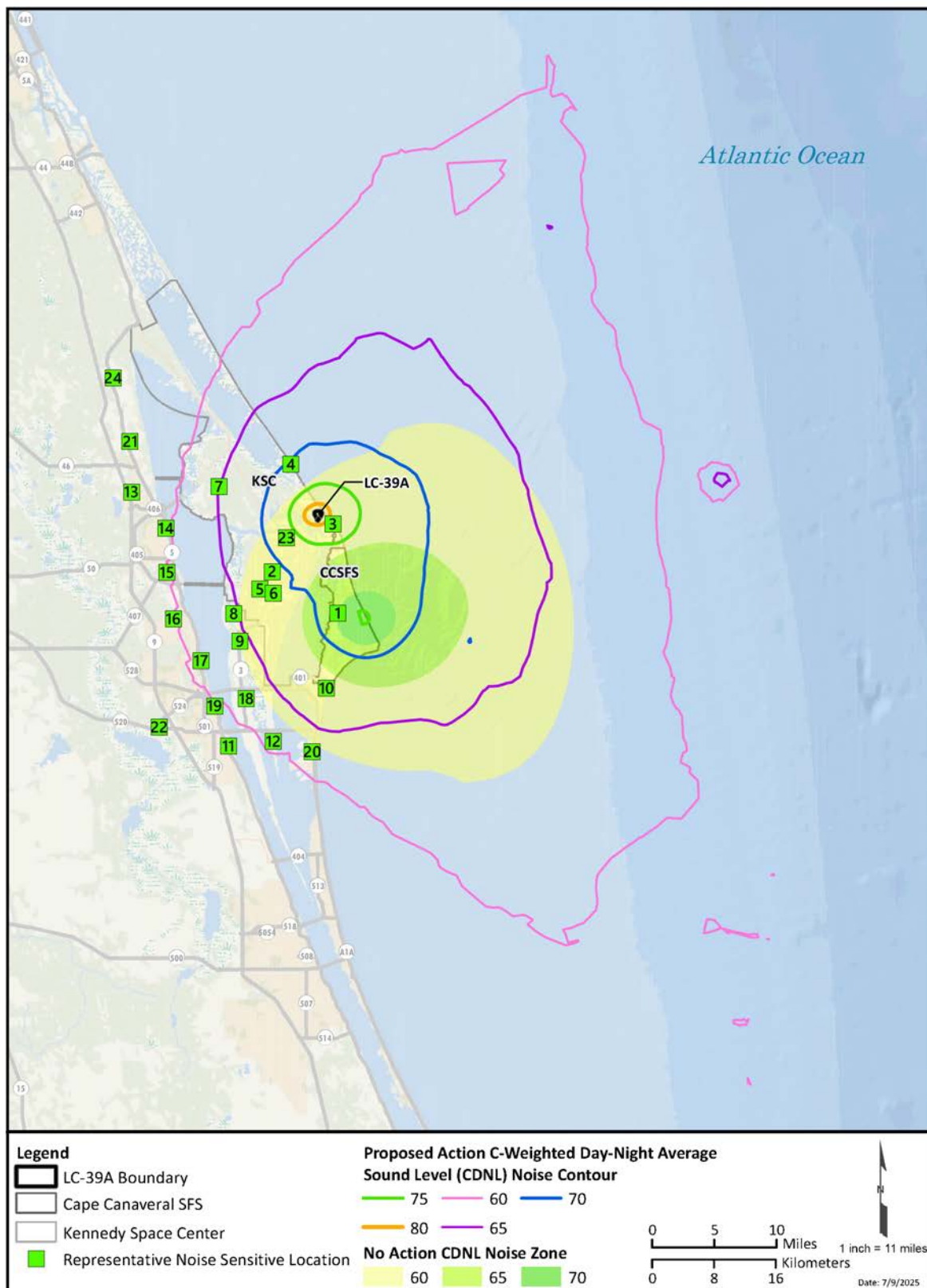


Figure 3.2-16. Proposed and No Action DNL



Sources: (FGDL, 2017; FGDL, 2018; FGDL, 2023a; FGDL, 2023b)

Figure 3.2-17. Proposed and No Action CDNL



The number of off-KSC/CCSFS acres of land at greater than 60 dB CDNL would increase relative to the No Action Alternative by 19,443 to 28,595, and the estimated number of residents at greater than 60 dB CDNL would increase by 51,514 to 70,343 (Table 3.2-9). People exposed to increased DNL and CDNL would be more likely to become annoyed, as described in Section 3.2.1, *Definition of Resource and Regulatory Setting*.

**Table 3.2-9. Proposed Action Off-Center Acres of Land and Estimated Number of Residents Affected by Greater than 60 dB CDNL**

| CDNL (dB)    | Off-KSC/CCSFS Land (acres) |                       | Estimated Off-KSC/CCSFS Residents |                       |
|--------------|----------------------------|-----------------------|-----------------------------------|-----------------------|
|              | Proposed Action            | Change from No Action | Proposed Action                   | Change from No Action |
| 60-64        | 23,194                     | +14,112               | 58,440                            | +39,616               |
| 65-69        | 5,366                      | +5,306                | 11,900                            | +11,897               |
| 70-74        | 28                         | +18                   | 3                                 | +1                    |
| 75-79        | 7                          | +7                    | 0                                 | -                     |
| 80-84        | -                          | -                     | 0                                 | -                     |
| ≥85          | -                          | -                     | 0                                 | -                     |
| <b>Total</b> | <b>28,595</b>              | <b>+19,443</b>        | <b>70,343</b>                     | <b>+51,514</b>        |

Notes: ≥ = greater than or equal to; - = minus; + = plus; CCSFS = Cape Canaveral Space Force Station; CDNL = C-weighted day-night average sound level; dB = decibels; KSC = Kennedy Space Center.

Source: (U.S. Census Bureau, 2024a)

Under the Proposed Action, noise levels would increase by as much as 8.1 dB DNL and by as much as 15.5 dB CDNL relative to the No Action Alternative at the sensitive locations studied (Table 3.2-10). Changes in supersonic noise levels would exceed FAA significance criteria at seven of the representative sensitive locations outside of KSC/CCSFS. Increases at locations on KSC/CCSFS, including CANA and MINWR, would exceed FAA DNL and CDNL significance criteria. All significant increases on and off KSC/CCSFS are bolded in Table 3.2-10.

**Table 3.2-10. Proposed Action DNL and CDNL at Sensitive Locations**

| ID | Location Description                                   | On/Off KSC/CCSFS | DNL (dBA)       |                       | CDNL (dB)       |                       |
|----|--------------------------------------------------------|------------------|-----------------|-----------------------|-----------------|-----------------------|
|    |                                                        |                  | Proposed Action | Change from No Action | Proposed Action | Change from No Action |
| 1  | CCSFS Representative Location                          | On               | 70.6            | +0.3                  | <b>72.2</b>     | <b>+2.2</b>           |
| 2  | SpaceX Operations Area                                 | On               | <b>65.1</b>     | <b>+5.1</b>           | <b>68.8</b>     | <b>+7.2</b>           |
| 3  | Titusville Beach                                       | On               | 93.3            | +0.5                  | <b>78.3</b>     | <b>+15.5</b>          |
| 4  | Playalinda Beach                                       | On               | <b>69.2</b>     | <b>+8.1</b>           | <b>70.4</b>     | <b>+11.5</b>          |
| 5  | Kennedy Space Center Visitor Complex                   | On               | 61.8            | +4.8                  | <b>67.0</b>     | <b>+5.8</b>           |
| 6  | KSC Child Development Center                           | On               | 62.6            | +4.1                  | <b>68.3</b>     | <b>+6.1</b>           |
| 7  | Merritt Island National Wildlife Refuge Visitor Center | On               | 60.5            | +7.8                  | <b>64.9</b>     | <b>+7.8</b>           |
| 8  | Pine Island Conservation Area/Pine Island Estates      | Off              | 57.4            | +4.8                  | <b>64.4</b>     | <b>+4.7</b>           |
| 9  | Kings Park Estates - Courtenay                         | Off              | 55.7            | +4.2                  | <b>64.4</b>     | <b>+4.4</b>           |
| 10 | Jetty Park Campground                                  | Off              | 57.7            | +1.0                  | <b>67.0</b>     | <b>+3.4</b>           |

**Table 3.2-10. Proposed Action DNL and CDNL at Sensitive Locations**

| ID | Location Description            | On/Off<br>KSC/CCSFS | DNL (dBA)          |                             | CDNL (dB)          |                             |
|----|---------------------------------|---------------------|--------------------|-----------------------------|--------------------|-----------------------------|
|    |                                 |                     | Proposed<br>Action | Change<br>from No<br>Action | Proposed<br>Action | Change<br>from No<br>Action |
| 11 | Rockledge High School           | Off                 | 48.1               | +3.1                        | 58.4               | +1.9                        |
| 12 | Merritt Island                  | Off                 | 49.7               | +2.8                        | <b>61.0</b>        | <b>+2.2</b>                 |
| 13 | Oak Park Elementary School      | Off                 | 52.0               | +7.0                        | 52.3               | +7.3                        |
| 14 | Titusville High School          | Off                 | 55.1               | +6.9                        | 57.5               | +12.5                       |
| 15 | Summerwood Villas               | Off                 | 54.2               | +6.3                        | 59.0               | +3.7                        |
| 16 | Atlantis Elementary School      | Off                 | 52.8               | +5.5                        | 58.7               | +3.2                        |
| 17 | Fairglen Elementary School      | Off                 | 52.1               | +4.6                        | <b>62.0</b>        | <b>+4.7</b>                 |
| 18 | Lewis Carroll Elementary School | Off                 | 51.8               | +3.4                        | <b>62.8</b>        | <b>+3.8</b>                 |
| 19 | Cocoa                           | Off                 | 50.0               | +3.9                        | 59.6               | +2.3                        |
| 20 | Cocoa Beach                     | Off                 | 50.6               | +1.9                        | <b>62.8</b>        | <b>+3.1</b>                 |
| 21 | Pinegrove Estates               | Off                 | 51.0               | +6.0                        | 51.8               | +6.8                        |
| 22 | Fern Meadows                    | Off                 | 46.6               | +1.6                        | 51.4               | +6.4                        |
| 23 | KSC Office                      | On                  | <b>73.3</b>        | <b>+7.4</b>                 | <b>72.9</b>        | <b>+11.6</b>                |
| 24 | The Rock Church                 | Off                 | 47.8               | +2.8                        | 50.8               | +5.8                        |

Notes: + = plus; CCSFS = Cape Canaveral Space Force Station; CDNL = C-weighted day-night average sound level; dB = decibels; dBA = A-weighted decibels; DNL = day-night average sound level; ID = location identification number; KSC = Kennedy Space Center; SpaceX = Space Exploration Technologies Corp.

**Hearing Conservation.** In known high-noise areas on KSC (e.g., immediate vicinity of LC-39A), personnel wear hearing protection as appropriate in accordance with applicable regulations (see Section 3.2.1, *Definition of Resource and Regulatory Setting*). Noise levels would exceed 108 dB LA<sub>max</sub>—the sound level permissible without hearing protection for 2.5-minute exposure according to KNPR 1820.3—in locations on KSC that are within approximately 5 miles (8 kilometers) of LC-39A. Sonic booms generated during Starship-Super Heavy landings would exceed 4 psf—approximately equivalent to the 140 dB criteria level—in some privately owned portions of Merritt Island and the City of Cape Canaveral. However, as noted in Section 3.2.1, sonic boom sound energy is primarily at low frequencies, which do not interact strongly with the human hearing mechanism (DNWG, 2024). Based on research summarized by the DoD Noise Working Group, the high-frequency noise energy in sonic booms of intensities associated with typical vehicle overflights is not sufficiently high to harm hearing mechanisms (DNWG, 2024). Sonic booms ranging from 50 psf to 144 psf (generated by fighter aircraft overflights as low as 85 feet above ground level) caused no direct injury to exposed researchers (Nixon, Hille, Sommer, & Guild, 1968). As shown in Table 3.2-6, psf during Super Heavy booster landings at off-KSC/CCSFS representative locations would be as high as 4.8 psf. Super Heavy booster landing psf values listed in Table 3.2-6 are for the representative landing trajectory with the highest overpressure value, and most booster return sonic booms would be less intense. Booster landings associated with the Proposed Action would occur 44 times per year, whereas the workplace criteria is established to be protective for workers exposed every workday during a 40-year career. Given these factors, the risk of hearing loss as a result of the Proposed Action would be minimal.

**Structural Damage Potential.** During launches, Super Heavy booster landings, and Super Heavy booster static fire tests, communities outside the boundaries of KSC and CCSFS would experience noise levels between 111 and 120 dB  $L_{max}$ . Sustained unweighted noise levels more than 111 dB are associated with a 1/1,000 probability of damage claims. Noise levels slightly exceeding 120 dB  $L_{max}$ , which are associated with a 1/100 probability of damage claims, would affect a relatively small number of residences on Merritt Island only during launches. Noise levels would not exceed 130 dB—a noise level associated with substantial risk of structural damage when sustained for more than 1 second—at any locations outside the boundaries of KSC and CCSFS. Sonic booms would be expected to exceed 2 psf, a magnitude associated with a 1/10,000 probability of breakage for a large window in portions of Titusville, Port Saint John, Merritt Island, Cocoa, Cocoa Beach, Rockledge, and Cape Canaveral. At locations outside the boundaries of KSC/CCSFS, expected sonic boom intensity would be less than 4 psf, a magnitude associated with 1/10,000 probability of breakage for a small window. If any damage were to occur as a result of sonic booms, it would be expected to be limited to lightweight or brittle structural elements, such as windows and plaster, as massive structural elements such as those that provide structural integrity are affected by noise and sonic booms to a lesser degree. Representative locations on KSC/CCSFS would be exposed to higher  $L_{max}$  and psf values, as shown in Table 3.2-11 and Table 3.2-6, respectively.

**Table 3.2-11.  $L_{max}$  at Representative Locations**

| ID | Location Description                                      | On/Off<br>KSC/CCSFS | Super Heavy<br>Booster Static<br>Fire Test | Launch | Super Heavy<br>Booster<br>Landing <sup>1</sup> | Starship<br>Landing |
|----|-----------------------------------------------------------|---------------------|--------------------------------------------|--------|------------------------------------------------|---------------------|
| 1  | CCSFS Representative Location                             | On                  | 117                                        | 121    | 113                                            | 104                 |
| 2  | SpaceX Operations Area                                    | On                  | 121                                        | 125    | 117                                            | 109                 |
| 3  | Titusville Beach                                          | On                  | 135                                        | 138    | 130                                            | 123                 |
| 4  | Playalinda Beach                                          | On                  | 125                                        | 129    | 121                                            | 112                 |
| 5  | Kennedy Space Center Visitor Complex                      | On                  | 118                                        | 123    | 114                                            | 105                 |
| 6  | KSC Child Development Center                              | On                  | 119                                        | 123    | 114                                            | 106                 |
| 7  | Merritt Island National Wildlife Refuge<br>Visitor Center | On                  | 119                                        | 123    | 114                                            | 105                 |
| 8  | Pine Island Conservation Area/Pine<br>Island Estates      | Off                 | 115                                        | 120    | 110                                            | 101                 |
| 9  | Kings Park Estates - Courtenay                            | Off                 | 113                                        | 118    | 109                                            | 99                  |
| 10 | Jetty Park Campground                                     | Off                 | 111                                        | 116    | 106                                            | 97                  |
| 11 | Rockledge High School                                     | Off                 | 108                                        | 113    | 102                                            | 93                  |
| 12 | Merritt Island                                            | Off                 | 108                                        | 113    | 103                                            | 93                  |
| 13 | Oak Park Elementary School                                | Off                 | 112                                        | 117    | 107                                            | 97                  |
| 14 | Titusville High School                                    | Off                 | 114                                        | 119    | 109                                            | 100                 |
| 15 | Summerwood Villas                                         | Off                 | 113                                        | 118    | 108                                            | 99                  |
| 16 | Atlantis Elementary School                                | Off                 | 112                                        | 117    | 107                                            | 97                  |
| 17 | Fairglen Elementary School                                | Off                 | 111                                        | 116    | 106                                            | 96                  |
| 18 | Lewis Carroll Elementary School                           | Off                 | 110                                        | 115    | 105                                            | 95                  |
| 19 | Cocoa                                                     | Off                 | 109                                        | 114    | 104                                            | 95                  |
| 20 | Cocoa Beach                                               | Off                 | 108                                        | 113    | 103                                            | 93                  |

**Table 3.2-11.  $L_{\max}$  at Representative Locations**

| ID | Location Description | On/Off KSC/CCSFS | Super Heavy Booster Static Fire Test | Launch | Super Heavy Booster Landing <sup>1</sup> | Starship Landing |
|----|----------------------|------------------|--------------------------------------|--------|------------------------------------------|------------------|
| 21 | Pinegrove Estates    | Off              | 111                                  | 116    | 106                                      | 96               |
| 22 | Fern Meadows         | Off              | 107                                  | 112    | 102                                      | 92               |
| 23 | KSC Office           | On               | 128                                  | 132    | 124                                      | 116              |
| 24 | The Rock Church      | Off              | 109                                  | 114    | 104                                      | 94               |

Notes: CCSFS = Cape Canaveral Space Force Station; ID = location identification number; KSC = Kennedy Space Center;  $L_{\max}$  = maximum sound level; SpaceX = Space Exploration Technologies Corp.

<sup>1</sup> Reflects the representative descent trajectory with highest value.

Noise-induced structural vibration may cause annoyance to building occupants because of induced secondary vibrations, or “rattle,” of objects within the building—hanging pictures, dishes, plaques, and bric-a-brac. Rattling objects are more likely for sounds that last several minutes at greater than 110 dB  $L_{\max}$ . Predicting whether an object will rattle when subjected to noise depends on several characteristics of the object and setting (e.g., mass of the object, firmness-of-fit of in supporting structure), characteristics of the structure (heavier structural elements respond less strongly), and characteristics of the noise (e.g., predominant frequencies and intensity). Although rattling of objects does occur during ongoing rocket operations and would occur with proposed Starship-Super Heavy operations, it is not necessarily associated with damage.

Ground vibrations induced by a Starship-Super Heavy launch at Boca Chica, Texas, were measured in April 2024 at roughly one-quarter mile (0.4 kilometers) from the launch pad and found to be approximately 1 inch per second (in/seconds) PPV (Straam Group, 2024). Vibrations during proposed Starship-Super Heavy operations at KSC would be expected to be similar due to the use of a water deluge system at both locations during launches. The transmission of vibrations through the ground is affected by several location-specific factors and generally decreases more rapidly with distance in “soft” ground (e.g., sandy soils) than in stiffer ground (e.g., rocky soils). A screening level analysis was conducted using a method for estimating as described in the Federal Transit Authority *Transit Noise and Vibration Impacts Assessment Manual* (FTA, 2018), Starship-Super Heavy launch vibration levels measured at Boca Chica, and default transmission parameters (which are considered conservative estimates given the typical composition of soils in the study area). At the closest private residence to LC-39A (10 miles [16 kilometers] away), ground-borne vibration levels are estimated to be 0.004 in/seconds PPV. This estimated ground-borne vibration level is well below the 0.12 in/sec PPV Federal Transit Authority vibration damage criteria level for buildings extremely susceptible to vibration damage. Therefore, the risk of damage to structures outside the boundaries of KSC and CCSFS caused by ground vibrations would be expected to be minimal under the Proposed Action.

The probability of structural damage occurring to structures located on KSC/CCSFS or outside the boundaries of KSC/CCSFS because of noise and vibrations generated by the Proposed Action would be low. The FAA requires SpaceX to maintain insurance in the event of claims of structural damage. In the unlikely event that damage to a structure on KSC/CCSFS or outside the boundaries of KSC/CCSFS were to occur because of Starship-Super Heavy operations, property owners may contact SpaceX directly to submit claims and evidence in support of the damage claim.



### 3.2.4.2.3 Reasonably Foreseeable Effects

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Actions applicable to noise and noise-compatible land use effects include continued launch activity at KSC and CCSFS and continued infrastructure development and improvements at KSC as identified in Table 2.2-1 and Table 2.2-2.

The same areas that would be exposed to elevated noise levels because of the Starship-Super Heavy operations at LC-39A under the Proposed Action would also experience noise generated by changes in Falcon Heavy operations at LC-39A, Falcon 9 operations at SLC-40, the introduction of Starship-Super Heavy operations at SLC-37, and other actions affecting spacecraft operations at KSC/CCSFS. Under the reasonably foreseeable actions operational scenario, there would be 460 launches, 299 landings, and 671 static fire tests per year (see Appendix C.1.1, *Noise Assessment*, Section 7 for additional details).

As shown in Figure 3.2-18, the combined total DNL exceeding 65 dB associated with these actions remains on KSC/CCSFS (except for beach areas not accessible to the public during rocket operations). As shown in Figure 3.2-19, CDNL exceeding 60 dB would expand further into neighboring communities. A total of 46,099 acres of off-center land and an estimated 120,941 residents would be exposed to CDNL greater than 60 dB (Table 3.2-12). The primary contributor to elevated noise levels in neighboring communities is late-night rocket operations.

**Table 3.2-12. Reasonably Foreseeable Action Acres of Land and Estimated Population Off Center Exposed to Greater than 65 dB DNL**

| CDNL (dB)    | Off-Center Land (acres) |                       | Estimated Off-Center Residents |                       |
|--------------|-------------------------|-----------------------|--------------------------------|-----------------------|
|              | RFFA                    | Change from No Action | Reasonably Foreseeable Action  | Change from No Action |
| 60-64        | 24,024                  | +14,932               | 69,774                         | +50,950               |
| 65-69        | 20,765                  | +20,705               | 47,499                         | +47,496               |
| 70-74        | 1,290                   | +1,280                | 3,665                          | +3,663                |
| 75-79        | 20                      | +20                   | 2                              | +2                    |
| 80-84        | -                       | -                     | 1                              | +1                    |
| ≥85          | -                       | -                     | 0.0                            | -                     |
| <b>Total</b> | <b>46,099</b>           | <b>+36,937</b>        | <b>120,941</b>                 | <b>+102,112</b>       |

Notes: ≥ = greater than or equal to; - = minus; + = plus; CDNL = C-weighted day-night average sound level; dB = decibels; DNL = day-night average sound level.

Source: (U.S. Census Bureau, 2024a)

Other projects that involve construction on KSC or CCSFS, such as the Roberts Road SpaceX Operations Area Expansion, would also generate temporary and localized noise increases. Because construction noise is generally only disturbing in areas in the vicinity of the construction site, noise-sensitive locations outside of KSC/CCSFS would not be expected to be affected even if multiple projects were to occur in the same area at the same time. Therefore, no reasonably foreseeable noise and noise-compatible land use effects would occur because of construction activities.

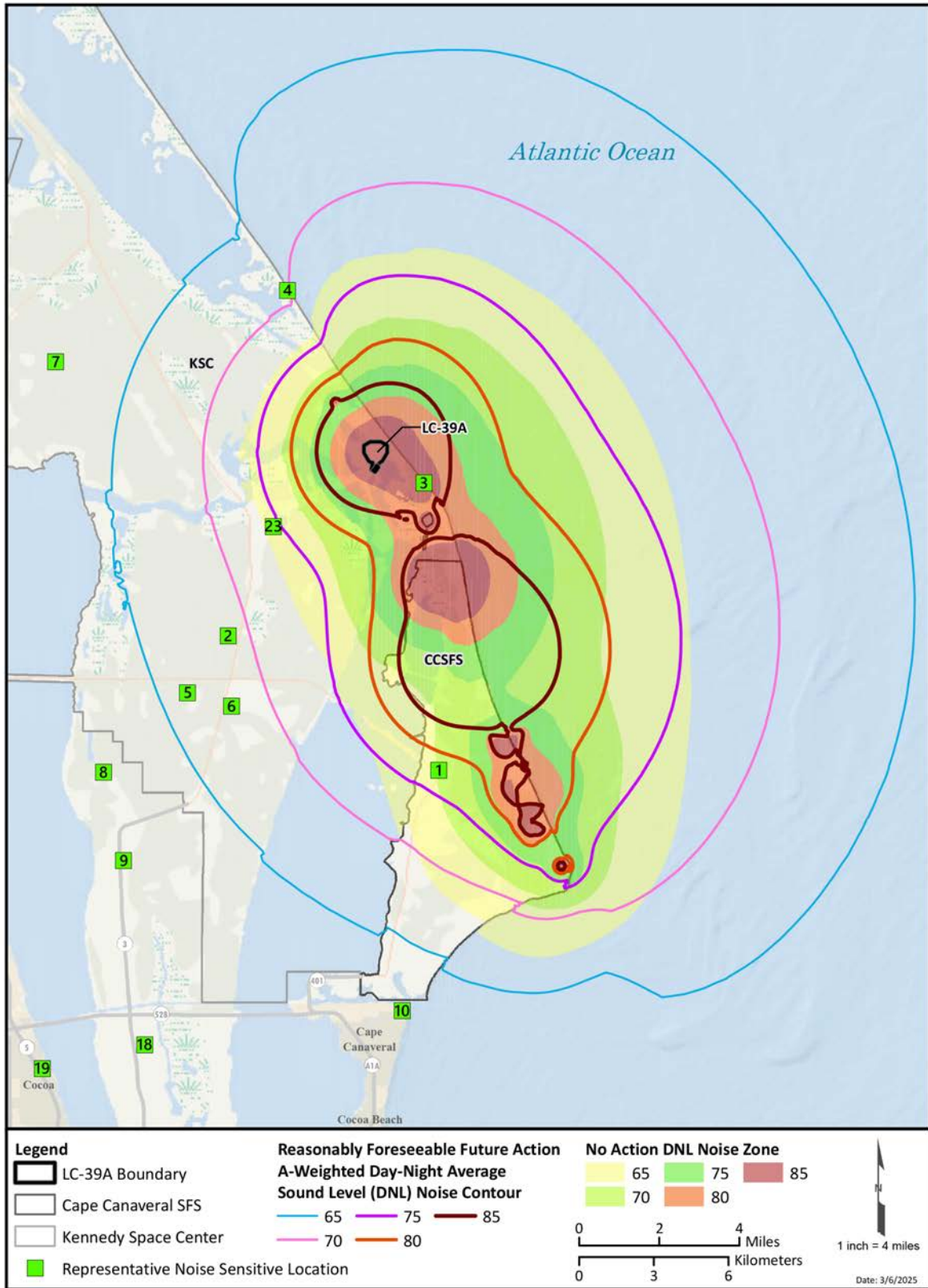


Figure 3.2-18. Reasonably Foreseeable Action and No Action DNL Contours

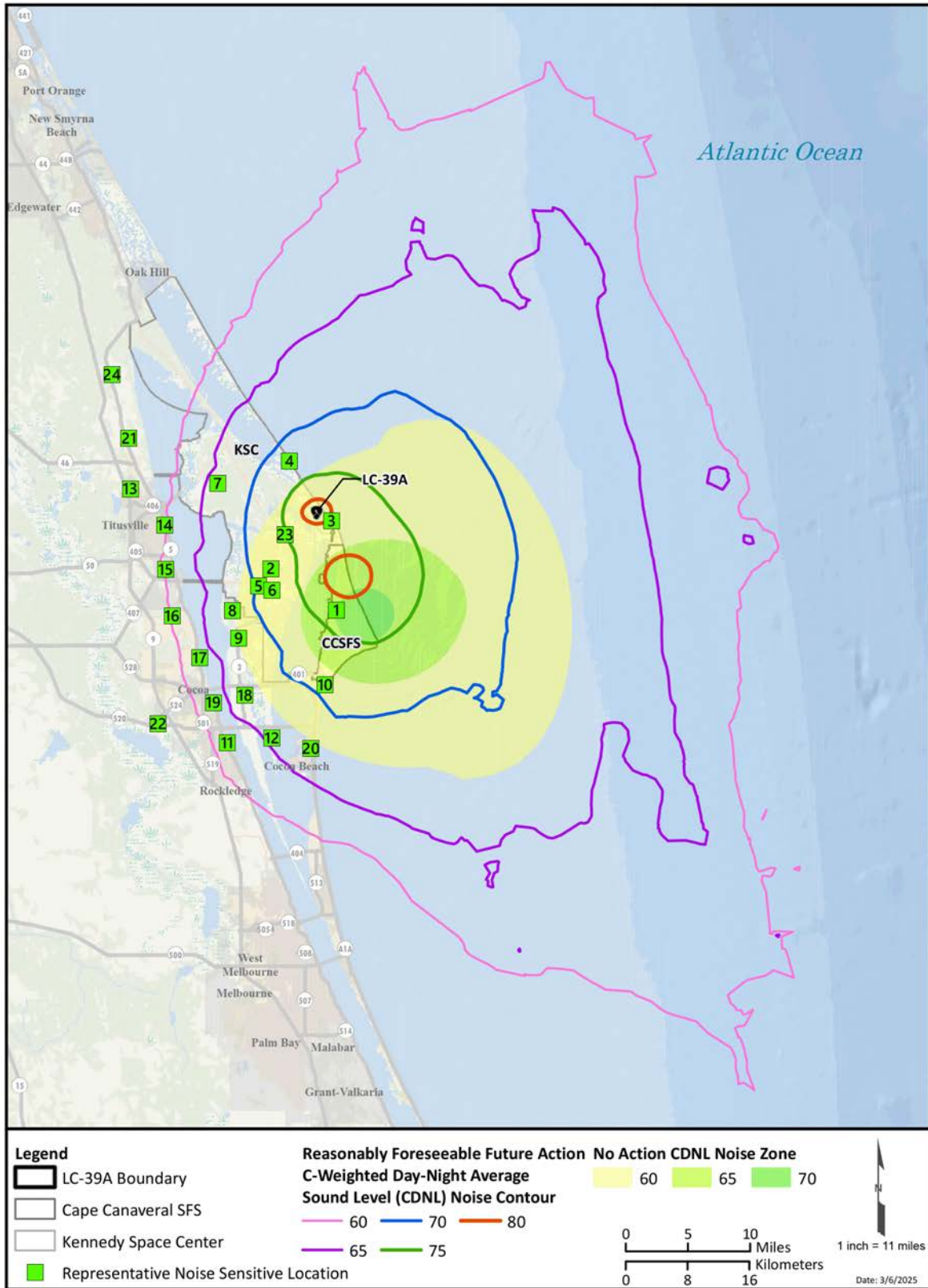


Figure 3.2-19. Reasonably Foreseeable Action and No Action CDNL Contours

### 3.2.5 Best Management Practices (BMPs), Mitigation, and Monitoring

The following BMPs may be implemented to minimize potential adverse effects; any accepted BMPs would be identified in the ROD and incorporated into the license agreement:

- To minimize the magnitude of the overpressure (sonic boom) impacting land, the FAA recommends that, when mission parameters allow, SpaceX slow the velocity of the launch vehicle at higher altitudes than assumed for these conservative analyses.
- Where practicable, loud equipment would be enclosed within structures. Air inlets and exhaust vents would incorporate silencers to reduce exterior noise levels.

The following mitigation measures would be adopted to minimize noise effects associated with the Proposed Action:

- Statements including scheduled dates and times for upcoming launches are already provided to news outlets and local law enforcement. Public and agency notifications would continue as baseline prior to each launch and would add Starship-Super Heavy launch and landing events. This serves to minimize the likelihood of people being surprised by noise associated with these events. *KSC-PLN-5000\_SIMS\_Rev\_B* documents processes and procedures used for planning of all NASA and Partner operations. The Spaceport Integrated Master Schedule provides insight and situational awareness of launch, landing, and/or recovery operations and major operations testing including tank tests, wet dress rehearsals, launch abort testing, and static fire tests. SIMS products and tools are accessible from the non-public *Inside Kennedy – Home* website. Internal notifications are also provided via email from [kennedyspacecenter@dcnotify.com](mailto:kennedyspacecenter@dcnotify.com). There are multiple sources accessible by the public that provide launch schedules, including [NASASpaceflight.com](https://NASASpaceflight.com) and a Florida Today app. Those wishing to receive notifications can register at the Brevard County Emergency Management website: <https://member.everbridge.net/892807736724796/login>.
- Property owners may contact SpaceX directly ([insurance@spacex.com](mailto:insurance@spacex.com)) to submit claims and evidence in support of damage claims.

### 3.2.6 Summary

Increased supersonic noise levels would result in significant noise effects based on criteria in FAA Order 1050.1F Desk Reference, Section 11.5.4.2, *Noise Prediction Modeling*, and other effect criteria described in Section 3.2.1, *Definition of Resource and Regulatory Setting*. Mitigations described in Section 3.2.5, *Best Management Practices, Mitigation, and Monitoring*, would reduce effects somewhat, but significant effects associated with the Proposed Action are unavoidable. Interruptions of activities in nearby communities during the 44 proposed annual Starship-Super Heavy launch and 88 landing events per year would be relatively brief. At representative locations outside KSC/CCSFS, outdoor noise levels would exceed 97 dBA. The likelihood of people exposed to noise being awakened indoors would be as high 82 percent during late-night operations, which would make up approximately half of total annual events at sensitive locations outside KSC/CCSFS. Noise levels would remain below 65 dBA DNL at all locations outside the boundaries of KSC/CCSFS under the Proposed Action; all land uses would remain compatible in accordance with guidelines at 14 CFR Part 150 with propulsion noise



levels. Sonic boom noise levels would exceed 60 dB CDNL, a level at which noise-sensitive land uses are not considered compatible, in 28,595 acres of off-KSC/CCSFS land. Propulsion noise levels would remain below hearing conservation criteria at all locations outside of KSC/CCSFS boundaries. Sonic booms exceeding 4 psf in portions of Merritt Island would be relatively infrequent, and sonic boom noise energy would be primarily at frequencies that do not interact strongly with hearing mechanisms. People in known high-noise areas on KSC would be provided hearing protection where appropriate, and the risk of hearing damage would remain minimal.

## 3.3 Land Use

### 3.3.1 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. LC-39A is bound by NASA land use requirements.

### 3.3.2 Study Area

The study area for land use evaluated under this assessment includes LC-39A at KSC and the surrounding land and water resources with potential to be affected by the proposed project, similar to that as described in Section 3.2.2, *Noise and Noise-Compatible Land Use, Study Area*. Surrounding land and water resources evaluated include CCSFS; MINWR; CANA; Port Canaveral; the cities of Cape Canaveral, Cocoa, and Titusville; and the neighboring community land use areas (i.e., parks and recreation) (see Figure 1.1-1, Figure 2.1-1, and Figure 3.3-1).

Land and open water resources of KSC comprise approximately 142,000 acres (57,000 hectares) in Brevard County and Volusia County and are located along the east coast of central Florida, roughly 50 miles east of Orlando. The majority of the KSC land is located on the northern part of Merritt Island, which forms a barrier island complex adjacent to Cape Canaveral. Approximately 7,500 of 142,000 acres (3,000 of 57,000 hectares) are actively used to support space mission operations. The remaining 134,500 acres (54,000 hectares) are undeveloped areas (uplands, wetlands, mosquito control impoundments, and open water) that comprise approximately 95 percent of KSC lands. Of the 95 percent, nearly 40 percent are open water areas of the Indian River Lagoon (IRL) system, including portions of the Indian River, Banana River, Mosquito Lagoon, and all of Banana Creek (NASA, 2017; NASA, 2020b).

LC-39A is a KSC-owned, SpaceX-leased launch site located on northern KSC property. Surrounding major landmarks include CANA and MINWR to the north, the Atlantic Ocean to the east, Indian River to the west, and the CCSFS, Port Canaveral, and Banana River Aquatic Preserve to the south.



Figure 3.3-1. Parks and Recreational Areas within the Study Area

### 3.3.3 Existing Conditions

#### **Land Use**

Detailed discussions of land use at KSC are available in the *Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC)* (NASA, 2019a), the *Kennedy Space Center Master Plan Final Programmatic Environmental Impact Statement* (NASA, 2016), the *Kennedy Space Center Master Plan Executive Summary 2012-2032* (NASA, 2017), and the *Environmental Resources Document [ERD]: John F. Kennedy Space Center* (hereafter referred to as the KSC ERD) (NASA, 2020b). A summary is provided in the following paragraphs.

KSC devised 18 land use categories to describe regions within which various types of operational or support activities are conducted. Refer to the *Kennedy Space Center Master Plan Final Programmatic Environmental Impact Statement* for a detailed description of each of these areas (NASA, 2016).

Of KSC's 142,000 acres (57,000 hectares), about 85,000 acres (34,000 hectares) are owned by NASA and the remaining 55,000 acres (22,000 hectares) by the State of Florida. The 135,223 acres (54,723 hectares) outside of NASA operational control (i.e., areas not directly utilized for NASA operations) are managed by the USFWS at MINWR and the NPS at CANA.

KSC was created for the purpose of human and commercial space flight and has been operating as such since the early 1960s. Land use planning at KSC is ongoing. Future planning efforts consider a range of future scenarios for repurposing existing facilities and recapitalizing infrastructure, and for reorganizing the management of the KSC and its land resources, with potentially various kinds of partnerships, some of which are already in place. Master planning includes development framework to support the growth of the multiuser spaceport model, including operations, activities, and facilities planning across a 20-year planning horizon. Refer to the *Kennedy Space Center Master Plan Final Programmatic Environmental Impact Statement* (NASA, 2016) and the *Kennedy Space Center Master Plan Executive Summary 2012-2032* (NASA, 2017) for descriptions of projects in development, including the Future Land Use Plan, Facility Development Plan, Area Development Plans, Transportation Plan, and Utilities Systems Plan. Figure 3.3-2 presents the future designated land uses at KSC.

#### **CCSFS Land Use**

Land use types at CCSFS include airfield, port operations, launch operations, launch and range support, commercial aerospace ventures, station support, maintenance areas, and open space. The beaches along CCSFS are restricted from public use.

Refer to the following installation plans for a description of land uses at CCSFS:

- U.S. Space Force's Range of the Future CCSFS District Plans (2024) – The plan provides a framework for future development to meet long-term planning goals as launch rates continue to increase over the next 20 years, as described in USSF (2024b).
- Space Florida's Cape Canaveral Spaceport Master Plan (2017) – provides a set of planning principles and concepts for the future operation and growth of Cape Canaveral Spaceport (Space Florida, 2017).

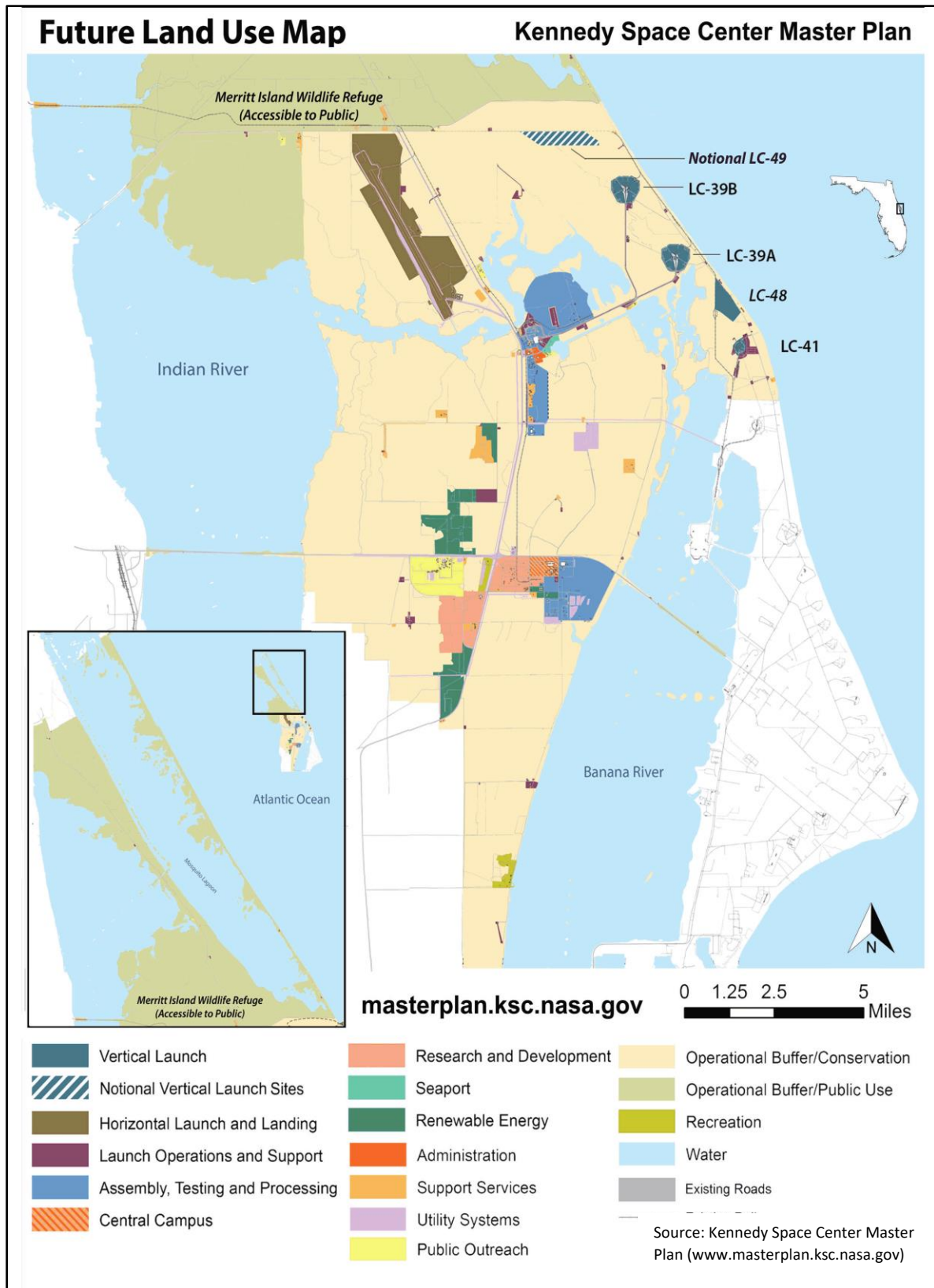


Figure 3.3-2. Designated Future Land Uses at KSC



### **MINWR and CANA Land Management**

MINWR was created in 1963 by agreement between the Bureau of Sport Fisheries and Wildlife (later the USFWS) and NASA to manage the undeveloped lands needed as a safety buffer around KSC. Congress established CANA in 1975. CANA is outside the boundaries of KSC and CCSFS, and includes about 58,000 acres (23,000 hectares) of barrier islands, open lagoons, coastal hammocks, and pine flat woods and about 24 miles (39 kilometers) of undeveloped beaches. Of the 58,000 acres, NASA owns roughly 39,000 acres (15,783 hectares), and much of that area (34,000 acres/13,759 hectares) is co-managed with MINWR. KSC has an agreement with the U.S. Department of the Interior for management of a portion of CANA by the NPS and a portion by the USFWS. The NPS administers a 6,654-acre (2,693-hectare) area of CANA, while the USFWS administers the remaining 128,569 acres (52,030 hectares) of CANA and MINWR (NASA, 2015; NASA, 2016). The USFWS is responsible for management activities, such as but not limited to, facilities and visitor use, endangered species oversight, fire, multi-species water level activities, invasive species control, and wildlife response.

Under the Interagency Agreement between NASA and the USFWS for Use and Management of Property at KSC known as MINWR (KCA-1649 Rev. C), the USFWS conducts habitat management activities, including prescribed burning. The USFWS coordinates prescribed burns on MINWR in accordance with the *Memorandum of Understanding between Space Launch Delta 45 [SLD 45], United States Fish and Wildlife Service, and John F. Kennedy Space Center for Prescribed Burning on the Merritt Island National Wildlife Refuge, John F. Kennedy Space Center, and Cape Canaveral Space Force Station, Florida, NASA KCA-4205* (hereafter referred to as the “MOU for Prescribed Burning”) (NASA, 2019a; SLD 45, USFWS, and KSC, 2025).

Several fire management units (FMUs) are located directly adjacent to LC-39A (T-33 [A-C], T-29 [A-B], T-25 [A-D], T-28 [A-B], and 7.3) and in the surrounding area (Figure 3.3-3). FMUs are defined as land management area(s) (definable by objectives, topographic features, access, values to be protected, political boundaries, fuel types, major fire regimes, etc.) in which integrated planning processes, prevention, and fighting fires is employed to protect people, property, and the forest resource. Burn planning and launch operations adhere to the MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025). The MOU lays out conditions and constraints for conducting prescribed burns on KSC. FMUs are scheduled to receive fire on a 3- to 4-year rotation; however, some FMUs do not receive fire according to the fire schedule. Figure 3.3-3 presents the FMUs that surround LC-39A and their last burn year (i.e., MINWR Fire History).

### **Port Canaveral**

Located to the south of KSC, Port Canaveral serves as a hub for the cruise industry, cargo transport, commercial fishing fleets, industrial parks (including marinas), charter fishing, and park facilities. According to the *Port Canaveral Land Use Plan - Final Report*, Port Canaveral is comprised of the following five main areas: Marina Area, Mullet Road/Scallop Drive, Canaveral Cove, Columbia Road, and the Banana River area (Wilbur Smith Associates, 2002). The *Port Canaveral 30 Year Strategic Vision Plan* details future planning goals and strategies for the Canaveral Port District, Brevard County, and the Central Florida region, with a focus on future goals for cruise, cargo, spaceport, commercial fishing, marine recreation, and commercial development (Port Canaveral, 2019).

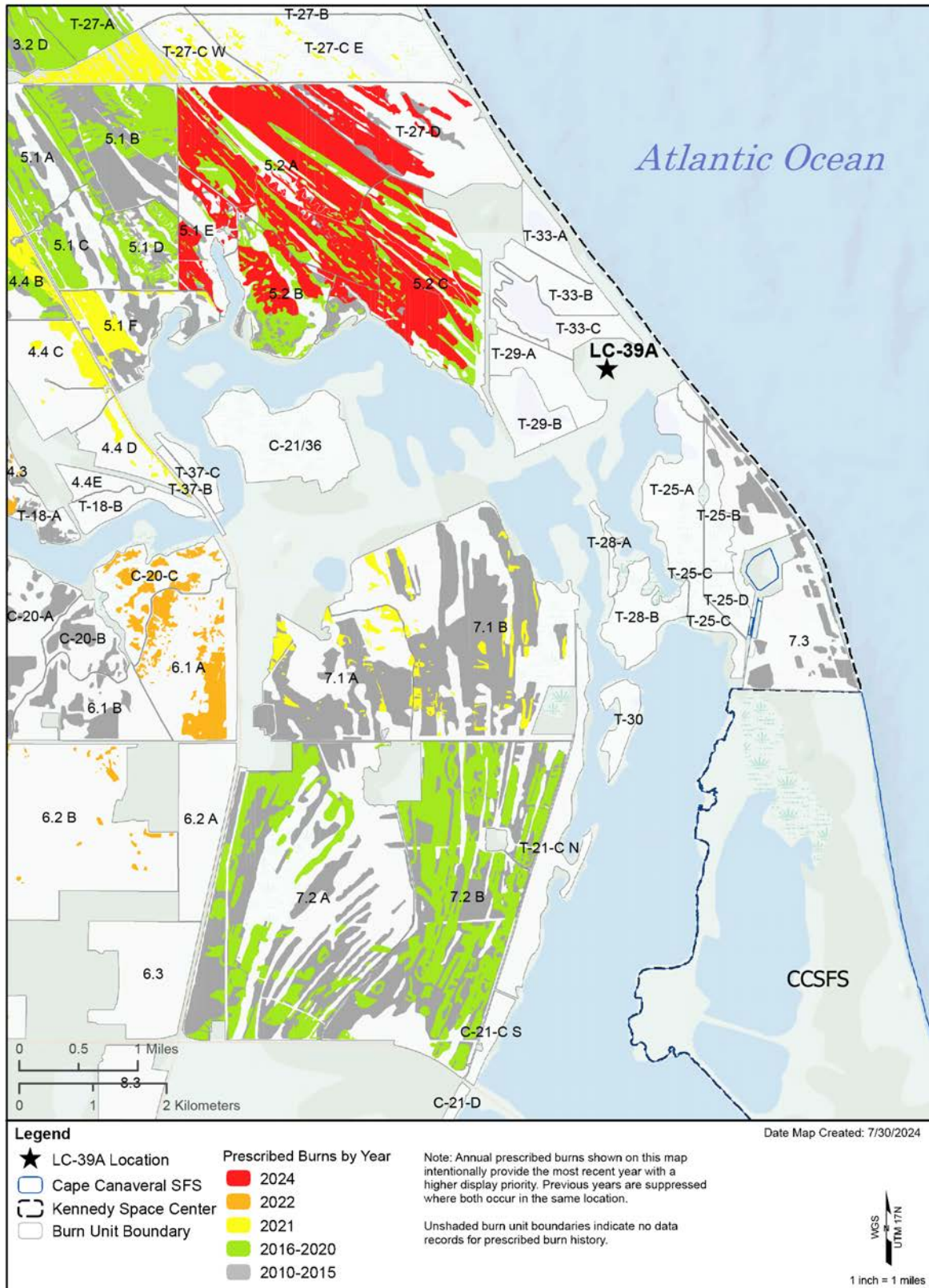


Figure 3.3-3. Fire Management Units at KSC

### **City of Cape Canaveral**

Cape Canaveral is a city on Florida’s Atlantic coast, located south of Port Canaveral and KSC. The city has a total area of 2.3 square miles (6.0 kilometers) with a population of 9,972 in 2020 and is a cross section of both single-family and multifamily residences amongst commercial and industrial areas (U.S. Census Bureau, 2024b). Refer to the *City of Cape Canaveral Comprehensive Plan* for a description of the city’s plan goals, objectives, and policies (City of Cape Canaveral, 2021). The City of Cape Canaveral Future Land Use Map can be viewed at the following location: [https://cms3.revize.com/revize/capecanaveral/document\\_center/cocc\\_flu\\_map\\_202203.pdf](https://cms3.revize.com/revize/capecanaveral/document_center/cocc_flu_map_202203.pdf).

### **City of Cocoa**

Cocoa is primarily a residential city located to the southwest of KSC, across the Indian River. It has a total area of 15.4 square miles (39.9 kilometers) and a population of 19,041 (U.S. Census Bureau, 2024b). Refer to the *City of Cocoa Comprehensive Plan 2020-2030* for Cocoa City’s land use plan goals, objectives, and policies (City of Cocoa, 2020).

### **City of Titusville**

Titusville has a population of over 43,000 people, covering over 30 square miles (78 square kilometers). Titusville is bordered on the west by the St. Johns River, the eastern edge runs along the IRL, providing access to MINWR, CANA, and KSC. Refer to the *City of Titusville Comprehensive Plan* for information regarding land use and planning in the area (City of Titusville, 2018).

### **City of Oak Hill**

With a population of 1,775, Oak Hill is a city in Volusia County, Florida, and is part of the Deltona–Daytona Beach–Ormond Beach, Florida Metropolitan Statistical Area (City of Oak Hill, 2021). General land use is presented on the Oak Hill Zoning District Map and can be viewed at the following location: [https://cdn.prod.website-files.com/63167e09617b3d29c29ef628/6327b67fcd40a87b721104f7\\_2015\\_official\\_zoning\\_map.pdf](https://cdn.prod.website-files.com/63167e09617b3d29c29ef628/6327b67fcd40a87b721104f7_2015_official_zoning_map.pdf).

### **Community Land Use Areas**

For this EIS, community land use areas are defined as the locations near KSC with potential to be affected by noise from the proposed project (Figure 3.3-1) that are open for recreation and public use (Table 3.3-1). More detail regarding public parks and recreation areas and waterfowl and wildlife refuges can be found in Section 3.7, *Department of Transportation Act, Section 4(f)*.

**Table 3.3-1. Selection of Parks and Recreational Areas within the Study Area**

| <b>Park or Recreational Area Name</b>                                                                       | <b>Owner/Operating Authority</b> | <b>Type of Park</b>      |
|-------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------|
| Canaveral National Seashore                                                                                 | NPS                              | National Park            |
| MINWR (Public Area)                                                                                         | USFWS                            | Wildlife Refuge          |
| Adams Ave Beach Access                                                                                      | City of Cape Canaveral           | Nature Park/Beach Access |
| Buchanan Ave Beach Access                                                                                   | City of Cape Canaveral           | Nature Park/Beach Access |
| Cocoa Beach<br>- Grant Avenue Beach Access<br>- Hayes Avenue Beach Access<br>- Garfield Avenue Beach Access | Brevard County                   | Nature Park/Beach Access |

**Table 3.3-1. Selection of Parks and Recreational Areas within the Study Area**

| <b>Park or Recreational Area Name</b>                          | <b>Owner/Operating Authority</b> | <b>Type of Park</b>                    |
|----------------------------------------------------------------|----------------------------------|----------------------------------------|
| - Arthur Avenue Beach Access<br>- McKinley Avenue Beach Access |                                  |                                        |
| Cocoa Riverfront Park                                          | City of Cocoa                    | Neighborhood Park/Mixed Use Recreation |
| Cape Canaveral City Park                                       | City of Cape Canaveral           | Neighborhood Park/Athletic             |
| Cherie Down Park                                               | Brevard County                   | Nature Park/Beach Access               |
| Fillmore Ave Beach Access                                      | City of Cape Canaveral           | Nature Park/Beach Access               |
| Jackson Ave Beach Access                                       | City of Cape Canaveral           | Nature Park/Beach Access               |
| Jefferson Ave Beach Access                                     | City of Cape Canaveral           | Nature Park/Beach Access               |
| Jetty Park/Jetty Park Drive Park                               | Canaveral Port Authority         | Neighborhood Park/Mixed Use Recreation |
| Johnson Ave Beach Access                                       | City of Cape Canaveral           | Nature Park/Beach Access               |
| Kelly Park East                                                | Merritt Island                   | Neighborhood Park/Mixed Use Recreation |
| Kelly Park West                                                | Merritt Island                   | Neighborhood Park/Mixed Use Recreation |
| Kings Park                                                     | Merritt Island                   | Neighborhood Park/Mixed Use Recreation |
| Lincoln Ave Beach Access                                       | City of Cape Canaveral           | Nature Park/Beach Access               |
| Lori Wilson Park                                               | City of Cocoa Beach              | Nature Park/Beach Access               |
| Madison Ave Beach Access                                       | City of Cape Canaveral           | Nature Park/Beach Access               |
| Manatee Cove Park                                              | Merritt Island                   | Neighborhood Park/Mixed Use Recreation |
| Monroe Ave Beach Access                                        | City of Cape Canaveral           | Nature Park/Beach Access               |
| Pierce Ave Beach Access                                        | City of Cape Canaveral           | Nature Park/Beach Access               |
| Playalinda Beach                                               | Canaveral National Seashore      | National Park/Beach Access             |
| Polk Ave Beach Access                                          | City of Cape Canaveral           | Nature Park/Beach Access               |
| Ridgewood Avenue Beach Access                                  | City of Cape Canaveral           | Nature Park/Beach Access               |
| Rotary Park                                                    | Merritt Island                   | Neighborhood Park/Mixed Use Recreation |
| Sand Point Park                                                | City of Titusville               | Neighborhood Park/Mixed Use Recreation |
| Shepard Park                                                   | City of Cocoa                    | Nature Park/Beach Access               |
| Sidney Fischer Park                                            | City of Cocoa                    | Nature Park/Beach Access               |
| Sunrise Park                                                   | City of Oak Hill                 | Neighborhood Park/Mixed Use Recreation |
| Taylor Ave Beach Access                                        | City of Cape Canaveral           | Nature Park/Beach Access               |
| Tyler Ave Beach Access                                         | City of Cape Canaveral           | Nature Park/Beach Access               |
| Washington Ave Beach Access                                    | City of Cape Canaveral           | Nature Park/Beach Access               |
| William Bennix Park                                            | City of Cape Canaveral           | Neighborhood Park/Open Space           |
| Woody Simpson Park                                             | Merritt Island                   | Neighborhood Park/Mixed Use Recreation |

Notes: Ave= Avenue; MINWR = Merritt Island National Wildlife Refuge; NPS = National Park Service; USFWS = United States Fish and Wildlife Service.

### 3.3.4 Environmental Consequences

#### **Analysis Methodology**

The FAA has not established a significance threshold or identified factors to consider when evaluating the context and intensity of potential environmental effects for land use (Exhibit 4-1 of the FAA Order 1050.1). The determination that significant land use effects exist is normally dependent on the significance of other effects (FAA, 2023b). Effects are determined by identifying any changes in land use or land management practices that are not in keeping with existing or future usages as described in land use plans, master plans, or local policies.

An effect on land use would be significant if any of the following were true for the Proposed Action:



- The Proposed Action was inconsistent or noncompliant with applicable land use plans or policies.
- The Proposed Action precluded the viability of existing land use.
- The Proposed Action precluded continued use or occupation of an area.
- The Proposed Action was incompatible with land uses in the vicinity to the extent that public health or safety was threatened.

### 3.3.4.1 No Action

Under the No Action Alternative, Starship-Super Heavy launch and landing operations at LC-39A and associated infrastructure improvements would not occur. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Land use would continue as described in Section 3.3.3, *Existing Conditions*, and future master planning at KSC would continue as described in the *Center Master Plan Final Programmatic Environmental Impact Statement* (NASA, 2016) and the *KSC Master Plan Executive Summary* (NASA, 2017).

Reasonably foreseeable effects on noise-compatible land use include additional launches and future development/construction activities associated with planned actions. Significant effects to noise-compatible land use may occur to areas exposed to sonic booms from reasonably foreseeable actions. Projected noise levels from sonic booms would exceed levels at which noise-sensitive land uses are not considered compatible. Additionally, reasonably foreseeable noise-related effects would occur within the community land use areas due to activity interference from launches and landings. The same areas that would be exposed to elevated noise levels because of the Starship-Super Heavy operations at LC-39A under the Proposed Action would also experience noise generated by changes in Falcon 9 operations at SLC-40, the introduction of Starship-Super Heavy operations at SLC-37, and other actions affecting spacecraft operations at KSC/CCSFS. Furthermore, the SLC-40 launch cadence will include up to 120 launches per year with a maximum of 34 landings annually.

### 3.3.4.2 Proposed Action

#### 3.3.4.2.1 Construction

Under the Proposed Action, SpaceX would improve existing infrastructure in areas previously approved for construction (and currently under development) under the *Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC)* (NASA, 2019a), as well as those associated with this Proposed Action (as described in Section 2.1.4, *LC-39A Infrastructure*). New construction would include new facilities and infrastructure improvements at LC-39A (Figure 2.1-11). Noise generated by heavy equipment during construction would be temporary and localized to the vicinity of the construction site. At this time, no transportation improvements outside those previously identified for LC-39A are proposed. Future transportation improvements to support KSC/SpaceX would be subject to NEPA review.

The Proposed Action would not result in any new effects on existing land use at KSC. All potential effects from construction, including those related to supporting SpaceX and other KSC operations, have been previously analyzed and addressed under existing NEPA documentation (NASA, 2019a; NASA, 2024b).

### 3.3.4.2.2 Operation

#### Land Use

Implementation of the Proposed Action would include coordinated pre-launch access restrictions and closure-related activities for safety purposes. As such, effects to land use within the specific areas subject to access restrictions would occur (Figure 2.1-5 provides a graphical representation of the closure areas associated with access restrictions). As discussed in Section 2.1.3.1, *Starship-Super Heavy Operations, Pre-Launch: Land-Side Coordination*, restricted areas are estimated and provide only a representative depiction; exact restricted areas would be determined prior to pre-launch activities and launch/landing. It is anticipated that, similar to other launch vehicles like Falcon, the access restricted area and associated restricted access/closure areas would reduce in size and duration as the program matures, more data is available, and the reliability of the vehicle improves.

Static fire tests would result in restricted access to areas not currently accessible to the public and would last approximately 3 hours each time; these would mostly affect land management and mission-related activities on MINWR and KSC. Restricted access areas associated with launches and landings would be expanded to also affect the northern portion of CCSFS, which would include SLC-41 (leased to United Launch Alliance) and SLC-40, and publicly accessible areas of MINWR and the southern portion of CANA that includes Playalinda Beach. Restricted areas affecting publicly accessible areas would result in closures during the identified operations due to safety concerns. All closures, whether dictated by public safety concerns (i.e., the Range or FAA require the closure) or due to visitor volumes exceeding capacity would be temporary.

**Noise.** Operation activities associated with the Starship-Super Heavy would also occur within areas previously approved and currently under development, as described in the *Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC)* (NASA, 2019a). While land use designations would not change, operation of new LC-39A infrastructure would add to the industrial acoustic environment that exists at LC-39A under existing conditions. While the proposed increase in operations, static fire tests, and landings would not affect noise-compatible land use, the increase in launch activities would exceed 90 dB LA<sub>max</sub>—a noise level considered likely to interfere with activities—in communities outside the boundaries of KSC and CCSFS (Section 3.2.4, *Noise and Noise-Compatible Land Use, Environmental Consequences*). Launch noise levels would exceed 90 dB ASEL in land areas within approximately 31 miles (50 kilometers) of LC-39A, which include the cities of Oak Hill, Mims, Titusville, Port Saint John, Cocoa, Rockledge, Cocoa Beach, Cape Canaveral, and Satellite Beach. Launches would exceed 100 dB ASELs in Titusville, Port Saint John, Merritt Island, and Cape Canaveral (Figure 3.2-8). Undeveloped land and open water mainly associated with CANA and/or MINWR, currently designated as operational buffer/conservation managed areas, comprises most of the land use categories exposed to the increase. Noise levels would remain below 65 dBA DNL at all locations outside the boundaries of KSC and CCSFS (Figure 3.2-16). As shown in Figure 3.2-17, land outside KSC/CCSFS that includes sensitive locations such as residences would be exposed to sonic boom noise levels exceeding 60 dB CDNL. These increases in CDNL would result in sensitive land uses becoming incompatible, resulting in significant effects. Refer to Section 3.2.4 for a detailed discussion regarding noise-compatible land use.

**Prescribed Burn Operations.** The Proposed Action would not change the existing use of the launch facilities or significantly change the fire management program activities at KSC. While the increase in projected launch operations and static fire testing over existing conditions could potentially overlap with the prescribed burn schedule, it is not anticipated that current fire management program activities would be significantly affected. This is because prescribed fire planning and interagency coordination activities would continue at all FMUs and adhere to the MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025). Continued enforcement of the

MOU would ensure that controlled burning of adjacent land and related issues are well communicated with the goal of limited, if any, effect to operations at the LCs. The SLD 45/USFWS/KSC Prescribed Burn Working Group has been established for general scheduling and coordination of prescribed burning activities on KSC, MINWR, and CCSFS. When NASA KSC receives USFWS notification of a planned prescribed burn of a targeted burn unit (and back-up unit) at KSC, NASA KSC notifies SpaceX to allow coordination of prescribed burns (SLD 45, USFWS, and KSC, 2025). Under implementation of the Proposed Action, NASA KSC management would continue to assist the USFWS in resolving any operational or other barriers to accomplish prescribed burns. As such, it is not anticipated that fire program activities would be significantly affected due to implementation of the Proposed Action.

The USFWS and Audubon Florida organization have expressed concern over conflict between requisite prescribed fire intervals and the unknown frequency of closure areas associated with static test fires, wet dress rehearsals, staging and transport of payloads, and launches. The USFWS and the Audubon Florida organization are seeking commitments from KSC that would allow launch activities and fire management activities to occur concurrently, so the ability to use prescribed fire intervals as needed may continue at KSC, CCSFS, CANA, and MINWR with the implementation of the Starship-Super Heavy program. Refer to the Recreation section below, as well Section 3.8.4, *Biological Resources, Environmental Consequences*, for a discussion of effects.

### Recreation

Impaired use (i.e., “Constructive Use”) of recreation areas such as parks, trails, water access, golf courses, campgrounds, and wildlife/waterfowl refuges due to the Proposed Action is discussed in Section 3.7, *Department of Transportation Act, Section 4(f)*.

The public, the USFWS, and NPS submitted comments expressing concern over potential community area restrictions and park closures. Such restrictions and closures could affect USFWS and NPS management activities, visitor opportunities, and visitor experiences at MINWR and CANA. Restrictions or closures associated with the Proposed Action could affect outdoor recreation visitor opportunities, experiences, and safety; the economic impact of closures is addressed in Section 3.4.4.2.2, *Socioeconomics and Children’s Environmental Health and Safety Risk, Operation*. Visitors within these areas are generally split into two distinct groups with different sets of activities and behaviors: (1) visitors participating in outdoor recreation at MINWR and CANA and (2) crowds viewing space launches and landings.

Negative effects to recreational land use could result if USFWS and NPS staff are required to divert their routine management priorities and projects attributable to increased time spent rearranging staff work assignments and halting contractor work, notifying the public to safely clear and close areas (i.e., updating social media and fielding visitor inquiries, phone calls and emails regarding the launch), and canceling visitor programs. There could also be a loss of visitor fees due to closures.

While restricted access requirements are limited to the duration the access restricted area is in effect (i.e., between 3 and 3.5 hours per event—see Table 2.1-1) the actual duration of a closure associated with publicly accessible areas may be longer due to logistical aspects. Based on information provided by the NPS, duration of closures for portions of CANA and Playalinda Beach is affected by the time of day/night that the test or launch occurs. Due to logistics of closures (e.g., NPS personnel clearing the park of visitors, etc.), midday (or later) launches or tests could result in the need to close portions of the park for the entire day; tests or launches occurring very early in the morning may result in the park being closed for a portion of the day. CANA is typically open 6:00 a.m. – 8:00 p.m. 7 days a week. As discussed in Section 2.1.3.1, *Starship-Super Heavy Operations, Pre-Launch*, it is estimated that there could be between 33 and 44 (using the most conservative estimate) full-day closures and up to 33 half-day closures, which equates to up to 60.5 total “closure days” per year (44 full

days + 33 half-days = 60.5 “full days”). Launch scrubs and weather delays could affect the length and/or number of closures; however, the extent of these occurrences cannot be quantified at this time.

Given that CANA is open 365 days per year, portions that include Playalinda Beach could be closed up to approximately 16.5 percent of the year, more or less depending on scheduling of launches/landings and the occurrences of scrubbed launches. This may be inconvenient to those wishing to visit the park during these times and may be exacerbated were launches/landings scheduled during high-use times such as holidays and weekends. However, advance notification to the public of launch schedules would help visitors plan accordingly.

When the park remains open for a rocket launch, USFWS and NPS staff must adjust operations while also protecting visitor safety and park resources. NPS stated that to serve visitors during a launch, the park must bring in additional law enforcement officers and fee booth staff on overtime for crowd and vehicle control and to collect fees; schedule additional trash pick-up, septic pumping, and bathroom cleaning due to the increase in visitation; schedule volunteers needed to monitor the park boundary to keep visitors out of closed areas; update park social media; and field the increase in phone calls and emails from park visitors related to the launch.

On April 3, 2025, the Secretary of the Interior issued Secretarial Order (SO) 3426, *Ensuring National Parks Are Open and Accessible*, which is “intended to ensure that all national parks and national historic sites, which are managed by the Department of the Interior (Department), remain open and accessible for the benefit and enjoyment of the American people and to ensure that the NPS will provide the best customer service experience for all visitors.” The policy as identified in the SO is that the NPS Director will ensure that all park units remain open and accessible to the American public during the specified hours of operation posted on the respective park units’ public webpages at <https://www.nps.gov/findapark/>. To ensure visitor access and satisfaction, any closures or reductions to operating hours, seasons, or any visitor services (including trails and campgrounds), in whole or in part, must be reviewed by the NPS Director and the Assistant Secretary for Fish and Wildlife and Parks prior to any reduction action by the individual park units. Therefore, before any closures are enacted, the closure activities must be reviewed and approved by the NPS Director and the Assistant Secretary for Fish and Wildlife and Parks. This will be coordinated between the FAA, NASA, SpaceX, and the Department of the Interior.

Notwithstanding the SO 3426, the Proposed Action is not otherwise inconsistent or incompatible with surrounding land uses and does not otherwise preclude the viability of existing land use at MINWR or CANA or continued use or occupation of MINWR or CANA. The socioeconomic effects of CANA closures are discussed in Section 3.4.4.2.2, *Socioeconomics and Children’s Environmental Health and Safety Risk, Operation*.

Activity interference may occur within the community land use areas due to increased noise during launches and landings; however, these events would be relatively short lived. The relatively short duration of potentially disturbing noise levels, as well as the fact that these areas are already subject to frequent launch-related noise, supports consideration of sensitive land uses in MINWR and CANA as being compatible (see Section 3.2.4, *Noise and Noise-Compatible Land Use, Environmental Consequences*).

### **3.3.4.2.3 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS, continued infrastructure development and improvements at KSC, and continued economic and community growth and development within the areas surrounding KSC as identified in



Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. The Proposed Action would be consistent with the current land uses at and in the vicinity of KSC and would continue to function to support space transportation operations and associated support requirements. In context with other reasonably foreseeable actions, projected effects to land use recreational resources would occur from activity interference from increased noise events/public exposure, increased park access restrictions, closures, and the associated changes to USFWS and NPS staff management priorities (altered by increased launches).

However, the FAA does not consider these effects to be significant as they do not permanently preclude the viability or use of the areas or threaten public health or safety. Additionally, the FAA does not anticipate that fire management program activities would significantly change in the area surrounding LC-39A due to continued enforcement of the MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025).

Reasonably foreseeable effects on noise-compatible land use include additional aggregate launches and future development/construction activities associated with planned actions. While noise levels would remain compatible at all locations outside the boundaries of KSC/CCSFS under the Proposed Action, significant effects to noise-compatible land use would occur to areas exposed to sonic booms. Projected noise levels from sonic booms would exceed levels at which noise-sensitive land uses are not considered compatible. Additionally, reasonably foreseeable noise-related effects would occur within the community land use areas due to activity interference from launches and landings. The same areas that would be exposed to elevated noise levels because of the Starship-Super Heavy operations at LC-39A under the Proposed Action would also experience noise generated by changes in Falcon 9 operations at SLC-40, the introduction of Starship-Super Heavy operations at SLC-37, and other actions affecting spacecraft operations at KSC/CCSFS. Furthermore, the SLC-40 launch cadence will include up to 120 launches per year with a maximum of 34 landings annually.

### 3.3.5 BMPs, Mitigation, and Monitoring

The following monitoring and management actions are currently implemented at KSC and would continue under the Proposed Action:

- *Noise*: Mitigations regarding launch notifications discussed under Section 3.2.5, *Noise and Noise-Compatible Land Use, Best Management Practices, Mitigation, and Monitoring*, would also apply to the *Land Use* section.
- *Prescribed Burn Operations*: When NASA KSC receives USFWS notification of a planned prescribed burn of a targeted burn unit (and back-up unit) at KSC, NASA KSC shall notify SpaceX a minimum of 3 days in advance to allow coordination of prescribed burns per the MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025).
- *Recreation*: Continued implementation of strategies to minimize the length of surrounding park closures. This helps to minimize public access restrictions in areas frequented by the public—mainly associated with Playalinda Beach and nearby surrounds of MINWR/CANA.

### 3.3.6 Summary

Under the Proposed Action, land use designations at KSC would remain unchanged. Construction and operations at LC-39A would occur within areas previously approved for construction (and currently under

development) as described in the Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC) (NASA, 2019a). The Proposed Action would be consistent with the current land uses at and in the vicinity of KSC and would continue to function to support space transportation operations and associated support requirements.

Impaired use (i.e., “Constructive Use”) of recreation areas such as parks, trails, water access, golf courses, campgrounds, and wildlife/waterfowl refuges due to the Proposed Action is discussed in Section 3.7, Department of Transportation Act, Section 4(f). In general, effects to recreational land use in the surrounding study area would occur due to increased noise events/public exposure, as well as increased access restrictions, closures, and the associated changes to USFWS and NPS staff management priorities altered by launches. However, the FAA has not determined a constructive use of these areas and does not consider these effects significant, as the noise and closure events would be temporary and would not permanently preclude the viability or use of the areas, as shown by their current exposure to frequent launch-related noise from both KSC and CCSFS. Land uses would not be affected to the extent that public health or safety was threatened. Additionally, it is not anticipated that fire management program activities would significantly change in the area surrounding KSC due to continued enforcement of the MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025). Before any closures are enacted, the closure activities must be reviewed and approved by the NPS Director and the Assistant Secretary for Fish and Wildlife and Parks under SO 3426. This will be coordinated between the FAA, SpaceX, and the Department of the Interior.

Noise-compatible land use outside of KSC and CCSFS would remain compatible with guidelines published at 14 CFR Part 150, except for those areas exposed to sonic booms exceeding 60 dB CDNL (Figure 3.2-17). In these areas projected noise levels from sonic booms would exceed levels at which noise-sensitive land uses are not considered compatible (see Section 3.2.4, Noise and Noise-Compatible Land Use, Environmental Consequences).

## 3.4 Socioeconomics and Children’s Environmental Health and Safety Risks<sup>34</sup>

### 3.4.1 Definition of Resource and Regulatory Setting

Appendix D.4, *Socioeconomics and Children’s Environmental Health and Safety Risks*, identifies and describes the statutes, regulations, executive orders, and other requirements related to socioeconomics and children’s environmental health and safety risks.

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<sup>34</sup> FAA Order 1050.1F includes environmental justice as a component of this impact category. On January 20, 2025, President Trump issued E.O. 14148, *Initial Rescissions of Harmful Executive Orders and Actions*, rescinding E.O. 14096, *Revitalizing Our Nation’s Commitment to Environmental Justice for All* (2023). E.O. 14096 supplemented E.O. 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994), establishing a government-wide mandate to advance environmental justice. As a result, the FAA no longer evaluates environmental justice as a part of its NEPA reviews. Thus, this EIS does not include any discussion of environmental justice, and environmental justice will not be considered by the FAA in its decision-making.

### ***Socioeconomics***

Socioeconomics refers to the human environment such as population, employment, housing, income, and public services that might be affected by the Proposed Action and alternatives.

#### ***Children's Environmental Health and Safety Risks***

Affects to children are considered separately in NEPA reviews because children may experience a different intensity of affect as compared to an adult exposed to the same event. Children may suffer disproportionately more environmental health and safety risks than adults because they are still developing their neurological, digestive, immunological, and other bodily systems. Children eat more food, drink more fluids, and breathe more air in proportion to their body weight than adults, which may cause them to experience higher rates of exposure to toxins, pollutants, and pathogens. Their behavior patterns may make them more susceptible to accidents because they are less able to protect themselves; and their size and weight may diminish their protection from standard safety features.

## **3.4.2 Study Area**

Social effects would be felt most by individuals, communities, residents, and workers in Brevard and Volusia Counties; therefore, these counties are defined as the study area for the analysis of socioeconomic resources.

The study area for children's environmental health and safety risks is primarily based on the potential for noise-related effects and shown in Figure 3.4-1. This study area is based on land areas where populations may be present in the 60 dB CDNL or greater contour. To ensure that all potentially affected populations were considered, the reasonably foreseeable conditions contour was used. This contour represents the area of greatest potential effect.

## **3.4.3 Existing Conditions**

### ***Socioeconomics***

#### **Population and Housing**

Table 3.4-1 shows the most recent population estimates at the time of this EIS from the U.S. Census Bureau and population projections from the Bureau of Economic and Business Research for Brevard County, Volusia County, and the State of Florida. The closest residence to the proposed location is located 10 miles (16 kilometers) southwest of LC-39A. Titusville is located approximately 12 miles (19 kilometers) west of LC-39A. The population of Titusville is estimated at 49,680 people. The city population has grown by 1.8 percent since the 2020 census population of 48,789 people (U.S. Census Bureau, 2024b). There are no populations within the 60 dB CDNL noise contour under existing conditions, as only areas on CCSFS are affected (see Figure 3.4-1).

**Table 3.4-1. Population in the Study Area**

| Location       | 2010 Census <sup>1</sup> | 2020 Census <sup>1</sup> | 2023 Estimate <sup>1</sup> | Percent Change 2020–2023 | Projected 2030 <sup>2,3,4</sup> | Projected 2035 <sup>2,3,4</sup> |
|----------------|--------------------------|--------------------------|----------------------------|--------------------------|---------------------------------|---------------------------------|
| Brevard County | 543,376                  | 606,612                  | 643,979                    | 6.2%                     | 694,600                         | 724,600                         |
| Volusia County | 494,593                  | 553,543                  | 590,357                    | 6.7%                     | 630,900                         | 657,200                         |
| Florida        | 18,801,310               | 21,538,187               | 22,610,726                 | 5.0%                     | 24,698,500                      | 25,815,000                      |

Note: % = percent.

<sup>1</sup> Census data as of April 1; Population estimates as of July 1.

<sup>2</sup> County projections based on starting estimates of population constructed by Bureau of Economic and Business Research on April 1, 2023.

<sup>3</sup> Population projections from the Bureau of Economic and Business Research were identified as “low,” “medium,” and “high.” Population projects shown in the table are those identified as “medium” from the Bureau of Economic and Business Research.

<sup>4</sup> State projections were based on the decennial census county for April 1, 2020.

Sources: (Bureau of Economic and Business Research, 2024; U.S. Census Bureau, 2024c)

Table 3.4-2 shows selected housing characteristics in the study area compared to the state. Between June 2018 and June 2024, the median listing price in Brevard County has increased 37 percent from \$290,000 to \$397,900. During the period, the median listing prices peaked in June 2022 at \$417,000. Over the last year, the median listing price in the county has trended up approximately 3 percent from a median listing price of \$385,950 in June 2023 to \$397,900 in June 2024 (Federal Reserve, 2024a). The median listing price in Volusia County between June 2018 and June 2024 increased by 47 percent from \$269,900 to \$397,000 and peaked at \$400,000 in June 2022. The median listing price in Volusia County increased by less than 1 percent between June 2023 and June 2024 (Federal Reserve, 2024b). Currently, property values are projected to continue their upward trend, albeit at a slower pace due to high mortgage rates and inflation, in Brevard and Volusia Counties based on the strong demand, limited inventory, and overall economic growth in the region.

**Table 3.4-2. Selected Housing Characteristics in the Study Area**

| 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                                    |

Notes: % = percent; \$ = United States dollars.

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





Figure 3.4-1. Schools and Childcare Facilities within the Study Area

## Employment and Income

Table 3.4-3 shows the most recent total full- and part-time employment (jobs) by industry for Brevard County and Volusia County from the U.S. Bureau of Economic Analysis.

**Table 3.4-3. Total Employment by Industry in the Study Area, 2022**

| Industry                                                                 | Brevard County |                         | Volusia County |                         |
|--------------------------------------------------------------------------|----------------|-------------------------|----------------|-------------------------|
|                                                                          | Number of Jobs | Percent of County Total | Number of Jobs | Percent of County Total |
| <b>Total Employment</b>                                                  | <b>339,006</b> | <b>100.00%</b>          | <b>282,141</b> | <b>100.00%</b>          |
| Farm Employment                                                          | 517            | 0.15%                   | 1,145          | 0.41%                   |
| Forestry, fishing, and related activities                                | 540            | 0.16%                   | 759            | 0.27%                   |
| Mining, quarrying, and oil and gas extraction                            | 326            | 0.10%                   | 239            | 0.08%                   |
| Utilities                                                                | 381            | 0.11%                   | 480            | 0.17%                   |
| Construction                                                             | 22,442         | 6.62%                   | 18,406         | 6.52%                   |
| Manufacturing                                                            | 32,780         | 9.67%                   | 12,707         | 4.50%                   |
| Wholesale trade                                                          | 6,723          | 1.98%                   | 6,406          | 2.27%                   |
| Retail trade                                                             | 35,540         | 10.48%                  | 34,803         | 12.34%                  |
| Transportation and warehousing                                           | 12,680         | 3.74%                   | 12,570         | 4.46%                   |
| Information                                                              | 3,665          | 1.08%                   | 2,812          | 1.00%                   |
| Finance and insurance                                                    | 15,137         | 4.47%                   | 14,955         | 5.30%                   |
| Real estate and rental and leasing                                       | 20,023         | 5.91%                   | 18,653         | 6.61%                   |
| Professional, scientific, and technical services                         | 29,503         | 8.70%                   | 16,854         | 5.97%                   |
| Management of companies and enterprises                                  | 3,599          | 1.06%                   | 2,298          | 0.81%                   |
| Administrative and support and waste management and remediation services | 24,773         | 7.31%                   | 17,697         | 6.27%                   |
| Educational services                                                     | 7,883          | 2.33%                   | 9,270          | 3.29%                   |
| Health care and social assistance                                        | 37,891         | 11.18%                  | 35,703         | 12.65%                  |
| Arts, entertainment, and recreation                                      | 7,427          | 2.19%                   | 7,586          | 2.69%                   |
| Accommodation and food services                                          | 26,682         | 7.87%                   | 26,805         | 9.50%                   |
| Other services (except government and government enterprises)            | 18,950         | 5.59%                   | 19,283         | 6.83%                   |
| Government and government enterprises                                    | 31,544         | 9.30%                   | 21,947         | 7.78%                   |

Note: % = percent.

Source: (U.S. Bureau of Economic Analysis, 2023)

Table 3.4-4 shows the most recent annual average unemployment rates available from the Bureau of Labor Statistics and per capita income and median household income from the U.S. Census Bureau for Brevard and Volusia Counties compared to the State of Florida (U.S. Census Bureau, 2022b).

**Table 3.4-4. Selected Economic Characteristics in the Study Area**

| Location       | Average Annual Unemployment Rate <sup>1</sup> | Per Capita Income <sup>2</sup> | Median Household Income <sup>2</sup> |
|----------------|-----------------------------------------------|--------------------------------|--------------------------------------|
| Brevard County | 3.0                                           | \$40,111                       | \$71,308                             |
| Volusia County | 3.3                                           | \$35,364                       | \$63,075                             |
| Florida        | 2.9                                           | \$38,850                       | \$67,917                             |

Notes: \$ = United States dollars; U.S. = United States.

<sup>1</sup> 2023 Annual Averages from the Bureau of Labor Statistics.

<sup>2</sup> Data from the most recent U.S. Census Bureau American Community Survey 5-Year Estimates 2018–2022.

Sources: (BLS, 2024a; BLS, 2024b; U.S. Census Bureau, 2022b)

### Aerospace and Aviation

The aerospace industry is an important economic generator in Brevard County and throughout Florida. In Brevard County, there are 14,828 jobs in the aerospace and aviation industry, 122 establishments in the sector, and sector wages totaling \$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 effect 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 effect on the state includes \$2.8 billion in gross domestic product and \$1.7 billion in household income (Space Commerce, 2023). Over the next five years, Space Florida’s total economic effect is expected to reach an average annual effect of \$1.1 billion totaling more than \$5.3 billion (Space Commerce, 2023).

### Maritime Activities

Port Canaveral, located approximately 13 miles (21 kilometers) south from LC-39A at KSC, plays an important role in the maritime transportation system throughout Florida. The total economic contribution of Port Canaveral to Florida in 2023 was \$6.1 billion representing an increase of up to 57 percent from 2018. Since 2018, the total number of jobs that the port supports increased 30 percent to approximately 42,700 jobs with total annual wages increasing 59 percent to \$2.1 billion (BREA, 2023). Statewide the port contributes \$189.5 million in local tax revenues. Indirect effects from the final sale or use of commodities flowing through the port support an additional 2,734 jobs paying \$104 million in annual wages (Port Canaveral, 2023).

Economic contributions from commercial and recreational fishing to coastal communities are characterized in the form of jobs, income, value-added effects, and sales effects. The South Atlantic Fishery Management Council (FMC) manages fishery resources in Federal waters off the coasts of North Carolina, South Carolina, Georgia, and east Florida to Key West (SAFMC, 2025). 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, \$664 million in income, \$1 billion in value-added effects, and \$2 billion (in 2016 dollars) to the U.S. economy each year (SAFMC, 2018).

The Southeastern Fisheries Association had concerns regarding restrictions imposed on commercial vessels and potential adverse effects on catches, in particular Spanish mackerel, which then may affect fishers, processors, and markets. National Oceanic and Atmospheric Administration fisheries report commercial and recreational landings of Spanish mackerel, and all species combined. Table 3.4-5 shows the number (in pounds) and value (in dollars) of commercial landings for Spanish mackerel and all species

combined and recreational landings (in pounds) for Spanish mackerel and all species combined off the Florida East Coast between 2012 and 2022.

**Table 3.4-5. Commercial and Recreational Landings, Florida East Coast, 2012–2022**

| Year | Commercial Landings |           |                      |            | Recreational Landings |                      |
|------|---------------------|-----------|----------------------|------------|-----------------------|----------------------|
|      | Spanish Mackerel    |           | All Species Combined |            | Spanish Mackerel      | All Species Combined |
|      | Pounds              | Dollars   | Pounds               | Dollars    | Pounds                | Pounds               |
| 2022 | 1,256,139           | 2,044,020 | 44,470,122           | 61,610,335 | 689,108               | 54,964,111           |
| 2021 | 3,417,562           | 3,210,043 | 39,000,646           | 65,873,532 | 5,645,803             | 59,884,527           |
| 2020 | 2,571,019           | 2,667,769 | 41,588,489           | 57,568,153 | 3,714,898             | 69,567,206           |
| 2019 | 3,004,860           | 2,834,108 | 45,638,405           | 64,454,127 | 1,011,815             | 54,294,252           |
| 2018 | 2,926,289           | 2,917,956 | 35,084,832           | 58,543,260 | 1,354,442             | 67,940,073           |
| 2017 | 2,672,658           | 2,759,701 | 36,797,846           | 64,112,573 | 1,146,125             | 70,531,695           |
| 2016 | 2,461,334           | 2,534,574 | 28,770,238           | 56,979,689 | 2,552,243             | 76,629,533           |
| 2015 | 1,807,967           | 2,171,226 | 25,322,952           | 52,374,051 | 342,603               | 66,479,032           |
| 2014 | 2,585,304           | 2,652,049 | 24,939,979           | 58,077,062 | 1,851,514             | 82,977,734           |
| 2013 | 2,265,505           | 2,677,561 | 24,121,856           | 50,913,706 | 2,923,786             | 67,239,877           |
| 2012 | 2,597,097           | 2,462,807 | 31,042,251           | 61,663,491 | 1,199,779             | 54,030,383           |

Note: \$ = United States dollars.

Sources: (NOAA Fisheries, 2022a; NOAA Fisheries, 2022b; NOAA Fisheries, 2022c; NOAA Fisheries, 2022d)

### Tourism

A recent study reported that the overall economic effect of tourism on Brevard County during 2023 was \$4.6 billion, visitor spending totaled \$2.95 billion, and the industry supported nearly 46,000 direct and indirect jobs with wages of nearly \$1.5 billion (Cranis, 2024). The same year, total visitor expenditures in Volusia County were calculated at \$5.4 billion and supported 32,400 leisure and hospitality employees with a payroll exceeding \$939 million (Mid-Florida Marketing and Research, 2023).

Viewing launches at KSC is a major contributor to the economy of Brevard County through trip expenditures and bed tax. Estimates suggest that the average party that stayed overnight to watch a launch spent about \$1,065, while individuals spent about \$350. Visitors who did not stay overnight spent an average of \$144 per day. While the majority of overnight visitors stay in Cocoa Beach, other popular areas include Cape Canaveral and Titusville. Between 2016 and 2019, bed tax collections in Titusville increased by 40 percent (Space Coast Office of Tourism, 2020).

Brevard County alone offers 71.6 miles (115.2 kilometers) of sandy beaches and a variety of state parks and lands (e.g., Indian River Lagoon Preserve State Park, Sebastian Inlet State Park, St. Sebastian River Preserve State Park, and Banana River Aquatic Preserve), Federal lands, bays and inlets, and river and paddling trails (FDEP, 2023a). Popular eco-tourism areas in the study area include MINWR and CANA. MINWR and CANA draw millions of visitors annually. Since 2021, there have been over 2 million recreation visits to CANA annually with the most popular months being March through June (NPS, 2024a). The number of visitors to MINWR has also increased recently with over 2 million visitors annually (Waymer, 2025).



Visitors to MINWR can participate in birdwatching, boating, fishing, hiking, wildlife photography, seasonal, hunting, and more. A fee pass is required to enter Black Point Wildlife Drive and Bio Lab Road and to launch a boat at Bairs Cove, Beacon 42, and Bio Lab boat ramps. (MINWR, 2025). MINWR and CANA generate economic value for visitors as well as local and regional economic activity from the people employed and the money spent by visitors on recreation and conservation activities.

### Public Services

Public services include emergency, medical, fire, and law enforcement. There are 78 fire stations located throughout Brevard County and 62 fire stations throughout Volusia County (Florida Geographic Data Library, 2018). There are also multiple hospitals and medical centers located throughout the counties. The closest hospitals to LC-39A include Parrish Medical Center, located 13.4 miles (21.6 kilometers) away in Titusville, and Health First Cape Canaveral Hospital, located 17.1 miles (27.5 kilometers) away in Cocoa Beach, Florida.

In 2021-2022 there were 1,408 practicing physicians in Brevard County and 1,232 practicing physicians in Volusia County representing an increase of 2.3 percent and 3.4 percent, respectively from the previous year. The per capita distribution of physicians per 10,000 population in both Brevard and Volusia Counties is between 10.1 to 25 (Florida Health, 2022).

The 2023 ratio of full-time officers in Florida is 2.17 officers per 1,000 population (includes sheriff's offices, police departments, state agencies and schools and ports) which has remained fairly consistent over the last ten years (Florida Department of Law Enforcement, 2023).

A new emergency operations center has opened in Brevard County, which includes a 140-seat command center and a permanent 911 communication center (Pallone, 2024). The emergency operations center, which seeks to enhance emergency response, activates a launch operations support team in preparation for a launch.

### ***Children's Environmental Health and Safety Risks***

Table 3.4-6 shows population estimates and the percentage of children by age group in Brevard and Volusia Counties compared to the state.

**Table 3.4-6. Summary of Children by Age Group by County**

| Location       | Total Population | Children Under 5 Years |         | Children 5–18 Years |         | All Children Under 18 Years |         |
|----------------|------------------|------------------------|---------|---------------------|---------|-----------------------------|---------|
|                |                  | Estimate               | Percent | Estimate            | Percent | Estimate                    | Percent |
| Brevard County | 643,979          | 27,691                 | 4.3%    | 88,225              | 13.7%   | 115,916                     | 18.0%   |
| Volusia County | 590,357          | 25,976                 | 4.4%    | 76,746              | 13.0%   | 102,722                     | 17.4%   |
| Florida        | 22,610,726       | 1,130,536              | 5.0%    | 3,255,945           | 14.4%   | 4,386,481                   | 19.4%   |

Notes: % = percent; U.S. = United States.

<sup>1</sup> Estimated number of children is based on percentages from the U.S. Census Bureau applied to Total Population (population estimates as of July 1, 2023).

<sup>2</sup> Estimates rounded to nearest whole number.

Source: (U.S. Census Bureau, 2024c)

There are a total of 47 census tracts in the study area with residential populations located in all, or portions of, the census tracts. The number of children and percentage of the population that are children in each census tracts that make up the study area are shown in Table 3.4-7.

**Table 3.4-7. Number and Percentage of Children by Census Tract within the Study Area**

| Census Tract <sup>1</sup> | Children<br>(under 18 years of age) |                                          |
|---------------------------|-------------------------------------|------------------------------------------|
|                           | Number                              | Percent of Population in<br>Census Tract |
| 610.01                    | 1,182                               | 18.4%                                    |
| 610.02                    | 433                                 | 13.6%                                    |
| 611                       | 1,579                               | 24.9%                                    |
| 612.01                    | 1,583                               | 19.6%                                    |
| 612.02                    | 382                                 | 10.9%                                    |
| 621.06                    | 441                                 | 15.8%                                    |
| 621.08                    | 1,428                               | 18.4%                                    |
| 621.09                    | 558                                 | 13.3%                                    |
| 621.10                    | 588                                 | 17.4%                                    |
| 621.11                    | 760                                 | 22.1%                                    |
| 621.12                    | 116                                 | 9.5%                                     |
| 621.13                    | 839                                 | 13.7%                                    |
| 621.14                    | 257                                 | 13.8%                                    |
| 621.15                    | 157                                 | 7.3%                                     |
| 623.01                    | 476                                 | 15.2%                                    |
| 623.02                    | 1,060                               | 26.5%                                    |
| 624.01                    | 343                                 | 19.0%                                    |
| 624.02                    | 1,241                               | 22.5%                                    |
| 625                       | 437                                 | 11.0%                                    |
| 626                       | 696                                 | 23.6%                                    |
| 628                       | 471                                 | 12.2%                                    |
| 629                       | 1,163                               | 19.3%                                    |
| 630                       | 976                                 | 22.8%                                    |
| 631.02                    | 1,273                               | 16.0%                                    |
| 631.04                    | 822                                 | 20.6%                                    |
| 631.05                    | 1,493                               | 15.4%                                    |
| 671                       | 442                                 | 27.5%                                    |
| 681.01                    | 408                                 | 11.7%                                    |
| 681.02                    | 249                                 | 10.9%                                    |
| 684                       | 112                                 | 6.1%                                     |
| 685.01                    | 99                                  | 4.8%                                     |
| 685.02                    | 270                                 | 11.2%                                    |
| 686.01                    | 104                                 | 4.8%                                     |

**Table 3.4-7. Number and Percentage of Children by Census Tract within the Study Area**

| Census Tract <sup>1</sup> | Children<br>(under 18 years of age) |                                          |
|---------------------------|-------------------------------------|------------------------------------------|
|                           | Number                              | Percent of Population in<br>Census Tract |
| 686.03                    | 258                                 | 14.0%                                    |
| 686.04                    | 22                                  | 1.0%                                     |
| 691                       | 832                                 | 17.9%                                    |
| 692                       | 424                                 | 17.2%                                    |
| 693                       | 546                                 | 18.1%                                    |
| 694                       | 1,056                               | 16.5%                                    |
| 697                       | 503                                 | 21.7%                                    |
| 698.01                    | 573                                 | 14.7%                                    |
| 698.02                    | 934                                 | 20.3%                                    |
| 699.03                    | 569                                 | 18.3%                                    |
| 699.04                    | 1,098                               | 18.5%                                    |
| 699.06                    | 674                                 | 36.1%                                    |
| 699.07                    | 432                                 | 15.2%                                    |
| 714.01                    | 198                                 | 15.4%                                    |
| 714.02                    | 297                                 | 14.2%                                    |
| 715                       | 100                                 | 4.2%                                     |
| 716.01                    | 416                                 | 24.5%                                    |
| 716.02                    | 456                                 | 16.2%                                    |
| 717                       | 416                                 | 7.6%                                     |
| 9800 <sup>2</sup>         | 0                                   | 0%                                       |

Notes: % = percent; LC-39A = Launch Complex 39A.

<sup>1</sup> Table only shows those census tracts that are totally or partially within a 24-mile (39-kilometer) radius from the center of LC-39A over land where residential areas are located. Census Tracts 699.05 and 9801 in Brevard County; 9900 in Brevard and Volusia Counties.

<sup>2</sup> Census tracts have a total population of greater than 1 person but have reported 0 children as reported by the census.

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

Figure 3.4-1 shows the location of schools and childcares within the study area. Table 3.4-8 lists the schools, childcares, and hospitals within the 60 dB CDNL noise contours under the different alternatives. The nearest school to LC-39A is Titusville High School located 12.3 miles (19.8 kilometers) away. Section 3.2.3, *Noise and Noise-Compatible Land Use, Existing Conditions*, describes the existing noise environment associated with rocket launches and landings.

**Table 3.4-8. List of Schools, Childcares, and Hospitals within the Study Area**

| Name                                                                  | Address                                  | No Action | Proposed Action | Reasonably<br>Foreseeable<br>Action |
|-----------------------------------------------------------------------|------------------------------------------|-----------|-----------------|-------------------------------------|
| <b>Hospitals in Relation to 60 dB CDNL and Greater Noise Contours</b> |                                          |           |                 |                                     |
| Health First Cape Canaveral Hospital                                  | 701 W. Cocoa Beach Causeway, Cocoa Beach | X         | X               |                                     |

**Table 3.4-8. List of Schools, Childcares, and Hospitals within the Study Area**

| Name                                                                   | Address                                         | No Action | Proposed Action | Reasonably Foreseeable Action |
|------------------------------------------------------------------------|-------------------------------------------------|-----------|-----------------|-------------------------------|
| <b>Childcares in Relation to 60 dB CDNL and Greater Noise Contours</b> |                                                 |           |                 |                               |
| Church of Our Saviour                                                  | 5301 Atlantic Avenue N. - Cocoa Beach           | X         | X               | X                             |
| Alpha Learning, Inc.                                                   | 3700 Courtenay Pkwy., Suite 102, Merritt Island |           | X               | X                             |
| Calvary Christian Chapel School                                        | 3500 Courtenay Pkwy., Merritt Island            |           | X               | X                             |
| Faces                                                                  | 5525 Courtenay Pkwy., Merritt Island            |           | X               | X                             |
| Divine Mercy Catholic Church Daycare                                   | 1940 Courtenay Pkwy., Merritt Island            |           | X               | X                             |
| Merritt Island Christian School                                        | 140 Magnolia Ave., Merritt Island               |           |                 | X                             |
| Brevard Home School Academy                                            | 508 S Plumosa St., Merritt Island               |           |                 | X                             |
| Lighthouse Christian Academy of Merritt Island                         | 175 Cone Rd., Merritt Island                    |           |                 | X                             |
| Space Coast Christian Academy                                          | 1950 Michigan Ave., Cocoa                       |           |                 | X                             |
| RFM Christian Academy                                                  | 1404 Dixon Blvd, Cocoa                          |           |                 | X                             |
| Creative Learning                                                      | 453 King St., Cocoa                             |           |                 | X                             |
| Saint Marks Academy                                                    | 2 Church Street, Cocoa                          |           |                 | X                             |
| Learning and Achievement Academy                                       | 830 Fiske Blvd., Rockledge                      |           |                 | X                             |
| Hatcher Academy of Excellence                                          | 221 Dixie Lane, Rockledge                       |           |                 | X                             |
| Assurance Academy Christian School                                     | 1009 Fiske Blvd. S., Rockledge                  |           |                 | X                             |
| Trinity Lutheran School Pvt                                            | 1330 Fiske Blvd., Rockledge                     |           |                 | X                             |
| Saint Mary School                                                      | 1152 Seminole Dr., Rockledge                    |           |                 | X                             |
| Educators Inc. Private Christian School                                | 400 Barton Blvd., Suite 204, Rockledge          |           |                 | X                             |
| Behavior Services of Brevard, Inc.                                     | 550 Solutions Way, Rockledge                    |           |                 | X                             |
| Lake Fern Montessori Academy                                           | 257 Aguinaldo Ave, Titusville                   |           |                 | X                             |
| Saint Teresa Catholic School                                           | 207 Ojibway St., Titusville                     |           |                 | X                             |
| <b>Schools in Relation to 60 dB CDNL and Greater Noise Contours</b>    |                                                 |           |                 |                               |
| Cape View Elementary School                                            | 8440 Rosalind Ave.                              | X         | X               | X                             |
| Robert L. Stevenson Elementary School                                  | 1450 Martin Blvd., Merritt Island               | X         | X               | X                             |
| Lewis Carroll Elementary School                                        | 1 Skyline Blvd., Merritt Island                 |           | X               | X                             |



**Table 3.4-8. List of Schools, Childcares, and Hospitals within the Study Area**

| <b>Name</b>                                          | <b>Address</b>                          | <b>No Action</b> | <b>Proposed Action</b> | <b>Reasonably Foreseeable Action</b> |
|------------------------------------------------------|-----------------------------------------|------------------|------------------------|--------------------------------------|
| Merritt Island High School                           | 100 Mustang Way, Merritt Island         |                  | X                      | X                                    |
| Audubon Elementary School                            | 1201 N. Banana River Dr.                |                  | X                      | X                                    |
| Theodore Roosevelt Elementary School                 | 1400 Minutemen Causeway, Cocoa Beach    |                  | X                      | X                                    |
| Cocoa Beach Junior/Senior High School                | 1500 Minutemen Causeway, Cocoa Beach    |                  | X                      | X                                    |
| Edgewood Junior/Senior High School                   | 180 E. Merritt Ave.                     |                  | X                      | X                                    |
| Fairglen Elementary School                           | 201 Indian Trail, Cocoa                 |                  | X                      | X                                    |
| North/Central Area Alternative Learning Center       | 301 Grove Blvd., Merritt Island         |                  | X                      | X                                    |
| Gardendale Separate Day School                       | 301 Grove Blvd., Merritt Island         |                  | X                      | X                                    |
| Freedom 7 Elementary School of International Studies | 400 S. 4th St., Cocoa Beach             |                  | X                      | X                                    |
| Project Search                                       | 701 W. Cocoa Causeway, Cocoa Beach      |                  | X                      | X                                    |
| Emma Jewel Charter Academy                           | 705 Blake Ave., Cocoa                   |                  |                        | X                                    |
| Atlantis Elementary School                           | 7300 Briggs Ave., Cocoa                 |                  |                        | X                                    |
| Tropical Elementary School                           | 885 S. Courtenay Pkwy., Merritt Island  |                  |                        | X                                    |
| Endeavour Elementary School                          | 905 Pineda St., Cocoa                   |                  |                        | X                                    |
| Ronald McNair Magnet Middle School                   | 1 Challenger Dr., Rockledge             |                  |                        | X                                    |
| Brevard Virtual School                               | 1225 Clearlake Rd., Cocoa               |                  |                        | X                                    |
| Thomas Jefferson Middle School                       | 1275 S. Courtenay Pkwy., Merritt Island |                  |                        | X                                    |
| Eastern Florida State College-Cocoa Campus           | 1519 Clearlake Rd., Cocoa               |                  |                        | X                                    |
| Golfview Elementary Magnet School                    | 1530 S. Fiske Blvd., Rockledge          |                  |                        | X                                    |
| Cambridge Elementary Magnet School                   | 2000 Cambridge Dr., Cocoa               |                  |                        | X                                    |
| Rockledge Senior High School                         | 220 Raider Rd., Rockledge               |                  |                        | X                                    |
| Mila Elementary School                               | 288 W. Merritt Ave., Merritt Island     |                  |                        | X                                    |

Notes: Ave. = Avenue; Blvd. = Boulevard; Inc. = Incorporated; N = North; Pkwy. = Parkway; Rd.= Road; S. = South; St. = Street; W. = West.

### 3.4.4 Environmental Consequences

According to FAA Order 1050.1F, the FAA has not established significance thresholds for socioeconomics or children's environmental health and safety risks. However, within FAA Order 1050.1 Desk Reference, Sections 12.1.3.1 and 12.3.3.1, the FAA has identified factors to consider when assessing the significance of potential effects (FAA, 2023b). For socioeconomics, the factors to consider that may be applicable to socioeconomic resources, if they are interrelated with natural or physical environmental effects, include, but are not limited to, situations in which the Proposed Action would have the potential to result in the following:

- 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
- Produce a substantial change in the community tax base

Other effects that may be considered outside of FAA Order 1050.1F guidance include impacts to visitor access and experience on public lands and impacts to wildlife resources and habitats and associated socioeconomic values.

For effects on children's environmental health and safety, a factor to consider may include, but is not limited to, situations in which the Proposed Action or Alternative(s) would have the potential to lead to a disproportionate health or safety risks to children.

#### ***Analysis Methodology***

The socioeconomic analysis considers population, employment, income, value, etc. effects in the region from construction activities and during implementation of the action (e.g., operation of facilities, launches and landings) at KSC. The children's environmental health and safety analysis considers children under the age of 18 years in the study area. Potential effects are evaluated according to context (e.g., local or regional) and intensity (e.g., adverse or beneficial; minimal or extensive changes). In assessing context and intensity, the duration of the effect is also considered.

#### 3.4.4.1 No Action

Under the No Action Alternative, Starship-Super Heavy construction and operations would not occur at LC-39A and socioeconomic conditions and trends would continue as described in Section 3.4.3, *Existing Conditions*. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Under this alternative, the number of people residing within the

60 dB CDNL and greater noise contour would be approximately 18,829 people. Potential noise effects to populations under this alternative are described in Section 3.2.4.1, *Noise and Noise-Compatible Land Use, No Action*. No significant effects to socioeconomic resources are anticipated under the No Action Alternative since there would be no incoming personnel associated with this alternative that would affect factors recommended by the FAA to consider, which are outlined in Section 3.4.4, *Environmental Consequences*.

Overall, the number of children under age 18 in Brevard and Volusia Counties comprise a smaller percentage of the total population compared to Florida, (see Table 3.4-6). Under the No Action Alternative, no new construction and operations associated with the Starship-Super Heavy would occur. Existing launches and landings contribute to environmental and health conditions currently experienced in the study area, such as noise, air quality, and health and safety. Implementation of OSHA regulations, other recognized standards, applicable NASA regulations or instructions, and SpaceX internal procedures would minimize potential environmental health and safety risks to the general public, including children. Under this alternative, two schools and one daycare facility would be within the 60 dB CDNL or greater noise contour (see Table 3.4-8). Potential impacts to children associated with noise events of 60 dB CDNL could include sleep disturbance and speech interference (during instructional time at school and at other times). Operations during the school day would be relatively infrequent. Therefore, no significant environmental health and safety risks to children would be anticipated.

Under the No Action Alternative, launch activity at KSC and CCSFS, unrelated to the Proposed Action, is projected to increase and would increase noise (see Section 3.2.4.1, *Noise and Noise-Compatible Land Use, No Action*), launch and development-related emissions (see Section 3.11.4.1, *Air Quality, No Action*), and health and safety (see Section 3.18.4.1, *Health and Safety, No Action*), which may affect socioeconomic resources and children.

### 3.4.4.2 Proposed Action

#### 3.4.4.2.1 Construction

##### Socioeconomics

Under the Proposed Action, there could be a temporary increase in jobs of up to 175 construction workers, with a peak of 300 construction workers at LC-39A. The employment of construction workers would contribute to total wages and salaries in the study area, and through the purchase of materials and equipment. Construction-related benefits would be local and possibly regional, low intensity, and short term, lasting only for the duration of the construction activities, which is planned to be completed within 24 months. Due to the number of construction jobs in Brevard and Volusia Counties (more than 40,000 jobs combined), any construction employment would be expected to be filled by the local labor force and not require a migration of workers into the area. The local housing market would not be substantially affected, and no new social services or support facilities would be required during construction activities. As described in Section 3.16.4.2.1, *Transportation, Construction*, construction vehicles on local roadways would create additional traffic, but most construction workers would access KSC prior to the 9:00 a.m. opening of KSC to visitors. As a result, existing roadway networks would be able to accommodate the additional traffic. This increased traffic would be temporary, with construction to be completed within 24 months (see Section 3.16.4.2.1), and would not significantly affect socioeconomic resources.

### Children's Environmental Health and Safety Risks

Under the Proposed Action, no members of the general public, including children, would have access to areas where construction activities would take place. BMPs and all applicable local, state, and Federal permits would minimize potential affects to water resources. Noise levels and changes in air quality during construction activities would not be sufficient to create an environmental health and safety risk to the public including children (see Section 3.11, *Air Quality*; Section 3.16.4.2.1, *Transportation, Construction*; and Section 3.2.4.2, *Noise and Noise-Compatible Land Use, Proposed Action*).

#### **3.4.4.2.2 Operation**

##### Socioeconomics

**Noise.** It would be expected that SpaceX would continue to use its existing workforce for launching and reentry operations based on the history and presence of KSC in the local economy, the unemployment rate, and the availability of workers specialized in the space industry. In addition to the existing workforce, implementation of the Proposed Action would increase the full-time work force assigned to KSC by approximately 50 workers, up to a peak of 100 workers, with some supporting both Falcon and Starship-Super Heavy operations. An increase in personnel would have a positive indirect and induced effect of jobs throughout Brevard and Volusia Counties.

Under the Proposed Action, approximately 70,343 people would reside within the 60 dB CDNL to 70 dB CDNL noise contours. A concern for some residents would be the potential noise effects to property values. Property values are dynamic and influenced by a combination of factors (e.g., market conditions, neighborhood characteristics, proximity to schools, and real property characteristics). Therefore, the overall effect of the Proposed Action on property values cannot be determined at this time. The median listing prices for homes in Brevard and Volusia Counties have been increasing over the last several years due to economic and population growth. It is anticipated that recent trends in property valuations would continue into the near future. However, the presence and operation of the Starship-Super Heavy could be considered undesirable for some residents and could result in lowered property values for private residential uses. In contrast, some of the affected neighborhoods could remain sought-after locations due to amenities such as proximity to work or employment and economic opportunities. Some persons may seek out homes in the area due to proximity to the Space Coast.

As stated in Section 3.2.4.2.2, *Noise and Noise-Compatible Land Use, Operation*, the probability of structural damage occurring because of noise and vibrations generated by the Proposed Action would be low. In the unlikely event that damage to a structure on KSC/CCSFS or outside the boundaries of KSC/CCSFS were to occur because of Starship-Super Heavy operations, SpaceX would be responsible for resolving that damage. SpaceX is required by the FAA regulations and the Commercial Space Launch Act to carry insurance to cover claims by third parties that result from licensed activities, including structural damage. Any such claims of damage would be subject to the insurance policy terms and the Commercial Space Launch Act.

Operation of the Proposed Action could affect how residents of Brevard and Volusia Counties experience their neighborhoods. The Proposed Action could also affect how residents and visitors experience their recreational opportunities and their perception of their quality of life due to potential changes in the noise environment, air quality, visual viewshed, traffic, delays and access to recreational areas, and number of



people in the area. While quality of life is highly subjective and cannot be quantified, it would be possible that an individual would perceive the potential effects of the operation of the Starship-Super Heavy operations as significantly affecting their experience and their quality of life.

Sonic booms associated with operations have the potential to annoy, disrupt, and startle people and animals. Public notices as part of normal operations would serve to inform the public and minimize this potential. However, regardless of notices, workers (e.g., commercial fisherman, boaters, oil rig workers, pilots, etc.) in the vicinity of a floating platform during an ocean landing may be startled from a sonic boom even with advanced notice.

**Airspace/Transportation.** Under the Proposed Action, Starship-Super Heavy operations would have potential effects to airspace and maritime activities if operations result in delays, reroutes, and cancellations. Depending on the timing and duration of the launch and reentry windows, commercial flights could be cancelled or diverted.

**Land Management/Use.** As discussed in Section 2.1.3.1, *Starship-Super Heavy Operations, Pre-Launch*, it is estimated that there could be between 33 and 44 (using the most conservative estimate) full-day closures and up to 33 half-day closures, which equates to up to 60.5 total “closure days” per year (44 full days + 33 half-days = 60.5 “full days”). Launch scrubs and weather delays could affect the length and/or number of closures; however, the extent of these occurrences cannot be quantified at this time. Given that CANA is open 365 days per year, portions that include Playalinda Beach could be closed up to approximately 16.5 percent of the year, more or less depending on scheduling of launches/landings and the occurrences of scrubbed launches. The NPS states that the Playalinda District, located in the southern portion of CANA, is the park’s most popular beach, receiving around 1.1 million recreation visits per year (NPS, 2025). Visitor counts are estimated at an average of approximately 3,285 per day (based on vehicle counts and an estimate of 3 persons per vehicle); numbers are lower on winter weekdays/weekends and higher on summer weekdays/weekends and on holidays. The NPS estimates that, based on transactions data from onsite pass sales at CANA and on the Playalinda District specifically, fee revenues vary depending on the day of the week and time of the year, averaging \$3,946 on a weekday, \$6,684 on a weekend (consisting of 2 days), and \$8,379 on a holiday (NPS, 2025)<sup>35</sup>. There are 52 weekends in a year (104 weekend days), and 11 Federal holidays recognized in the United States. These numbers can then be used to formulate an estimate of the lost revenue that could potentially occur due to closures:

- Approximate Potential Annual Average Lost Revenue (low end): \$239,000
  - 60.5 (total closure days) multiplied by \$3,946 (average weekday revenue) = approximately \$239,000
  - Assumption: all closures occur on weekdays.
  - Qualifier: weekday revenues are variable during the year, with values slightly lower in the winter and higher in the summer.
- Approximate Potential Annual Average Lost Revenue (high end): \$259,000

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<sup>35</sup> NPS notes this is a conservative estimate as it does not account for online purchases of passes that could also be affected by park closures.

- 11 (holiday closures) multiplied by \$8,379 (average holiday revenue) = approximately \$92,000
- 25 (weekends of closure<sup>36</sup>) multiplied by \$6,684 (average weekend revenue) = approximately \$167,000
- Assumptions: all closures occur on holidays and weekends.
- Qualifier: weekend revenues are variable during the year, with values slightly lower in the winter and higher in the summer.

These estimates are annual averages; were more closures to occur during the summer or winter in a year, revenue loss would be slightly higher or lower, respectively. Additionally, it is improbable that closures would only occur on weekends and holidays. It is more likely that there would be minimal to no events that would result in holiday closures. Event scrubs or weather delays, depending on scope may also result in a slight increase in revenue loss.

Based on the average fee revenue numbers provided by NPS (NPS, 2025), average annual fee revenues for 11 holidays (\$8,379 each = \$92,169), 52 weekends<sup>37</sup> (\$6,684 each = \$347,568), and 250 remaining weekdays (\$3,946 each = \$986,500) for the CANA Playalinda District are approximately \$1,426,000. With the range of annual fee loss potentially between \$239,000 and \$259,000 that equates to a potential annual average revenue loss of between approximately 17 percent and 18 percent. This would adversely affect the NPS's ability to fund projects, staff, and maintain the park; the NPS may consider this significant.

With regard to visitor impact, closures during launch/landing operations would inconvenience visitors who want to visit the park; the situation would be exacerbated when launches/landings are scheduled during high-use times such as holidays and weekends. For those persons intending to visit the park and finding it closed, expenses incurred and time spent traveling would be lost. Using data from a recent visitor survey conducted at CANA and a travel cost model that estimates opportunity costs for travelers accounting for factors that include travel distance and time, the number of people splitting trip expenses, and demographic characteristics (income, age, and gender) of respondents, the NPS estimates an average of 1.33 days per visit based on the visitor survey data resulting in an average value (or cost) of \$54.42 per visitor-day (NPS, 2025), or approximately a cost of \$72 per person that is turned away from the park due to closure. However, advance notification to the public of launch schedules would help visitors plan accordingly and help to minimize persons turned away who are unaware of the closures.

For prescribed burns, firing operations, which consist of putting fire on the ground, typically begin around 11 a.m. or 12 p.m. to maximize peak hours of the day and firing operations typically end around 4 p.m. Other activities take place after 4 p.m. Advanced notice would be given to minimize interruptions to commercial and recreational participants and park staff. Depending on the scheduled time of a launch, not every launch would require park closure for the entire day. Closures would be short term and localized. However, even with advanced notice and temporary restrictions, it would be possible that some individuals would perceive any changes in access and restrictions to public land as a significant effect.

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<sup>36</sup> This does not account for the fact that some holidays may occur on weekend days. 60.5 closure days minus 11 holidays = 49.5 remaining closure days; 49.5 days divided by two = 24.75, or approximately 25 weekends.

<sup>37</sup> This does not account for the fact that some holidays may occur on weekend days.

Brevard and Volusia Counties are large communities with police, fire, and other public services. Demand for public services in the study area could increase during launches. However, advanced notice of launches and cooperation amongst agencies provides opportunities for public services to prepare and plan accordingly. In the event that a launch draws a larger number of visitors than expected, temporary and last-minute schedule personnel changes and additional volunteers or employee hours may be required.

As stated in Section 3.15.3, *Farmlands, Existing Conditions*, there are no prime or unique farmlands within the operational study area and, therefore, no economic effects to agriculture or farmlands would be anticipated under the Proposed Action.

#### Children's Environmental Health and Safety Risks

Noise, air quality, water, health and safety, and hazardous materials effects resulting from the Proposed Action have the potential to affect children. Under the Proposed Action, there would be potential for noise effects associated with Starship-Super Heavy operations. Noise levels of 65 dBA DNL or greater would be within the KSC boundary, which is uninhabited; however, under this alternative, approximately 13 schools and 5 daycares would be within the 60 dB CDNL or greater noise contours (see Table 3.4-8). Potential effects to children associated with noise events of 60 dB CDNL could include sleep disturbance and speech interference (during instructional time at school and at other times). Additionally, as stated in Section 3.2.4.2.2, *Noise and Noise-Compatible Land Use, Operation*, Starship-Super Heavy operations would have the potential to interfere with certain activities such as conversation or watching television. Operations during the school day would be relatively infrequent and relatively short-lived. Static test operations would last 15 minutes each, while the launch and landing operations would generate elevated noise levels for less time.

As stated in Section 3.11.4.2.2, *Air Quality, Operation*, project operational emissions would not contribute to an exceedance of any National Ambient Air Quality Standards (NAAQS) except NO<sub>x</sub>. Exposure to NO<sub>x</sub>, particularly nitrogen dioxide (NO<sub>2</sub>), can have adverse health effects on children. In the short term, exposure to NO<sub>x</sub> can irritate airways in the human respiratory system leading to coughing, wheezing, or difficulty breathing, while long-term exposure to NO<sub>x</sub> can contribute to the development of asthma and potentially increase susceptibility to respiratory infections. Children are considered disproportionately affected by NO<sub>x</sub> exposure compared to adults, due to their higher breathing rate and small airways (USEPA, 2024a).

No significant effects to water have been identified under the Proposed Action (Section 3.9.6, *Water Resources, Summary*) that would affect children's health and safety.

Public health and safety procedures discussed in Section 3.18.4.2.2, *Health and Safety, Operation*, and mitigation and monitoring BMPs outlined in Section 3.18.5, *Health and Safety, BMPs, Mitigation, and Monitoring*, would minimize risks to safety and human health including children during operational activities associated with the Proposed Action.

Although unlikely, in the event of a launch anomaly, there could be potential of hazardous materials and/or debris present that may affect the county and the general public including children. Brevard County Emergency Management activates in support of every space launch and works with NASA and

KSC/CCSFS to ensure the public is well protected and informed through advertisements and posted updates on social media.

#### **3.4.4.2.3 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC, and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. The aeronautical industry is a large economic generator to the area supporting thousands of jobs and personal income. The Proposed Action, in context with other reasonably foreseeable actions, would continue to support SpaceX's mission capability to NASA and other SpaceX customers providing for a strong and stable economy. Additionally, operations associated with reasonably foreseeable actions in combination with the Proposed Action, may require more frequent restricted access to airspace, maritime areas, MINWR, and CANA that are typically open to the public for commercial and/or recreation. Advanced notice of closures is provided online and updated frequently for public services and commercial and recreational participants to plan accordingly. The Proposed Action would have short-term, local, and regional effects that, when combined with reasonably foreseeable actions, may result in long-term, local, and regional effects of high intensity, which could result in reasonably foreseeable effects to socioeconomic resources. Implementation of BMPs and mitigation measures would minimize adverse reasonably foreseeable effects to socioeconomic resources. However, even with implementation of BMPs and mitigation measures, an individual may perceive any changes in the natural or human environment as a result of the Proposed Action, which are intrinsically valuable and provide aesthetic, recreational, and socioeconomic value, as significant.

The Proposed Action in context with other reasonably foreseeable actions could result in adverse environmental and health risks to children in the study area. Potential effects to children associated with increased noise could include sleep disturbance and speech interference (during instructional time at school and at other times). However, implementation of OSHA regulations, other recognized standards, applicable NASA regulations or instructions, and SpaceX internal procedures would minimize potential environmental health and safety risks to the public including children.

### **3.4.5 BMPs, Mitigation, and Monitoring**

SpaceX is required by the FAA regulations and Commercial Space Launch Act to carry insurance to cover claims by third parties that result from licensed activities, including structural damage. Any such claims of damage would be subject to the insurance policy terms and Commercial Space Launch Act. Other mitigation and monitoring requirements include the following:

- Advanced notifications of launches would continue to be available on websites (e.g., NASA's main website has the launch schedule), applications, social media, and print sources for the public and recreational and commercial participants to plan accordingly and minimize disruptions such as delays and rerouting (see Section 3.2.5, *Noise and Noise-Compatible Land Use, Best Management Practices, Mitigation, and Monitoring*, for mitigation measures that would be adopted to minimize noise effects and which are applicable to socioeconomic resources).



- NASA would continue to offer a variety of outreach and education initiatives including hands-on activities, online resources, and partnerships with educational institutions (e.g., schools, colleges, universities, museums, etc.). The Kennedy Space Center Visitor Complex would continue to offer educational programs to students.
- MINWR would continue to offer information relevant to the sensitive resources and habitat surrounding the SpaceX facilities at their visitor center and CANA would continue to offer field trips to students.
- Launch notifications would continue to be provided to the Child Development Center from KSC via [kennedyspacecenter@dcnotify.com](mailto:kennedyspacecenter@dcnotify.com). KSC-PLN-5000\_SIMS\_Rev\_B includes mitigation measures such as sheltering indoors to leverage the attenuation of the facility in addition to other options.
- Property owners may contact SpaceX directly ([insurance@spacex.com](mailto:insurance@spacex.com)) to submit claims and evidence in support of damage claims.
- Closures are coordinated between KSC security, Spaceport Integration and Services, the USFWS, and NPS by monitoring to ensure parking lot thresholds are not exceeded, and roadways allow for emergency egress for any form of emergency associated with large crowds. KSC, the USFWS, and NPS established an agreement that allows KSC Security Police, and Brevard County Sheriff's Office support when necessary, to extend badge checkpoints at the KSC boundary SR 402, SR 405, SR 3 – South. Additionally, the Base Operations Spaceport Services contractor raises the Haulover Canal Bridge, making access from SR-3 North impassable.
- KSC would continue to inform all Spaceport Programs and Partners of planned Spaceport activities to mitigate operational conflicts and support efficient planning.

### 3.4.6 Summary

Based on the analysis provided in Section 3.4.4.2, *Proposed Action*, and consideration for the Proposed Action to affect factors outlined in Section 3.4.4, *Environmental Consequences*, significant effects to socioeconomic resources would not be anticipated because there would not be a large change in personnel that would induce substantial economic growth, disrupt or divide the physical arrangement of an established community, cause extensive relocation of residents and community businesses, substantially reduce the levels of service of roads, or produce a substantial change in the community tax base. However, construction and operational activities would have positive and short-term direct, indirect, and induced employment and income effects. These effects would last for the duration of the construction activities and/or during the up to 220 static fire, launch and landing events. During the 44 launches/booster landings and 44 Starship reentries/landings, restricted access to airspace, maritime activities, and effects to MINWR and CANA (e.g., commercial and recreational boating and fishing) may create delays from rescheduling or rerouting, annoyance, and potential losses of income and economic value. NOTAMs and NOTMARs would be issued in advance to allow airspace and maritime participants to plan accordingly.

Launches/booster landings and reentries would occur 88 times per year and be scheduled in advance to minimize interruption to commercial and recreational participants that may be affected by temporary closures or restricted access to certain areas. NPS could experience a range of annual fee loss due to

closures potentially between \$239,000 and \$259,000, which equates to a potential annual average revenue loss of between approximately 17 percent and 18 percent. This would adversely affect the NPS's ability to fund projects, staff, and maintain the park; NPS may consider this a significant adverse effect to their operations. Persons visiting the park that are turned away due to closures would experience a loss of time spent and related travel costs. A robust notification and awareness system would serve to minimize this potential.

SpaceX is required to carry insurance to cover claims by third parties that result from licensed activities, including structural damage; claims would be subject to the insurance policy terms and Commercial Space Launch Act.

Implementation of OSHA regulations, other recognized standards, applicable NASA regulations or instructions, and SpaceX internal procedures associated with existing launches and landings minimize potential environmental health and safety risks to the general public, including children. These regulations would continue under the Proposed Action. As stated in Section 3.11.6, *Air Quality, Summary*, the FAA anticipates that launching and landing activities would result in NO<sub>x</sub> emissions above indicator thresholds and would be considered potentially significant unless localized air-dispersion modeling could demonstrate that the emissions would not cause or contribute substantially to a projected air quality violation of an ambient air quality standard. Significant levels of NO<sub>x</sub> emissions could result in a disproportionate health and safety risk to children.

## 3.5 Historical, Architectural, Archaeological, and Cultural Resources

### 3.5.1 Definition of Resource and Regulatory Setting

Historical, architectural, archaeological, and cultural resources in the study area may be affected by the proposed activities. This section outlines specific details of the NHPA Section 106 process as identified in the regulations at 36 CFR Part 800, including describing the regulatory setting, the Area of Potential Effects (APE), and the scope of resources within that area.

Cultural resources include a range of sites, properties, and resources related to human behavior and culture in the past, and which have meaning to people in the present. These resources may be considered important to a culture or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic architectural resources, and Traditional Cultural Places (TCPs). Historic properties (as defined in 36 CFR §800.16(l)(1)) are significant archaeological, architectural, or traditional resources that are either listed in, or eligible for listing in, the National Register of Historic Places (NRHP). Both historic properties and significant TCPs that may or may not meet the NRHP criteria (as defined in 36 CFR §60.4) but that are identified by American Indian tribes or other recognized traditional cultural groups are evaluated for potential adverse effects from an action.

Eligibility for listing in the NRHP is defined in 36 CFR §60.4. A historic property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet at least one of four criteria: (a) association with events that have made a significant contribution to the broad patterns of our history; (b) association with the lives of persons significant in our past; (c) embodiment of distinctive

characteristics of a type, period, or method of construction; and (d) yield, or likelihood to yield, information important in prehistory or history. Ordinarily, a historic property must be more than 50 years old, and certain types of properties are not typically considered for listing in the NRHP, such as birthplaces and graves, and cemeteries. However, under certain criteria considerations, these properties may be eligible for listing in the NRHP, assuming that they already meet the regular requirement. For example, a grave may be eligible for listing in the NRHP if it is associated with a historical figure of outstanding importance (Criteria Consideration C), a cemetery may be eligible for the NRHP if it derives its primary significance from age, distinctive design features, or association with historic events (Criteria Consideration D), and a property, such as LC-39A (discussed below), may be eligible if it has achieved significance within the past 50 years if it is of exceptional importance (Criteria Consideration G).

Chapter 8 of the FAA Order 1050.1F Desk Reference (FAA, 2023b), includes additional information about cultural resources. Appendix D.5, *Historical, Architectural, Archaeological, and Cultural Resources*, lists and describes the laws, executive orders, agency regulations, and other guidance associated with cultural resources that apply to the Proposed Action.

### **Section 106 and DOT Act, Section 4(f)**

Section 106 of the NHPA requires Federal agencies to consider the effects of its action (the undertaking) on historic properties, as outlined in 36 CFR Part 800. Compliance with Section 106 requires consultation with the SHPO, Tribal Historic Preservation Officer (THPO), federally recognized Native American tribes, the public, and other interested parties. Steps of the Section 106 process include identifying the APE, identification and evaluation of historic properties within the APE, and applying the criteria of adverse effect to identified historic properties. If, through consultation, an undertaking results in an adverse effect to historic properties, consulting parties can resolve adverse effects through mitigation and the execution of a Memorandum of Agreement. In some cases, consulting parties may consider developing a program alternative to the standard Section 106 process, resulting in the execution of a Programmatic Agreement (PA).

Historic sites listed in, or eligible for inclusion in, the NRHP are also protected under the DOT Act, Section 4(f). Analyses and findings made in accordance with Section 106 may support DOT Section 4(f) determinations. Findings of no historic properties present or affected, or no historic properties adversely affected, under Section 106 support determinations of no use (either constructive or physical) under Section 4(f) of the DOT Act. Findings of adverse effects do not automatically trigger Section 4(f); however, if there is a physical taking of the property, or adverse effects that substantially impair the affected resource's historical integrity, there may be a "use" under Section 4(f). Additionally, Section 106 requires only that effects on historic properties be considered and that the SHPO or THPO, as well as the Advisory Council on Historic Preservation if necessary, be afforded the opportunity to comment and allows the lead Federal agency to move forward with an undertaking if the SHPO or THPO fails to respond (36 CFR §800.3(c)3-4). In contrast, Section 4(f) requires that historic properties only be used if there is no feasible and prudent alternative (49 U.S.C. §303(c)(1)). Refer to Section 3.7, *Department of Transportation Act, Section 4(f)*, of this EIS for a discussion of Section 4(f) analysis.

## **3.5.2 Study Area**

The study area for cultural resources is equivalent to the APE as defined under the NHPA's Section 106 regulations (36 CFR §800.16(d)). The APE of an undertaking is defined as "the geographic area or areas within

which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist” (36 CFR §800.16(d)). The APE accounts for potential direct and indirect effects resulting from the proposed undertaking and considers both the construction and operation of the proposed project. As such, the APE has been developed to consider both a construction APE and an operational APE. The construction APE is limited within the existing boundaries of LC-39A. It is anticipated that proposed new construction associated with the Proposed Action will be compatible with the characteristics of other launch complex infrastructure and will not pose viewshed effects to historic properties. The operational APE considers the auditory effects of the Proposed Action as well as the overpressure effects of the sonic boom generated during atmospheric reentry. FAA guidance stipulates consideration of a 130 dB threshold for launch effects and a 2 psf threshold for effects from the sonic boom. The 2 psf threshold is utilized based on the *Identification of Historic Properties and Finding of No Effect, SpaceX Increased Launch Cadence, Vandenberg Space Force Base*, which, based on other studies, utilized this threshold for potential structural damage resulting from sonic booms (overpressure) and to establish a related APE (USSF, 2023a).

Based on this information, and previous research regarding rocket engine noise and vibration effects to structures, the APE was established as any area subjected to greater than or equal to 2 psf from sonic booms under annual mean weather conditions for the range of launch/landing activities. This area also encompasses the 130 dB threshold for launch effects, as well as the construction APE. The APE is roughly circular with an approximate western radius of 18.5 miles (29.8 kilometers) from the center of LC-39A (Figure 3.5-1). The Florida SHPO concurred with the APE in a meeting that included the FAA, NASA, SpaceX, and Leidos on January 23, 2025.

### 3.5.3 Existing Conditions

#### ***Integrated Cultural Resource Management Plan and LC-39A***

KSC has developed an Integrated Cultural Resource Management Plan (ICRMP) that reflects NASA’s commitment to the protection of significant cultural resources. The most recent version of the ICRMP covers the 2024–2029 time period (KSC, 2024a). Currently, KSC operates under the 2009 *Programmatic Agreement Among the National Aeronautics and Space Administration, John F. Kennedy Space Center, Advisory Council on Historic Preservation*, and the *Florida State Historic Preservation Officer Regarding Management of Historic Properties at the Kennedy Space Center, Florida* (NASA, 2009).

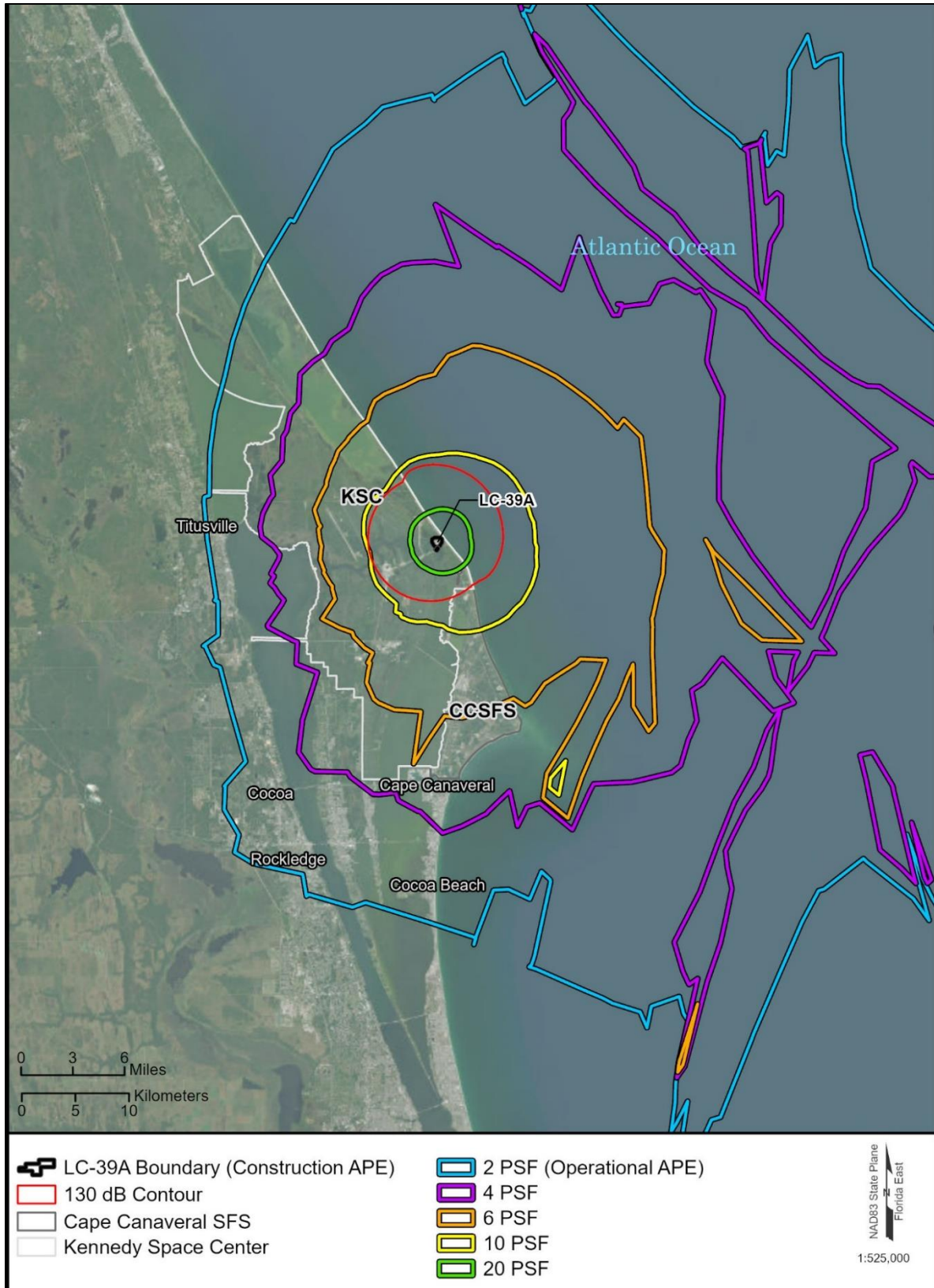


Figure 3.5-1. The APEs and psf Contours



In January 2000, LC-39A (constructed in 1965) became one of the first KSC sites to be listed in the NRHP, under State Identification No. 8BR2686. LC-39A has approximately 24 contributing resources (e.g., camera pads, LOX/liquid hydrogen facility, support buildings, etc.). LC-39A was the site of the first Saturn V launch in 1967, the Apollo 4 mission, and the Apollo 11 mission in 1969, which took astronauts Armstrong, Aldrin, and Collins to the moon. In total, 11 Apollo missions and one Skylab mission, all using the Saturn V rocket, were launched at LC-39A. On April 14, 1981, the first Space Shuttle was launched from LC-39A, followed by an additional 80 launches. This LC-39A area has been subject to historic properties survey and evaluation and will not require additional study.

### ***Identification of Previously Recorded and Previously Unrecorded Resources***

NASA, as the lead Federal agency for Section 106 acting in coordination with the FAA, and SEARCH, LLC (SEARCH) conducted a study to identify previously recorded cultural resources within the APE, and to identify unrecorded historic properties within the APE. The Florida Master Site File (FMSF) was queried to identify previously recorded resources. Alternate sources consulted to create an inventory of previously recorded cultural resources included the NRHP database, the ICRMPs for KSC and the CCSFS, and information provided by consulting parties and members of the public.

Because thousands of unrecorded buildings and structures are within the APE, NASA, in coordination with the FAA and in consultation with the SHPO, SpaceX, and Leidos developed an identification approach to make a reasonable and good faith effort to identify historic properties within the APE that may be affected by the Proposed Action. Identification efforts focused on properties greater than 45 years of age, in areas that have not been surveyed within the last 10 years and limited to those historic properties and potential historic properties that may reasonably be affected by the undertaking. Previously recorded resources that were determined ineligible for listing in the NRHP will be excluded from further identification and evaluation efforts.

Historic properties were identified in two ways. First, NASA compiled an inventory of previously recorded cultural resources within the APE that are listed in the NRHP, eligible for listing in the NRHP, potentially eligible for listing in the NRHP, and unevaluated for listing in the NRHP. These data were supplemented with information on unrecorded cultural resources provided by consulting parties and the public. County property appraiser databases were queried to identify unrecorded historic aboveground resources within the APE. Historic maps and aerial photographs were used to examine land use and development changes over time, and a historic context was developed for the APE. The cumulative data was used to develop a Geographic Information System heat map of the APE to identify areas with high concentrations of unrecorded structures that are 45 years old or older. These data sets were used to identify and create a list of properties and areas that were subjected to survey fieldwork.

Survey fieldwork was then conducted with three primary objectives:

1. Conduct a windshield survey guided by the heat map discussed above, to identify potential historic properties.
2. Document and describe potential historic properties with a reasonable possibility to be adversely affected identified during the windshield survey.
3. Revisit previously recorded NRHP-listed or -eligible individual properties with a reasonable possibility to be adversely affected, and assess their integrity.

### Previously Recorded Architectural History Resources

#### Architectural History Resources at NASA KSC

Since 1972, numerous architectural surveys and NRHP nominations have been carried out at NASA KSC. Presently, 24 historic properties associated with NASA KSC are determined to be individually eligible or listed in the NRHP, with 22 properties located at NASA KSC and two located at CCSFS. A further 86 properties are determined to be contributing elements to seven listed or eligible historic districts, two of which are located at CCSFS. The FMSF includes four cemeteries on KSC. Table 3.5-1 quantifies resource types by category at KSC, and Table 3.5-2 lists previously recorded NRHP-listed and NRHP-eligible resources at KSC. Note that some historic properties owned and under NASA KSC control are located within MINWR, CANA, and CCSFS.

**Table 3.5-1. Historic Resource Types on KSC within the APE**

| Resource Type           | Total      |
|-------------------------|------------|
| Buildings or Structures | 110        |
| Resource Groups         | 8          |
| Cemeteries              | 4          |
| <b>Total</b>            | <b>122</b> |

Notes: APE = Area of Potential Effects; KSC = Kennedy Space Center.

**Table 3.5-2. Previously Recorded NRHP-Listed and NRHP-Eligible Historic Resources Located at KSC, Including Demolished Resources Previously Determined NRHP Eligible**

| FMSF/NRHP Number       | Resource Name                                                                 | psf Threshold | Associated Programs | Year Built/Period of Significance | NRHP Status  |
|------------------------|-------------------------------------------------------------------------------|---------------|---------------------|-----------------------------------|--------------|
| <b>Resource Groups</b> |                                                                               |               |                     |                                   |              |
| 8BR1686/NRHP #99001638 | LC 39 Pad A Historic District                                                 | 20 psf        | Apollo/SSP          | 1967-1985                         | NRHP Listed  |
| 8BR1687/NRHP #99001639 | LC 39 Pad B Historic District                                                 | 20 psf        | Apollo/SSP          | 1967-1985                         | NRHP Listed  |
| 8BR1986                | SLF Historic District                                                         | 6 psf         | SSP                 | 1969-2010                         | Eligible     |
| 8BR1990                | Orbiter Processing Historic District                                          | 10 psf        | SSP                 | 1969-2010                         | Eligible     |
| 8BR2932                | NASA KSC Railroad System Historic District                                    | 10 psf        | SSP                 | 1978-2010                         | Eligible     |
| 8BR1996                | SRB Disassembly and Refurbishment Complex Historic District                   | 10 psf        | SSP                 | 1962-2011                         | Eligible     |
| 8BR2015*               | Hypergolic Maintenance and Checkout Area Historic District                    | 6 psf         | SSP                 | 1969-2011                         | Not Eligible |
| 8BR3073                | NASA-owned Cape Canaveral Air Force Station Industrial Area Historic District | 6 psf         | Mercury/ELV/SSP     | 1958-Present                      | Eligible     |

**Table 3.5-2. Previously Recorded NRHP-Listed and NRHP-Eligible Historic Resources Located at KSC, Including Demolished Resources Previously Determined NRHP Eligible**

| FMSF/NRHP Number                                              | Resource Name                                                 | psf Threshold | Associated Programs | Year Built/Period of Significance | NRHP Status  |
|---------------------------------------------------------------|---------------------------------------------------------------|---------------|---------------------|-----------------------------------|--------------|
| <b>Buildings/Structures (Individually Eligible or Listed)</b> |                                                               |               |                     |                                   |              |
| -                                                             | Orbiter Atlantis                                              | 10 psf        | SSP                 | 1984                              | Eligible     |
| 8BR1684                                                       | Vehicle Assembly Building                                     | 10 psf        | Apollo/SSP          | 1962-1966                         | NRHP Listed  |
| 8BR3150                                                       | VAB Utility Annex                                             | 10 psf        | Apollo              | 1966                              | NRHP Listed  |
| 8BR2986                                                       | Barge Terminal Facility                                       | 10 psf        | Apollo/SSP          | 1965                              | Eligible     |
| 8BR1685                                                       | Launch Control Center                                         | 10 psf        | Apollo/SSP          | 1966                              | NRHP Listed  |
| 8BR1689                                                       | Crawlerway                                                    | 20 psf        | Apollo/SSP          | 1963-1965                         | NRHP Listed  |
| 8BR1688                                                       | Crawler Transporter 1 & 2                                     | 20 psf        | Apollo/SSP          | 1965                              | NRHP Listed  |
| 8BR1690                                                       | Press Site: Clock and Flag Pole                               | 10 psf        | Apollo              | 1969                              | NRHP Listed  |
| 8BR1691*                                                      | Headquarters Building                                         | 6 psf         | Apollo              | 1965                              | Not Eligible |
| 8BR1693                                                       | Neil Armstrong O&C Building                                   | 6 psf         | Apollo              | 1964                              | NRHP Listed  |
| 8BR1692*                                                      | Central Instrumentation Facility                              | -             | Apollo              | 1965                              | Not Eligible |
| 8BR1998                                                       | Manufacturing BFF                                             | 6 psf         | SSP                 | 1986                              | Eligible     |
| 8BR2014*                                                      | Parachute Refurbishment Facility                              | -             | SSP                 | 1964                              | Not Eligible |
| 8BR2016                                                       | Canister Rotation Facility (aka Launch Abort System Facility) | 6 psf         | SSP                 | 1993                              | Eligible     |
| 8BR2017*                                                      | Payload Cannister 1 & 2                                       | -             | SSP                 | 1978                              | Eligible     |
| 8BR2019*                                                      | Retrieval Ship, Liberty Star                                  | -             | SSP                 | 1980-1981                         | Eligible     |
| 8BR2020*                                                      | Retrieval Ship, Freedom Star                                  | 6 psf         | SSP                 | 1980-1981                         | Eligible     |
| 8BR2021                                                       | Mobile Launcher Platforms 1, 2, and 3                         | 10 psf        | SSP                 | 1963-1968                         | Eligible     |
| 8BR1997                                                       | Rotation/Processing Facility                                  | 10 psf        | SSP                 | 1984                              | Eligible     |
| 8BR2671                                                       | Space Station Processing Facility                             | 6 psf         | ISS                 | 1992                              | Eligible     |
| -                                                             | Ammonia Vapor Containment Building                            | 10 psf        | ISS                 | 2006                              | Eligible     |
| 8BR2905*                                                      | BOSU                                                          | -             | Apollo              | 1965                              | Not Eligible |
| 8BR2990                                                       | Beach House                                                   | 10 psf        | Apollo/SSP          | 1962                              | Eligible     |
| 8BR2969                                                       | Engineering Development Lab                                   | 6 psf         | Apollo              | 1966                              | Eligible     |
| <b>Historic Bridges</b>                                       |                                                               |               |                     |                                   |              |
| 8BR2956*                                                      | Indian River Bridge                                           | -             | Apollo/SSP/ISS      | 1964                              | Not Eligible |
| 8BR2957                                                       | Haulover Canal Bridge                                         | 2 psf         | Apollo/SSP/ISS      | 1965                              | Eligible     |
| 8BR2955                                                       | Banana River Bridge                                           | 6 psf         | Apollo/SSP/ISS      | 1964                              | Eligible     |

**Table 3.5-2. Previously Recorded NRHP-Listed and NRHP-Eligible Historic Resources Located at KSC, Including Demolished Resources Previously Determined NRHP Eligible**

| FMSF/NRHP Number                                              | Resource Name                       | psf Threshold | Associated Programs | Year Built/Period of Significance | NRHP Status                     |
|---------------------------------------------------------------|-------------------------------------|---------------|---------------------|-----------------------------------|---------------------------------|
| <b>Buildings/Structures (Contributors to Resource Groups)</b> |                                     |               |                     |                                   |                                 |
| 8BR1995                                                       | LC 39 Pad A                         | 20 psf        | Apollo/SSP          | 1967-1985                         | NRHP Listed (Contributor to RG) |
| 8BR2010                                                       | LC 39 Pad B                         | 20 psf        | Apollo/SSP          | 1967-1985                         | NRHP Listed (Contributor to RG) |
| 8BR2094                                                       | High Pressure GH2 Facility          | 10 psf        | Apollo/SSP          | 1968                              | NRHP Listed (Contributor to RG) |
| 8BR2095                                                       | LOX Facility                        | 20 psf        | Apollo/SSP          | 1966                              | NRHP Listed (Contributor to RG) |
| 8BR2096                                                       | A-1 Operations Support Building     | 20 psf        | Apollo/SSP          | 1966                              | NRHP Listed (Contributor to RG) |
| 8BR2102                                                       | A-2 Operations Support Building     | 20 psf        | Apollo/SSP          | 1966                              | NRHP Listed (Contributor to RG) |
| 8BR2097                                                       | Camera Pad No. 1                    | 20 psf        | Apollo/SSP          | 1966                              | NRHP Listed (Contributor to RG) |
| 8BR2105                                                       | Camera Pad No. 2                    | 20 psf        | Apollo/SSP          | 1965                              | NRHP Listed (Contributor to RG) |
| 8BR2107                                                       | Camera Pad No. 3                    | 20 psf        | Apollo/SSP          | 1965                              | NRHP Listed (Contributor to RG) |
| 8BR2106                                                       | Camera Pad No. 4                    | 20 psf        | Apollo/SSP          | 1965                              | NRHP Listed (Contributor to RG) |
| 8BR2100                                                       | Camera Pad No. 6                    | 20 psf        | Apollo/SSP          | 1965                              | NRHP Listed (Contributor to RG) |
| 8BR2098                                                       | LH <sub>2</sub> Facility            | 20 psf        | Apollo/SSP          | 1965                              | NRHP Listed (Contributor to RG) |
| 8BR2101                                                       | Electrical Equipment Building No. 1 | 20 psf        | Apollo/SSP          | 1979                              | NRHP Listed (Contributor to RG) |
| 8BR2099                                                       | Electrical Equipment Building No. 2 | 20 psf        | Apollo/SSP          | 1979                              | NRHP Listed (Contributor to RG) |
| 8BR2110*                                                      | Electrical Equipment Building No. 3 | -             | SSP                 | 1979                              | Not Eligible                    |
| 8BR2111                                                       | Electrical Equipment Building No. 4 | 20 psf        | SSP                 | 1979                              | Eligible (Contributor to RG)    |
| 8BR2103                                                       | Slidewire Termination Facility      | 20 psf        | Apollo/SSP          | 1965                              | NRHP Listed                     |
| 8BR2104                                                       | Water Chiller Building              | 20 psf        | Apollo/SSP          | 1968                              | NRHP Listed                     |
| 8BR2108                                                       | Water Tank                          | 20 psf        | SSP                 | 1980                              | NRHP Listed (Contributor to RG) |
| 8BR2109                                                       | Flare Stack                         | 20 psf        | SSP                 | 1985                              | NRHP Listed (Contributor to RG) |
| 8BR2113                                                       | Hypergol Fuel Facility              | 20 psf        | SSP                 | 1979                              | Eligible (Contributor to RG)    |
| 8BR2112*                                                      | Hypergol Oxidizer Facility          | -             | SSP                 | 1979                              | Not Eligible                    |
| -                                                             | Foam Building                       | 10 psf        | Apollo              | 1965                              | NRHP Listed (Contributor to RG) |

**Table 3.5-2. Previously Recorded NRHP-Listed and NRHP-Eligible Historic Resources Located at KSC, Including Demolished Resources Previously Determined NRHP Eligible**

| FMSF/NRHP Number | Resource Name                       | psf Threshold | Associated Programs | Year Built/Period of Significance | NRHP Status                     |
|------------------|-------------------------------------|---------------|---------------------|-----------------------------------|---------------------------------|
| -                | Pump House                          | 10 psf        | Apollo              | 1964                              | NRHP Listed                     |
| -                | Compressed Air Building             | 10 psf        | Apollo              | 1965                              | NRHP Listed (Contributor to RG) |
| -                | Remote Air Intake Building          | 10 psf        | Apollo              | 1965                              | NRHP Listed (Contributor to RG) |
| _*               | Azimuth Alignment Station           | -             | Apollo              | 1965                              | NRHP Listed (Contributor to RG) |
| 8BR2114          | B-1 Operations Support Building     | 10 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2122          | B-2 Operations Support Building     | 20 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2115*         | High-Pressure GH2 Facility          | -             | Apollo/SSP          | 1967                              | Not Eligible                    |
| 8BR2116          | LOX Facility                        | 10 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2118          | Camera Pad B No. 1                  | 10 psf        | Apollo/SSP          | 1968                              | NRHP Listed (Contributor to RG) |
| 8BR2124          | Camera Pad B No. 2                  | 20 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2127          | Camera Pad B No. 3                  | 20 psf        | Apollo/SSP          | 1968                              | NRHP Listed (Contributor to RG) |
| 8BR2126          | Camera Pad B No. 4                  | 20 psf        | Apollo/SSP          | 1968                              | NRHP Listed (Contributor to RG) |
| 8BR2117          | Camera Pad B No. 6                  | 10 psf        | Apollo/SSP          | 1968                              | NRHP Listed (Contributor to RG) |
| 8BR2119          | LH <sub>2</sub> Facility            | 20 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2121          | Electrical Equipment Building No. 1 | 20 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2120          | Electrical Equipment Building No. 2 | 10 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2123          | Slidewire Termination Facility      | 10 psf        | Apollo/SSP          | 1967                              | NRHP Listed (Contributor to RG) |
| 8BR2128          | Flarestack                          | 20 psf        | SSP                 | 1985                              | Eligible (Contributor to RG)    |
| 8BR2125          | Water Chiller Building              | 20 psf        | Apollo/SSP          | 1968                              | NRHP Listed (Contributor to RG) |
| 8BR2129          | Water Tank                          | 20 psf        | SSP                 | 1981                              | Eligible (Contributor to RG)    |
| 8BR3046          | Foam Building                       | 20 psf        | Apollo              | 1968                              | NRHP Listed (Contributor to RG) |
| 8BR2130*         | Hypergol Oxidizer Facility          | -             | SSP                 | 1981                              | Not Eligible                    |
| 8BR2132*         | Hypergol Fuel Facility              | -             | SSP                 | 1981                              | Not Eligible                    |



**Table 3.5-2. Previously Recorded NRHP-Listed and NRHP-Eligible Historic Resources Located at KSC, Including Demolished Resources Previously Determined NRHP Eligible**

| <b>FMSF/NRHP Number</b> | <b>Resource Name</b>                                                                                | <b>psf Threshold</b> | <b>Associated Programs</b> | <b>Year Built/ Period of Significance</b> | <b>NRHP Status</b>              |
|-------------------------|-----------------------------------------------------------------------------------------------------|----------------------|----------------------------|-------------------------------------------|---------------------------------|
| 8BR2131*                | Electrical Equipment No. 3                                                                          | -                    | SSP                        | 1981                                      | Not Eligible                    |
| 8BR2133*                | Electrical Equipment No. 4                                                                          | -                    | SSP                        | 1981                                      | Not Eligible                    |
| -                       | Compressed Air Building                                                                             | 10 psf               | Apollo                     | 1967                                      | NRHP Listed (Contributor to RG) |
| -                       | Azimuth Alignment Station                                                                           | 10 psf               | Apollo                     | 1967                                      | NRHP Listed (Contributor to RG) |
| -                       | Remote Air Intake Building                                                                          | 10 psf               | Apollo                     | 1967                                      | NRHP Listed (Contributor to RG) |
| 8BR1987                 | Shuttle Landing Runway                                                                              | 6 psf                | SSP                        | 1976                                      | Eligible (Contributor to RG)    |
| 8BR1988                 | Landing Aids Control Building                                                                       | 6 psf                | SSP                        | 1976                                      | Eligible (Contributor to RG)    |
| 8BR1989*                | Mate-Demate Device                                                                                  | -                    | SSP                        | 1977-1978                                 | Not Eligible                    |
| 8BR1991                 | Orbiter Processing Facility                                                                         | 10 psf               | SSP                        | 1977                                      | Eligible (Contributor to RG)    |
| 8BR1992                 | Orbiter Processing Facility High Bay 3 (includes the Space Shuttle Main Engine Processing Facility) | 10 psf               | SSP                        | 1987                                      | Eligible (Contributor to RG)    |
| 8BR1994                 | Thermal Protection System Facility                                                                  | 10 psf               | SSP                        | 1988                                      | Eligible (Contributor to RG)    |
| 8BR2001                 | Hangar AF                                                                                           | 10 psf               | SSP                        | 1962                                      | Eligible (Contributor to RG)    |
| 8BR2002                 | High-Pressure Gas Facility                                                                          | 10 psf               | SSP                        | 1963                                      | Eligible (Contributor to RG)    |
| 8BR2003                 | High-Pressure Wash Facility                                                                         | 10 psf               | SSP                        | 1979                                      | Eligible (Contributor to RG)    |
| 8BR2004*                | First Wash Building                                                                                 | -                    | SSP                        | 1979                                      | Not Eligible                    |
| 8BR2005                 | SRB Recovery Slip                                                                                   | 10 psf               | SSP                        | 1979                                      | Eligible (Contributor to RG)    |
| 8BR2006                 | SRB Paint Building                                                                                  | 10 psf               | SSP                        | 1984                                      | Eligible (Contributor to RG)    |
| 8BR2007*                | Robot Wash Building                                                                                 | -                    | SSP                        | 1987                                      | Not Eligible                    |
| 8BR2008                 | Thrust Vector Control Deservicing Building                                                          | 10 psf               | SSP                        | 1985                                      | Eligible (Contributor to RG)    |
| 8BR2009                 | Multi-Media Blast Facility                                                                          | 10 psf               | SSP                        | 1992                                      | Eligible (Contributor to RG)    |
| 8BR2931                 | Railroad Track                                                                                      | 6 psf                | SSP                        | ca. 1963                                  | Eligible (Contributor to RG)    |
| 8BR2906                 | Jay Jay Bridge                                                                                      | 10 psf               | SSP                        | 1963                                      | Eligible (Contributor to RG)    |
| 8BR2908                 | 70-Ton Aft Skirt Car                                                                                | 10 psf               | SSP                        | 1985                                      | Eligible (Contributor to RG)    |

**Table 3.5-2. Previously Recorded NRHP-Listed and NRHP-Eligible Historic Resources Located at KSC, Including Demolished Resources Previously Determined NRHP Eligible**

| FMSF/NRHP Number  | Resource Name                          | psf Threshold | Associated Programs | Year Built/Period of Significance | NRHP Status                  |
|-------------------|----------------------------------------|---------------|---------------------|-----------------------------------|------------------------------|
| 8BR3042*          | 70-Ton Aft Skirt Car                   | -             | SSP                 | 1985                              | Eligible (Contributor to RG) |
| 8BR2923*          | Locomotive 1                           | -             | SSP                 | 1968                              | Eligible (Contributor to RG) |
| 8BR3043*          | Locomotive 2                           | -             | SSP                 | 1970                              | Eligible (Contributor to RG) |
| 8BR3044*          | Locomotive 3                           | -             | SSP                 | 1970                              | Eligible (Contributor to RG) |
| 8BR1993*          | Hypergol Module Processing North       | -             | SSP                 | 1964                              | Not Eligible                 |
| 8BR2933*          | Hypergol Module Processing South       | -             | SSP                 | 1964                              | Not Eligible                 |
| 8BR2000*          | Hypergol Support Building              | -             | SSP                 | 1964                              | Not Eligible                 |
| 8BR3069           | Hangar N                               | 6 psf         | SSP                 | 1958                              | Eligible (Contributor to RG) |
| 8BR2190           | Little N Storage Building              | 6 psf         | SSP                 | 1958                              | Eligible (Contributor to RG) |
| 8BR2972*          | Hangar M Annex                         | -             | SSP                 | 1963                              | Not Eligible                 |
| 8BR2977*          | Solar Array Test Building              | -             | ELV                 | 1966                              | Not Eligible                 |
| 8BR2975           | Engineering and Operations Building    | 6 psf         | Mercury/ELV         | 1961                              | Eligible (Contributor to RG) |
| 8BR2976           | Missile Assembly Building AE           | 6 psf         | ELV                 | 1959                              | Eligible (Contributor to RG) |
| 8BR3070           | Hangar S                               | 6 psf         | Mercury             | 1959                              | Eligible (Contributor to RG) |
| <b>Cemeteries</b> |                                        |               |                     |                                   |                              |
| 8BR0191           | African American Graves/New Haulover 2 | 2 psf         | -                   | 1880                              | Not Evaluated by SHPO        |
| 8BR0186           | Campbell-Jackson Cemetery              | 2 psf         | -                   | 1913                              | Not Evaluated by SHPO        |
| 8BR1626           | Crook/Watton Cemetery                  | 2 psf         | -                   | 1915                              | Not Evaluated by SHPO        |
| 8BR1624           | Emma Watton Cemetery                   | 2 psf         | -                   | 1882                              | Not Evaluated by SHPO        |

Notes: # = number; aka = also known as; BFF = Building/Booster Fabrication Facility; BOSU = Bioastronautics Operations Support Unit; ca. = circa; ELV = Expendable Launch Vehicle; FMSF = Florida Master Site File; GH2 = green hydrogen; ICRMP = Integrated Cultural Resource Management Plan; ISS = International Space Station; KSC = Kennedy Space Center; LC = Launch Complex; LH<sub>2</sub> = liquid hydrogen; LOX = liquid oxygen; NASA = National Aeronautics and Space Administration; No. = Number; NRHP = National Register of Historic Places; O&C = Operations and Checkout; psf = pounds per square foot; RG = Resource Group; SHPO = State Historic Preservation Officer; SLF = Shuttle Landing Facility, SRB = Solid Rocket Booster; SSP = Space Shuttle Program; VAB = Vehicle Assembly Building.

Entries marked with an "\*" are noted in the KSC ICRMP as demolished or removed from KSC property.

One NRHP-listed resource at NASA KSC, LC-39-A Historic District (8BR1686/NRHP #99001638) is within the 130 dB  $L_{max}$  contour, and is within the construction APE. As noted above in Section 3.5.3, *Existing Conditions*, the NRHP-listed LC-39A area has been subject to historic properties survey and evaluation and will not require additional study.

No field survey to identify historic properties was conducted at NASA KSC during this study, and NASA has no recommendations for significance or NRHP eligibility beyond those previously documented and presented in Table 3.5-2.

#### Architectural History Resources at CCSFS

Since 1980, several efforts to identify historic properties at CCSFS have resulted in the recordation of numerous resources associated with the early U.S. space program. These resources are inventoried and described in the 2023 ICRMP, and in most instances the resources are included in the FMSF. They include 1 National Historic Landmark (NHL), 23 eligible or unevaluated historic districts, 153 properties considered contributing elements to the NHLs and historic districts, and 8 cemeteries (Table 3.5-3). Some of these properties are documented resources at NASA KSC (owned and controlled by NASA KSC, but within the boundaries of CCSFS) and are referenced in the previous section and Table 3.5-3.

Notably, Cape Canaveral Air Force Station was designated an NHL in 1984 for its association with the early space program (DAF 2023). CCSFS is not within the 130 dB  $L_{max}$  contour for the undertaking but is within the APE. Table 3.5-4 provides a list of NRHP-listed, NRHP-eligible, and unevaluated resources located at CCSFS and their NRHP status.

**Table 3.5-3. CCSFS Historic Resource Types within the APE**

| Resource Type           | Total      |
|-------------------------|------------|
| Buildings or Structures | 153        |
| Resource Groups         | 24         |
| Cemeteries              | 8          |
| <b>Total</b>            | <b>185</b> |

Notes: APE = Area of Potential Effects; CCSFS = Cape Canaveral Space Force Station.

**Table 3.5-4. Previously Recorded NRHP-Listed and NRHP-Eligible Resources at CCSFS**

| FMSF/NRHP Number        | Resource Name                                                 | psf Threshold | Year Built/Period of Significance | SEARCH Recommendation |
|-------------------------|---------------------------------------------------------------|---------------|-----------------------------------|-----------------------|
| <b>Resource Groups</b>  |                                                               |               |                                   |                       |
| 8BR00216/NRHP #84003872 | Cape Canaveral Space Force Station National Historic Landmark | 6/4 psf       | 1950-Present                      | NHL and NRHP Listed   |
| 8BR03034                | Delta II Solid Rocket Motor Area Historic District            | 6 psf         | 1963-1965                         | Eligible              |
| 8BR02269                | Launch Complex 19                                             | 6 psf         | 1956-1966                         | Eligible              |
| 8BR03036                | Delta Spin Test Facility Historic District                    | 6 psf         | 1966-2010                         | Eligible              |
| 8BR02272                | Launch Complex 30                                             | 6 psf         | 1950-Present                      | Eligible              |
| 8BR02209                | Launch Complex 14                                             | 6 psf         | 1957-1966                         | Eligible              |
| 8BR00198                | Launch Complex 13                                             | 6 psf         | 1956-1966                         | Eligible              |

**Table 3.5-4. Previously Recorded NRHP-Listed and NRHP-Eligible Resources at CCSFS**

| <b>FMSF/NRHP Number</b>     | <b>Resource Name</b>                                                     | <b>psf Threshold</b> | <b>Year Built/Period of Significance</b> | <b>SEARCH Recommendation</b>   |
|-----------------------------|--------------------------------------------------------------------------|----------------------|------------------------------------------|--------------------------------|
| 8BR02518                    | Launch Complex 25                                                        | 6 psf                | 1958-1969                                | Eligible                       |
| 8BR02022/8BR 1985           | Launch Complex 21/22                                                     | 6 psf                | 1950-Present                             | Eligible                       |
| 8BR02033                    | Cape Canaveral Lighthouse Station Historic District                      | 4 psf                | 1861-1865                                | Not Evaluated by SHPO          |
| 8BR03166                    | Skid Strip Historic District                                             | 6 psf                | 1950-Present                             | Eligible                       |
| 8BR03433                    | Control Tower Road Tracking Site                                         | 6 psf                | 1950-Present                             | Eligible                       |
| 8BR2170                     | Patrick Air Force Base Missile Instrumentation Station Historic District | <2 psf               | -                                        | Eligible                       |
| 8BR2181                     | BOMARC-SAGE Tracking Facility Historic District                          | 6 psf                | -                                        | Eligible                       |
| 8BR2438                     | Patrick Air Force Base Facilities Landplace Historic District            | <2 psf               | -                                        | Eligible                       |
| 8BR03369                    | Cape Canaveral Air Force Station Industrial Area Historic District       | 6 psf                | 1946-1989                                | Eligible                       |
| 8BR02369                    | Launch Complex 17                                                        | 6 psf                | 1957-1960                                | Eligible                       |
| 8BR02279                    | Launch Complex 34                                                        | 6 psf                | 1961-1971                                | Eligible                       |
| 8BR03034                    | Delta II Solid Rocket Motor Area                                         | 6 psf                | 1963-1965                                | Eligible                       |
| 8BR03036                    | Delta Spin Test Facility                                                 | 6 psf                | 1966-2010                                | Eligible                       |
| 8BR2440                     | Patrick Air Force Base Administrative Historic District                  | <2 psf               | -                                        | Eligible                       |
| 8R02515                     | Launch Complex 31/32                                                     | 6 psf                | 1950-Present                             | Eligible                       |
| 8BR2076                     | High Explosive Storage Facility Historic District                        | 6 psf                | -                                        | Eligible                       |
| 8BR1975                     | Banana River Naval Air Station Seaplane Historic District                | <2 psf               | -                                        | Eligible                       |
| <b>Buildings/Structures</b> |                                                                          |                      |                                          |                                |
| 8BR0174                     | Air Force Space Museum/LC-26                                             | 6 psf                | 1958                                     | NHL Listed                     |
| 8BR0212                     | Cape Canaveral Lighthouse                                                | <2 psf               | 1867                                     | Eligible                       |
| 8BR1970                     | Seaplane Ramp                                                            | <2 psf               | -                                        | NHL Listed (Contributor to RG) |
| 8BR1971                     | Seaplane Ramp                                                            | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR1972                     | Seaplane Ramp                                                            | <2 psf               | -                                        | NHL Listed (Contributor to RG) |
| 8BR1974                     | A&R Shop                                                                 | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR1980                     | Hangar C                                                                 | 4 psf                | 1953                                     | Eligible (Contributor to RG)   |
| 8BR1981                     | Launch Building 21/22                                                    | 6 psf                | 1958                                     | Eligible (Contributor to RG)   |
| 8BR1982                     | CX 21/22 Utility Room                                                    | 4 psf                | 1958                                     | Eligible (Contributor to RG)   |
| 8BR1983                     | LC-21/22 Blockhouse                                                      | 4 psf                | 1958                                     | Eligible (Contributor to RG)   |

**Table 3.5-4. Previously Recorded NRHP-Listed and NRHP-Eligible Resources at CCSFS**

| <b>FMSF/NRHP Number</b> | <b>Resource Name</b>                       | <b>psf Threshold</b> | <b>Year Built/Period of Significance</b> | <b>SEARCH Recommendation</b>   |
|-------------------------|--------------------------------------------|----------------------|------------------------------------------|--------------------------------|
| 8BR1984                 | Storage Building                           | 6 psf                | -                                        | Eligible (Contributor to RG)   |
| 8BR02001*               | Hangar AF                                  | 6 psf                | 1962                                     | Eligible (Contributor to RG)   |
| 8BR02002*               | High Pressure Gas Building                 | 6 psf                | 1963                                     | Eligible (Contributor to RG)   |
| 8BR02003*               | High Pressure Wash Facility                | 6 psf                | 1979                                     | Eligible (Contributor to RG)   |
| 8BR02004*               | First Wash Building                        | 6 psf                | 1979                                     | Eligible (Contributor to RG)   |
| 8BR02006*               | SRB Paint Building                         | 6 psf                | 1984                                     | Eligible (Contributor to RG)   |
| 8BR02007*               | Robot Wash Building                        | 6 psf                | 1987                                     | Eligible (Contributor to RG)   |
| 8BR02008*               | Thrust Vector Control Deservicing Building | 6 psf                | 1985                                     | Eligible (Contributor to RG)   |
| 8BR02009*               | Multi-Media Blast Facility                 | 6 psf                | 1982                                     | Eligible (Contributor to RG)   |
| 8BR2025                 | Seaside Chapel                             | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR02031                | Oil House at Cape Canaveral Lighthouse     | 4 psf                | 1868                                     | Not Evaluated By SHPO          |
| 8BR02032                | Storage Shed at Cape Canaveral Lighthouse  | 4 psf                | 1865                                     | Eligible (Contributor to RG)   |
| 8BR2034                 | Inert Storage Magazine                     | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR2035                 | Inert Storage Magazine                     | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR2036                 | Inert Storage Magazine                     | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR2045                 | 45th Space Wing Headquarters               | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR2046                 | Administrative Building                    | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR2136                 | AFTAC                                      | <2 psf               | -                                        | Eligible (Contributor to RG)   |
| 8BR2144                 | LC-18 Blockhouse                           | 6 psf                | 1956                                     | Eligible (Contributor to RG)   |
| 8BR2183                 | LC-9 Launch Platform                       | 4 psf                | 1953                                     | Eligible (Contributor to RG)   |
| 8BR2185                 | LC-9/10 Blockhouse                         | 4 psf                | 1953                                     | Eligible (Contributor to RG)   |
| 8BR2186                 | LC-9/10 Pumphouse                          | 6 psf                | 1953                                     | Eligible (Contributor to RG)   |
| 8BR2190*                | Little N Storage Building                  | 6 psf                | 1958                                     | Eligible (Contributor to RG)   |
| 8BR2200                 | LC-13 Launch Pad and Ramp                  | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2201                 | LC-13 Flume and Skimming Basin             | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2202                 | LC-13 LOX Storage Area                     | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2203                 | LC-13 Guard Shack                          | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2204                 | LC-13 POL Building                         | 6 psf                | 1960                                     | Eligible (Contributor to RG)   |
| 8BR2205                 | LC-13 Water Demineralization Building      | 6 psf                | 1957                                     | Eligible (Contributor to RG)   |
| 8BR2206                 | LC-13 Gantry Rails and Parking Area        | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2207                 | LC-13 Propellant Facility                  | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2208                 | LC-13 POL Building                         | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2210                 | LC-14 Launch Pad and Ramp                  | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2211                 | LC-14 Propellant Transfer Unit             | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |



**Table 3.5-4. Previously Recorded NRHP-Listed and NRHP-Eligible Resources at CCSFS**

| <b>FMSF/NRHP Number</b> | <b>Resource Name</b>                     | <b>psf Threshold</b> | <b>Year Built/Period of Significance</b> | <b>SEARCH Recommendation</b>   |
|-------------------------|------------------------------------------|----------------------|------------------------------------------|--------------------------------|
| 8BR2212                 | LC-14 JP-4 Facility                      | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2214                 | LC-14 LOX Storage Area                   | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2215                 | LC-14 Flume and Skimming Basin           | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2216                 | LC-14 Blockhouse                         | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2217                 | LC-14 Ready Building                     | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2218                 | LC-14 Communications Cable Building      | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2219                 | LC-14 Water Demineralization Building    | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2220                 | LC-14 LOX Storage Area                   | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2221                 | Mercury Memorial                         | 6 psf                | 1957                                     | NHL Listed (Contributor to RG) |
| 8BR2233                 | Recreational Storage Building            | 6 psf                | 1958                                     | Eligible                       |
| 8BR2236                 | LC-3/4 Blockhouse                        | 4 psf                | 1951                                     | Eligible (Contributor to RG)   |
| 8BR2237                 | LC-3 Launch Pad                          | 4 psf                | 1951                                     | Eligible (Contributor to RG)   |
| 8BR2238                 | LC-4 Launch Pad                          | 4 psf                | 1950                                     | Eligible (Contributor to RG)   |
| 8BR2240                 | Bomare Building                          | 4 psf                | 1955                                     | Eligible (Contributor to RG)   |
| 8BR2241                 | Comp. and Cool Building                  | 4 psf                | 1955                                     | Eligible (Contributor to RG)   |
| 8BR2242                 | High Pressure Air Facility               | 6 psf                | 1951                                     | Eligible (Contributor to RG)   |
| 8BR2249                 | LC-1/2 Blockhouse                        | 4 psf                | 1951                                     | Eligible (Contributor to RG)   |
| 8BR2250                 | LC-1 Launch Pad                          | 4 psf                | 1951                                     | Eligible (Contributor to RG)   |
| 8BR2251                 | LC-2 Launch Pad                          | 4 psf                | 1951                                     | Eligible (Contributor to RG)   |
| 8BR2252                 | Transformer Building                     | 6 psf                | 1951                                     | Eligible (Contributor to RG)   |
| 8BR2253                 | LC-23/24 Snark Pad                       | 4 psf                | 1953                                     | Eligible (Contributor to RG)   |
| 8BR2261                 | LC-19 Blockhouse                         | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2262                 | LC-19 Cableway                           | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2263                 | LC-19 Decontamination Building           | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2264                 | LC-19 Launch Stand and Ramp              | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2266                 | LC-19 Instrumentation Building           | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2267                 | LC-19 Oxidizer Holding Area              | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2268                 | LC-19 Theodolite Building No. 1          | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2269                 | LC-19 Fuel Holding Area                  | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2270                 | LC-19 Flume and Catchment Building       | 6 psf                | ca. 1956                                 | NHL Listed (Contributor to RG) |
| 8BR2271                 | LC-19 Theodolite Building No. 2          | 6 psf                | 1961                                     | NHL Listed (Contributor to RG) |
| 8BR2280                 | LC-34 Blockhouse                         | 6 psf                | 1969                                     | NHL Listed (Contributor to RG) |
| 8BR2281                 | LC-34 High Pressure Gas Storage Facility | 6 psf                | 1960                                     | NHL Listed (Contributor to RG) |

**Table 3.5-4. Previously Recorded NRHP-Listed and NRHP-Eligible Resources at CCSFS**

| <b>FMSF/NRHP Number</b> | <b>Resource Name</b>                                | <b>psf Threshold</b> | <b>Year Built/Period of Significance</b> | <b>SEARCH Recommendation</b>   |
|-------------------------|-----------------------------------------------------|----------------------|------------------------------------------|--------------------------------|
| 8BR2282                 | LC-34 Oxidizer Storage Facility                     | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2283                 | LC-34 Oxygen Storage Building                       | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2284                 | LC-34 Theodolite Building                           | 6 psf                | 1965                                     | NHL Listed (Contributor to RG) |
| 8BR2285                 | LC-34 Toxic Vapor Disposal Pad                      | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2286                 | LC-34 RP-1 Storage Facility                         | 6 psf                | 1960                                     | NHL Listed (Contributor to RG) |
| 8BR2287                 | LC-34 RP-1 Electrical Equipment Building            | 6 psf                | 1960                                     | NHL Listed (Contributor to RG) |
| 8BR2288                 | LC-34 RP-1 Special Liquids Storage Building         | 6 psf                | 1960                                     | NHL Listed (Contributor to RG) |
| 8BR2289                 | LC-34 Cableway                                      | 6 psf                | 1960                                     | NHL Listed (Contributor to RG) |
| 8BR2290                 | LC-34 Launch Pad                                    | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2291                 | LC-34 Mobile Service Tower Parking Area             | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2292                 | LC-34 Launch Pedestal                               | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2293                 | LC-34 Flame Deflectors and Deflector Parking Area   | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2294                 | LC-34 Launch Pad Environmental Control Building     | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2295                 | LC-34 Flume and Catchment Basin                     | 6 psf                | 1961                                     | NHL Listed (Contributor to RG) |
| 8BR2296                 | LC-34 Liquid Hydrogen Electrical Equipment Building | 6 psf                | 1963                                     | NHL Listed (Contributor to RG) |
| 8BR2297                 | LC-34 High Pressure Hydrogen Storage Facility       | 6 psf                | 1965                                     | NHL Listed (Contributor to RG) |
| 8BR2298                 | LC-34 Automatic Ground Control Station              | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2299                 | LC-34 Liquid Hydrogen Storage Facility              | 6 psf                | 1963                                     | NHL Listed (Contributor to RG) |
| 8BR2300                 | LC-34 High Pressure Gas Storage Battery             | 6 psf                | 1959                                     | NHL Listed (Contributor to RG) |
| 8BR2322                 | LC-16 Blockhouse                                    | 6 psf                | 1959                                     | Eligible (Contributor to RG)   |
| 8BR2333                 | LC-36 Blockhouse                                    | 4 psf                | 1959                                     | Eligible (Contributor to RG)   |
| 8BR2348                 | NRC Experimentation Facility                        | 4 psf                | 1952                                     | Eligible (Contributor to RG)   |
| 8BR2353                 | Hangar K                                            | 6 psf                | 1957                                     | Eligible (Contributor to RG)   |
| 8BR2370                 | LC-17 Blockhouse                                    | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG)   |
| 8BR2371                 | LC-17 Alignment Building                            | 4 psf                | 1970                                     | Eligible (Contributor to RG)   |
| 8BR2372                 | LC-17B Launch Pad                                   | 4 psf                | 1959                                     | Eligible (Contributor to RG)   |
| 8BR2373                 | LC-17B Mobile Service Tower                         | 4 psf                | 1959                                     | Eligible (Contributor to RG)   |

**Table 3.5-4. Previously Recorded NRHP-Listed and NRHP-Eligible Resources at CCSFS**

| <b>FMSF/NRHP Number</b> | <b>Resource Name</b>                     | <b>psf Threshold</b> | <b>Year Built/Period of Significance</b> | <b>SEARCH Recommendation</b> |
|-------------------------|------------------------------------------|----------------------|------------------------------------------|------------------------------|
| 8BR2374                 | LC-17B Umbilical Tower                   | 4 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2375                 | LC-17 Deluge Basin                       | 6 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2376                 | LC-17A Launch Pad                        | 6 psf                | 1959                                     | Eligible (Contributor to RG) |
| 8BR2377                 | LC-17A Mobile Service Tower              | 4 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2378                 | LC-17A Umbilical Tower                   | 4 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2379                 | LC-17A Deluge Basin                      | 4 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2380                 | LC-17 Switch Control Building            | 4 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2381                 | LC-17 Electrical Distribution Building   | 4 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2382                 | LC-17 Change and Rest Home               | 4 psf                | 1968                                     | Eligible (Contributor to RG) |
| 8BR2383                 | LC-17 Cases Storage Area                 | 4 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2384                 | LC-17B DIGs Building                     | 4 psf                | 1973                                     | Eligible (Contributor to RG) |
| 8BR2385                 | LC-17A DIGs Building                     | 6 psf                | 1973                                     | Eligible (Contributor to RG) |
| 8BR2386                 | LC-17 Chiller Building                   | 4 psf                | 1994                                     | Eligible (Contributor to RG) |
| 8BR2387                 | LC-17 UPS Building                       | 4 psf                | 1969                                     | Eligible (Contributor to RG) |
| 8BR2388                 | LC-17 RP-1 Storage Building              | 6 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2389                 | LC-17 LH2 Storage Area                   | 4 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2390                 | LC-17 Paint, Oil, and Lubricant Building | 6 psf                | 1967                                     | Eligible (Contributor to RG) |
| 8BR2391                 | LC-17 Delta Operations Building          | 4 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2392                 | LC-17 Battery Laboratory                 | 4 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2393                 | LC-17 Electrical Distribution Building   | 4 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2394                 | LC-17 Locker and Storage Facility        | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2397                 | GPI Camera Pad                           | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG) |
| 8BR2398                 | GPI Camera Pad                           | 6 psf                | ca. 1956                                 | Eligible (Contributor to RG) |
| 8BR2454                 | Hangar AO                                | 6 psf                | ca. 1964                                 | Not Evaluated by SHPO        |
| 8BR2480                 | Heavy Equipment Shop                     | 6 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2516                 | LC-32 Blockhouse                         | 6 psf                | 1959                                     | Not Evaluated by SHPO        |
| 8BR2517                 | LC-31 Blockhouse                         | 4 psf                | 1959                                     | Not Evaluated by SHPO        |
| 8BR2519                 | LC-25 Blockhouse                         | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2520                 | LC-25 Electrical Distribution Building   | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2021                 | LC-25 Substation                         | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2022                 | LC-25 Pad A/B Instrumentation Ditches    | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2523                 | LC-25 Pad A                              | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2524                 | LC-25 Pad B                              | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2525                 | LC-25 Pad C/D Instrumentation Ditches    | 6 psf                | 1958                                     | Eligible (Contributor to RG) |

**Table 3.5-4. Previously Recorded NRHP-Listed and NRHP-Eligible Resources at CCSFS**

| <b>FMSF/NRHP Number</b> | <b>Resource Name</b>          | <b>psf Threshold</b> | <b>Year Built/Period of Significance</b> | <b>SEARCH Recommendation</b> |
|-------------------------|-------------------------------|----------------------|------------------------------------------|------------------------------|
| 8BR2526                 | LC-25 Pad C/D                 | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2527                 | LC-25 C Missile Access Stand  | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2528                 | Pad Service Building          | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2530                 | LC-29 Blockhouse              | 6 psf                | 1960                                     | Eligible (Contributor to RG) |
| 8BR2531                 | LC-29 Substation              | 6 psf                | 1960                                     | Eligible (Contributor to RG) |
| 8BR2532                 | LC-29 Instrumentation Tunnel  | 6 psf                | 1960                                     | Eligible (Contributor to RG) |
| 8BR2533                 | LC-29 Pad A                   | 6 psf                | 1960                                     | Eligible (Contributor to RG) |
| 8BR2536                 | Hangar AA                     | 6 psf                | 1959                                     | Eligible (Contributor to RG) |
| 8BR2537                 | Hangar AM                     | 6 psf                | 1964                                     | Eligible (Contributor to RG) |
| 8BR2538                 | Satellite Processing Facility | 6 psf                | 1964                                     | Eligible (Contributor to RG) |
| 8BR2546                 | Hangar F                      | 6 psf                | 1955                                     | Eligible (Contributor to RG) |
| 8BR2587                 | Hangar G                      | 6 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2588                 | Hangar U                      | 6 psf                | 1958                                     | Eligible (Contributor to RG) |
| 8BR2590                 | Mission Control Center        | 6 psf                | 1956                                     | Eligible (Contributor to RG) |
| 8BR2905*                | BOSU                          | 6 psf                | 1964                                     | Not Evaluated by SHPO        |
| <b>Cemeteries</b>       |                               |                      |                                          |                              |
| 8BR2354                 | Penny Cemetery                | 6 psf                | ca. 1890                                 | Insufficient Information     |
| 8BR2355                 | Quartermen North Cemetery     | 6 psf                | ca. 1920                                 | Not Evaluated by SHPO        |
| 8BR2356                 | Quartermen South Cemetery     | 6 psf                | ca. 1869                                 | Not Evaluated by SHPO        |
| 8BR3366                 | Wilson Cemetery               | 4 psf                | ca. 1940                                 | Insufficient Information     |
| 8BR2352                 | Burnham Cemetery              | 4 psf                | ca. 1866                                 | Insufficient Information     |
| 8BR0233                 | Cape Road Cemetery            | 4 psf                | ca. 1894                                 | Insufficient Information     |
| 8BR2358                 | Stinktown Cemetery            | 4 psf                | 1913                                     | Eligible                     |
| 8BR2357                 | Osman Cemetery                | 6 psf                | ca. 1913                                 | Eligible                     |

Notes: < = less than; BOSU = Bioastronautics Operations Support Unit; ca. = circa; CCSFS = Cape Canaveral Space Force Station; DIGS = Digital Image Generation System; FMSF = Florida Master Site File; ICRMP = Integrated Cultural Resources Management Plan; KSC = Kennedy Space Center; LC = Launch Complex; LH<sub>2</sub> = Liquid Hydrogen; LOX = Liquid Oxygen; NHL = National Historic Landmark; No. = Number; NRHP = National Register of Historic Places; NRC = Nuclear Regulatory Commission; POL = Petroleum, Oil, and Lubricant; psf = pounds per square foot; RG = Resource Group; SAGE = Semi-Automatic Ground Environment; SEARCH = SEARCH, LLC; SHPO = State Historic Preservation Officer; SRB = Solid Rocket Booster.

Entries marked with an "\*" are noted as demolished or removed from KSC in KSC ICRMP.

### Architectural History Resources on Non-Federal Property

Background research identified 1,592 previously recorded architectural history resources located outside Federal property within the APE. An intensive architectural history survey and NRHP evaluation for 97 previously recorded resources, resource groups, bridges, and cemeteries was conducted. These included 18 NRHP-listed resources or resource groups, 35 resources or resource groups previously determined eligible or previously eligible by the SHPO, and 43 resources without SHPO determinations, which were previously recommended NRHP eligible by earlier surveys. Resources previously determined ineligible for

NRHP listing were not surveyed. Seven of these previously recorded resources are no longer extant (8BR00681, 8BR00759, 8BR00946, 8BR00953, 8BR01762, 8BR1763, and 8BR01764). All 18 NRHP-listed resources or resource groups retain sufficient integrity to remain NRHP listed. NASA recommends that 64 previously recorded resources are eligible for NRHP inclusion; recommends 1 previously recorded resource is eligible as a resource group contributor (8BR00703); and recommends six previously recorded resources are not eligible for NRHP inclusion. Additionally, one previously recorded resource (8BR01812) remains unevaluated for NRHP eligibility due to a lack of survey access (Table 3.5-5).

**Table 3.5-5. Intensive Architectural History Survey Results Summary**

| <b>FMSF Number</b>     | <b>Name/Address</b>                       | <b>Year Built</b> | <b>psf Threshold</b> | <b>SHPO Determination</b> | <b>SEARCH Recommendation</b> |
|------------------------|-------------------------------------------|-------------------|----------------------|---------------------------|------------------------------|
| <b>Resource Groups</b> |                                           |                   |                      |                           |                              |
| 8BR00560               | Titusville Commercial District            | 1890-1930         | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR01611               | Rockledge Drive Residential District      | 1880-1926         | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR01612               | Valencia Subdivision Residential District | 1924-1926         | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR01613               | Barton Avenue Residential District        | 1884-1926         | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR04229               | Jonathan H. Sams Farmstead                | 1878              | 4 psf                | Eligible                  | Eligible                     |
| 8BR01870               | Florida East Coast Railroad               | 1821-1929         | 2 psf                | Eligible                  | Eligible                     |
| <b>Buildings</b>       |                                           |                   |                      |                           |                              |
| 8BR00177               | St. Gabriel's Episcopal Church            | 1887              | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00211               | E.P. Porcher House                        | 1916              | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00278               | Cocoa Junior High                         | ca. 1924          | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00282               | Aladdin Theater Building                  | 1924              | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00397               | Wager House                               | ca. 1891          | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00399               | Judge George Robbins House                | ca. 1892          | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00480               | Spell House                               | ca. 1911          | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00524               | Pritchard House                           | 1891              | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00581               | St. Luke's Episcopal Church               | 1889              | 4 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00860               | Dr. George E. Hill House                  | ca. 1880          | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR01657               | City Point Community Church               | 1885              | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR01702               | J.R. Field Homestead                      | ca. 1900          | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR01825               | Cocoa Post Office                         | 1940              | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR04215               | Imperial Towers                           | ca. 1963          | 2 psf                | NRHP Listed               | NRHP Listed                  |
| 8BR00425               | 422 Julia Street                          | 1926              | 2 psf                | Eligible                  | Eligible                     |
| 8BR00426               | 428 Julia Street                          | 1905              | 2 psf                | Eligible                  | Eligible                     |
| 8BR00430               | 423 Main Street                           | ca. 1910          | 2 psf                | Eligible                  | Eligible                     |
| 8BR00444               | 1423 Main Street                          | ca. 1915          | 2 psf                | Not Evaluated             | Eligible                     |
| 8BR00465               | Brevard County Courthouse                 | ca. 1912          | 2 psf                | Eligible                  | Eligible                     |
| 8BR00467               | 423 Palm Avenue                           | 1901              | 2 psf                | Not Evaluated             | Eligible                     |
| 8BR00468               | 420 Pine Street                           | 1925              | 2 psf                | Eligible                  | Eligible                     |
| 8BR00508               | 300 Washington Avenue S                   | ca. 1925          | 2 psf                | Not Evaluated             | Eligible                     |



**Table 3.5-5. Intensive Architectural History Survey Results Summary**

| <b>FMSF Number</b> | <b>Name/Address</b>                   | <b>Year Built</b> | <b>psf Threshold</b> | <b>SHPO Determination</b>     | <b>SEARCH Recommendation</b> |
|--------------------|---------------------------------------|-------------------|----------------------|-------------------------------|------------------------------|
| 8BR00586           | 351 Rockledge Drive                   | 1923              | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00617           | 515 Rockledge Drive                   | ca. 1925          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00620           | Dr. S.D. Rambo Residence              | ca. 1900          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00640           | 635 Rockledge Drive                   | ca. 1905          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00641           | 633 Rockledge Drive                   | ca. 1910          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00642           | 629 Rockledge Drive                   | ca. 1915          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00644           | 621 Rockledge Drive                   | ca. 1890          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00648           | 709 Rockledge Drive                   | ca. 1915          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00668           | 106 Valencia Road                     | ca. 1925          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00678           | 133 Valencia Road                     | ca. 1925          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00681           | 825 Osceola Drive                     | ca. 1926          | 2 psf                | Eligible                      | Not Extant                   |
| 8BR00685           | 26 Orange Avenue                      | ca. 1925          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00698           | 23 Barton Avenue                      | ca. 1890          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00699           | 27 Barton Avenue                      | ca. 1890          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00700           | White's Cottage                       | ca. 1875          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00702           | Andrew Anderson Jr. Residence         | ca. 1890          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00703           | 34 Barton Avenue                      | ca. 1890          | 2 psf                | Not Evaluated                 | Eligible as RG Contributor   |
| 8BR00705           | 39 Barton Avenue                      | ca. 1890          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00715           | St. Mary's Catholic Church            | ca. 1917          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00719           | 1101 Rockledge Drive                  | ca. 1900          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR00720           | 1119 Rockledge Drive                  | ca. 1910          | 2 psf                | Not Evaluated                 | Not Eligible                 |
| 8BR00721           | 1125 Rockledge Drive                  | ca. 1910          | 2 psf                | Not Evaluated                 | Not Eligible                 |
| 8BR00724           | Troy E. Caldwell Residence            | ca. 1905          | 2 psf                | Eligible                      | Eligible                     |
| 8BR00729           | 1273 Rockledge Drive                  | ca. 1905          | 2 psf                | Potentially Eligible for NRHP | Eligible                     |
| 8BR00730           | 1277 Rockledge Drive                  | ca. 1915          | 2 psf                | Eligible                      | Eligible                     |
| 8BR00731           | 1279 Rockledge Drive                  | ca. 1887          | 2 psf                | Potentially Eligible          | Eligible                     |
| 8BR00743           | 1341 Rockledge Drive                  | ca. 1920          | 2 psf                | Potentially Eligible          | Eligible                     |
| 8BR00759           | Marion S. Whaley Citrus Packing House | 1930              | 2 psf                | Eligible                      | Not Extant                   |
| 8BR00871           | John Miot House                       | 1920              | 2 psf                | Potentially Eligible          | Eligible                     |
| 8BR00889           | 6195 N Tropical Trail                 | ca. 1882          | 4 psf                | Not Evaluated                 | Eligible                     |
| 8BR00946           | Melissa Moore house                   | ca. 1890          | 2 psf                | Not Evaluated                 | Not Extant                   |
| 8BR00953           | Mt. Moriah AME Church                 | 1923              | 2 psf                | Eligible                      | Not Extant                   |
| 8BR00991           | Old Weathers House                    | ca. 1930          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR01023           | Snider House                          | ca. 1915          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR01035           | Claranet Inn                          | ca. 1924          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR01039           | E.C. Johnson House                    | ca. 1905          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR01046           | 719 Forest Avenue                     | ca. 1930          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR01066           | Charles B. Provost House              | ca. 1910          | 2 psf                | Not Evaluated                 | Eligible                     |
| 8BR01071           | Gertrude Alfred House                 | 1938              | 2 psf                | Not Evaluated                 | Not Eligible                 |
| 8BR01076           | John D'Albora House                   | ca. 1935          | 2 psf                | Not Evaluated                 | Eligible                     |

**Table 3.5-5. Intensive Architectural History Survey Results Summary**

| <b>FMSF Number</b> | <b>Name/Address</b>                       | <b>Year Built</b> | <b>psf Thresho Id</b> | <b>SHPO Determination</b> | <b>SEARCH Recommendation</b> |
|--------------------|-------------------------------------------|-------------------|-----------------------|---------------------------|------------------------------|
| 8BR01078           | Charles Smith House                       | ca. 1938          | 2 psf                 | Not Evaluated             | Eligible                     |
| 8BR01082           | Carl Schnabel House                       | ca. 1895          | 2 psf                 | Not Evaluated             | Eligible                     |
| 8BR01084           | Norman Clinden House                      | ca. 1908          | 2 psf                 | Not Evaluated             | Eligible                     |
| 8BR01086           | 3113 Indian River Drive                   | 1900              | 2 psf                 | Potentially Eligible      | Eligible                     |
| 8BR01094           | 2515 McFarland Drive                      | ca. 1924          | 2 psf                 | Not Evaluated             | Not Eligible                 |
| 8BR01096           | 2415 McFarland Drive                      | ca. 1924          | 2 psf                 | Not Evaluated             | Eligible                     |
| 8BR01101           | 2205 McFarland Drive                      | ca. 1926          | 2 psf                 | Not Evaluated             | Eligible                     |
| 8BR01163           | Mattie Lamar House                        | 1917              | 2 psf                 | Eligible                  | Eligible                     |
| 8BR01723           | Cocoa Cemetery Storage Building           | ca. 1931          | 2 psf                 | Eligible                  | Eligible                     |
| 8BR01739           | Ashley's Café and Lounge                  | ca. 1932          | 2 psf                 | Eligible                  | Eligible                     |
| 8BR01741           | Rockledge Gardens Nursery and Landscaping | ca. 1930          | 2 psf                 | Eligible                  | Eligible                     |
| 8BR01762           | Reynolds Oil Gasoline Tanks               | ca. 1927          | 2 psf                 | Potentially Eligible      | Not Extant                   |
| 8BR01763           | Reynolds Oil Pump House                   | ca. 1927          | 2 psf                 | Potentially Eligible      | Not Extant                   |
| 8BR01764           | Reynolds Oil Office/Warehouse             | ca. 1927          | 2 psf                 | Potentially Eligible      | Not Extant                   |
| 8BR01765           | Bohn Equipment Company                    | ca. 1927          | 2 psf                 | Eligible                  | Not Eligible                 |
| 8BR01812           | 1265 Rockledge Drive "Hunting Lodge"      | ca. 1905          | 2 psf                 | Potentially Eligible      | No Access                    |
| 8BR01873           | John Sam's House                          | ca. 1875          | 4 psf                 | Not Evaluated             | Eligible                     |
| 8BR02704           | 400 Lucerne Drive                         | ca. 1966          | 2 psf                 | Eligible                  | Eligible                     |
| 8BR02779           | 317 Rosa Jones Drive                      | 1962              | 2 psf                 | Eligible                  | Eligible                     |
| 8BR03378           | Cape Canaveral Original City Hall         | 1965              | 4 psf                 | Not Evaluated             | Not Eligible                 |
| 8BR03614           | The Norwood House                         | 1920              | 2 psf                 | Not Evaluated             | Eligible                     |
| 8BR03955           | 2460 Courtenay Parkway N                  | ca. 1965          | 2 psf                 | Eligible                  | Eligible                     |
| <b>Cemeteries</b>  |                                           |                   |                       |                           |                              |
| 8BR01705           | Indianola Pioneer Cemetery                | ca. 1890          | 2 psf                 | Eligible                  | Eligible                     |
| 8BR01724           | Hilltop Cemetery                          | ca. 1887          | 2 psf                 | Eligible                  | Eligible                     |
| 8BR01777           | Cocoa Cemetery                            | ca. 1890          | 2 psf                 | Eligible                  | Eligible                     |
| <b>Bridges</b>     |                                           |                   |                       |                           |                              |
| 8BR02906           | Jay Jay Bridge                            | ca. 1963          | 2 psf                 | Eligible                  | Eligible                     |
| 8BR02955           | Banana River Bridge                       | ca. 1964          | 6 psf                 | Eligible                  | Eligible                     |
| 8BR02956           | Indian River                              | 1964              | 2 psf                 | Eligible                  | Eligible                     |
| 8BR02957           | Haulover Canal                            | 1965              | 2 psf                 | Eligible                  | Eligible                     |

Notes: AME = African Methodist Episcopal; ca. = circa; FMSF = Florida Master Site File; N = North; NRHP = National Register of Historic Places; psf = pounds per square foot; RG = Resource Group; S = South; SEARCH = SEARCH, LLC; SHPO = State Historic Preservation Officer.

An architectural history survey was conducted for 142 previously recorded architectural history resources within existing resource group boundaries or without determinations or recommendations, or cemeteries without determinations or recommendations. One resource (8BR02171/St. Mary's Church Rectory) and one resource group (8BR03345) are no longer extant, and are therefore not eligible for NRHP inclusion. NASA recommends 122 resources are eligible as resource group contributors; and nine resources are eligible for NRHP inclusion. NASA recommends six resources are ineligible for NRHP inclusion.

Additionally, two previously recorded cemeteries (8BR01979 and 8BR03334); and one previously recorded resource group (8BR02143) remain unevaluated for NRHP eligibility due to a lack of survey access (Table 3.5-5). For the purposes of this analysis, resources recorded as unevaluated for NRHP eligibility are also included in the discussion.

A windshield survey (defined as a method of assessment conducted from a vehicle, focusing on the exterior of buildings and structures) was conducted to identify architectural styles, distinguishing characteristics, and general development patterns in areas with a high concentration of unrecorded resources to reasonably analyze the effects on notable characteristics, such as stained-glass windows and decorative woodwork, as a result of the Starship-Super Heavy launch and landing activities. Areas of concentration in Titusville North, Titusville South, and Merritt Island were identified to characterize architectural styles, distinguishing characteristics, integrity, and inform interpretations about development patterns.

The windshield survey concluded that a large concentration of unsurveyed properties in the APE is associated with post-1945 subdivision development. Research and heat mapping informed the surveyors that these subdivisions ranged from single street developments to multi-phased neighborhoods. Some, but not all, may be associated with the rapid development of the Joint Long-Range Proving Ground and NASA. Based on guidance provided in the National Cooperative Highway Research Program's *A Model for Identifying and Evaluating the Historic Significance of Post-World War II Housing* (NCHRP, 2012a), SEARCH recommends the subdivisions in the APE are not significant under Criterion C. However, some may have significance under Criterion A. With most constructed during the period associated with the Joint Long-Range Proving Ground and NASA programs, part of their character may be connected to the visual and atmospheric events associated with NASA KSC launch activities. As such, adverse effects are considered unlikely.

### ***Previously Recorded Archaeological Sites***

#### **Archaeological Resources**

The FMSF was researched to identify archaeological sites within the APE. Sites that were documented to include a site type with clear aboveground components such as precontact mounds, building remains, or structures were further researched. Modern aerial imagery and site details recorded in the FMSF for the last field visit were reviewed to assess the potential for aboveground components that may contribute to NRHP eligibility to be extant. Sites that were previously found to be ineligible for listing in the NRHP and presumably lack integrity, significant historical associations, and information potential were excluded because impacts to these sites are not likely to be significant. Sites that have the potential to contain human remains were accounted for regardless of the presence of aboveground components or NRHP eligibility.

There are 354 sites recorded on the FMSF database within the APE (see Appendix D, *Applicable Regulations by Resource Area*). Of these sites, 261 do not have the potential to retain aboveground components, may have aboveground components but were determined ineligible, or do not contain human remains. The remaining 92 sites within the APE are eligible for listing, potentially eligible for listing, or have not been evaluated for the NRHP, and are recorded in the FMSF as site types with aboveground or landscape features or that could contain human remains (Table 3.5-6). Site types that are listed in the FMSF and considered to have the potential for aboveground or landscape features include precontact

mound(s), building remains, farmstead, homestead, or any type of structure. There are 15 sites that have the potential to retain aboveground components that may contribute to the site's NRHP eligibility. Of these sites, there are several that are likely to be heavily disturbed and no longer retain their aboveground components, are destroyed, or are at risk due to shoreline erosion.

**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID    | Site Name                        | General Site Type              | NRHP Status              | psf Threshold |
|------------|----------------------------------|--------------------------------|--------------------------|---------------|
| 8BR00540   | Daigle Place                     | Building remains               | Not Evaluated            | 6 psf         |
| 8BR00541   | Hughes Place                     | Building remains               | Ineligible               | 6 psf         |
| 8BR00542   | Parsons Place                    | Building remains               | Ineligible               | 4 psf         |
| 8BR00543   | Griffith Place                   | Building remains               | Ineligible               | 6 psf         |
| 8BR00544   | Lopez Orchard                    | Building remains               | Not Evaluated            | 6 psf         |
| 8BR00031   | No name                          | Precontact mound(s)            | Not Evaluated            | 2 psf         |
| 8BR00060   | No name                          | Habitation (precontact)        | Not Evaluated            | 2 psf         |
| 8BR00061   | No name                          | Habitation (precontact)        | Not Evaluated            | 4 psf         |
| 8BR00062*  | Moore Mound                      | Precontact mound(s)            | Not Evaluated            | 4 psf         |
| 8BR00063*  | Sams Mound                       | Precontact mound(s)            | Not Evaluated            | 4 psf         |
| 8BR00064*  | Tiffin Mound                     | Precontact mound(s)            | Ineligible               | 4 psf         |
| 8BR00065   | No name                          | Precontact mound(s)            | Not Evaluated            | 2 psf         |
| 8BR00066   | No name                          | Precontact mound(s)            | Not Evaluated            | 2 psf         |
| 8BR00067   | No name                          | Precontact shell midden        | Not Evaluated            | 2 psf         |
| 8BR00068   | No name                          | Precontact shell midden        | Not Evaluated            | 2 psf         |
| 8BR00069*  | No name                          | Precontact mound(s)            | Not Evaluated            | 2 psf         |
| 8BR00070   | No name                          | Precontact shell midden        | Not Evaluated            | 2 psf         |
| 8BR00071   | No name                          | Precontact shell midden        | Not Evaluated            | 2 psf         |
| 8BR00076   | Haulover                         | Land-terrestrial               | Not Evaluated            | 2 psf         |
| 8BR00077*  | Nauman's Place                   | Precontact burial(s)           | Not Evaluated            | 4 psf         |
| 8BR00078   | Dummett's Place                  | Building remains               | Not Evaluated            | 4 psf         |
| 8BR00078A  | Dummett Midden                   | Land-terrestrial               | Ineligible               | 4 psf         |
| 8BR00078B  | Dummett Homestead                | Building remains               | Potentially Eligible     | 4 psf         |
| 8BR00078C  | Duke's Castle                    | Building remains               | Ineligible               | 4 psf         |
| 8BR00078D  | Dummett's Grove                  | Land-terrestrial               | Potentially Eligible     | 4 psf         |
| 8BR00079   | Titusville Beach: Chester Shoals | Building remains               | Ineligible               | 20 psf        |
| 8BR00082   | De Soto Grove Midden             | Campsite (precontact)          | Eligible                 | 6 psf         |
| 8BR00082A* | De Soto Grove Midden A           | Homestead                      | Eligible                 | 6 psf         |
| 8BR00082B  | De Soto Grove Midden B           | Habitation (precontact)        | Not Evaluated            | 6 psf         |
| 8BR00083*  | De Soto Grove Burial Mound       | Land-terrestrial               | Eligible                 | 6 psf         |
| 8BR00084   | No name                          | Historic fort                  | Not Evaluated            | 10 psf        |
| 8BR00085*  | Burns                            | Precontact mound(s)/ homestead | Insufficient Information | 4 psf         |
| 8BR00086*  | Holmes Mound                     | Precontact mound(s)/ homestead | Eligible                 | 4 psf         |
| 8BR00087   | Gulbransen Mound                 | Precontact mound(s)/ homestead | Not Evaluated            | 4 psf         |

**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID    | Site Name                               | General Site Type                             | NRHP Status                 | psf Threshold |
|------------|-----------------------------------------|-----------------------------------------------|-----------------------------|---------------|
| 8BR00088A* | Hammock Mound A                         | Precontact mound(s)/<br>homestead             | Not Evaluated               | 4 psf         |
| 8BR00088B  | Hammock Mound B                         | Homestead                                     | Not Evaluated               | 4 psf         |
| 8BR00088C  | Hammock Mound C                         | Precontact shell midden/<br>possible mound(s) | Not Evaluated               | 4 psf         |
| 8BR00089*  | Norris Mound                            | Precontact mound(s)/<br>homestead             | Not Evaluated               | 4 psf         |
| 8BR00090*  | Fuller Mound A                          | Precontact mound(s)                           | Not Evaluated               | 4 psf         |
| 8BR00091*  | Fuller Mound B                          | Precontact mound(s)                           | Not Evaluated               | 4 psf         |
| 8BR00092   | Fuller Mound C                          | Precontact mound(s)                           | Not Evaluated               | 4 psf         |
| 8BR00093*  | Fuller Mound D                          | Precontact mound(s)                           | Not Evaluated               | 4 psf         |
| 8BR00094*  | Fuller Mound E                          | Precontact mound(s)                           | Not Evaluated               | 4 psf         |
| 8BR00095   | Fuller Mound F                          | Precontact mound(s)                           | Not Evaluated               | 4 psf         |
| 8BR00096   | Carter Midden                           | Land-terrestrial                              | Not Evaluated               | 4 psf         |
| 8BR00243H  | Pier Road Houses Site H                 | Habitation (precontact)                       | Not Evaluated               | 4 psf         |
| 8BR01857   | Samela Site                             | Campsite (precontact)                         | Not Evaluated               | 2 psf         |
| 8BR01872*  | Sam's Site                              | Agriculture/farm structure                    | Eligible                    | 4 psf         |
| 8BR01819   | 3 POINT PIECES                          | Precontact lithics only, but not<br>quarry    | Ineligible                  | 2 psf         |
| 8BR02513   | Facility 1390: Theodolite<br>Tower 1.40 | Building remains                              | Not Evaluated               | 6 psf         |
| 8BR02514   | Facility 1090 Security<br>Police Bldg   | Building remains                              | Not Evaluated               | 6 psf         |
| 8BR02515   | Cinetheodolite                          | Building remains                              | Ineligible                  | 4 psf         |
| 8BR02534   | Navaho X-10 Drone<br>Debris Site        | Aircraft wreckage/crash site                  | Eligible                    | 6 psf         |
| 8BR00139   | Dummit Grove Ne                         | Land-terrestrial                              | Eligible                    | 4 psf         |
| 8BR00140*  | Edwards                                 | Precontact mound(s)/<br>destroyed             | Not Evaluated               | 2 psf         |
| 8BR00142*  | Butler Campbell's Mound                 | Precontact mound(s)                           | Not Evaluated               | 2 psf         |
| 8BR00143   | Ragin Midden                            | Land-terrestrial                              | Eligible                    | 2,4 psf       |
| 8BR00144   | No name                                 | Precontact midden(s)                          | Insufficient<br>Information | 4 psf         |
| 8BR00145*  | Clark Slough                            | Precontact burial(s)                          | Eligible                    | 6 psf         |
| 8BR00146   | No name                                 | Land-terrestrial                              | Insufficient<br>Information | 6 psf         |
| 8BR00147   | No name                                 | Precontact shell midden                       | Not Evaluated               | 6 psf         |
| 8BR00148   | No name                                 | Precontact midden(s)                          | Not Evaluated               | 6 psf         |
| 8BR00149   | No name                                 | Precontact midden(s)                          | Not Evaluated               | 6 psf         |
| 8BR00150*  | Oyster Prong Creek<br>Mound             | Precontact mound(s)                           | Not Evaluated               | 6 psf         |
| 8BR00151*  | No name                                 | Precontact mound(s)                           | Insufficient<br>Information | 10 psf        |
| 8BR00152   | No name                                 | Precontact midden(s)                          | Not Evaluated               | 2 psf         |
| 8BR00153   | Pardon                                  | Precontact midden(s)                          | Not Evaluated               | 2 psf         |
| 8BR00154   | Eddy Creek                              | Precontact shell midden                       | Not Evaluated               | 6 psf         |



**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID   | Site Name                     | General Site Type                                   | NRHP Status              | psf Threshold |
|-----------|-------------------------------|-----------------------------------------------------|--------------------------|---------------|
| 8BR00155  | Granny Cove                   | Precontact shell midden                             | Potentially Eligible     | 2 psf         |
| 8BR00156  | No name                       | Precontact mound(s)                                 | Not Evaluated            | 4 psf         |
| 8BR00157  | Kars Park                     | Campsite (precontact)                               | Ineligible               | 4 psf         |
| 8BR00158* | Penny Plot                    | Precontact burial(s)/ historic burial(s)/ homestead | Not Evaluated            | 6 psf         |
| 8BR00159  | No name                       | Artifact scatter-low density (< 2 per square meter) | Not Evaluated            | 2 psf         |
| 8BR00160  | Black Point Midden            | Precontact midden(s)                                | Not Evaluated            | 2 psf         |
| 8BR00161* | Cocoa Beach Mound             | Possible mound                                      | Not Evaluated            | 4 psf         |
| 8BR00167  | Payne's Midden                | Precontact shell midden                             | Not Evaluated            | 6 psf         |
| 8BR00169  | South Access Road             | Campsite (precontact)                               | Ineligible               | 6 psf         |
| 8BR00170  | Opposite Futch Cove           | Precontact mound(s)                                 | Eligible                 | 10 psf        |
| 8BR00171  | Stony Island                  | Single artifact or isolated find                    | Not Evaluated            | 4 psf         |
| 8BR00175  | Fort Ann                      | Historic fort                                       | Not Evaluated            | 2 psf         |
| 8BR00183  | Pardon Island                 | Precontact shell midden                             | Not Evaluated            | 6 psf         |
| 8BR00184  | Widgeon Bay                   | Specialized site for procurement of raw materials   | Not Evaluated            | 4 psf         |
| 8BR00185  | No name                       | Specialized site for procurement of raw materials   | Not Evaluated            | 4 psf         |
| 8BR00197  | Brock                         | Farmstead                                           | Ineligible               | 6 psf         |
| 8BR00200  | Saurwalt-Shipwreck            | Ceramic scatter                                     | Eligible                 | 2 psf         |
| 8BR00205  | Max Hoeck Mound and Midden    | Precontact mound(s)                                 | Not Evaluated            | 10 psf        |
| 8BR00206  | Pepper Hammock                | Precontact mound(s)                                 | Insufficient Information | 20 psf        |
| 8BR00207  | Jones Point                   | Artifact scatter-low density (< 2 per square meter) | Not Evaluated            | 2 psf         |
| 8BR00217  | 20th-Century Historic Deposit | Artifact scatter-low density (< 2 per square meter) | Not Evaluated            | 6 psf         |
| 8BR00219  | No name                       | Subsurface features are present                     | Insufficient Information | 10 psf        |
| 8BR00221* | No name                       | Homestead                                           | Eligible                 | 6 psf         |
| 8BR00222  | No name                       | Campsite (precontact)                               | Insufficient Information | 6 psf         |
| 8BR00223* | Quarterman                    | Building remains/ historic burial(s)/ farmstead     | Insufficient Information | 6 psf         |
| 8BR00224  | No name                       | Land-terrestrial                                    | Not Evaluated            | 6 psf         |
| 8BR00225  | No name                       | Land-terrestrial                                    | Not Evaluated            | 4 psf         |
| 8BR00226  | No name                       | Land-terrestrial                                    | Not Evaluated            | 4 psf         |
| 8BR00227  | No name                       | Specialized site for procurement of raw materials   | Insufficient Information | 4 psf         |
| 8BR00228  | No name                       | Land-terrestrial                                    | Not Evaluated            | 4 psf         |
| 8BR00229  | No name                       | Campsite (precontact)                               | Ineligible               | 4 psf         |
| 8BR00230  | No name                       | Land-terrestrial                                    | Ineligible               | 4 psf         |
| 8BR00232  | No name                       | Habitation (precontact)                             | Eligible                 | 4 psf         |
| 8BR00234  | Old Lighthouse                | Building remains                                    | Not Evaluated            | 4 psf         |

**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID   | Site Name                           | General Site Type                                   | NRHP Status              | psf Threshold |
|-----------|-------------------------------------|-----------------------------------------------------|--------------------------|---------------|
| 8BR00235  | Cloisters                           | Building remains                                    | Ineligible               | 10 psf        |
| 8BR00236  | North Boundary                      | Habitation (precontact)                             | Not Evaluated            | 10 psf        |
| 8BR00237  | Desoto Beach                        | Building remains                                    | Ineligible               | 10 psf        |
| 8BR00238A | Canaveral Town Site B               | Building remains                                    | Insufficient Information | 4 psf         |
| 8BR00238B | Canaveral Town Site C               | Building remains                                    | Not Evaluated            | 6 psf         |
| 8BR00238C | Canaveral Town Site D               | Building remains/homestead                          | Insufficient Information | 6 psf         |
| 8BR00238D | Canaveral Town Site E               | Building remains/homestead                          | Insufficient Information | 6 psf         |
| 8BR00239* | Stinktown And Jeffords              | Building remains/ historic burial(s)                | Potentially Eligible     | 4 psf         |
| 8BR00240  | Hotel                               | Industrial                                          | Not Evaluated            | 4 psf         |
| 8BR00240A | Hotel Site A                        | Other                                               | Not Evaluated            | 4 psf         |
| 8BR00240B | Hotel Site B                        | Habitation (precontact)                             | Not Evaluated            | 4 psf         |
| 8BR00241  | No name                             | Habitation (precontact)                             | Ineligible               | 6 psf         |
| 8BR00243  | Pier Road Houses                    | House                                               | Not Evaluated            | 4 psf         |
| 8BR00243A | Pier Road Houses Site A             | Habitation (precontact)                             | Not Evaluated            | 4 psf         |
| 8BR00243B | Pier Road Houses Site B             | Building remains                                    | Not Evaluated            | 4 psf         |
| 8BR00243C | Pier Road Houses Site C             | Building remains                                    | Not Evaluated            | 4 psf         |
| 8BR00243D | Pier Road Houses Site D             | Variable density scatter of artifacts               | Not Evaluated            | 4 psf         |
| 8BR00243E | Pier Road Houses Site E             | Historic refuse / dump                              | Not Evaluated            | 4 psf         |
| 8BR00243F | Pier Road Houses Site F             | Habitation (precontact)                             | Not Evaluated            | 4 psf         |
| 8BR00243G | Pier Road Houses Site G             | Habitation (precontact)                             | Not Evaluated            | 4 psf         |
| 8BR00550  | Savannahs, The                      | Artifact scatter-low density (< 2 per square meter) | Not Evaluated            | 4 psf         |
| 8BR00551  | Sunset Hill                         | Building remains                                    | Ineligible               | 4 psf         |
| 8BR00553  | Horti Point                         | Precontact shell midden                             | Not Evaluated            | 2 psf         |
| 8BR00555  | Eddy Creek Boat Launch Area         | Habitation (precontact)                             | Not Evaluated            | 6 psf         |
| 8BR00556  | Playalinda Beach Parking Area No. 8 | Campsite (precontact)                               | Not Evaluated            | 6 psf         |
| 8BR00557  | AREA 55-1                           | Habitation (precontact)                             | Not Evaluated            | 4 psf         |
| 8BR00558  | AREA 55-2                           | Habitation (precontact)                             | Not Evaluated            | 4 psf         |
| 8BR00566  | UWF 2 & 4                           | Campsite (precontact)                               | Not Evaluated            | 4 psf         |
| 8BR00572  | UWF 10                              | Single artifact or isolated find                    | Not Evaluated            | 2 psf         |
| 8BR00582  | Dune and Swale                      | Lithic scatter/quarry (precontact: no ceramics)     | Ineligible               | 10 psf        |
| 8BR00773  | Vip West                            | Land-terrestrial                                    | Ineligible               | 6 psf         |
| 8BR00774  | Astronaut Road                      | Campsite (precontact)                               | Eligible                 | 6,10 psf      |
| 8BR00909  | East Max Hoeck Creek Midden/Cana 78 | Specialized site for procurement of raw materials   | Not Evaluated            | 10 psf        |
| 8BR00910  | Scorching Machete                   | Campsite (precontact)                               | Ineligible               | 10 psf        |
| 8BR00911  | Happy Creek One                     | Campsite (precontact)                               | Ineligible               | 10 psf        |
| 8BR00912  | Rotten Dock                         | Campsite (precontact)                               | Ineligible               | 10 psf        |

**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID   | Site Name                            | General Site Type                                     | NRHP Status              | psf Threshold |
|-----------|--------------------------------------|-------------------------------------------------------|--------------------------|---------------|
| 8BR00913  | Landfill South                       | Campsite (precontact)                                 | Eligible                 | 6,10 psf      |
| 8BR00914  | LC-41 South                          | Campsite (precontact)                                 | Eligible                 | 10 psf        |
| 8BR00915  | Titusville Beach West 1              | Campsite (precontact)                                 | Ineligible               | 20 psf        |
| 8BR00916  | Titusville Beach West 2              | Campsite (precontact)                                 | Ineligible               | 20 psf        |
| 8BR00917  | Gator Hole                           | Campsite (precontact)                                 | Ineligible               | 20 psf        |
| 8BR01608  | Kars Park North                      | Campsite (precontact)                                 | Ineligible               | 4 psf         |
| 8BR01617  | Dummit Place South                   | Artifact scatter-dense (> 2 per square meter)         | Ineligible               | 4 psf         |
| 8BR01618  | Minute Flake                         | Single artifact or isolated find                      | Ineligible               | 4 psf         |
| 8BR01619  | Dummitt Creek North Midden           | Precontact shell midden                               | Eligible                 | 4 psf         |
| 8BR01620  | Southeast of Nauman's Place          | Artifact scatter-low density (< 2 per square meter)   | Eligible                 | 4 psf         |
| 8BR01621  | Granny Cove North                    | Artifact scatter-low density (< 2 per square meter)   | Ineligible               | 2 psf         |
| 8BR01622  | Allenhurst Midden                    | Precontact shell midden                               | Potentially Eligible     | 2 psf         |
| 8BR01623  | Duckroost Grove                      | Artifact scatter-low density (< 2 per square meter)   | Ineligible               | 2 psf         |
| 8BR01625  | Dike Access Road                     | Land-terrestrial                                      | Ineligible               | 2 psf         |
| 8BR01627  | Patillo Creek                        | Single artifact or isolated find                      | Ineligible               | 2 psf         |
| 8BR01632  | Edgar/Campbell Midden                | Precontact shell midden                               | Eligible                 | 2 psf         |
| 8BR01633  | Apiary-53                            | Land-terrestrial                                      | Insufficient Information | 2 psf         |
| 8BR01636  | NS BR1                               | Campsite (precontact)                                 | Not Evaluated            | 6,10 psf      |
| 8BR01637  | NS BR 2                              | Habitation (precontact)                               | Not Evaluated            | 6 psf         |
| 8BR01638  | NS BR 3                              | Habitation (precontact)                               | Not Evaluated            | 6 psf         |
| 8BR01639  | NS BR 4                              | Building remains                                      | Not Evaluated            | 4 psf         |
| 8BR01640  | NS BR 5                              | Land-terrestrial                                      | Not Evaluated            | 4 psf         |
| 8BR01641  | NS BR 6                              | Land-terrestrial                                      | Eligible                 | 4 psf         |
| 8BR01642  | NS BR 7                              | Habitation (precontact)                               | Insufficient Information | 4 psf         |
| 8BR01659  | Tea Hammock West                     | Campsite (precontact)                                 | Ineligible               | 10 psf        |
| 8BR01660* | New Lighthouse Site                  | Agriculture/farm structure/building remains/homestead | Ineligible               | 4 psf         |
| 8BR01663  | Orbiter Storage                      | Land-terrestrial                                      | Ineligible               | 10 psf        |
| 8BR01664  | Archaic Surface Scatter Site         | Land-terrestrial                                      | Not Evaluated            | 6 psf         |
| 8BR01665  | Old Canal Midden                     | Campsite (precontact)                                 | Insufficient Information | 2 psf         |
| 8BR01666  | Marsh Crossing Artifact Scatter Site | Land-terrestrial                                      | Not Evaluated            | 4 psf         |
| 8BR01667  | Thin Sand Ridge Site                 | Land-terrestrial                                      | Not Evaluated            | 4 psf         |
| 8BR01668  | Ceramic Surface Cluster Site         | Land-terrestrial                                      | Insufficient Information | 4 psf         |

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| Site ID   | Site Name                            | General Site Type                    | NRHP Status              | psf Threshold |
|-----------|--------------------------------------|--------------------------------------|--------------------------|---------------|
| 8BR01669  | Spoon Bill Site                      | Campsite (precontact)                | Insufficient Information | 4 psf         |
| 8BR01670  | Haulover Canal Midden                | Building remains                     | Insufficient Information | 2 psf         |
| 8BR01671  | Haulover Artifact Scatter Site       | Land-terrestrial                     | Insufficient Information | 2 psf         |
| 8BR01672  | Haulover Pond Midden Site            | Campsite (precontact)                | Insufficient Information | 2 psf         |
| 8BR01673* | Haulover Sand Mound And Midden (A,B) | Precontact mound(s)                  | Eligible                 | 2 psf         |
| 8BR01674  | 76th Street Nw Midden Site           | Habitation (precontact)              | Insufficient Information | 2 psf         |
| 8BR01675  | Little Midden Point Site             | Habitation (precontact)              | Insufficient Information | 2 psf         |
| 8BR01677  | Campbell/Jackson Sheet Midden        | Land-terrestrial                     | Insufficient Information | 2 psf         |
| 8BR01678  | Friable Sherds Site                  | Land-terrestrial                     | Insufficient Information | 2 psf         |
| 8BR01679  | Diffuse Ceramic Scatter Site         | Land-terrestrial                     | Insufficient Information | 2 psf         |
| 8BR01680  | Relic Grove Site                     | Habitation (precontact)              | Insufficient Information | 2 psf         |
| 8BR01695  | Dr. Zoom                             | Land-terrestrial                     | Not Evaluated            | 4 psf         |
| 8BR01696  | Sonic Boom                           | Land-terrestrial                     | Not Evaluated            | 4 psf         |
| 8BR01714  | Sharpe                               | Land-terrestrial                     | Ineligible               | 2 psf         |
| 8BR01715  | Canal                                | Land-terrestrial                     | Ineligible               | 2 psf         |
| 8BR01716  | Carol and Nicole                     | Land-terrestrial                     | Ineligible               | 2 psf         |
| 8BR01717  | Tower 176                            | Land-terrestrial                     | Ineligible               | 2 psf         |
| 8BR01718  | Tower 180                            | Land-terrestrial                     | Ineligible               | 2 psf         |
| 8BR01719  | Carol and Nicole Site B              | Land-terrestrial                     | Ineligible               | 2 psf         |
| 8BR01779  | Woodward's Flat                      | Habitation (precontact)              | Not Evaluated            | 2 psf         |
| 8BR01845  | Muntz Metal Shipwreck Site           | Historic shipwreck                   | Not Evaluated            | 10 psf        |
| 8BR01850  | Jerome Road Ridge/Bull Snake Ridge   | Land-terrestrial                     | Not Evaluated            | 4 psf         |
| 8BR01854  | Provost Site                         | Campsite (precontact)                | Not Evaluated            | 2,4 psf       |
| 8BR01890  | Sams Creek Site                      | Land-terrestrial                     | Not Evaluated            | 4 psf         |
| 8BR01891  | McDonalds Island                     | River/stream/creek-riverine          | Not Evaluated            | 4 psf         |
| 8BR01894  | PPOF Site 1                          | Campsite (precontact)                | Ineligible               | 4 psf         |
| 8BR01895  | PPOF Site 2                          | Campsite (precontact)                | Ineligible               | 4 psf         |
| 8BR01896  | PPOF Site 3                          | Campsite (precontact)                | Ineligible               | 4 psf         |
| 8BR01897  | PPOF Site 4                          | Campsite (precontact)                | Ineligible               | 4 psf         |
| 8BR01933* | Little Midden                        | Building remains                     | Eligible                 | 4 psf         |
| 8BR01935  | Lone Cistern                         | Building remains/farmstead/homestead | Not Evaluated            | 4 psf         |
| 8BR01936* | Cabo Verde                           | Land-terrestrial                     | Ineligible               | 4 psf         |

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| Site ID   | Site Name                               | General Site Type                                 | NRHP Status              | psf Threshold |
|-----------|-----------------------------------------|---------------------------------------------------|--------------------------|---------------|
| 8BR01942  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR01943  | Dogs Cross                              | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR01944  | Dead Mangrove Island                    | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR01945  | Scorpion Dike                           | Specialized site for procurement of raw materials | Not Evaluated            | 2.4 psf       |
| 8BR01946  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR01947  | Bay Head Midden                         | Specialized site for procurement of raw materials | Not Evaluated            | 2,4 psf       |
| 8BR01948  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01949  | Long Shore Midden                       | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01950  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01951  | North Mangrove Midden                   | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01952  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01953  | Shell Dipper                            | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01954  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01955  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01956  | Cut Corner Midden                       | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01958  | No name                                 | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01959  | Canoer's Corner                         | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR01964  | Pritchard House                         | Campsite (precontact)                             | Not Evaluated            | 2 psf         |
| 8BR02029  | False Cape Scatter                      | Land-terrestrial                                  | Ineligible               | 10 psf        |
| 8BR02052  | Facility 1222 CZR Camera Pad U15R146    | Building remains                                  | Not Evaluated            | 6 psf         |
| 8BR02053  | Facility 36900: GLOTRAC Site            | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02054  | Facility 114-G: LC-25 Warning Horn Site | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02055  | Facility 1212-CZR Camera Site U36R175   | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02077  | Sarah                                   | Campsite (precontact)                             | Insufficient Information | 10 psf        |
| 8BR02078  | Pace's Landing                          | Building remains/ homestead                       | Not Evaluated            | 2 psf         |
| 8BR02085* | Odyssey Street Remains                  | Precontact burial(s)                              | Not Evaluated            | 4 psf         |



**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID   | Site Name                                  | General Site Type                                 | NRHP Status              | psf Threshold |
|-----------|--------------------------------------------|---------------------------------------------------|--------------------------|---------------|
| 8BR02087  | Jupiter Missile Crash Site                 | Subsurface features are present                   | Eligible                 | 4 psf         |
| 8BR02160  | FIM Van Site S-5                           | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02161  | Facility 1209-Rate Antenna Pad A           | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02165  | Facility 289 - Flame Attenuation Site      | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02166  | James W. Merchant Homestead                | Building remains/ farmstead                       | Not Evaluated            | 4 psf         |
| 8BR02167  | Facility 1126: Telemetry ELSSE             | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02174  | Beach Trail                                | Specialized site for procurement of raw materials | Ineligible               | 4 psf         |
| 8BR02175  | 97 Hammock                                 | Land-terrestrial                                  | Insufficient Information | 4 psf         |
| 8BR02229  | Clifton Schoolhouse                        | Agriculture/farm structure/homestead              | Insufficient Information | 2 psf         |
| 8BR02243  | Terryn Homestead                           | Homestead                                         | Ineligible               | 4 psf         |
| 8BR02246  | Oyster and Pipe                            | Homestead                                         | Not Evaluated            | 10 psf        |
| 8BR02256  | Azusa Site                                 | Building remains                                  | Ineligible               | 6 psf         |
| 8BR02276  | Launch Complex 15 Theodolite Building      | Building remains                                  | Ineligible               | 6 psf         |
| 8BR02314  | Sherds in the Road                         | Land-terrestrial                                  | Ineligible               | 4 psf         |
| 8BR02315  | Watermark                                  | Habitation (precontact)                           | Ineligible               | 4 psf         |
| 8BR02318  | City of Vera Cruz                          | Historic shipwreck                                | Not Evaluated            | 4 psf         |
| 8BR02319  | Fountain Shell Feature                     | Precontact shell midden                           | Ineligible               | 2 psf         |
| 8BR02340  | Halfway There                              | Land-terrestrial                                  | Ineligible               | 6 psf         |
| 8BR02341  | Purple Glass                               | Homestead                                         | Insufficient Information | 4 psf         |
| 8BR02343  | Cape Point                                 | Land-terrestrial                                  | Ineligible               | 6 psf         |
| 8BR02349  | Artesian Well                              | Homestead                                         | Ineligible               | 4 psf         |
| 8BR02350  | Cross the Line                             | Farmstead                                         | Ineligible               | 4 psf         |
| 8BR02351  | Murray Parcel                              | Farmstead/ homestead                              | Not Evaluated            | 4 psf         |
| 8BR02364  | Bottle Dump Site                           | Subsurface features are present                   | Ineligible               | 20 psf        |
| 8BR02365  | Facility 1330B: Beat-Beat DOVAP 12-110-PLM | Building remains                                  | Eligible                 | 4 psf         |
| 8BR02367  | Camera Pad D44R53                          | Building remains                                  | Ineligible               | 4 psf         |
| 8BR02396  | Facility 1343: East Compass Rose           | Building remains                                  | Eligible                 | 4 psf         |
| 8BR02400* | Ulumay Lagoon                              | Precontact mound(s)                               | Not Evaluated            | 2 psf         |
| 8BR02412  | Gallinipper Basin #1                       | Specialized site for procurement of raw materials | Not Evaluated            | 6 psf         |
| 8BR02413  | No name                                    | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR02414  | No name                                    | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR02415  | No name                                    | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |

**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID  | Site Name                                 | General Site Type                                 | NRHP Status              | psf Threshold |
|----------|-------------------------------------------|---------------------------------------------------|--------------------------|---------------|
| 8BR02416 | Gallinipper Basin #2                      | Specialized site for procurement of raw materials | Not Evaluated            | 6 psf         |
| 8BR02672 | CANA-180                                  | Specialized site for procurement of raw materials | Ineligible               | 4 psf         |
| 8BR02673 | CANA-181                                  | Specialized site for procurement of raw materials | Ineligible               | 4 psf         |
| 8BR02675 | Cactus Island Midden (2311.07)            | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR02676 | Harrier Midden (2311.08)                  | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR02677 | Kestrel Midden (2311.09)                  | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR02678 | Plover Midden (2311.10)                   | Specialized site for procurement of raw materials | Not Evaluated            | 2 psf         |
| 8BR02679 | Turnstone Midden (2311.11)                | Specialized site for procurement of raw materials | Not Evaluated            | 4 psf         |
| 8BR02680 | Klondike Beach Tower Ruins (2311.12)      | Building remains                                  | Not Evaluated            | 4 psf         |
| 8BR02953 | Sharpes Train Station                     | Land-terrestrial                                  | Insufficient Information | 2 psf         |
| 8BR03047 | QB-17 Crash Site                          | Aircraft wreckage/crash site                      | Eligible                 | 4 psf         |
| 8BR03048 | Old MacDonald's Farm                      | Farmstead/ homestead                              | Insufficient Information | 2 psf         |
| 8BR03050 | River Shores                              | Building remains                                  | Ineligible               | 2 psf         |
| 8BR03076 | TMDL Pond Site 1                          | Land-terrestrial                                  | Ineligible               | 2 psf         |
| 8BR03152 | Clark Slough Earthwork                    | Precontact mound(s)                               | Not Evaluated            | 6 psf         |
| 8BR03176 | Angy's Scatter                            | Farmstead                                         | Ineligible               | 6 psf         |
| 8BR03177 | Atlas Debris                              | Land-terrestrial                                  | Ineligible               | 6 psf         |
| 8BR03178 | Canaveral Rose's Garden                   | Specialized site for procurement of raw materials | Ineligible               | 6 psf         |
| 8BR03273 | The Walker Midden                         | Habitation (precontact)                           | Not Evaluated            | 2 psf         |
| 8BR03274 | The Dunal Ridge Midden                    | Precontact mound(s)                               | Not Evaluated            | 4 psf         |
| 8BR03276 | The Brent Russell Midden                  |                                                   | Not Evaluated            | 4 psf         |
| 8BR03279 | Beachside Midden                          | Precontact shell mound(s)                         | Not Evaluated            | 2 psf         |
| 8BR03335 | Facility 17200: Weather Theodolite Pad B  | Building remains                                  | Eligible                 | 6 psf         |
| 8BR03336 | Facility 1331: Telemetry ELSEE 12-110-PL  | Building remains                                  | Eligible                 | 4 psf         |
| 8BR03337 | Facility 1333B:Beat-Beat DOVAP 14-110-PLM | Building remains                                  | Eligible                 | 6 psf         |
| 8BR03338 | Facility 1333A:Beat-Beat DOVAP 14-110-PR  | Building remains                                  | Eligible                 | 4 psf         |
| 8BR03339 | Facility 1334: Telemetry ELSEE 12-110-PRS | Building remains                                  | Eligible                 | 4 psf         |
| 8BR03341 | Facility 74610: Camera Pad                | Building remains                                  | Eligible                 | 4 psf         |
| 8BR03359 | Cocoa Prison Site                         | Land-terrestrial                                  | Ineligible               | 2 psf         |
| 8BR03370 | 1-5 G13                                   | Agriculture/farm structure                        | Ineligible               | 4 psf         |

**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID  | Site Name                                 | General Site Type                | NRHP Status              | psf Threshold |
|----------|-------------------------------------------|----------------------------------|--------------------------|---------------|
| 8BR03371 | 8-5 E6                                    | Homestead                        | Ineligible               | 6 psf         |
| 8BR03372 | 15-9 A9                                   | Aircraft wreckage/crash site     | Ineligible               | 4,6 psf       |
| 8BR03373 | 18-7 G22/Lansing Beach School             | Homestead                        | Ineligible               | 4 psf         |
| 8BR03374 | 11-22.5 E20                               | Land-terrestrial                 | Ineligible               | 4 psf         |
| 8BR03375 | 31-3 T6                                   | Agriculture/farm structure       | Ineligible               | 6 psf         |
| 8BR03376 | 10-3 G1                                   | Homestead                        | Ineligible               | 6 psf         |
| 8BR03379 | 17.5-11-E21                               | Land-terrestrial                 | Ineligible               | 4 psf         |
| 8BR03380 | 32-1-E25                                  | Land-terrestrial                 | Ineligible               | 4 psf         |
| 8BR03381 | 31-6.5-E24                                | Homestead                        | Ineligible               | 4, 6 psf      |
| 8BR03390 | Bronze Cannon Wreck                       | Saltwater submerged site         | Not Evaluated            | 6 psf         |
| 8BR03534 | Former NAA Control Tower Site             | Building remains                 | Eligible                 | 6 psf         |
| 8BR03557 | CR11                                      | Habitation (precontact)          | Ineligible               | 6 psf         |
| 8BR03558 | ICBM Concrete Pad                         | Building remains                 | Ineligible               | 6 psf         |
| 8BR03560 | Hurricane Irma Canoe                      | Log boat –historic or precontact | Not Evaluated            | 2 psf         |
| 8BR03711 | Luna Trails Site                          | Land-terrestrial                 | Ineligible               | 2 psf         |
| 8BR03912 | SCT 1                                     | Campsite (precontact)            | Insufficient Information | 2 psf         |
| 8BR03913 | SCT 2                                     | Campsite (precontact)            | Insufficient Information | 2 psf         |
| 8BR03931 | Thule's Rise                              | Campsite (precontact)            | Insufficient Information | 2 psf         |
| 8BR03956 | No name                                   | Campsite (precontact)            | Not Evaluated            | 6 psf         |
| 8BR03995 | CCAFS LMU 87 Missile Crash                | Land-terrestrial                 | Not Evaluated            | 4 psf         |
| 8BR03996 | CCAFS LMU 142 Missile Crash Site          | Land-terrestrial                 | Not Evaluated            | 4 psf         |
| 8BR03997 | CCAFS Facility 1485 - Camera Pad Site (D) | Land-terrestrial                 | Not Evaluated            | 4 psf         |
| 8BR03998 | CCAFS Facility 1430 - Shanicle Building   | Building remains                 | Not Evaluated            | 4 psf         |
| 8BR04001 | No name                                   | Land-terrestrial                 | Ineligible               | 10 psf        |
| 8BR04002 | No name                                   | Subsurface features are present  | Ineligible               | 10 psf        |
| 8BR04003 | No name                                   | Land-terrestrial                 | Ineligible               | 10 psf        |
| 8BR04004 | No name                                   | Building remains                 | Ineligible               | 10 psf        |
| 8BR04005 | No name                                   | Land-terrestrial                 | Ineligible               | 10 psf        |
| 8BR04006 | No name                                   | Land-terrestrial                 | Ineligible               | 10 psf        |
| 8BR04007 | No name                                   | Land-terrestrial                 | Ineligible               | 6 psf         |
| 8BR04008 | No name                                   | Campsite (precontact)            | Ineligible               | 4 psf         |
| 8BR04009 | No name                                   | Land-terrestrial                 | Ineligible               | 4 psf         |
| 8BR04010 | No name                                   | Building remains                 | Ineligible               | 4 psf         |
| 8BR04011 | No name                                   | Building remains                 | Ineligible               | 10 psf        |
| 8BR04012 | No name                                   | Land-terrestrial                 | Ineligible               | 10 psf        |
| 8BR04013 | No name                                   | Building remains                 | Ineligible               | 10 psf        |
| 8BR04014 | No name                                   | Campsite (precontact)            | Ineligible               | 4 psf         |

**Table 3.5-6. Previously Recorded Archaeological Sites within the APEs**

| Site ID   | Site Name                                   | General Site Type                                    | NRHP Status                 | psf Threshold |
|-----------|---------------------------------------------|------------------------------------------------------|-----------------------------|---------------|
| 8BR04185  | CCAFS Facility 19110<br>Camera Site U142L62 | Land-terrestrial                                     | Ineligible                  | 6 psf         |
| 8BR04188  | CCAFS LMU 53 Concrete<br>Pads               | Building remains                                     | Ineligible                  | 6 psf         |
| 8BR04189  | CCAFS LMU 61 Concrete<br>Remains            | Building remains                                     | Ineligible                  | 6 psf         |
| 8BR04190  | Camera Road E Artifact<br>Scatter           | Land-terrestrial                                     | Ineligible                  | 6 psf         |
| 8BR04221  | Cocoa Hill                                  | Land-terrestrial                                     | Insufficient<br>Information | 2 psf         |
| 8BR04231  | Whaley's Farmstead                          | Farmstead                                            | Ineligible                  | 4 psf         |
| 8BR04364  | The Granite Rock<br>Homestead               | Building remains                                     | Ineligible                  | 4 psf         |
| 8BR04368  | Site One                                    | Saltwater submerged site                             | Not Evaluated               | 6 psf         |
| 8BR04369  | Site Two                                    | Saltwater submerged site                             | Not Evaluated               | 6 psf         |
| 8BR04370  | Site Three                                  | Saltwater submerged site                             | Not Evaluated               | 6 psf         |
| 8BR04371  | Site Four                                   | Saltwater submerged site                             | Not Evaluated               | 6 psf         |
| 8BR04442  | Wydra Canoe                                 | Log boat – historic or<br>precontact                 | Not Evaluated               | 2 psf         |
| 8BR04532  | 28th Street SE 1949<br>Homestead            | Building remains                                     | Not Evaluated               | 4 psf         |
| 8BR04579  | Surface Scatter 1                           | Land-terrestrial                                     | Ineligible                  | 4 psf         |
| 8BR04656* | Klondike                                    | Land-terrestrial                                     | Not Evaluated               | 2 psf         |
| VO09281   | Teal Midden (2311.02)                       | Specialized site for procurement<br>of raw materials | Not Evaluated               | 2 psf         |
| VO09282   | Mallard Midden<br>(2311.03)                 | Specialized site for procurement<br>of raw materials | Not Evaluated               | 2 psf         |
| VO09283   | Preacher's Island<br>(2311.04)              | Specialized site for procurement<br>of raw materials | Not Evaluated               | 2 psf         |
| VO09284   | Merganser Midden<br>(2311.05)               | Specialized site for procurement<br>of raw materials | Not Evaluated               | 2 psf         |
| VO09285   | Caracara Midden<br>(2311.06)                | Specialized site for procurement<br>of raw materials | Not Evaluated               | 2 psf         |
| VO00151   | Cat Hammock                                 | Precontact shell midden                              | Not Evaluated               | 2 psf         |
| VO00158   | No name                                     | Precontact shell midden                              | Not Evaluated               | 2 psf         |
| VO00159   | Vann's Island                               | Precontact shell midden                              | Not Evaluated               | 2 psf         |
| VO06786   | Kuhl Midden                                 | Habitation (precontact)                              | Eligible                    | 2 psf         |
| VO08885   | Target Rock                                 | Land-terrestrial                                     | Not Evaluated               | 2 psf         |
| VO08977   | Vann's Slough Midden                        | Specialized site for procurement<br>of raw materials | Not Evaluated               | 2 psf         |
| VO08978   | Northwest of Vann's                         | Specialized site for procurement<br>of raw materials | Not Evaluated               | 2 psf         |

Notes: # = number; < = less than; > = greater than; APE = Area of Potential Effects; Bldg = Building; FMSF = Florida Master Site File; LC = Launch Complex; NRHP = National Register of Historic Places; psf = pounds per square foot. Entries marked with an "\*" are noted in FMSF as potentially containing human remains.

In a Technical Memorandum prepared for NASA and KSC by TRC in 2024, Sites 8BR00084, 8BR0540, and 8BR0544 were revisited and reported to be likely destroyed, Site 8BR0161 is heavily disturbed or destroyed, and Site 8BR0206 is at risk due to shoreline erosion (TRC, 2024) and is actively eroding into the Banana River. Following review of modern aerial imagery and information regarding the last site visit in the FMSF, Mound Sites 8BR00031, 8BR00064, 8BR00065, 8BR00066, 8BR00069, 8BR00089–8BR00095, 8BR02400, and 8BR03279 are likely destroyed by development. The buildings were razed or removed (leaving only the potential for artifact scatters and no foundation remnants) at Sites 8BR00223, 8BR00239, 8BR00240, 8BR00243, 8BR00243C, 8BR02160, 8BR02161, 8BR02165, 8BR02167, 8BR02229, 8BR02351, 8BR02507, 8BR02680, and 8BR03048, and the building remains for Sites 8BR00540, 8BR00544, and 8BR02078 are likely destroyed by development.

There are 34 site types that are documented in the FMSF to contain mounds or shell middens that are possible mounds as suggested by their site name. Two sites with mounds (BR00086, BR01673) are NRHP eligible. Review of modern aerial imagery indicated that both mounds are within heavily vegetated and undeveloped areas and have the potential to retain aboveground features. Sites BR00086 and BR01673 are approximately 11.8 miles (18.9 kilometers) south and 12.7 miles (20.4 kilometers) northwest respectively from LC-39A. Site BR00064 is ineligible but is documented as potentially containing human remains, although the site has been extensively disturbed and the last survey did not confirm the presence of human remains. The remaining 31 sites are not eligible, not evaluated, or have insufficient information. Of these sites, 13 are within developed areas and review of modern aerial imagery identified no clear evidence of a mound, and 7 are within densely vegetated areas with no obvious disturbance or development and have the potential to retain aboveground features. Some site disturbances, human and natural, are documented in the FMSF concerning sites with mounds. A portion of BR00063 is on private property and was documented as disturbed by digging activity. Mound Sites 8BR00031, 8BR00064, 8BR00065, 8BR00066, 8BR00069, 8BR00089–8BR00095, 8BR02400, and 8BR03279 are likely destroyed, as modern aerial imagery depicts these areas as developed.

There are 55 sites in the FMSF that have a site type indicating the potential existence of aboveground components related to historic-era activity, excluding sites that also contain mounds and the focus of significance is not the historic component. Of these sites, 33 appear to no longer be extant following review of the latest site visit results in the FMSF and modern aerial imagery. Of the remaining sites, 15 are documented to contain aboveground features that are low to the ground or at ground level (such as a concrete pad) that do not contribute to the site's eligibility and there is the potential for aboveground components that could contribute to NRHP eligibility to be extant at 8 sites.

Site 8BR00078B is approximately 10.8 miles (17.4 kilometers) northwest of LC-39A, potentially eligible, and is documented to contain a standing chimney structure. Site 8BR00239 is potentially eligible; however, the aboveground components of the site are no longer extant and the eligibility is likely to be in the potential for subsurface deposits. Site 8BR01872 is approximately 11.7 miles (18.9 kilometers) southwest of LC-39A and is an NRHP-eligible site with foundation remnants that could potentially retain aboveground components. Site 8BR4532 includes building remains of a 20th-century homestead that were exposed following a prescribed burn, and the site is unevaluated. Sites 8BR00082A, 8BR00221, and 8BR01933 are documented to contain aboveground components; however, their NRHP-eligible status is due to the potential for subsurface precontact deposits and their aboveground components are no longer extant. Most of the remaining sites are not eligible on their own but contribute to NRHP-listed districts associated with historic activities on NASA KSC and their aboveground components are not extant or have



a low profile and do not contribute to NRHP eligibility. Of these sites, six contribute to the Control Tower Tracking Sites District (8BR3433; Sites 8BR02365, 8BR03336, 8BR03337, 8BR03338, 8BR03339, and 8BR03341) and one site (8BR03335) contributes to Skid Strip Historic District (8BR3186).

The FMSF documents 33 sites within the APE that have the potential to contain human remains. Review of modern aerial imagery shows that many of these areas are densely vegetated with no apparent disturbances, but some sites have likely been destroyed by development including Mound Sites 8BR00064, 8BR00069, 8BR00089–8BR00091, 8BR00093, 8BR00094, and 8BR02400 and Sites 8BR00223 and 8BR00239 that potentially contain historic-era burials. In addition, Sites 8BR00077, 8BR00142, and 8BR00145 contain repatriated Native American remains.

#### Traditional Cultural Places

A TCP is generally defined as a property that is eligible for the NRHP because of its association with cultural practices or beliefs of a living community that are rooted in that community's history and are important in maintaining the continuing cultural identity of the community (see criteria in 36 CFR §60.4 and (NPS, 2024b)). When evaluating TCPs, it is important to note that significance derives from past and continuous use of the site for specific cultural practices. TCPs are typically identified through consultation with tribes or other consulting parties that have cultural affiliation with the APE. There are no previously recorded TCPs, or resources described as TCPs in the FMSF, within the APE.

NASA invited the following federally recognized Native American tribes to participate in Section 106 consultation in compliance with the NHPA, and the FAA engaged in government-to-government consultation in compliance with E.O. 13007, E.O. 13175, and NEPA to identify TCPs: Muscogee (Creek) Nation, Seminole Nation of Oklahoma, Seminole Tribe of Florida, Thlopthlocco Tribal Town, and Miccosukee Tribe of Indians of Florida. Copies of tribal correspondence are provided in Appendix A.3.6, *Government-to-Government Tribal Correspondence*. As of this document's preparation, no TCPs have been identified within the APE.

### 3.5.4 Environmental Consequences

The FAA has not established a significance threshold for this impact category; however, the FAA has identified a factor to consider when evaluating the context and intensity of potential environmental impacts for historical, architectural, archaeological, and cultural resources. This factor includes, but is not limited to, situations in which the proposed action or alternative(s) would result in a finding of Adverse Effect through the Section 106 process (FAA, 2023b). This factor is not intended to be a threshold, because an effect that is adverse under Section 106 is not necessarily significant under NEPA. The Section 106 consultation process and advice from the Advisory Council on Historic Preservation and SHPO/THPO may assist the FAA in making this determination. Resolution of adverse effects under 36 CFR §800.6 may be sufficient to avoid significance (FAA, 2023b).

#### 3.5.4.1 No Action

Under the No Action Alternative, Starship-Super Heavy launch and landing operations at LC-39A and associated infrastructure improvements would not occur. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action.

Effects to historical, architectural, archaeological, and cultural resources resulting from reasonably foreseeable actions are possible, but significant impacts to these resources are unlikely because of the infrequency of damage to these kinds of resources when exposed to sonic boom overpressure events and vibratory effects expected within the APE. However, poorly maintained structures or previously damaged structures may be more susceptible to damage from repeated exposure to auditory and sonic boom overpressure events. The effects of repeated sonic boom overpressure events on subsurface archaeological sites, if any, are poorly understood. Any effects potentially resulting from such events have not been systematically documented or studied in the past.

NASA and the FAA would continue to consult with the SHPO under Section 106 of the NHPA, federally recognized Native American tribes, and other consulting parties, and would implement any required future identification, evaluation, monitoring, and mitigation to address any effects resulting from reasonably foreseeable actions within their jurisdiction.

### 3.5.4.2 Proposed Action

#### ***Construction at LC-39A***

Modifications would be necessary at LC-39A to support the proposed Starship-Super Heavy launch vehicle. As discussed in the 2019 *Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center* (Section 3.4.2)<sup>38</sup>, Historic American Engineering Record (HAER FL-8-11-F), at a Level II, for LC-39A was completed in 2010 to mitigate for “adverse effects” that might occur with post Shuttle Program redevelopment. The Florida SHPO, in a letter dated May 10, 2013, concurred future consultation is not required for the reuse of LC-39A by a commercial entity (Bendus, 2013). As a result, adverse effects to LC-39A cultural resources associated with site improvements and launch operations are not considered in this EIS and no consultation with the Florida SHPO is required.

During construction, if any archaeological material (e.g., artifacts, cultural features, or human remains) is found, work must stop immediately and the KSC Cultural Resources Manager will be contacted.

#### ***Reasonably Foreseeable Effects***

The increased vibratory impacts from the undertaking have the potential to cause adverse effects to cultural resources, including archaeological sites, buildings, structures, objects, TCPs, and historic districts. While there is the potential for such adverse effects due to the vibratory and sonic boom overpressure events related to Starship-Super Heavy activities, no studies have been completed in Florida, to date, that examine these types of impacts to cultural resources. In 2021, an analysis was conducted that specifically addressed potential impacts on cultural resources from engine noise and sonic booms associated with static tests and launches from the proposed Blue Origin Orbital Launch Site in Santa Barbara County, California (Nocerino et al., 2021). The results of this analysis and few other studies inform this section to posit some of the impacts that could be expected and outline what impacts would be considered an adverse effect to a historic property. It is also important to acknowledge that some adverse effects to cultural resources are more obvious than others; while a broken window can be identified immediately

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<sup>38</sup> Page 54 – *Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center* ([https://netpublic.grc.nasa.gov/main/20190919\\_Final\\_EA\\_SpaceX\\_Starship.pdf](https://netpublic.grc.nasa.gov/main/20190919_Final_EA_SpaceX_Starship.pdf)).

following a launch, for example, an alteration to subsurface archaeological deposits at a site due to vibration or overpressure events cannot be readily ascertained.

For aboveground resources, including buildings, structures, objects, and historic districts, an understanding of the resource's character-defining features is integral to assessing adverse effects. Such features could include neon signage or a rural setting. For an archaeological resource, adverse effects are typically physical impacts that alter features or archaeological deposits and thus reduce the site's research potential.

Current literature indicates that high sound pressure levels and vibrations have the potential to cause building/structural damage. In general, however, structural damage to buildings due to propulsion/engine noise is rare. The historic building element "most susceptible to damage from launch vehicle noise [are] windows, and more infrequently, plastered walls and ceilings" (Nocerino et al., 2021, p. 15). Masonry buildings and structures are most susceptible to vibration damage through the "wearing of joints...which can cause load to be redistributed due to a weakening of a structural member" (NCHRP, 2012b, p. 35). Further, vibration effects may be greatest to "non-structural building elements [such as] fragile glass, loose plaster mosaics or pieces of stone" (NCHRP, 2012b, p. 36). Previous analysis also indicates "wood and steel are more elastic than masonry, such as brick and stone" (NCHRP, 2012b, p. 2). Therefore, increased exposure to vibration may diminish the integrity of a resource's significant historic features.

Sonic booms also have the potential to result in structural damage. A large degree of variability exists in the possible effects of a sonic boom. For example, the probability of a window breaking when exposed to a sonic boom of 1 psf ranges from one in a billion to one in a million (Sutherland, 1990) with much of the variability depending upon the condition of the glass. At 10 psf, the probability of glass breaking is between 1 in 100 and 1 in 1,000. Laboratory tests involving glass have shown that properly installed glass will not break at overpressures below 10 psf, even when exposed to repeated sonic booms (White, 1972). Damage to plaster has the potential to occur in the same range of overpressures as damage to glass. Plaster often cracks due to shrinkage over time or due to structural settling. Sonic boom damage to plaster may occur when internal stresses are already high as a result of these processes. In general, for well-maintained structures, the threshold for potential damage from sonic booms is 2 psf; below 2 psf, damage is unlikely (Haber et al., 1989). The majority of documented resources outside of NASA KSC and CCSFS are within the 2 psf overpressure contour. However, resources located on KSC and CCSFS are within the 20, 10, 6, and 4 psf contours. Resources subjected to higher overpressure resulting from sonic booms may be more susceptible to adverse effects.

Additionally, the setting and feeling of historic properties may be temporarily altered by the visual, audible, and vibratory effects of the undertaking. Setting refers to the physical environment of a resource, while feeling refers to the aesthetic qualities of a resource as they relate to the specific time during which the resource became significant. The setting and feeling of historic properties may be altered by repeated launches. Importantly, no NRHP-listed or NRHP-eligible properties identified within the APE are described as having a quiet setting as a character-defining feature. However, future identification efforts within the APE (discussed in Section 3.5.5, *BMPs, Mitigation, and Monitoring*) should consider setting when evaluating NRHP eligibility.

Concerning archaeological resources, there is no research to support that archaeological deposits at or below ground surface are affected by vibratory effects or overpressure effects of increased sonic boom exposure. Archaeological sites that consist of only surface and/or buried archaeological material were

excluded from 2021 analysis of potential impacts at the Blue Origin Orbital Launch Site because it was assumed that soil would protect materials in place (Nocerino et al., 2021). Although there is no research to support that assumption, as it relates to archaeological sites, sound dB and sonic boom overpressure would be significantly lower underground due to sound attenuation in the air depending on factors such as humidity, temperature, and wind profiles (Leal et al., 2021), passing through the interface of the air and ground, and in the soil depending on conditions such as moisture and sediment type. Ground motion resulting from a sonic boom is rare (DAF, 2025). Aboveground components of archaeological sites, such as building remains, have the potential to be affected by vibratory or overpressure effects like those described for buildings, structures, objects, and historic districts. These aboveground components of archaeological sites may contribute to their NRHP eligibility. Native American mounds are aboveground features and may have an unstable soil matrix due to lack of sufficient vegetation cover, human or animal disturbances, or are influenced by natural erosion processes and could be vulnerable to vibratory or overpressure effects. In addition, some sites within the APE have the potential to contain interred human remains and the vibratory or overpressure effects have the potential, although low, to compromise the integrity of their deposition.

Concerning submerged archaeological deposits, there is limited understanding of how they could be affected by vibratory effects or overpressure effects. A portion of a sound wave that originates above the water would be reflected into the air at the water and air interface depending on the angle of incidence. Water is acoustically dense, and the remaining portion of the sound wave would continue to travel but a sound wave has a higher dB in the air than in water (NOAA, 2022). Therefore, vibratory and overpressure effects are likely to be significantly less underwater from a sound that originates in the air.

The NPS provides guidelines for interpreting the seven aspects of integrity (location, design, setting, materials, workmanship, feeling, and association) as they relate to the potential effects of an undertaking (NPS, 1995, p. 45). The effects of the undertaking examined in this report are unlikely to impact the location or association of historic properties within the APE. As noted above, there are limited circumstances in which the effects of vibration may result in damage to aboveground structures. Such damage may potentially affect the design, materials, and workmanship of historic properties, particularly as they relate to exterior and ornamental detailing and other character-defining features.

Physical adverse effects that could occur due to the proposed undertaking include, but are not limited to, the following:

- Damage to glass elements, including original single-pane units and stained glass windows
- Damage to neon signage on commercial buildings
- Weakening to the structural members of a building, including joints
- Damage to plaster elements, including plaster and lathe walls and decorative plaster medallions
- Damage to fragile roof elements, including steeples, clay tiles, and slate shingles
- Damage to poorly mixed or poorly maintained concrete elements, including within structures, headstones, and cemetery vaults
- Damage to the loose matrix of a shell midden or mound

- Disarticulation of fragile and fragmentary human remains, within both cemeteries and archaeological sites

Importantly, there are likely adaptation efforts already in place in this region of Florida that reduce the potential for adverse effects. For example, due to the known, ongoing risk of hurricanes, many buildings in Florida, including historic-age buildings, have been constructed or modified using concrete that is able to withstand powerful storms, and, if properly built, these buildings are less likely to be impacted by vibratory effects. Additional storm proofing for buildings could include reinforced roofs with additional tie-ins, metal strapping to trusses and joints throughout the structure, and the addition of storm shutters, all of which may reduce the risk of structural damage and window breakage.

While effects to historical, architectural, archaeological, and cultural resources resulting from the Proposed Action are possible, significant impacts to these resources are unlikely because of the infrequency of damage to these kinds of resources when exposed to sonic boom overpressure events and vibratory effects expected within the APE. However, poorly maintained structures or previously damaged structures may be more susceptible to damage from repeated exposure to auditory and sonic boom overpressure events. Furthermore, historic materials including windows that do not meet modern construction standards, or that have deteriorated over time, may be more susceptible to damage. The reasonably foreseeable effects of repeated auditory, vibratory, and sonic boom overpressure events on subsurface archaeological sites, if any, are poorly understood. Any effects potentially resulting from such events have not been systematically documented or studied in the past.

### **Section 106 NHPA Consultation**

NASA KSC is acting as the lead Federal agency for Section 106 consultation, in coordination with the FAA. NASA KSC has initiated and is in the process of conducting Section 106 consultation with federally recognized Native American tribes, the Florida SHPO, and other consulting parties. Consulting parties include individuals or organizations with a demonstrated interest in the project due to a legal or economic relationship to the affected historic properties or their concern with the undertaking's effects on them. Members of the public are also given an opportunity to provide comment. The FAA is conducting government-to-government consultation with federally recognized Native American tribes.

On November 19, 2024, NASA KSC had a pre-consultation meeting with the SHPO to discuss the Proposed Action, APE, and future consultation meetings. On December 20, 2024, NASA KSC initiated Section 106 consultation with the SHPO, the Seminole Tribe of Florida, the Seminole Nation of Oklahoma, the Miccosukee Tribe of Indians of Florida, and the Muskogee Creek Nation via email. The email included a description of the undertaking and APE, a preliminary assessment of previously recorded cultural resources within the APE, and a proposed approach for the identification of historic properties in the APE. The SHPO was also provided with a list of organizations invited to participate as consulting parties in the Section 106 process. The emails were followed by hard-copy submittals of this information on January 7, 2024. On January 27, 2025, NASA KSC initiated Section 106 consultation with the Thlopthlocco Tribal Town of Oklahoma via email, followed by hard-copy documents on January 31, 2025.

On January 23, 2025, NASA KSC held a follow-up meeting with the SHPO to discuss any concerns about the APE and proposed approach for the identification of historic properties, and to get input on potential additional consulting parties. The SHPO indicated that the APE and approach seemed appropriate and did



not have any recommendations for consulting parties that were not already on the consulting party invitation list.

To date, the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, the Seminole Nation of Oklahoma, and the Thlopthlocco Tribal Town have confirmed their interest as consulting parties. The Seminole Tribe of Florida and Miccosukee Tribe of Indians requested additional technical information about the effects of vibrations caused by rocket launches, which was provided by NASA on January 10, 2025, and January 27, 2025, respectively. The Muscogee Creek Nation officially declined to participate, stating that the project is located outside of their historic tribal area of interest.

As of the preparation of this document, the FAA has not received formal requests from federally recognized tribes for government-to-government consultation.

On January 7, 2024, NASA KSC initiated Section 106 with 24 additional organizations, requesting their participation as consulting parties to the Section 106 consultation. As of the preparation of this document, organizations that have elected to participate as consulting parties include the following:

- NPS CANA
- Cape Canaveral Lighthouse Foundation
- CCSFS
- City of Titusville
- Historical Society of North Brevard
- MINWR
- North Brevard Heritage Foundation

The NPS CANA responded with a comment about potential effects to curated historical objects contained in its curatorial facility, located by the entrance gate to Playalinda Beach off of Beach Road and immediately to the north for NASA KSC's secure area. The facility is within the APE, 5.5 miles (8.9 kilometers) northwest of LC-39A. The facility is outside of the 130 dB  $L_{max}$  contour, and within the 6.0 psf overpressure contour. The facility itself is not a historic property, but contains historic objects collected from historic properties at NPS CANA and NASA KSC collections related to historic properties within the APE. Movement of objects within buildings is discussed as part of the noise analysis contained in Section 3.2, *Noise and Noise-Compatible Land Use*, of this EIS.

NASA has posted all Section 106 materials related to the establishment of the APE, the identification and evaluation of historic properties, and effects findings on its publicly facing website. No comments have been received to date.

#### **3.5.4.2.1 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS, continued infrastructure development and improvements at KSC, and continued economic and community growth and development within the areas surrounding KSC as identified in

Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. Effects to historical, architectural, archaeological, and cultural resources resulting from the Proposed Action in context with other reasonably foreseeable actions are possible, however, significant impacts to these resources are unlikely because of the infrequency of damage to these kinds of resources when exposed to sonic boom overpressure events and vibratory effects expected within the APE. However, poorly maintained structures or previously damaged structures may be more susceptible to damage from repeated exposure to auditory and sonic boom overpressure events. The effects of repeated sonic boom overpressure events on subsurface archaeological sites, if any, are poorly understood. Any effects potentially resulting from such events have not been systematically documented or studied in the past.

NASA as the lead Federal agency for Section 106, in coordination with the FAA, would continue to consult with the SHPO under Section 106 of the NHPA, federally recognized Native American tribes, and other consulting parties, and would implement any required future identification, evaluation, monitoring, and mitigation to address any effects resulting from the Proposed Action and other reasonably foreseeable actions within their jurisdiction.

### 3.5.5 BMPs, Mitigation, and Monitoring

Because a final determination of how Starship-Super Heavy launch and landing activities will affect historic properties is not possible at this time, NASA, in coordination with the FAA, intends to develop and execute a PA pursuant to 36 CFR §800.14(b). Although the stipulations of the PA will be negotiated among the consulting parties, the following mitigation and monitoring strategies are based on initial consultation feedback received from the FAA, SHPO, and Seminole Tribe of Florida:

- *Monitoring historic properties within different psf contours for effects.* The potential for adverse effects to historic properties within the 2 psf is possible, though unlikely, based on existing data. While most historic properties in Titusville and outside of NASA KSC and CCSFS are within the 2 psf contour, several are within the 4 psf counter. However, numerous resources on NASA KSC and CCSFS are within the 4, 6, 10, and 20 psf contours. There is limited data on how historic buildings and structures may be affected by repeated exposure to sonic booms. A longitudinal study monitoring the effects of sonic boom and vibratory effects on historic properties over the long term could inform consulting parties on the nature and severity of adverse effects to different property types and would serve as a resource for future studies evaluating the potential effects of future undertakings involving spacecraft launches and landings.
- *Monitoring sonic boom overpressure and vibration at archaeological sites.* Previous studies on effects to archaeological sites resulting from sonic boom overpressure are limited in scope and make assumptions related to the lack of subsurface effects. Additionally, similar studies focused on resource types such as those within the APE (shell and sand mounds, for example) have not been conducted, and existing archaeological literature does not specifically note, describe, or discuss effects resulting from vibratory and sonic boom-related effects resulting from spacecraft launches (if any). A longitudinal study of surface and subsurface exposure to launch-related overpressure and vibratory events at archaeological sites may inform whether such exposure results in effects to subsurface archaeological deposits. Additionally, such a study would serve as a resource for future studies evaluating the potential effects of future undertakings involving spacecraft launches and landings.

### 3.5.6 Summary

Based on the information provided in Section 3.5.3, *Existing Conditions*, and Section 3.5.4, *Environmental Consequences*, while effects to historical, architectural, archaeological, and cultural resources are possible, significant impacts to these resources are unlikely because of the infrequency of damage to these kinds of resources when exposed to sonic boom overpressure events and vibratory effects expected within the APE as the result of the Proposed Action. However, poorly maintained structures or previously damaged structures may be more susceptible to damage. The long-term effects of repeated sonic boom overpressure events on subsurface archaeological sites, if any, are poorly understood. Any effects potentially resulting from such events have not been systematically documented in the past.

NASA, as the lead agency for NHPA consultation and in coordination with the FAA, intends to continue Section 106 consultation with the SHPO, federally recognized tribes, and other consulting parties to develop and execute a PA pursuant to 36 CFR §800.14(b). The PA will include ongoing consultation and monitoring efforts, and mitigation strategies to resolve any potential adverse effects resulting from the Proposed Action.

## 3.6 Visual Effects

### 3.6.1 Definition of Resource and Regulatory Setting

Visual resources are the natural and man-made features that give a particular environment its aesthetic qualities. In undeveloped areas, landforms, water surfaces, and vegetation are the primary components that characterize the landscape. In predominantly natural areas, man-made features (such as buildings, fences, power lines, piers, and wharves) can contrast with the forms and colors of natural landscape. In developed areas, the natural landscape is more likely to become a background for more obvious man-made features. Visual character refers to the overall visual makeup of the existing environment where a proposed action and alternative(s) would be located. Potential visual effects are determined by estimating the degree of change to the visual character and attributes of a viewshed that would result from a proposed action. This considers the visual quality or value of the affected landscape or viewshed, as expressed by viewers, and any state and Federal visual management objectives for resources under their jurisdiction. The value of visual resources also reflects the intrinsic attributes of the landscape and its cultural and social relevance. Visual quality is a function of this intrinsic value and the level of current degradation, or lack thereof.

Visual effects would be created when either the proposed action or alternatives either detract from historic properties, scenic resources, and the scenic experiences of people who view the landscape; or generate light emissions that adversely affect the health of humans, plants, or animals.

*Light emissions* are used in this section to describe artificial light sources emanating into the surrounding environment. Light emissions are not inherently problematic; it is when they become inappropriate and excessive such that they can be considered “light pollution.” Light pollution is tied to human land use, and positively correlated with population density (Gallaway et al., 2010).

Sources of artificial light emissions include outdoor site lighting, employee/visitor parking lighting, airborne and ground-based vehicle operations, and roadway lighting. Light pollution includes glare (perceived unnecessary brightness from a continuous source of light), glint (momentary light emissions redirected off a reflective surface); light trespass (light falling where it is not intended), and sky glow (brightening of the night sky over inhabited areas). According to the NPS Natural Sounds and Night Skies Division, which works to protect, maintain, or restore dark night sky environments in NPS areas, sky glow is exacerbated by atmospheric particles, such as dust, moisture, and aerosols, and therefore intensified by air pollution (NPS, 2024c). Sky glow has been associated with ecological changes and human health effects, since natural circadian rhythms are driven by light patterns and are foundational for the functions of biota in any given context density (Narisada & Schreuder, 2004). Diminishing dark skies is a concern not just in developed areas but also in pristine areas where the absence of light is valued for the experience of darkness and higher visibility of the sky and stars. The NPS is directed under the Organic Act of 1916 to “conserve the scenery and the natural and historic objects therein,” and considers the naturally dark night sky part of “a complex ecosystem that supports natural, cultural, and economic resources” (NPS, 2024c). The USFWS Dark Skies Initiative considers naturally dark skies a resource integral to natural processes, as well as a scenic resource (USFWS, 2024c). Artificial light can negatively affect wildlife within the USFWS NWRs, which the USFWS is directed to preserve and protect under the Fish and Wildlife Act of 1956 (16 U.S.C. §742(a)-754). Artificial nighttime lights can be examined using satellite imagery.

Although there are no Federal special purpose laws or requirements specific to light emissions and visual effects, there are special purpose laws and requirements that may be relevant. In addition to NEPA, laws protecting resources that may be affected by visual effects include Section 106 of the NHPA, Section 4(f) of the U.S. DOT Act, the Wild and Scenic Rivers Act, the CZMA, and state and regional coastal protection acts. Visual resources are also protected and managed on Federal resource lands, such as under U.S. Forest Service Resource Management Plans and the Bureau of Land Management Visual Resource Management System. These laws and regulations are discussed in applicable resource sections in this EIS. There are specific ordinances, codes, and instructions developed by state and local entities to manage light pollution. The State of Florida implemented Section 161.163, Florida Statutes, which requires the FDEP to establish guidelines for local government regulations that control beachfront lighting to protect hatching sea turtles. Brevard County, and Federal and municipal entities therein, have created local lighting codes. Appendix D.6, *Visual Effects*, identifies and describes local lighting codes applicable to visual resources analysis.

### 3.6.2 Study Area

The study area for visual resources is the area in which the construction and launch, test, and landing events at LC-39A would be visible. The proposed catch tower, at 480 feet (146 meters) tall, would be a permanent structure that would be continuously present. An object with a known height would disappear over the horizon after a certain distance, determined using the Pythagorean theorem and the radius of Earth (3,959 miles [6,371 kilometers] (The International Union of Geodesy and Geophysics, 1967)). Using this formula the catch tower at 480 feet (146 meters) would be visible from approximately 27 miles (43 kilometers). This distance is based on a theoretical “bare earth curve,” where in fact there may be many impediments to the line of site, including terrain, vegetation, haze, or other structures.

### 3.6.3 Existing Conditions

In 1961, NASA requested appropriations for initial land purchases on Merritt Island to support the Apollo Lunar Landing Program, the pivotal program in the so-called Space Race with the Soviet Union. During this time, Brevard County more than doubled in population, with residents of the area adopting the moniker “Space Coast,” which persists to this day. NASA first opened to public tours in 1965, and within 2 years received over a million visitors. Current day tourism in Brevard County \$4.6 billion per year (Meredith, 2024). In 2023, the combined orbital launches from both KSC and CCSFS set a new launch record with 72 missions (Tribou, 2024). The number of launch operations is part of the mission of KSC to function as a multi-use spaceport for launch operations by NASA and private partners (NASA, 2024a). The KSC facilities and launch operations have been visual elements integral to the identity of the region for more than 60 years.

Counties, municipalities, and land use are described in Section 3.3.3, *Land Use, Existing Conditions*, of the EIS. The land use and land cover within the study area, seen on Figure 3.3-1, is primarily water: the Atlantic Ocean covers 57 percent of the study area, while other waters constitute 12 percent. Wetlands are the second greatest natural land cover, at 15 percent of the study area. Upland forests, shrubland, and non-forested uplands together total less than 7 percent of the natural environment in the study area. Among human land uses, residential is the most common, at 3.7 percent of the study area, followed by agriculture at 2.2 percent; urban built-up areas, transportation, communication, and utilities together total less than 3 percent (FDEP, 2023b).

Other elements of the human-built environment within the study area include 11 other objects greater in height than the proposed catch tower (480 feet [146 meters]), including 1 building, 2 transmission lines spans/wires/cables (catenary objects), and 8 towers. These objects range from 494 to 574 feet (151 to 175 meters) in height above ground level and are shown in Figure 3.6-1. Three of these objects are on KSC, to the west of the proposed catch tower, ranging in height from 491 to 573 feet (150 to 174 meters); five are at CCSFS to the south, ranging in height from 494 to 574 feet (151 to 175 meters) (FAA, 2024b). These objects are consistent with the visual aesthetic of the operations conducted at KSC and CCSFS. The other three objects, all towers, range from 504 to 518 feet (154 to 158 meters) in height and are located in the municipalities of Bonaventure, Titusville, and Oak Hill.

According to the Florida Natural Areas Inventory (FNAI), there are 61 lands wholly or partially in the study area that FNAI has identified as having natural resource value and that are being managed at least partially for conservation purposes. These include five Federal lands (CANAL, CCSFS, MINWR, Patrick Space Force Base, and St. Johns NWR, shown in Figure 3.6-1); 21 state, 32 local, and three privately managed areas (FDEP, 2022).

The NRHP is the official list of historic buildings, districts, sites, structures, and objects worthy of preservation. NRHP listings within the study area include seven historic districts, three of which are at CCSFS, three of which are in Rockledge, and one of which is in Titusville; 20 buildings; two sites; two objects; and one structure (NPS, 2014a). Cultural resources are discussed further in Section 3.5, *Historical, Architectural, Archaeological, and Cultural Resources*.

Figure 3.6-1 shows the average annual nighttime radiance for 2023 within the study area. The highest nighttime radiance is within the City of Cocoa; with other areas of high radiance including the City of Cape Canaveral, several facilities at KSC, as well as urbanized areas along roadways.



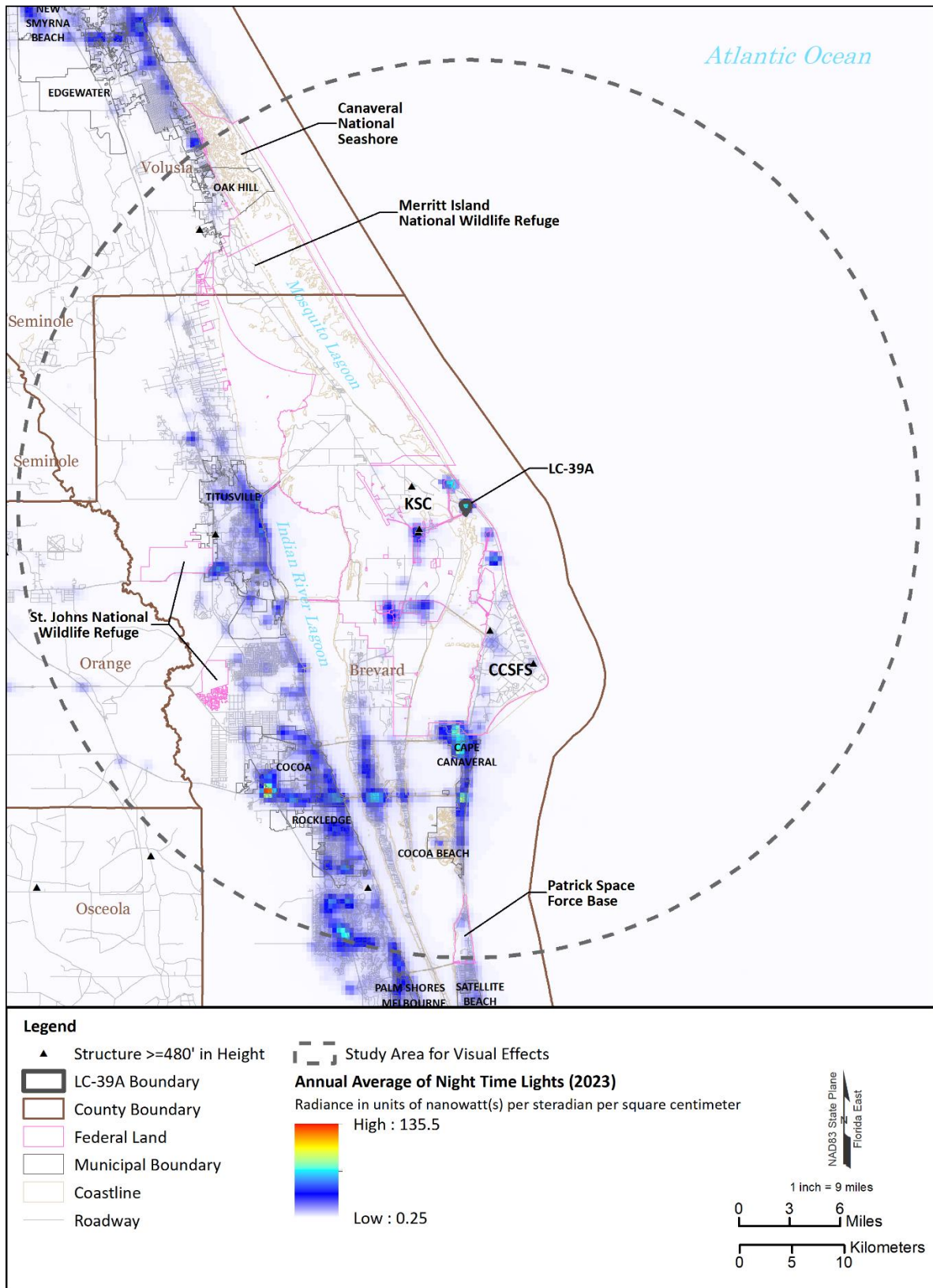


Figure 3.6-1. Average Annual Nighttime Radiance (2023) within the Study Area

## 3.6.4 Environmental Consequences

### ***Analysis Methodology***

The FAA has not established a significance threshold for visual effects. However, within the FAA Order 1050.1F Desk Reference, Section 13.3.3, *Visual Effects, Significance Determination*, the FAA has identified factors to consider when evaluating the context and intensity of potential visual effects (FAA, 2023b)<sup>39</sup>:

- Light Emissions Effects
  - The degree to which the action would have the potential to create annoyance or interfere with normal activities from light emissions
  - The degree to which the action would have the potential to affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resources
- Visual Resources and Visual Character Effects
  - The degree to which the action would have the potential to affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources
  - The degree to which the action would have the potential to contrast with the visual resources and/or visual character in the study area
  - The degree to which the action would have the potential to block or obstruct the views of visual resources, including whether these resources would still be viewable from other locations

Visually protected coastal areas, sensitive wildlife species, and Section 106 and Section 4(f) properties are discussed in detail under the appropriate environmental effect categories in their respective sections of this EIS.

### 3.6.4.1 No Action

Under the No Action Alternative, Starship-Super Heavy launch and landing operations at LC-39A and associated infrastructure improvements would not occur. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Lighting at existing facilities would remain the same and would continue to be managed by their respective lighting operations manuals, as described in Section 3.6.3, *Existing Conditions*. Other launch operations by NASA and private partners would continue as planned.

New facilities on KSC and CCSFS would be consistent with existing land uses and the visual landscape, while local development projects would likely be consistent with local visual landscapes due to local ordinances and requirements governing new construction. At some point, due to necessary buffers and other restrictions,

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<sup>39</sup> These factors are not intended to be thresholds. If these factors exist, there is not necessarily a significant impact; rather, the FAA must evaluate these factors in light of context and intensity to determine if there are significant impacts.

the number of launch complexes at both KSC and CCSFS would be capped and launch support infrastructure such as towers would necessarily be limited.

As new facilities become operational, and local economic development continues, sky glow would continue to increase. Lighting management plans at KSC and CCSFS, as well as local ordinances for lighting control, would serve to limit this effect. However, increases in sky glow due to increased development in the local area cannot be avoided. The significance of increased sky glow effects would be dependent on the amount of future development and the implementation and effectiveness of lighting management requirements on KSC, CCSFS, and throughout the local community.

### 3.6.4.2 Proposed Action

#### 3.6.4.2.1 Construction

It is anticipated that construction would occur during daylight hours, and therefore no additional artificial lighting would be needed at the site during this phase. The facilities that would be constructed are consistent with the existing appearance of LC-39A, which has historically supported launch operations and has infrastructure associated with this kind of use.

#### 3.6.4.2.2 Operation

The presence of the vehicle(s) in the night sky (over both land and ocean) during launch and landing would be consistent with ongoing operations/activities at both KSC and CCSFS and would not introduce new or unique visual elements; for members of the public this is often an attraction for observation.

The catch tower would be approximately 480 feet tall (146 meters) and is the tallest proposed permanent structure under the Proposed Action. In accordance with FAA AC 70/7460-1M, *Obstruction Marking and Lighting* (FAA, 2024c), features above 200 feet (61 meters) are aviation hazards and for safety purposes, they require permits, markings, and continual lighting to mark their location. Practices that minimize potential effects from tower lighting would include using the minimum amount of pilot warning and obstruction avoidance lighting required by the FAA and using only white or red strobe lights at night at the minimum intensity, number, and number of flashes per minute allowed by the FAA. There are other structures at KSC that are of similar or greater height, as shown in Figure 3.6-1, so the proposed catch tower is consistent with existing landscape features. As a result, the FAA does not anticipate that the addition of the catch tower or other facilities at LC-39A would result in significant adverse effects.

The use of external lighting would be required for security, routine ground support operations, and launch/landing operations, with security lighting and routine ground support operations occurring during dark hours throughout the year. Nighttime launch and landing would require bright spotlighting for short durations to illuminate the launch vehicle.

Lighting at new facilities would be designed and utilized in accordance with KSC's Exterior Lighting Requirements to further reduce excessive or stray artificial lighting effects during both operational and non-operational periods. For the public, lighting at LC-39A would appear consistent with existing conditions given current Falcon operations at the site, as well as other KSC facilities. Lighting effects to wildlife (i.e., protected species) are discussed in Section 3.8, *Biological Resources*.

### 3.6.4.2.3 Reasonably Foreseeable Effects

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions would continue to contribute to the visual landscape in this regard. New facilities on KSC and CCSFS would be consistent with existing land uses and the visual landscape, while local development projects would likely be consistent with local visual landscapes due to local ordinances and requirements governing new construction. At some point, due to necessary buffers and other restrictions, the number of launch complexes at both KSC and CCSFS would be capped and launch support infrastructure such as towers would necessarily be limited.

As new facilities become operational, and local economic development continues, sky glow would continue to increase. Lighting management plans at KSC and CCSFS, as well as local ordinances for lighting control, would serve to limit this effect. However, increases in sky glow due to increased development in the local area cannot be avoided. The significance of increased sky glow effects would be dependent on the amount of future development and the implementation and effectiveness of lighting management requirements on KSC, CCSFS, and throughout the local community. The Proposed Action, in context with other reasonably foreseeable actions, would have a negligible overall effect on the visual landscape.

## 3.6.5 BMPs, Mitigation, and Monitoring

In the absence of any significant adverse effects, no resource-specific BMPs, mitigation, or monitoring requirements have been identified. As discussed, KSC currently has an exterior lighting plan that identifies requirements for minimizing nighttime lighting effects.

## 3.6.6 Summary

The new LC-39A infrastructure and lighting would be consistent with the existing visual landscape, which already consists of launch support facilities. Launch support facilities already operate under lighting management plans for both KSC and CCSFS to reduce lighting effects, and LC-39A would continue this practice. As a result, the FAA has not identified any significant adverse visual effects associated with facility construction or operations.

## 3.7 Department of Transportation Act, Section 4(f)

### 3.7.1 Definition of Resource and Regulatory Setting

For operations at LC-39A, SpaceX must obtain a new license or modification of their existing vehicle operator license from the FAA for Starship-Super Heavy launch and landing operations, and the FAA would need to close appropriate airspace for those launch and landing operations. Issuing a new license or modifying an existing vehicle operator license and approving airspace closures are considered major Federal actions for purposes of NEPA, as amended by the Fiscal Responsibility Act of 2023 (42 U.S.C. §4321 et seq.).

Section 4(f) of the U.S. DOT Act of 1966 (now codified at 49 U.S.C. §303) protects significant publicly owned parks, recreational areas, wildlife and waterfowl refuges, and public and private historic sites. Section 4(f)

provides that the Secretary of Transportation may approve a transportation program or project requiring the use of publicly owned land of a public park, recreation area, or wildlife or waterfowl refuge of national, state, or local significance; or land of a historic site of national, state, or local significance; only if there is no feasible and prudent alternative to the using that land and the program or project includes all possible planning to minimize harm resulting from the use. Attachment B of FAA Order 1050.1F outlines the requirements for inclusion of Section 4(f) analyses in the EIS. This project also considers 23 CFR Part 771, *Environmental Impacts and Related Procedures*, and the Federal Highway Administration's (FHWA's) 2012 *Section 4(f) Policy Paper* (FHWA Policy Paper) (FHWA, 2012) in the Section 4(f) Use Determination Report (included as Appendix B.4, *Department of Transportation Act Section 4(f) Consultation*).

#### **Joint Development Exception to Section 4(f)**

The FAA has determined, for the reasons explained in this section, that it is not required to prepare a Section 4(f) evaluation for this project for MINWR, managed by the USFWS, or CANA, managed by the NPS (Figure 3.7-1).

The FAA has not promulgated its own section 4(f) regulations. However, the FAA's sister modes of the DOT—the FHWA and the Federal Transit Administration (FTA)—have promulgated joint 4(f) regulations (see 23 CFR Part 774). The FHWA/FTA regulations "...are not binding on the FAA. However, the FAA may use them as guidance to the extent relevant to aviation" (FAA, 2023b, pp. B-9).

The joint FHWA/FTA regulations, as outlined in Section 23 CFR §774.11(i), provide that (1) "[w]hen a property is formally reserved for a future transportation facility before or at the same time a park, recreation area, or wildlife and waterfowl refuge is established," and (2) "concurrent or joint planning or development of the transportation facility and the Section 4(f) resource occurs, then any resulting impacts of the transportation facility will not be considered a use" for purposes of Section 4(f). This provision is sometimes known as the "joint development exception." Both MINWR and CANA meet these two requirements. MINWR and CANA meet the first prong of the joint development exception, formal reservation, due to the following:

- **MINWR:** In 1962, NASA acquired the lands and waters adjacent to Cape Canaveral to establish the John F. Kennedy Space Center. The formal reservation of property for KSC is documented in the 1962 deeds of lands from the State of Florida to the United States, which state the primary use as being for the "Manned Lunar Program." NASA built a launch complex and other space-related facilities, and the Congressional bill creating KSC specified that buffer zones be established. These buffer zones provided both security and a separation of people from safety hazards, including noise, potential debris, and other impacts. In 1963, NASA and the Bureau of Sport Fisheries and Wildlife (predecessor to the USFWS) entered into a land use agreement to create MINWR to utilize the buffer areas as an overlay of KSC, with the specification that the refuge "will not interfere with [NASA] operations."<sup>40</sup> According to the agreement, the lands and waters of KSC were primarily to serve the space program and secondarily to serve as a wildlife refuge or park, with NASA having the ability to terminate the permit if activities were not compatible with "the nature of NASA's project activities." In 1964, NASA increased the permitted area for MINWR through an amendment to the 1963 agreement, with the same terms and conditions outlined in the 1963 agreement.<sup>41</sup>

<sup>40</sup> *National Aeronautics and Space Administration Agreement with the Bureau of Sport Fisheries and Wildlife for the Use of Property at Merritt Island, Florida, 1963.*

<sup>41</sup> *Amendment #1 to the National Aeronautics and Space Administration Agreement with the Bureau of Sport Fisheries and Wildlife for the Use of Property at Merritt Island, Florida, 1964.*



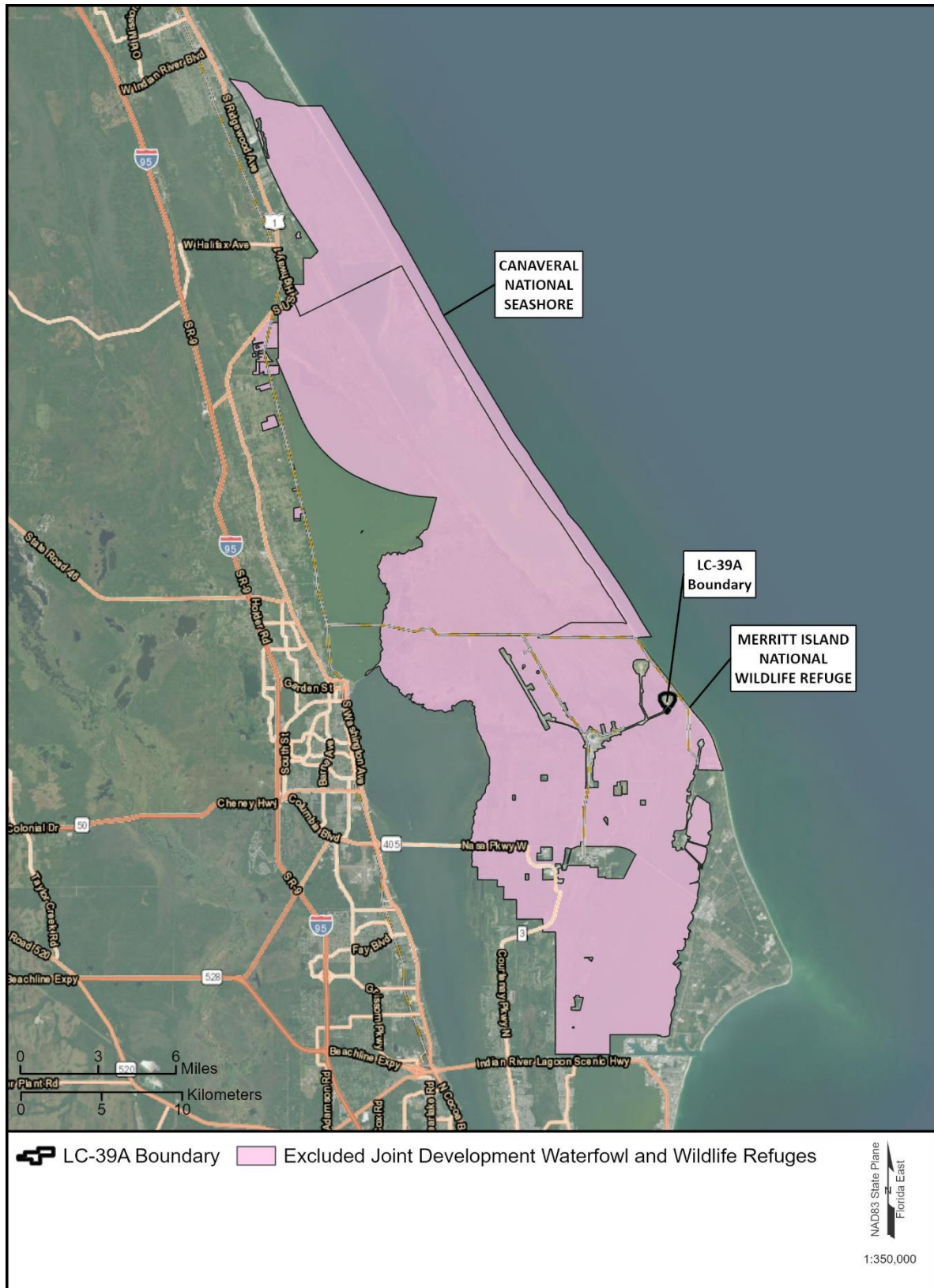


Figure 3.7-1. Canaveral National Seashore and Merritt Island National Wildlife Refuge (not subject to Section 4(f))

- **CANA:** Like MINWR, CANA was created as an additional overlay of KSC. Created by an act of Congress in 1975 (Public Law 93-626, 88 Statute 2121), the CANA-enabling legislation included 54,000 acres (22,000 hectares) of NASA-owned land, 12,500 acres (5,060 hectares) owned by the State of Florida, and 900 acres (400 hectares) owned by private parties. For the NASA-owned land, the law required that the Secretary of the Interior enter into an agreement with NASA to “assure the use of such lands in a manner which is deemed consistent with the public safety and with the needs of the space and defense programs of the Nation” (Section 2). Further, the enabling legislation clarified that in exercising its administrative authority to manage the day-to-day operation of the seashore, the Secretary of the Interior, upon the request of NASA, “shall close this area or any part thereof to the public when necessary for space operations” (Section 5(c)(1)).

MINWR and CANA meet the second prong of the joint development exception, joint planning, due to the following (among other reasons):

- **MINWR:** Evidence of concurrent or joint planning is documented in a number of interagency agreements, including the Interagency Agreement between NASA and the Bureau for Use and Management of Property at KSC known as MINWR (KCA-1649 Rev. B) and the MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025) interagency agreement, which governs how prescribed burns on MINWR are managed. As KSC would consider other proposed uses for MINWR land, NASA would engage the USFWS. In 1978, for example, Brevard County sought to construct a wastewater treatment project in the wildlife refuge. The USFWS opposed, and NASA ultimately denied this request. Similarly, in 1984, NASA coordinated with the USFWS in denying a General Services Administration request for land in the refuge area for other than space program purposes. Subsequent to the 1964 Amendment, NASA has entered into no less than six additional agreements regarding MINWR with the USFWS.
- **CANA:** The 1975 agreement between NASA and the Secretary of the Interior is an example of joint planning. In addition, in 1981, the NPS’s General Management Plan (GMP) for CANA specified that “NASA will retain principal authorities over its lands within the Seashore to ensure its capabilities to continue its mission.”<sup>42</sup> The GMP further provides that closures “will increase in the future as launch rates increase” and that the NPS would provide measures for beach access “if agreeable to NASA.” In 2014, the NPS published its Final EIS, which addresses the environmental impacts of the proposed implementation of its “Final General Management Plan” for the seashore (NPS, 2014b). In the document, the NPS committed to “increased coordination with land-managing partners,” and noted that “temporary closures of the Playalinda Beach area to visitor use before scheduled launches and landings may continue.”<sup>43</sup>

NASA, NPS, and USFWS staff also cooperatively and jointly engage in the management of historic properties, which may be located at CANA or MINWR (e.g., see CANA Final GMP, Alternative B “Preferred Alternative”: “NPS staff [will] continue to assist USFWS staff and NASA staff with...management of cultural resources”). NASA identifies the USFWS and NPS as “consulting

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<sup>42</sup> Available at

[https://www.google.com/books/edition/Canaveral\\_National\\_Seashore\\_Statement\\_of/vj43AQAAAMAJ?hl=en&gbpv=1&dq=%22playalinda%22+%22closure&pg=PA22&printsec=frontcover](https://www.google.com/books/edition/Canaveral_National_Seashore_Statement_of/vj43AQAAAMAJ?hl=en&gbpv=1&dq=%22playalinda%22+%22closure&pg=PA22&printsec=frontcover).

<sup>43</sup> Other areas that may be affected by NASA-imposed requirements include, but are not limited to, the lands/waters south of State Route 402; NASA tracking facilities; temporary closures of parking areas 5 and half of 4.

parties” under Section 106 of the NHPA, which gives both agencies an opportunity to review and provide comment on all cultural resource materials that NASA sends to the Florida State Historic Preservation Office. NASA sends all ground-disturbing construction permits to the NPS and USFWS for comment and has loan agreements with the NPS for the curation of archaeological resources. All three agencies meet monthly to coordinate cultural resources and other environmental issues.

Given the formal reservation of KSC as a space transportation facility, coupled with the robust joint planning between NASA, the USFWS, and the NPS, the FAA considers its sister operating administrations’ interpretations of Section 4(f) to be compelling and has determined that the FHWA/FTA regulation establishing the joint development exception to Section 4(f) is useful guidance for the FAA. The FAA has considered the regulation in reaching its decision to apply the exception to this project. In short, the joint development exception applies to space program activities that are proposed to occur at KSC as part of the project. Therefore, even if the project otherwise would result in any use of MINWR and CANA, no Section 4(f) evaluation is required.

### 3.7.2 Study Area

The study area for the Section 4(f) use determination area was defined differently for historic sites, public parks and recreation areas, and wildlife and waterfowl refuges to maintain consistency in the baseline thresholds used in different regulatory frameworks in a highly complicated and complex project area.

The study area for historic sites was defined by the APE used in the Section 106 of the NHPA consultation process. The APE was established as any area subjected to greater than or equal to 2 psf from sonic booms under annual mean weather conditions for the range of launch/landing activities. This area also encompasses the 130-dB threshold for launch effects, as well as the construction APE. The APE is roughly circular with an approximate western radius of 18.5 miles (29.8 kilometers) from the center of LC-39A (Figure 3.7-2).

The study area for public parks and recreation areas was established using the FAA’s minimum threshold of 60 dB CDNL to identify areas that may experience noise impacts. A noise level of 60 dB CDNL is commonly used by the FAA as a threshold to evaluate potential Section 4(f) use based on noise impacts. 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 dB. For impulsive noises (i.e., sonic booms), the FAA uses 60 dB as the threshold level above which not all land uses are considered compatible. Land use noise-compatibility analysis considers the effects of noise on special management areas, such as national parks, and other sensitive noise receptors where a quiet setting is a generally recognized purpose and attribute. The study area for public parks and recreation areas is a crescent segment with an approximate western radius of 14 miles (23 kilometers) from the center of LC-39A (Figure 3.7-3).

The study area for wildlife and waterfowl refuges was established using the NEPA study area for biological resources. The study area was developed considering the construction phase of the project and the operational aspects of Starship-Super Heavy. The former is centered on the construction area at LC-39A, and the latter considers the introduction of noise and vibratory elements of Starship-Super Heavy operation and RTLS. The biological resources study area was set based on areas that would experience the introduction of no less than 1 psf overpressure and no less than 60 dB CDNL during Starship-Super Heavy operations. The area associated with Starship-Super Heavy operations is roughly circular with an approximate western radius of 15 miles (24 kilometers) from the center of LC-39A. The RTLS area is associated with the sonic booms that

may be produced when Starship-Super Heavy reenters to land at LC-39A and largely shares the same area of the operational contours with a western expansion inland associated with 1 psf overpressure. The contingency landing area, an extensive area that may experience no more than five landings per year, is an approximately 225-mile-long (362-kilometer-long), 40-mile-wide (60-kilometer-wide) band spanning the Atlantic Ocean and land between Jacksonville and south to Vero Beach (Figure 3.7-4).

### 3.7.3 Existing Conditions

The existing conditions of the project considered under Section 4(f) of the U.S. DOT Act include historic sites, public parks and recreation areas and wildlife and waterfowl refuges. The Section 4(f) Use Determination Report used definitions included in the FHWA Policy Paper (2012) and 23 CFR Part 774 to identify the resources that would be considered under Section 4(f). A full list of the Section 4(f) resources within the project area and figures showing their specific locations relative to LC-39A are included in the Section 4(f) Use Determination Report.

#### ***Historic Sites***

Historic sites include 135 individual properties or historic districts that are either listed, or eligible for listing, in the NRHP. This project also considers those sites currently unevaluated for listing in the NRHP or sites with insufficient information to make an evaluation. Additionally, there are 93 archaeological sites that are either listed, eligible for listing in the NRHP, potentially eligible for listing in the NRHP, found to have insufficient information for evaluation, or the current information is not sufficient to evaluate. Sites thought to contain human remains are also included for consideration. Section 4(f) applies to archaeological sites that are eligible for listing in the NRHP and warrant preservation in place (PIP). Existing documentation associated with these sites does not indicate whether the sites warrant PIP (FHWA, 2012). Therefore, the FAA is including these sites in the Section 4(f) documentation for the Proposed Action. However, it is likely that the number of sites that may warrant PIP is limited. It is also possible there are no sites within the Section 106 APE that warrant PIP. The historic sites were identified through the Section 106 consultation process for this project and are summarized in Section 3.5.3, *Historical, Architectural, Archaeological, and Cultural Resources, Existing Conditions*.

#### ***Public Parks and Recreation Areas***

Properties were identified by mapping the limits of 60 dB CDNL over mapped datasets published within the Florida Statewide Parcel dataset published by the Florida Geographic Information Officer, which “contains a subset of property tax roll information provided by each of Florida’s 67 county property appraisers” (Florida Geographic Information Office, 2025). Geographic Information System data from FNAI, FDEP, and the University of Florida Geoplan Center were also reviewed and incorporated into the Proposed Action’s mapping. SpaceX and its consultant investigated the probable officials with jurisdiction by first noting the ownership of each parcel and then reviewing the Federal, state, or local agency’s website to identify a specific person or role that would be considered the official with jurisdiction, according to “Officials with Jurisdiction: Consultation and Decision Making” in the FHWA Policy Paper (Questions 9A to 9C) (FHWA, 2012). The FAA has presumed that the identified properties are significant. Assumptions of significance are commonly made when an official with jurisdiction cannot confirm significance or when a management plan for a resource, if one exists, does not address significance.



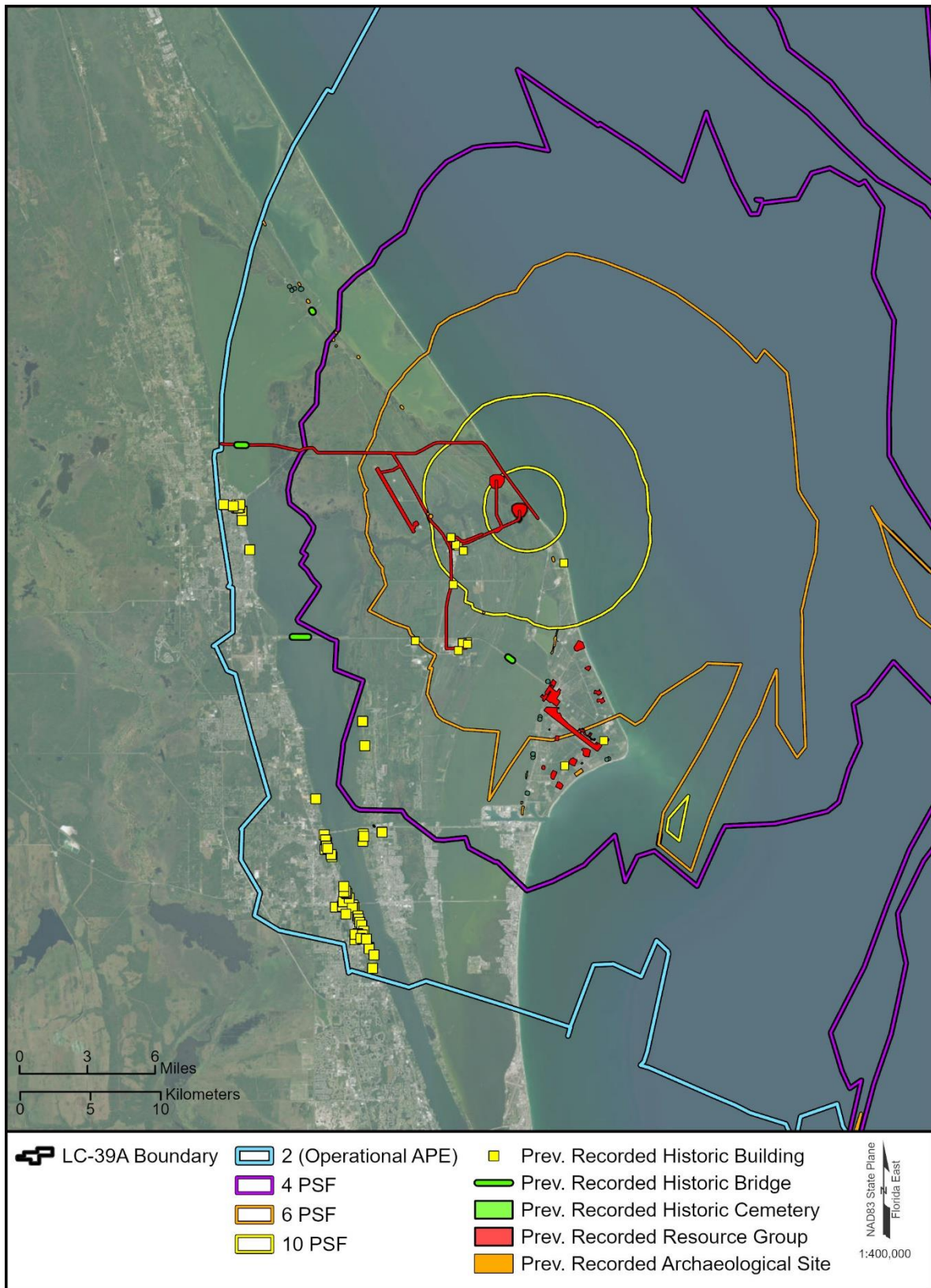


Figure 3.7-2. Historic Site Overview



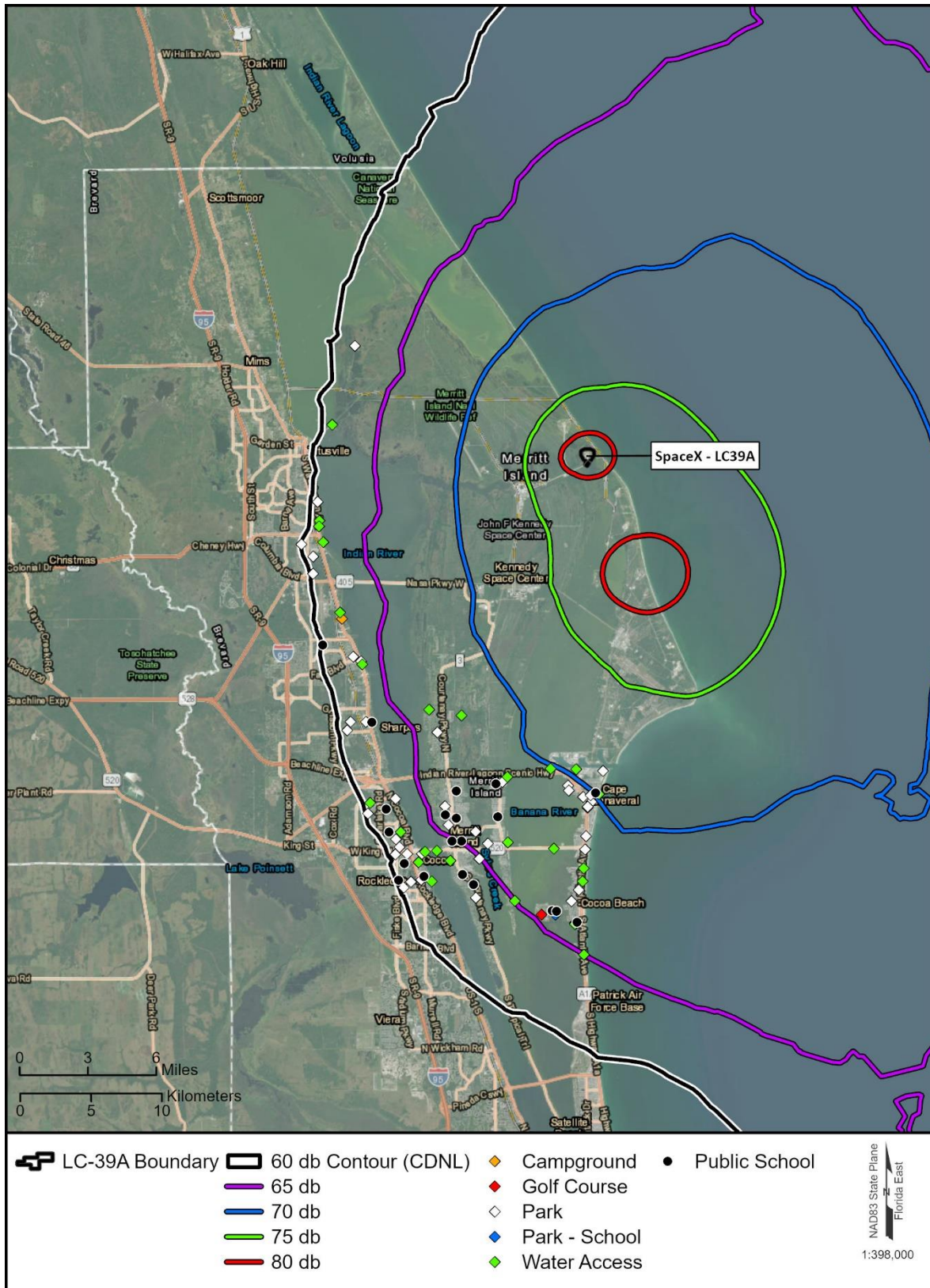


Figure 3.7-3. Public Parks and Recreation Areas

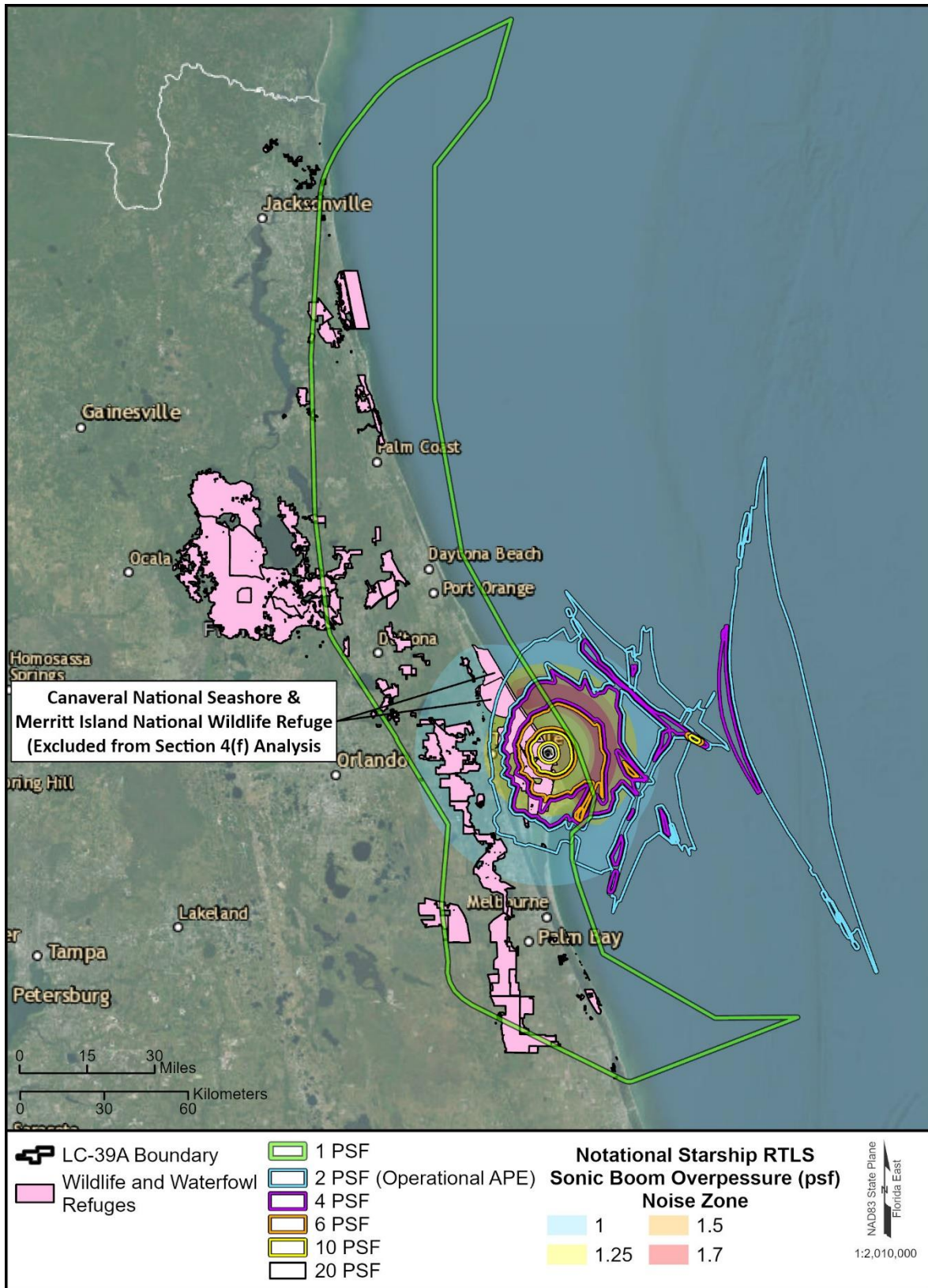


Figure 3.7-4. Wildlife and Waterfowl Refuges



There are 94 publicly owned, publicly accessible recreation areas in the study area (Figure 3.7-3). The 94 recreation areas can be organized into five broad categories: (1) park, (2) water access, (3) campground, (4) golf course, and (5) trail. The attributes of each are described in the Section 4(f) Use Determination Report. Notably, the majority are owned by Brevard County, including the School Board of Brevard County. Of the 94 recreation areas, approximately two-thirds (61) are owned and managed by Brevard County, including 20 school parks managed by the School Board of Brevard County. The county's holdings include 35 parks, 1 trail, and 6 water access sites. Forty-one recreation areas were identified as under the jurisdiction of eight individuals within the Brevard County government. The remaining 31 resources are distributed under the jurisdiction of the Indian County School Board, the Cape Canaveral Port Authority, the City of Cape Canaveral, the City of Cocoa, the City of Cocoa Beach, the City of Rockledge, the City of Titusville, and the State of Florida.

### ***Wildlife and Waterfowl Refuges***

There are 70 Federal, state, or locally owned conservation areas in the study area that meet the definition of a "wildlife and waterfowl refuge," as defined in the 2012 FHWA Policy Paper and 23 CFR Part 774 (Figure 3.7-4). The NEPA study area for biological resources was used as the project area to identify potential wildlife and waterfowl refuges. The study area was set based on areas that would experience the introduction of no less than 1 psf overpressure and no less than 60 dB CDNL during Starship-Super Heavy operations. The study area was developed considering the construction phase of the project and the operational aspects of Starship-Super Heavy. The former is centered on the construction area at LC-39A and the latter considers the introduction of noise and vibratory elements of Starship-Super Heavy operation.

The limits of the 1 psf and 60 dB CDNL were used to create a map that was compared against the publicly available parcel ownership data throughout the limits of each threshold. Similarly to how public parks and recreation areas were identified, the FAA identified publicly owned parcels used for wildlife management, conservation, and refuges. These parcels were only categorized as wildlife and waterfowl refuges if their primary purpose was related to the conservation, restoration, or management of wildlife or waterfowl, including the conservation, restoration, and management of habitat. SpaceX and its consultant investigated the probable officials with jurisdiction by first noting the ownership of each parcel and then reviewing the Federal, state, or local agency's website to identify a specific person or role that would be considered the official with jurisdiction, according to "Officials with Jurisdiction: Consultation and Decision Making" in the FHWA Policy Paper (Questions 9A to 9C) (FHWA, 2012).

The FAA and SpaceX identified that the Starship-Super Heavy return activities would introduce noise in the areas of the RTLS trajectories. The FAA developed contours greater than or equal to 1 psf associated with the sonic boom overpressures that may occur with reentry. The RTLS contours largely overlap with the 1 psf contours established for Starship-Super Heavy operations.

The FAA and SpaceX identified that the Starship-Super Heavy return activities would introduce noise in the areas of the RTLS trajectories. The FAA developed contours greater than or equal to 1 psf associated with the sonic boom overpressures that may occur with reentry. The RTLS contours largely overlap with the 1 psf contours established for Starship-Super Heavy operations.

The FAA and SpaceX also identified a contingency landing area of 1 psf in the Atlantic Ocean. This landing area has a reduced likelihood of landings as compared to the operational area. The contingency area

includes wildlife and waterfowl refuges. SpaceX and the FAA anticipate that the contingency landing area may be used up to five times per year.

### 3.7.4 Environmental Consequences

According to the FAA's 1050.1F Desk Reference, a significant impact under DOT Section 4(f) would occur when *"The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a 'constructive use' based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource."* A significant impact under NEPA would not occur if mitigation measures eliminate or reduce the effects of the use below the threshold of significance. If a project would physically use Section 4(f) property, the FAA is responsible for complying with Section 4(f) even if the impacts are less than significant for NEPA purposes. For historic properties subject to Section 4(f) of the DOT Act, a significant impact would occur when the action involves more than minimal physical use of a Section 4(f) resource or constitutes a "constructive use" based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource (FAA, 2023b).

#### 3.7.4.1 No Action

Under the No Action Alternative, NASA would not develop, implement, or approve agreements with SpaceX associated with Starship-Super Heavy operations at LC-39A. The FAA would not issue SpaceX a new license or modify their existing vehicle operator license for Starship-Super Heavy operations at LC-39A or approve the closure of any associated airspace. SpaceX would not launch Starship-Super Heavy from LC-39A. The No Action Alternative would not meet the purpose and need.

The No Action Alternative includes reasonably foreseeable actions that would still occur regardless of the Proposed Action, such as future launch activity at both KSC and CCSFS. Projects are identified as reasonably foreseeable if they are in published planning documents, are in the process of NEPA evaluation, or have completed NEPA evaluation but the project has not yet been implemented.

Table 2.2-1 shows the launch-related activities that have already been approved under separate NEPA analysis considered in the overall No Action Alternative analysis (see Appendix C.1, *Noise Assessment and Noise Assessment Appendix*). The actions are relevant because they are in proximity to LC-39A, are planned to occur under the No Action, and could result in direct or indirect operational launch/landing or development-related effects within the Proposed Action study area for various resources.

#### 3.7.4.2 Proposed Action

##### 3.7.4.2.1 Construction

Modifications would be necessary at LC-39A to support the proposed Starship-Super Heavy launch vehicle. The proposed project does not propose to permanently incorporate land into transportation use, nor will it require temporary occupancy or permanent easement of lands from Section 4(f) resources.

Adverse effects to historic properties under Section 106 of the NHPA, regardless of permanent incorporation or temporary occupancy of land, may constitute use of historic sites under Section 4(f) (FHWA, 2012). As discussed in the 2019 *Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center* (NASA, 2019a, p. 54), a Historic American Engineering

Record (HAER FL-8-11-F), documented at a Level II, was completed for LC-39A in 2010 to mitigate for “adverse effects” that might occur with post Shuttle Program redevelopment. The Florida SHPO, in a letter dated May 10, 2013, concurred future consultation is not required for the reuse of LC-39A by a commercial entity (Bendus, 2013). Adverse effects to LC-39A cultural resources associated with site improvements and launch operations are not considered in this EIS and no consultation with the Florida SHPO is required. Therefore, there is no use of Section 4(f) resources associated with the construction area of the proposed project.

There are no public parks and recreation areas or wildlife or waterfowl refuges in the construction area of the Proposed Action.

#### **3.7.4.2.2 Operation**

The Section 4(f) evaluation established that the project does not require the permanent incorporation or temporary occupancy of land from Section 4(f) resources. Thus, the assessment focuses on the potential for constructive use of Section 4(f) resources. Constructive use is defined as “the absence of permanent incorporation or temporary occupancy” and when “the proximity impacts of a project on adjacent or near-by Section 4(f) property, after incorporation of impact mitigation...the attributes which qualify the property for protection under Section 4(f) are substantially impaired” [23 CFR §774.17 and (FHWA, 2012)]. In 2012, the FHWA expanded on this definition in its Section 4(f) Policy Paper, writing “as a general matter this means that the value of the resource, in terms of its Section 4(f) purpose and significance, will be meaningfully reduced or lost” (FHWA, 2012). Additionally, the FHWA clarified that the assessment for constructive use should be based on the impact that is directly attributable to the project under review, not the overall impacts to a Section 4(f) property from multiple sources over time.

The operational area (including the contingency landing area) of the proposed project subject to noise and vibration introductions comprises a large area. With most of the Section 4(f) resources in the operational area (versus the construction area) of the project, Section 3.2, *Noise and Noise-Compatible Land Use*; Section 3.3, *Land Use*; Section 3.5, *Historic, Architectural, Archaeological, and Cultural Resources*; and Section 3.8, *Biological Resources*, of the EIS were used in the evaluation because these sections considered the potential impacts resulting from the introduction of audio and visual elements to resources that are commonly determined to be Section 4(f) resources. The evaluation of potential constructive use also considers guidance in the FHWA Policy Paper, Section 1050.F Desk Reference (FAA, 2023b) and 23 CFR Part 774.

The Section 4(f) assessment concluded that historic sites would not be substantially impaired as a result of the project. The Section 106 of the cultural resources assessment survey completed as part of the Section 106 of the NHPA consultation process concluded that the Proposed Action is unlikely to result in adverse effects to historic sites. However, because the Section 106 consultation is ongoing, a final determination of how the undertaking will affect historic properties is not possible at this time. Thus, a PA to monitor and mitigate potential adverse effects is under development by NASA. Specifically, the cultural resources assessment survey recommended the following for inclusion in the PA:

1. Additional efforts to identify and evaluate historic properties
2. Monitoring of historic properties within different psf contours for effects
3. Monitoring of sonic boom overpressure and vibration at archaeological sites



It is assumed that if monitoring reveals potential effects to architectural resources (e.g., not archaeological sites) that preventative or corrective action will be taken. Actions may include the installation of systems (which meet the Secretary of the Interior's Standards and Guidelines for the Treatment of Historic Properties) to minimize damage to character-defining features or the replacement-in-kind of character-defining features. It is also assumed that preventative or corrective actions to architectural resources would result in a finding of no adverse effect under the PA. The potential effects of sonic boom overpressure and vibration to archaeological sites is not currently understood. However, it is likely that the outcome of the additional efforts to identify resources recommended in the PA would confirm that the overwhelming majority, if not all, of the NRHP-eligible archaeological sites included in this assessment do not warrant PIP. Thus, Section 4(f) would not apply to these sites.

The Section 4(f) assessment concluded that public parks and recreation areas would not be substantially impaired as a result of the Proposed Action. While noise would exceed 60 dBA CDNL, instances would be of short duration. The short duration of potentially disturbing noise levels supports that all land uses would remain compatible in accordance with the guidelines at 14 CFR Part 150. The introduction of a brief noise event during the hours of 10:00 p.m. and 7:00 a.m. for an average of three to four times per month does not represent a substantial impairment. While the nighttime activities may be considered an annoyance and may disrupt sleep or startle users, the frequency is not likely to substantially diminish the activities, features, or attributes of the resources, because the annual frequency and duration is a small portion of the total operational hours of the resources in a given year.

The Section 4(f) assessment concluded that wildlife and waterfowl refuges would not be substantially impaired as a result of the Proposed Action. The Proposed Action does not include potential closure or restriction at waterfowl or wildlife refuges, including viewing points. Officials with jurisdiction over the properties would be able to manage the refuges according to existing management plans. The public would be able to access these properties for use as normal, including hunting and wildlife viewing. The noise events associated with Starship-Super Heavy are predicted to be of short duration, approximately 88 times a year, either day or night. Additionally, while the noise and sonic booms are considered annoyances, the Proposed Action is not likely to substantially impair the attributes of the 18 wildlife and waterfowl refuges because it is not anticipated that the proposed project would jeopardize the continued existence of species; cause substantial habitat effects, including loss; or cause long-term or permanent loss of plant or wildlife species or populations. Nor would the introduction of noise 88 times a year substantially impair access to viewing points, as there are no proposed closures.

### 3.7.5 BMPs, Mitigation, and Monitoring

Historic sites will be subject to monitoring according to the forthcoming PA, as described previously. The EIS outlines mitigation and monitoring processes for resources covered by Section 3.2, Noise and Noise-Compatible Land Use; Section 3.3, Land Use, and Section 3.8, Biological Resources, including notification to agencies prior to launch, landing, and static fire activity. This will specifically include the officials with jurisdiction over the Section 4(f) resources in the project area. The FAA reviewed the mitigation measures included in Chapter 3, Affected Environment and Environmental Consequences, of the EIS to evaluate if the measures also reduce the potential or prevent substantial impairment of Section 4(f) resources. After reviewing Chapter 3, of which Section 3.2, Noise and Noise-Compatible Land Use; Section 3.3, Land Use; and Section 3.8, Biological Resources, are most applicable, the FAA

concluded that the mitigation measures developed for the EIS would reduce or prevent substantial impairment of Section 4(f) resources. Thus, the FAA determined development of targeted mitigation as part of the Section 4(f) process was not necessary.

### 3.7.6 Summary

There are 392 Section 4(f) resources in the proposed project area. The FAA determined that the MINWR and CANA are subject to the Joint Development Exemption and thus not subject to Section 4(f) evaluation. The FAA determined the proposed project does not require the permanent incorporation or temporary occupancy of Section 4(f) resources. Additionally, the FAA determined, and detailed in the Section 4(f) Use Determination Report, that the proposed project does not significantly impair historic sites, public parks and recreation areas, or wildlife and waterfowl refuges; thus, the project would not use Section 4(f) resources.

## 3.8 Biological Resources

### 3.8.1 Definition of Resource and Regulatory Setting

Biological resources include native vegetation, wildlife, and the habitats in which they occur. Protected species and invasive and non-native species also are considered in this section.

Key biological resources laws and regulations pertinent to the Proposed Action are the ESA, MSFCMA, MMPA, BGEPA, and MBTA, which are summarized in Section 1.5.2, *Other Licenses, Permits, and Approvals*. Appendix D.8, *Biological Resources*, lists and describes the laws, executive orders, agency regulations, and other guidance that apply to biological resources.

### 3.8.2 Study Area

The study area for biological resources includes (1) LC-39A; (2) area surrounding LC-39A that would be exposed to traffic, launch and landing plumes, sonic booms, and noise (construction, operational, and launch and landing noise); (3) area in the Atlantic Ocean where Super Heavy boosters and Starship vehicles might land or be expended; (4) area in the Pacific Ocean where Starship vehicles might land or be expended; and (5) area in the Indian Ocean where Starship vehicles might be expended. The following sections discuss the factors considered in determination of each portion of the study area.

#### 3.8.2.1 LC-39A and Surrounding Area

##### ***Construction and Launch Plumes***

Construction would be limited to inside the perimeter fence of LC-39A. The plumes generated from Starship-Super Heavy static fire tests and launches would travel away from the launch pad, with an estimated vapor plume extent of up to approximately 0.2 miles (0.3 kilometers) and temperatures expected to reach ambient temperature (90 degrees Fahrenheit or 32 degrees Celsius) by 0.2 miles from the pads. For Starship and Super Heavy landings, the estimated vapor and heat plume extent is

approximately 96 feet (29 meters) from the landing pad (Figure 3.8-1). Note that there are no natural wetlands within LC-39A.

### ***Propulsion/Engine Noise***

Noise disturbances are expected from construction, operational, and launch noise. Different organisms are typically most sensitive to sounds within a limited frequency range and hence will perceive sounds with different frequency spectra differently, even if the sound levels are identical. Noise studies tailored to human health and safety typically weight noise intensities to the human hearing spectrum in a process known as A-weighting. Using dBA values is not necessarily appropriate for analysis of wildlife impacts given that species perceive noise differently; for example, high-frequency echolocating bats will have drastically different frequency sensitivities than humans. However, most noise-monitoring and studies are geared toward the human environment and are reported in dBA. It may be difficult to find comparative metrics in unweighted dB. Humans and many species of terrestrial wildlife also do not perceive very low-frequency sound, which is a substantial component of launch noise. Therefore, use of unweighted estimates could potentially inflate the analysis of impacts beyond those that would realistically occur.

A noise descriptor/metric for noise effects on wildlife has not been universally adopted, but some research indicates SEL<sup>44</sup> is the most useful predictor of responses (FRA, 2012). Much of the research has lacked systematic documentation of the source noise event. Many studies report “sound levels” without specifying the frequency spectrum or duration. A notable exception is a study sponsored by the DAF that identifies SEL as the best descriptor for response of domestic turkey poults to low-altitude aircraft overflights (Bradley et al., 1990). This study identifies a threshold of response for disturbance of domestic turkeys (100 percent rate of crowding) as an ASEL of 100 dB. Another report questions whether an A-weighted sound level used in the SEL for aircraft overflights is appropriate for animals since their hearing differs from humans (Manci et al., 1988). However, because no weighting has been established for representing the hearing characteristics of wild animals, the A-weighted sound level continues to be used.

### ***Sonic Booms***

Sonic booms are thunder-like noises that people and animals hear when launch vehicles travel faster than the speed of sound. These high-amplitude, impulsive noises are typically quantified in terms of their overpressure, or increase in pressure over atmospheric conditions, as traditional noise metrics do not adequately capture the full array of energetic effects of sonic booms.

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<sup>44</sup> SEL values represent the total sound energy of noise event in terms of an equivalent event that only lasts 1 second, providing a consistent comparison basis for sound events of differing durations.

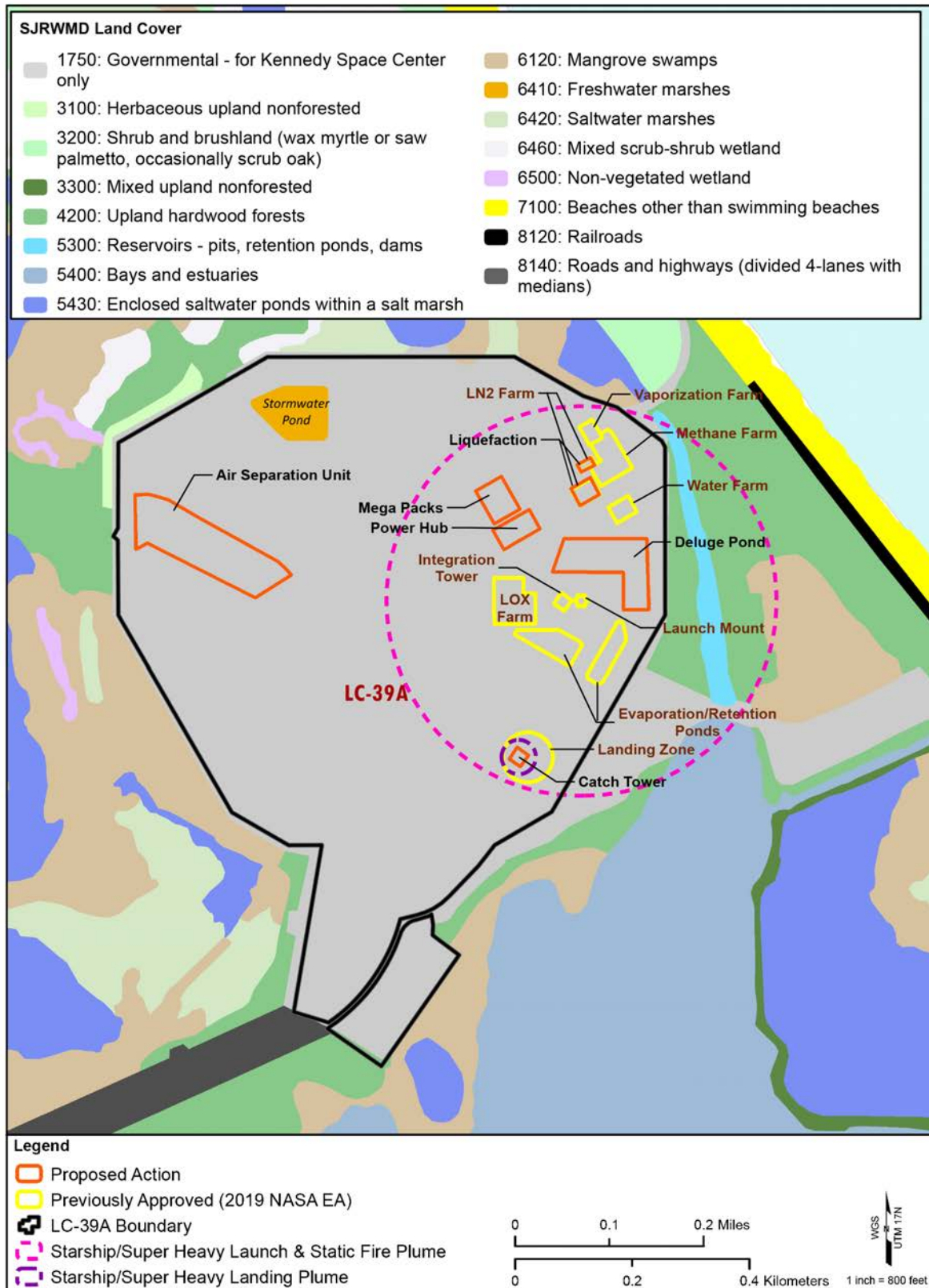


Figure 3.8-1. Land Cover Around LC-39A Construction and Plume Areas

An overpressure of 1 psf is equivalent to a C-weighted<sup>45</sup> SEL of 102 dBC (Rylander, 1974) and a 128 peak sound pressure level (dB). An overpressure of 2 psf (134 peak sound pressure level [dB]) is similar to thunder from 1 kilometer. Most sonic boom studies on animals were conducted between 1960 and 1990 due to interest in commercial supersonic travel and generally focused on 1 to 2 psf sonic booms, which are typical of aircraft. The scant available information suggests that sonic booms below 1 psf elicit little to no noticeable startle reaction from receptor species (Epsmark, 1972). More pronounced startle reactions have been observed at the 1 psf threshold in some species of birds (Ellis et al., 1991) and mammals (Rylander, 1974), although it is important to note that reactions vary widely based on the species in question.

### **Summary**

Based on the above, NASA delineated the portion of the study area surrounding LC-39A as the outermost predicted (modeled) ASEL 100 dB contour for engine noise (including static fires, launches, and landings) and the outermost predicted (modeled) 1 psf contour for overpressure events (Figure 3.8-2). This area encompasses all areas expected to be affected by construction activities, daily operations, heat and vapor plumes, surveillance support, vehicle traffic, barge traffic, and events with smaller noise and sonic boom footprints.

## **3.8.2.2 Ocean Landing Areas**

### **Atlantic Ocean**

The Atlantic landings area includes the portion of the Atlantic Ocean where Starship vehicles and Super Heavy boosters may be expended or land on droneships (Figure 2.1-6); this landing area comes no closer than within 5 nautical miles of the U.S. coastline. The Super Heavy landing area extends in a triangle from LC-39A, as the Super Heavy would return within the arc of the 40-degree and 115-degree azimuths (Figure 2.1-6). The Starship contingency landing area includes an additional area from 1 nautical mile to 5 nautical miles offshore for 50 miles (80 kilometers) north and south of LC-39A (Figure 2.1-6). The Starship contingency landing area with a 1 psf overpressure contour encompasses noise and overpressure effects from Starship contingency landings (Figure 3.2-15). On-land noise and overpressure effects from Super Heavy Atlantic landings are encompassed within the 1-psf/100-dB ASEL contour surrounding LC-39A (Figure 3.8-2). The Atlantic landing area, which includes the Starship contingency landing area, would encompass potential lighting and direct physical impacts associated with Atlantic landings and boat/barge traffic, as well as associated noise and overpressure effects not already delineated (Figure 2.1-6).

### **Pacific Ocean**

The Pacific landing area includes multiple portions of the Pacific Ocean where Starship vehicles may be expended, including areas around Hawaii (Figure 2.1-8 and Figure 2.1-9). The Pacific landing area would encompass potential noise, overpressure, lighting, and direct physical impacts associated with Starship landings.

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<sup>45</sup> C-weighting is a frequency weighting that measures the impact of loud noises on the human ear. C-weighting is used for peak sound pressure measurements, such as measuring impulse noise.



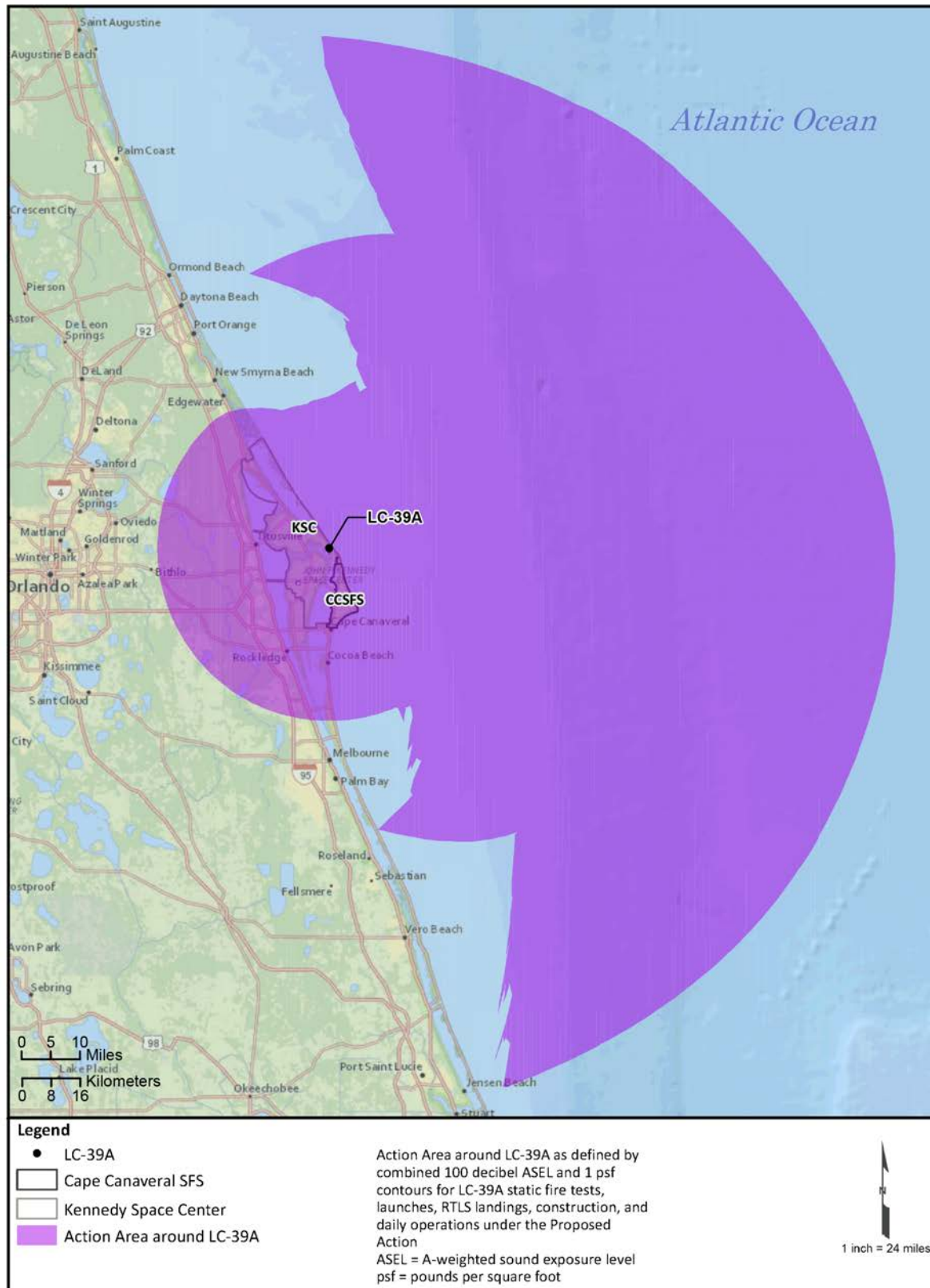


Figure 3.8-2. Biological Resources Study Area Around LC-39A

## Indian Ocean

The Indian Ocean landing area includes the portion of the Indian Ocean where Starship vehicles may be expended (Figure 2.1-7). The Indian Ocean landing area would encompass potential noise, overpressure, lighting, and direct physical impacts associated with Starship landings.

### 3.8.3 Existing Conditions

#### Federally Protected Species

This section covers species protected under the ESA and MMPA. Migratory birds and bald eagles are discussed separately in the *Migratory Birds and Bald Eagles* subsection. The USFWS Information for Planning and Consultation (IPaC) system was queried to obtain lists of the ESA-listed and proposed species under USFWS jurisdiction, as well as their proposed and designated critical habitat, that may occur within the Study Area (Table 3.8-1). ESA-protected species under USFWS jurisdiction occur in terrestrial, estuarine, and marine habitats.

On March 20, 2025, NASA submitted to the USFWS the *Final Biological and Conference Assessment [BCA] for SpaceX Starship-Super Heavy Launch and Landing Operations at Launch Complex-39A at the Kennedy Space Center, Merritt Island, Florida* (Fish and Wildlife Service [FWS] Log #2024-0058364). On May 1, 2025, NASA submitted the *Revised Final Biological and Conference Assessment for SpaceX Starship-Super Heavy Launch and Landing Operations at Launch Complex-39A at the Kennedy Space Center, Merritt Island, Florida*, to the USFWS to address the addition of a Starship Atlantic Ocean contingency landing area and items in the Request for Additional Information received from the USFWS on April 11, 2025; this revised BCA is hereafter referred to as the USFWS Starship-Super Heavy LC-39A Revised BCA. The *Addendum to the May 2025 Biological and Conference Assessment for SpaceX Starship-Super Heavy Launch and Landing Operations at Launch Complex 39A at Kennedy Space Center, Merritt Island, Florida, Addressing an Expanded Range of Starship Return to Launch Site Trajectories* was submitted to the USFWS on June 12, 2025, to address additional Starship RTLS trajectories; this addendum is hereafter referred to as the USFWS Addendum. The USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum are available in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*.

**Table 3.8-1. ESA-Protected Species under USFWS Jurisdiction with Potential to Occur in Study Area**

| Common Name<br>(Scientific Name)                                                 | 1-psf/100-dB ASEL<br>Contour around<br>LC-39A | 1 psf Contour around<br>Atlantic Contingency<br>Landing Area | Atlantic<br>Landing Area | Pacific<br>Landing Area | Federal Status |
|----------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------|--------------------------|-------------------------|----------------|
| <b>Birds</b>                                                                     |                                               |                                                              |                          |                         |                |
| Band-rumped storm-petrel ( <i>Oceanodroma castro</i> ) (Hawaii DPS) <sup>1</sup> | -                                             | -                                                            | -                        | x                       | E              |
| Bermuda petrel ( <i>Pterodroma cahow</i> ) <sup>1</sup>                          | x                                             | -                                                            | x                        | -                       | E              |
| Black-capped petrel ( <i>Pterodroma hasitata</i> ) <sup>1</sup>                  | x                                             | x                                                            | x                        | -                       | E              |
| Crested caracara ( <i>Caracara plancus audubonii</i> ) [Florida]                 | x                                             | x                                                            |                          | -                       | T              |

**Table 3.8-1. ESA-Protected Species under USFWS Jurisdiction with Potential to Occur in Study Area**

| Common Name<br>(Scientific Name)                                                            | 1-psf/100-dB ASEL<br>Contour around<br>LC-39A | 1 psf Contour around<br>Atlantic Contingency<br>Landing Area | Atlantic<br>Landing Area | Pacific<br>Landing Area | Federal Status            |
|---------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------|--------------------------|-------------------------|---------------------------|
| Distinct Population<br>Segment] <sup>1</sup>                                                |                                               |                                                              |                          |                         |                           |
| Eastern black rail<br>( <i>Laterallus jamaicensis<br/>jamaicensis</i> ) <sup>1</sup>        | x                                             | x                                                            |                          | -                       | T                         |
| Everglade snail kite<br>( <i>Rostrhamus sociabilis<br/>plumbeus</i> ) <sup>1,2</sup>        | x                                             | x                                                            |                          | -                       | E                         |
| Florida grasshopper<br>sparrow ( <i>Ammodramus<br/>savannarum floridanus</i> ) <sup>1</sup> | -                                             | x                                                            |                          | -                       | E                         |
| Florida scrub-jay<br>( <i>Aphelocoma<br/>coerulescens</i> ) <sup>1</sup>                    | x                                             | x                                                            |                          | -                       | T                         |
| Hawaiian petrel<br>( <i>Pterodroma<br/>sandwichensis</i> ) <sup>1</sup>                     | -                                             | -                                                            |                          | x                       | E                         |
| Newell's shearwater<br>( <i>Puffinus newelli</i> ) <sup>1</sup>                             | -                                             | -                                                            |                          | x                       | T                         |
| Piping plover ( <i>Charadrius<br/>melodus</i> ) <sup>1,4</sup>                              | x                                             | x                                                            |                          | -                       | T                         |
| Red-cockaded<br>woodpecker ( <i>Picoides<br/>borealis</i> ) <sup>1</sup>                    | x                                             | x                                                            |                          | -                       | T                         |
| Roseate tern ( <i>Sterna<br/>dougallii</i> ) <sup>1</sup>                                   | x                                             | -                                                            | x                        | -                       | E                         |
| Rufa red knot ( <i>Calidris<br/>canutus rufa</i> ) <sup>1,3</sup>                           | x                                             | x                                                            | -                        | -                       | T                         |
| Short-tailed albatross<br>( <i>Phoebastria albatrus</i> ) <sup>1</sup>                      | -                                             | -                                                            | -                        | x                       | E                         |
| Whooping crane ( <i>Grus<br/>americana</i> ) <sup>1</sup>                                   | x                                             | x                                                            | -                        | -                       | T (NEP)                   |
| Wood stork ( <i>Mycteria<br/>americana</i> ) <sup>1</sup>                                   | x                                             | x                                                            | -                        | -                       | T (delisting<br>proposed) |
| <b>Crustacean</b>                                                                           |                                               |                                                              |                          |                         |                           |
| Black Creek crayfish<br>( <i>Procambarus pictus</i> ) <sup>1</sup>                          | -                                             | x                                                            | -                        | -                       | PE                        |
| <b>Insect</b>                                                                               |                                               |                                                              |                          |                         |                           |
| Monarch butterfly<br>( <i>Danaus plexippus</i> ) <sup>1</sup>                               | x                                             | x                                                            | -                        | -                       | PT                        |
| <b>Mammals</b>                                                                              |                                               |                                                              |                          |                         |                           |
| Anastasia Island beach<br>mouse ( <i>Peromyscus<br/>polionotus phasma</i> ) <sup>1</sup>    | -                                             | x                                                            |                          |                         | E                         |
| Florida bonneted bat<br>( <i>Eumops floridanus</i> ) <sup>2,5</sup>                         | -                                             | x                                                            |                          |                         | E                         |

**Table 3.8-1. ESA-Protected Species under USFWS Jurisdiction with Potential to Occur in Study Area**

| Common Name<br>(Scientific Name)                                                                         | 1-psf/100-dB ASEL<br>Contour around<br>LC-39A | 1 psf Contour around<br>Atlantic Contingency<br>Landing Area | Atlantic<br>Landing Area | Pacific<br>Landing Area | Federal Status |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------|--------------------------|-------------------------|----------------|
| Florida panther ( <i>Puma</i> [= <i>Felis</i> ] <i>concolor coryi</i> ) <sup>1</sup>                     | x                                             | x                                                            | -                        | -                       | E              |
| Puma ( <i>Puma</i> [= <i>Felis</i> ] <i>concolor</i> , all subspecies except <i>coryi</i> ) <sup>1</sup> | x                                             | x                                                            | -                        | -                       | T (S/A)        |
| Southeastern beach mouse ( <i>Peromyscus polionotus niveiventris</i> ) <sup>1</sup>                      | x                                             | x                                                            | -                        | -                       | T              |
| Tricolored bat ( <i>Perimyotis subflavus</i> ) <sup>1</sup>                                              | x                                             | x                                                            | -                        | -                       | PE             |
| West Indian manatee ( <i>Trichechus manatus</i> ) <sup>1,3,4</sup>                                       | x                                             | x                                                            | x                        | -                       | T, MMPA        |
| <b>Plants</b>                                                                                            |                                               |                                                              |                          |                         |                |
| Beautiful pawpaw ( <i>Deeringothamnus pulchellus</i> ) <sup>1</sup>                                      | x                                             | x                                                            | -                        | -                       | E              |
| Carter's mustard ( <i>Warea carteri</i> ) <sup>1</sup>                                                   | x                                             | x                                                            | -                        | -                       | E              |
| Etonia rosemary ( <i>Conrafina etonia</i> ) <sup>1</sup>                                                 | -                                             | x                                                            | -                        | -                       | E              |
| Fragrant prickly-apple ( <i>Cereus eriophorus</i> var. <i>fragrans</i> ) <sup>1</sup>                    | -                                             | x                                                            | -                        | -                       | E              |
| Lakela's mint ( <i>Dicerandra immaculata</i> ) <sup>1</sup>                                              | -                                             | x                                                            | -                        | -                       | E              |
| Lewton's polygala ( <i>Polygala lewtonii</i> ) <sup>1</sup>                                              | x                                             | x                                                            | -                        | -                       | E              |
| Okeechobee gourd ( <i>Cucurbita okeechobeensis okeechobeensis</i> ) <sup>1</sup>                         | -                                             | x                                                            | -                        | -                       | E              |
| Papery whitlow-wort ( <i>Paronychia chartacea</i> ) <sup>1</sup>                                         | x                                             | x                                                            | -                        | -                       | T              |
| Pigeon wings ( <i>Clitoria fragrans</i> ) <sup>1</sup>                                                   | x                                             | x                                                            | -                        | -                       | T              |
| Pygmy fringe-tree ( <i>Chionanthus pygmaeus</i> ) <sup>1</sup>                                           | x                                             | x                                                            | -                        | -                       | E              |
| Rugel's pawpaw ( <i>Deeringothamnus rugelii</i> ) <sup>1</sup>                                           | x                                             | x                                                            | -                        | -                       | E              |
| Sandlace ( <i>Polygonella myriophylla</i> ) <sup>1</sup>                                                 | x                                             | x                                                            | -                        | -                       | E              |
| Tiny polygala ( <i>Polygala smallii</i> ) <sup>1</sup>                                                   | -                                             | x                                                            | -                        | -                       | E              |

**Table 3.8-1. ESA-Protected Species under USFWS Jurisdiction with Potential to Occur in Study Area**

| Common Name<br>(Scientific Name)                                              | 1-psf/100-dB ASEL<br>Contour around<br>LC-39A | 1 psf Contour around<br>Atlantic Contingency<br>Landing Area | Atlantic<br>Landing Area | Pacific<br>Landing Area | Federal Status |
|-------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------|--------------------------|-------------------------|----------------|
| <b>Reptiles</b>                                                               |                                               |                                                              |                          |                         |                |
| American alligator<br>( <i>Alligator mississippiensis</i> ) <sup>1</sup>      | x                                             | x                                                            | -                        | -                       | T (S/A)        |
| American crocodile<br>( <i>Crocodylus acutus</i> ) <sup>1</sup>               | x                                             | x                                                            | -                        | -                       | T              |
| Atlantic salt marsh snake<br>( <i>Nerodia clarkia taeniata</i> ) <sup>1</sup> | x                                             | x                                                            | -                        | -                       | T              |
| Eastern indigo snake<br>( <i>Drymarchon couperi</i> ) <sup>1</sup>            | x                                             | x                                                            | -                        | -                       | T              |
| Green sea turtle<br>( <i>Chelonia mydas</i> ) <sup>1,3</sup>                  | x                                             | x                                                            | -                        | -                       | T              |
| Hawksbill sea turtle<br>( <i>Eretmochelys imbricata</i> ) <sup>1,2</sup>      | x                                             | x                                                            | -                        | -                       | E              |
| Kemp's ridley sea turtle<br>( <i>Lepidochelys kempii</i> ) <sup>1</sup>       | x                                             | x                                                            | -                        | -                       | E              |
| Leatherback sea turtle<br>( <i>Dermochelys coriacea</i> ) <sup>1,2</sup>      | x                                             | x                                                            | -                        | -                       | E              |
| Loggerhead sea turtle<br>( <i>Caretta caretta</i> ) <sup>1,4</sup>            | x                                             | x                                                            | -                        | -                       | T              |

Notes: - = not applicable; DPS = distinct population segment; E = endangered; IPaC = Information for Planning and Consultation; MMPA = Marine Mammal Protection Act; NEP = non-essential experimental population; PE = proposed endangered; psf = pounds per square foot; PT = proposed threatened; S/A = Similarity of Appearance; ssp. = subspecies; T = threatened; USFWS = United States Fish and Wildlife Service; var. = variety; x = potential to occur.

<sup>1</sup> Species is listed on IPaC report.

<sup>2</sup> The study area does not overlap designated critical habitat for this species.

<sup>3</sup> The study area overlaps proposed critical habitat for this species.

<sup>4</sup> The study area overlaps designated critical habitat for this species.

Sources: (USFWS, 2008; NPS, 2014b; NASA, 2020b; USSF, 2023b; SpaceX, 2024b; NOAA Fisheries, 2025); USFWS Revised Biological Conference Assessment and USFWS Biological Conference Assessment Addendum provided in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*

For additional information on the federally protected species listed in Table 3.8-1, see the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, as well as the KSC ERD (NASA, 2020b), *Space Launch Delta 45 (SLD 45) Integrated Natural Resources Management Plan (INRMP)* (hereafter referred to as the SLD 45 INRMP) (USSF, 2023b), *General Management Plan/Environmental Impact Statement for Canaveral National Seashore, Florida* (hereafter referred to as the CANA Final GMP/EIS) (NPS, 2014b), *Merritt Island National Wildlife Refuge Comprehensive Conservation Plan* (hereafter called the MINWR CCP) (USFWS, 2008), and the *St. Johns National Wildlife Refuge [SJNWR] Comprehensive Conservation Plan* (hereafter referred to as the SJNWR CCP) (USFWS, 2011). Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, contains maps showing documented and potential habitat for federally protected species under USFWS jurisdiction in relation to construction areas; plume, noise, and sonic boom contours; and ocean landing areas. Note that the landing area in the Indian Ocean and some of the landing areas in the Pacific Ocean were not



analyzed in the Starship-Super Heavy LC-39A Revised BCA because no ESA species protected under USFWS jurisdiction are present, as verified in IPaC searches.

Table 3.8-2 identifies ESA-listed species under NMFS jurisdiction with potential occurrence in the study area, including portions of the Atlantic Ocean, Pacific Ocean, and Indian Ocean, as identified in the *Biological Assessment [BA] of SpaceX Starship-Super Heavy Launch Vehicle and Reentry Operations to Support Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service* (hereafter referred to as the NMFS Starship BA) (SpaceX, 2024a) and *Conference and Biological Opinion on SpaceX Starship-Super Heavy Increased Launch Cadence and Operations in the North Atlantic Ocean, Gulf of Mexico (non-U.S. waters), Gulf of America, North Pacific Ocean, South Pacific Ocean, and Indian Ocean Authorized by the Federal Aviation Administration* (hereafter referred to as the NMFS Increased Cadence BO) (NMFS, 2025a). Additional information on the species in the table is provided in the NMFS Starship BA (SpaceX, 2024a), NMFS Increased Cadence BO (NMFS, 2025a), KSC ERD (NASA, 2020b), SLD 45 INRMP (USSF, 2023b), CANA Final GM/EIS (NPS, 2014b), *Incidental Harassment Authorization (IHA) Application for SpaceX Starship-Super Heavy Launch Vehicle and Reentry Operations* (hereafter referred to as the SpaceX IHA application) (SpaceX, 2024b), and *Atlantic Fleet Training and Testing EIS/Overseas EIS* (DoN, 2018a). Note that the current NMFS Increased Cadence BO is an update to an earlier version of the BO (NMFS, 2025b), with revisions based on addendum requests related to contingency Starship landings in the Atlantic Ocean, including expansion of the Atlantic Ocean Action Area from no closer than 5 nautical miles to no closer than 1 nautical mile from shore (50 miles [80 kilometers] north and south of LC-39A) (FAA, 2025c; FAA, 2025d; FAA, 2025e).

Dozens of marine mammal species occur in the study area, including whales, dolphins, manatees, seals, and sea lions (Appendix C.3, *Biological Resources Supplemental Information*). All species are protected under the MMPA. As indicated in Table 3.8-2, several species are protected under the ESA as well. Marine mammals are found in all water depths and may occur individually, in small groups, or in pods of hundreds of animals. Species that occur in the Atlantic Ocean and Pacific Ocean landing areas are identified in the SpaceX IHA application (SpaceX, 2024b) and NMFS stock assessment reports (Caretta, et al., 2023; Hayes et al., 2023). Species that occur in the Indian Ocean landing area are identified in the SpaceX IHA application (SpaceX, 2024b) and *Tiered EA for SpaceX Starship Indian Ocean Landings* (FAA, 2024a), with source data in the tiered EA from density modeling in support of the U.S. Navy's *Supplemental EIS for Operation of Surveillance Towed Array Sensor System Low Frequency Active Sonar* (DoN, 2019). The bottlenose dolphin and West Indian manatee are the only marine mammals with expected occurrence in estuarine waters near LC-39A; these species were identified by reviewing distribution information in the SLD 45 INRMP (USSF, 2023b) and on the NOAA Fisheries species website (NOAA Fisheries, 2025).

**Table 3.8-2. ESA-Protected Species under NMFS Jurisdiction with Potential to Occur in Study Area**

| Common Name<br>(Scientific Name)                              | Distinct Population<br>Segment                           | Atlantic<br>Ocean<br>(Starship<br>contingency<br>landing<br>area) | Atlantic<br>Ocean<br>(greater<br>than 5<br>NM<br>offshore) | Pacific<br>Ocean | Indian<br>Ocean | Federal<br>Status |
|---------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------|------------------|-----------------|-------------------|
| <b>Fishes</b>                                                 |                                                          |                                                                   |                                                            |                  |                 |                   |
| Atlantic sturgeon ( <i>Acipenser oxyrinchus oxyrinchus</i> )  | Carolina, South Atlantic, Chesapeake Bay, New York Bight | x                                                                 | x                                                          | -                | -               | E                 |
|                                                               | Gulf of Maine                                            | -                                                                 | x                                                          | -                | -               | T                 |
| Giant manta ray ( <i>Manta birostris</i> )                    | -                                                        | x                                                                 | x                                                          | x                | x               | T                 |
| Nassau grouper ( <i>Epinephelus striatus</i> )                | -                                                        | x                                                                 | x                                                          | -                | -               | T                 |
| Oceanic whitetip shark ( <i>Carcharhinus longimanus</i> )     | -                                                        | -                                                                 | x                                                          | x                | X               | T                 |
| Scalloped hammerhead shark ( <i>Sphyrna lewini</i> )          | Central and Southwest Atlantic                           | -                                                                 | x                                                          | -                | -               | T                 |
|                                                               | Eastern Pacific                                          | -                                                                 | -                                                          | x                | -               | E                 |
|                                                               | Indo-West Pacific                                        | -                                                                 | -                                                          | -                | X               | T                 |
| Smalltooth sawfish ( <i>Pristis pectinata</i> )               | -                                                        | x                                                                 | x                                                          | -                | -               | E                 |
| <b>Sea Turtles</b>                                            |                                                          |                                                                   |                                                            |                  |                 |                   |
| Green sea turtle ( <i>Chelonia mydas</i> ) <sup>1</sup>       | North Atlantic                                           | x                                                                 | x                                                          | -                | -               | T                 |
|                                                               | East Pacific, Central North Pacific                      | -                                                                 | -                                                          | x                | -               | T                 |
|                                                               | East Indian-West Pacific, North Indian, Southwest Indian | -                                                                 | -                                                          | -                | x               | T (Foreign)       |
| Hawksbill sea turtle ( <i>Eretmochelys imbricata</i> )        | -                                                        | x                                                                 | x                                                          | x                | x               | E                 |
| Kemp's ridley sea turtle ( <i>Lepidochelys kempii</i> )       | -                                                        | x                                                                 | x                                                          | -                | -               | E                 |
| Leatherback sea turtle ( <i>Demochelys coriacea</i> )         | -                                                        | x                                                                 | x                                                          | x                | x               | E                 |
| Loggerhead sea turtle ( <i>Caretta caretta</i> ) <sup>2</sup> | Northwest Atlantic Ocean                                 | x                                                                 | x                                                          | -                | -               | T                 |
|                                                               | North Pacific Ocean                                      | -                                                                 | -                                                          | x                | -               | E                 |
|                                                               | South Pacific Ocean                                      | -                                                                 | -                                                          | x                | -               | E (Foreign)       |
|                                                               | North Indian Ocean                                       | -                                                                 | -                                                          | -                | x               | E (Foreign)       |
|                                                               | Southwest Indian Ocean, Southeast Indo-Pacific Ocean     | -                                                                 | -                                                          | -                | x               | T (Foreign)       |
| Olive ridley sea turtle ( <i>Lepidochelys olivacea</i> )      | -                                                        | -                                                                 | -                                                          | x                | x               | E/T <sup>3</sup>  |

**Table 3.8-2. ESA-Protected Species under NMFS Jurisdiction with Potential to Occur in Study Area**

| Common Name<br>(Scientific Name)                                          | Distinct Population<br>Segment   | Atlantic<br>Ocean<br>(Starship<br>contingency<br>landing<br>area) | Atlantic<br>Ocean<br>(greater<br>than 5<br>NM<br>offshore) | Pacific<br>Ocean | Indian<br>Ocean | Federal<br>Status |
|---------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------|------------------------------------------------------------|------------------|-----------------|-------------------|
| <b>Marine Mammals (species additionally protected under the MMPA)</b>     |                                  |                                                                   |                                                            |                  |                 |                   |
| Blue whale/pygmy blue whale<br>( <i>Balaenoptera musculus</i> )           | -                                | -                                                                 | x                                                          | x                | x               | E, MMPA           |
| False killer whale ( <i>Pseudorca<br/>crassidens</i> )                    | Main Hawaiian<br>Islands Insular | -                                                                 | -                                                          | x                | -               | E, MMPA           |
| Fin whale ( <i>Balaenoptera physalus</i> )                                | -                                | -                                                                 | x                                                          | x                | x               | E, MMPA           |
| Guadalupe fur seal ( <i>Arctocephalus<br/>townsendii</i> )                | -                                | -                                                                 | -                                                          | x                | -               | T, MMPA           |
| Hawaiian monk seal ( <i>Neomonachus<br/>schauinslandi</i> )               | -                                | -                                                                 | -                                                          | x                | -               | E, MMPA           |
| Humpback whale ( <i>Megaptera<br/>novaeangliae</i> )                      | Central America                  | -                                                                 | -                                                          | x                | -               | E, MMPA           |
|                                                                           | Mexico                           | -                                                                 | -                                                          | x                | -               | T, MMPA           |
| North Atlantic right whale<br>( <i>Eubalaena glacialis</i> ) <sup>2</sup> | -                                | x                                                                 | x                                                          | -                | -               | E, MMPA           |
| Sei whale ( <i>Balaenoptera borealis</i> )                                | -                                | -                                                                 | x                                                          | x                | x               | E, MMPA           |
| Sperm whale ( <i>Physeter<br/>macrocephalus</i> )                         | -                                | -                                                                 | x                                                          | x                | x               | E, MMPA           |

Notes: - = not applicable; BCA = Biological and Conference Assessment; DPS = distinct population segment; E = endangered; ESA = Endangered Species Act; LC-39A = Launch Complex 39A; MMPA = Marine Mammal Protection Act; NM = nautical miles; NMFS = National Marine Fisheries Service; T = threatened; USFWS = United States Fish and Wildlife Service; x = potential to occur.

<sup>1</sup> The study area overlaps proposed critical habitat for this species.

<sup>2</sup> The study area overlaps designated critical habitat for this species.

<sup>3</sup> Olive ridley sea turtles belonging to Mexico's Pacific Coast breeding populations are considered endangered by NMFS. All other populations are considered threatened. Accordingly, olive ridleys in the southeast Pacific Ocean Starship Landing Area are endangered and are threatened in other portions of the study area.

Sources: USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*; (SpaceX, 2024a; SpaceX, 2024b; NMFS, 2025a; NOAA Fisheries, 2025)

### **Critical Habitat**

Designated and proposed critical habitat occurs in the Study Area for the piping plover, red knot, Florida bonneted bat, West Indian manatee, green sea turtle, loggerhead sea turtle, and North Atlantic right whale (Figure 3.8-3 and Figure 3.8-4). Figure 3.8-5 shows designated and proposed critical habitat in relation to Port Canaveral, barge and boat routes, and the KSC Turn Basin. There is no designated or proposed critical habitat within the Pacific Ocean and Indian Ocean landing areas. The USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, contains maps showing designated and potential critical habitat areas under USFWS jurisdiction in relation to construction areas; plume, noise, and sonic boom contours; and ocean landing areas. Information on sources of critical habitat descriptions for these species is provided in Table 3.8-3.

**Table 3.8-3. Designated and Proposed Critical Habitat Information Sources**

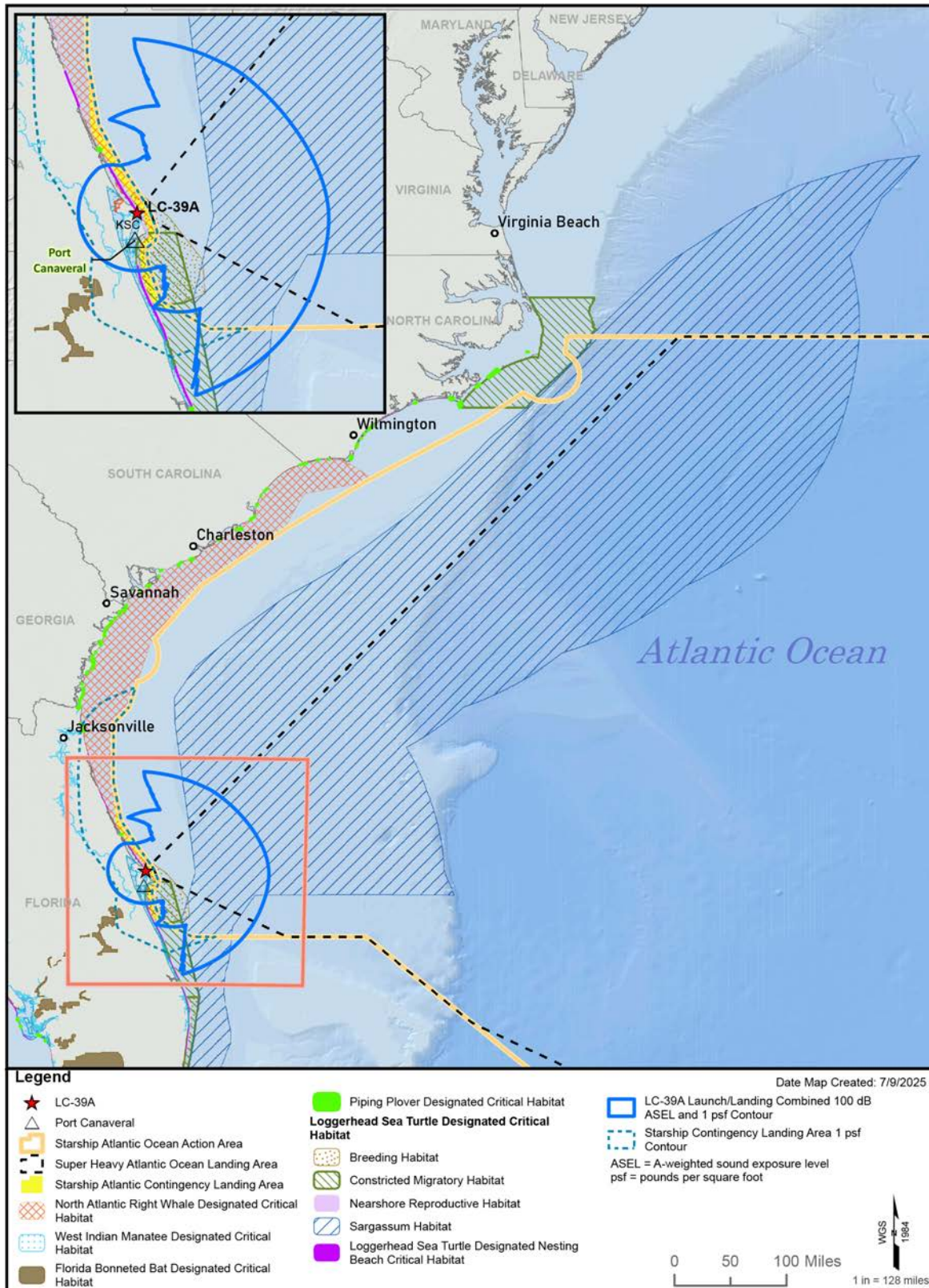
| Species                                                      | Information Sources                                                                                                                                                                                         | Critical Habitat Status |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| Piping plover<br>( <i>Charadrius melodus</i> )               | USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, <i>Endangered Species Act Section 7 Consultation (USFWS)</i> ; 66 Federal Register 36038                                                     | Designated              |
| Red knot<br>( <i>Calidris canutus rufa</i> )                 | USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum in Appendix B.1, <i>Endangered Species Act Section 7 Consultation (USFWS)</i> ; 86 Federal Register 37410; 88 Federal Register 22530       | Proposed                |
| Florida bonneted bat<br>( <i>Eumops floridanus</i> )         | USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, <i>Endangered Species Act Section 7 Consultation (USFWS)</i> ; 89 Federal Register 16624                                                     | Designated              |
| West Indian manatee<br>( <i>Trichechus manatus</i> )         | USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum in Appendix B.1, <i>Endangered Species Act Section 7 Consultation (USFWS)</i> ; 42 Federal Register 47840                                  | Designated              |
| West Indian manatee<br>( <i>Trichechus manatus</i> )         | USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum in Appendix B.1, <i>Endangered Species Act Section 7 Consultation (USFWS)</i> ; 89 Federal Register 78134                                  | Proposed                |
| Green sea turtle<br>( <i>Chelonia mydas</i> )                | USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum (Appendix B.1, <i>Endangered Species Act Section 7 Consultation (USFWS)</i> ); NMFS Starship BA (SpaceX, 2024a); 88 Federal Register 46572 | Proposed                |
| Loggerhead sea turtle<br>( <i>Caretta caretta</i> )          | USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum (Appendix B.1, <i>Endangered Species Act Section 7 Consultation (USFWS)</i> ); NMFS Starship BA (SpaceX, 2024a); 79 Federal Register 39856 | Designated              |
| North Atlantic right whale<br>( <i>Eubalaena glacialis</i> ) | NMFS Starship BA (SpaceX, 2024a); addendum requests for the NMFS Increased Cadence Conference and Biological Opinion (FAA, 2025c; FAA, 2025d; FAA, 2025e); 81 Federal Register 4838                         | Designated              |

Notes: BA = Biological Assessment; BCA = Biological and Conference Assessment; LC-39A = Launch Complex 39A; NMFS = National Marine Fisheries Service; USFWS = United States Fish and Wildlife Service.

### **Essential Fish Habitat**

EFH and habitat areas of particular concern (HAPC), which are subsets of EFH that provide extremely important ecological functions or that are especially vulnerable to degradation, occur in estuarine waters near LC-39A, the Super Heavy Atlantic Ocean Landing Area, and the Starship Atlantic Ocean Action Area. The Pacific Ocean Starship Landing Area occurs entirely outside the Hawaii EEZ and, therefore, does not contain EFH. Three FMCs have jurisdiction over various managed species found in the study area (South Atlantic FMC, Mid-Atlantic FMC, and New England FMC). In addition, EFH for highly migratory species (e.g., billfish and sharks) is present. NMFS has management authority for highly migratory species. EFH and HAPC in estuarine waters potentially affected by plumes consists of the water column and bottom habitats including sediments, seagrass, algae, emergent wetland vegetation, mangroves, and oyster reefs/shell banks. EFH and HAPC occur in the Super Heavy and Starship Atlantic Ocean Landing Areas for numerous species and life stages and consist of the water column and most bottom habitats, including soft and coarse substrates, hard structure, vegetation, sponge communities, floating *Sargassum*, and deep-water corals. Refer to the LC-39A Starship EFH Assessment (Appendix B.2, *Essential Fish Habitat Assessment (NMFS)*) for more details.

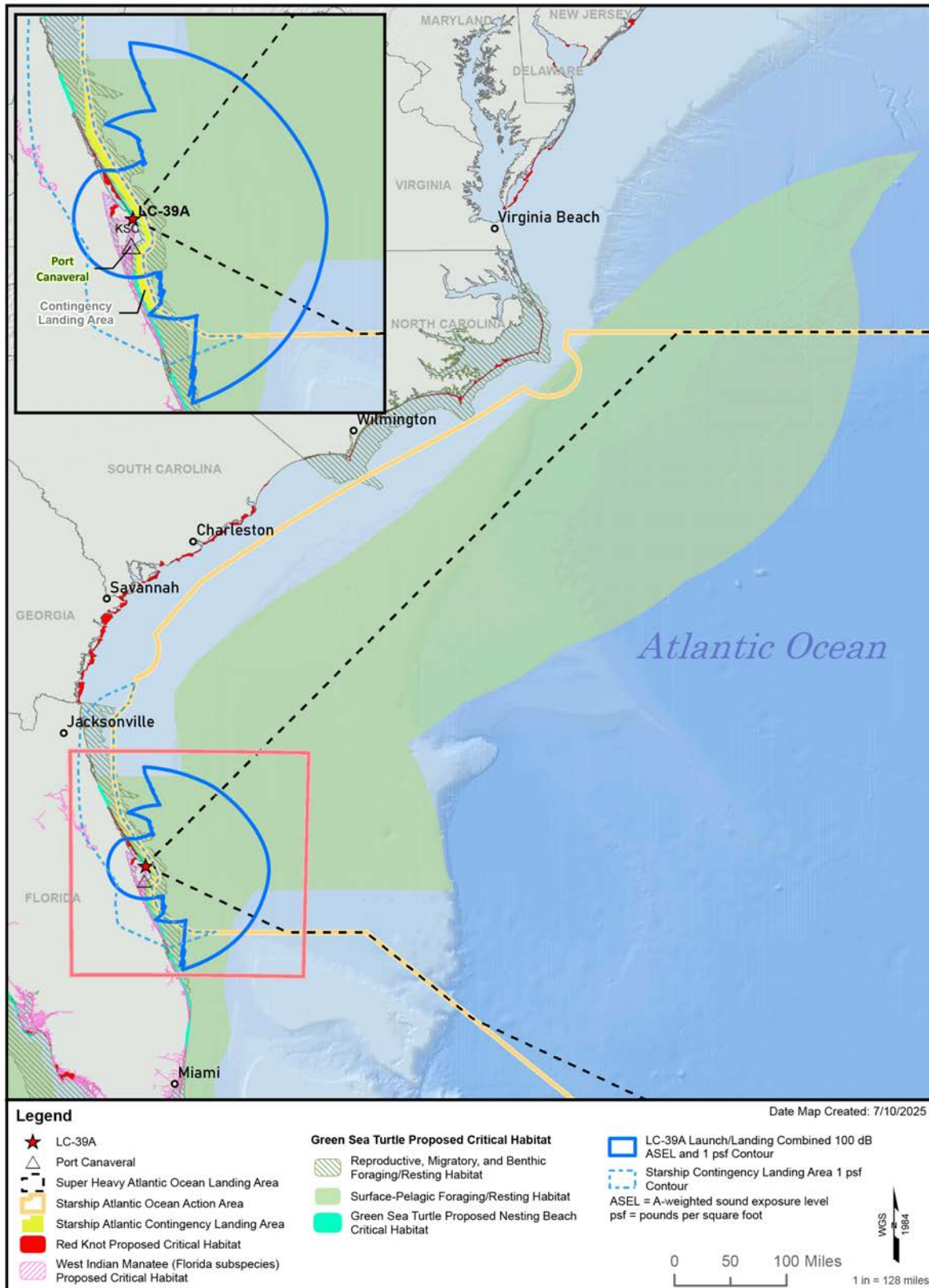




Sources: (USFWS, 1977; NOAA, 2014; NOAA, 2016; USFWS, 2023a; USFWS, 2024a; USFWS, 2025)

Figure 3.8-3. Designated Critical Habitat in the Study Area

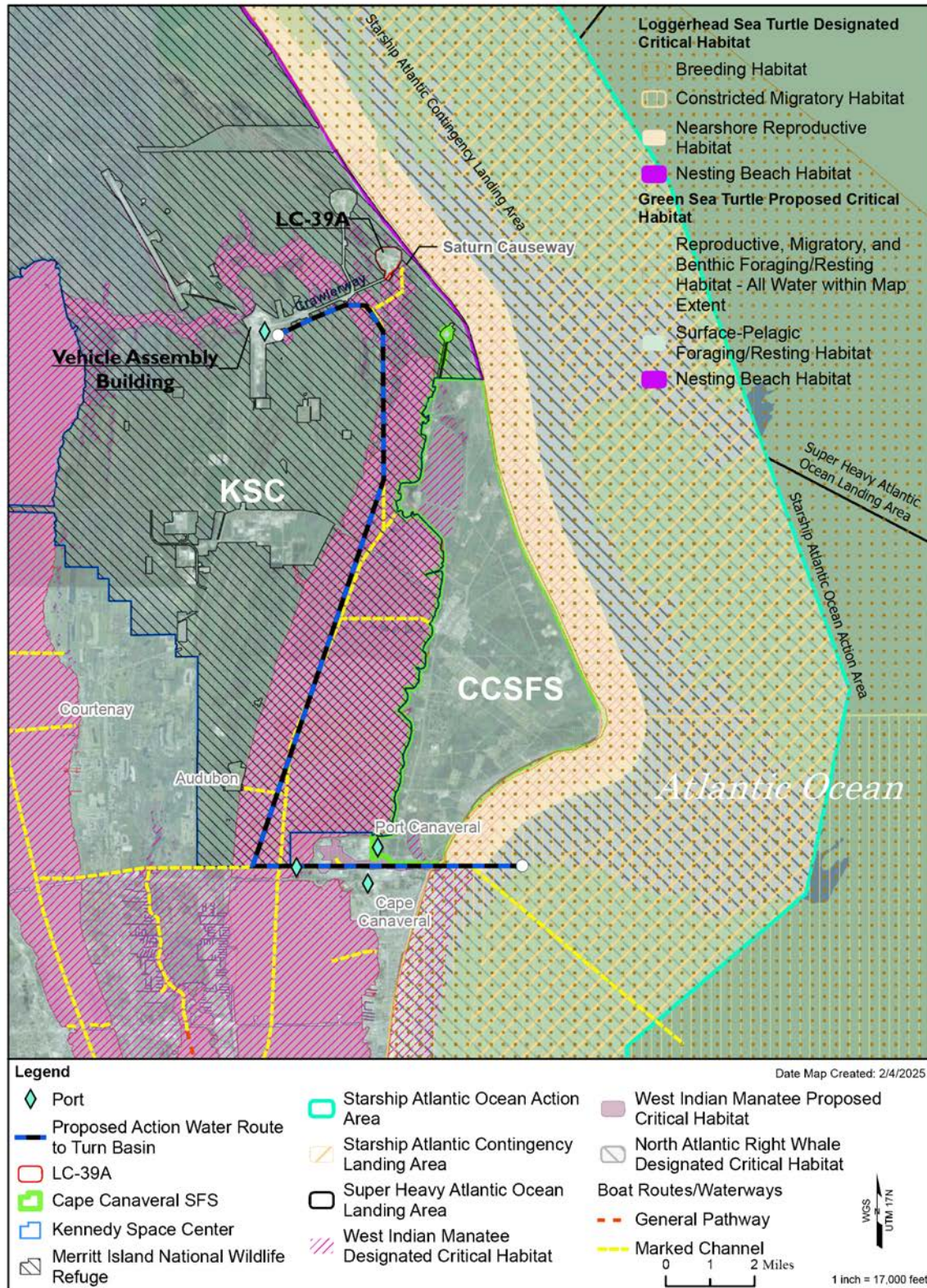




Sources: (NOAA, 2023a; USFWS, 2023b; USFWS, 2023c; USFWS, 2024b)

Figure 3.8-4. Proposed Critical Habitat in the Study Area





Sources: (USFWS, 1977; NOAA, 2016; USFWS, 2024b)

Figure 3.8-5. Designated and Proposed Critical Habitat in the Context of Barge and Other Vessel Transit Routes

### **State-Protected Species**

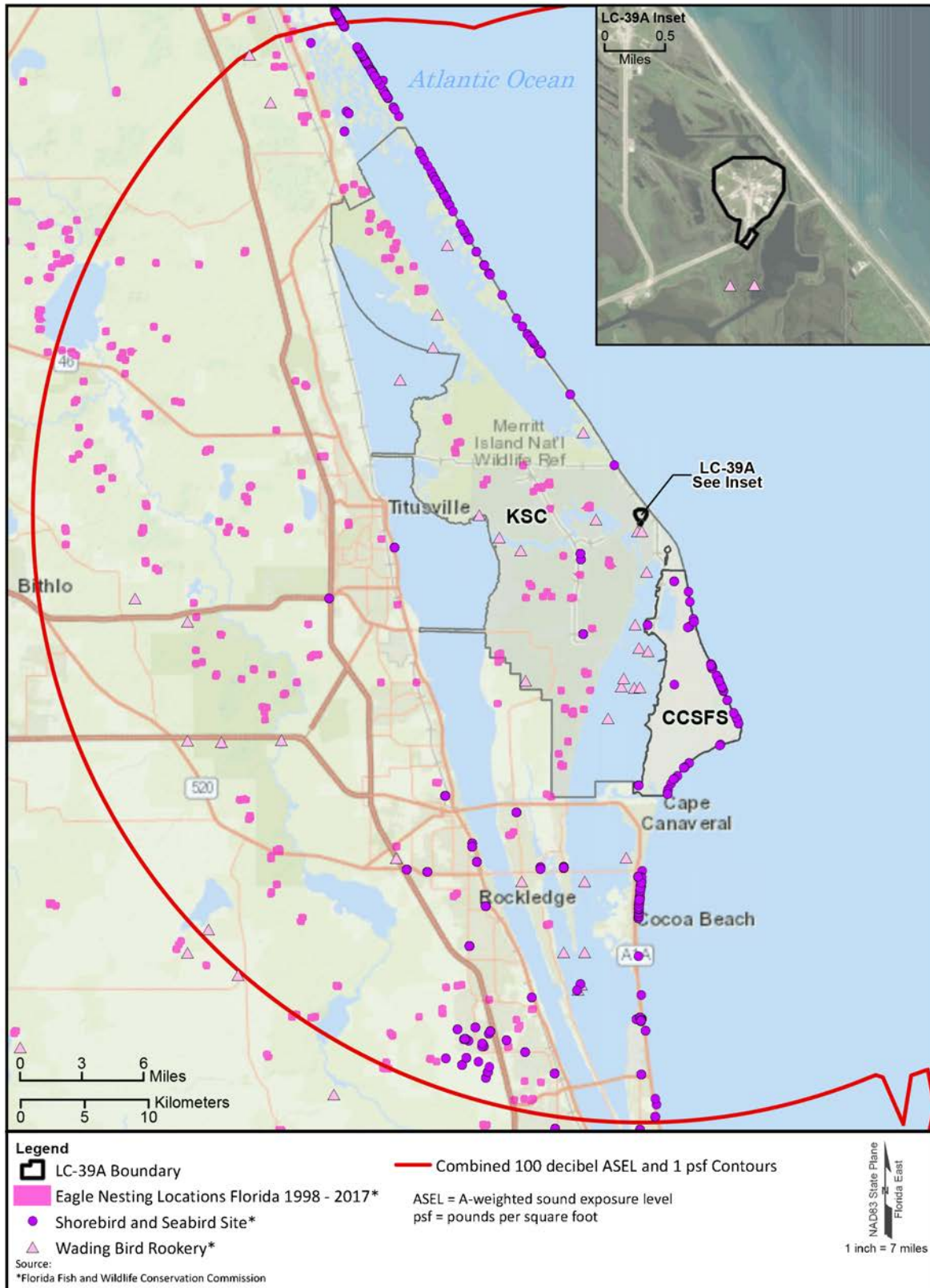
Inquiries of the internet-based FNAI Searchable Field Guides and Tracking List yielded a total of 43 state-listed animal species that may occur in the counties that are at least partially within the biological study area for the Proposed Action, including 1 amphibian species, 19 bird species, 1 crustacean species, 3 fish species, 5 mammal species, and 14 reptile species (FNAI, 2025). See Table C.3-1 in Appendix C.3, *Biological Resources Supplemental Information*, for a listing of the species that may occur within each county. State-protected plant and animal species potentially found at KSC, MINWR, CCSFS, SJNWR, and CANA are listed in the KSC ERD (NASA, 2020b), SLD 45 INRMP (USSF, 2023b), MINWR CCP (USFWS, 2008), SJNWR CCP (USFWS, 2011), and CANA Final GM/EIS (NPS, 2014b). The Florida Fish and Wildlife Conservation Commission Imperiled Species website (<https://myfwc.com/wildlifehabitats/wildlife/>) provides species profiles and information on the management of imperiled fish and wildlife species in Florida. The FNAI website for Florida Rare Species Field Guides (<https://www.fnai.org/species-communities/species-guides/field-guides-main>) includes rare plant and animal species descriptions, habitat information, photos, maps, and management information.

### **Migratory Birds and Bald Eagles**

The term *migratory birds* includes almost all wild native birds found in the United States excluding resident game birds, which are managed by each state. Non-native species are also excluded. The study area is situated along the Atlantic Flyway for migratory birds and thus supports a wide variety of migratory birds, changing throughout the year as birds move north and south seasonally. Various songbirds, shorebirds, wading birds, and other types of migratory birds utilize the wetland, shoreline, and upland habitats within the study area for foraging, nesting, and roosting. Reports run in the IPaC tool for the biological study area identified 76 migratory bird species that may warrant special attention within the 1-psf/100-dB ASEL contour around LC-39A, 1-psf contour around the Atlantic contingency landing area, and Atlantic landing area, 40 of which are Birds of Conservation Concern (BCC) (see IPaC appendix of the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*). Table C.3-2 in Appendix C.3, *Biological Resources Supplemental Information*, provides a listing of these migratory bird species, the portion of the study area where they may be found, and their breeding patterns. Most of these species occur within Bird Conservation Region 31 (Peninsular Florida), with a few in Marine Bird Conservation Region M19 (Southeast U.S. Continental Shelf and U.S. waters [M16] beyond the shelf). For the Pacific Ocean and Indian Ocean landing areas, the IPaC tool indicated that there were no USFWS migratory birds of concern within the vicinity of the project area, and the Rapid Avian Information Locator tool reported that insufficient data were available to produce results. Due to the distance from land, these portions of the study area likely support a limited number of seabird species and other transient species. The *Birds of Conservation Concern 2021, Migratory Bird Program* report provides a map and full list of the BCC within these regions (USFWS, 2021).

The 1-psf/100-dB ASEL contour around LC-39A includes multiple bald eagle nesting locations, wading bird rookeries, and shorebird and seabird sites (Figure 3.8-6). The study area supports multiple species of terns, sparrows, petrels, warblers herons, egrets, plovers, woodpeckers, and other bird species that utilize the variety of habitats at KSC and surrounding areas; see the MINWR Bird List (USFWS, 2019), KSC ERD (NASA, 2020b), SLD 45 INRMP (USSF, 2023b), SJNWR CCP (USFWS, 2011), and CANA Final GM/EIS (NPS, 2014b) for listings of the bird species that have been documented at MINWR, KSC, CCSFS, SJNWR, and CANA.





Sources: (FWC, 2015; FWC, 2023)

Figure 3.8-6. Bald Eagle Nesting Locations, Wading Bird Rookeries, and Shorebird and Seabird Sites

## **General Wildlife and Habitats**

### **Terrestrial and Estuarine Wildlife and Habitats**

This section discusses the general wildlife and habitats found within the terrestrial and estuarine portions of the Study Area. Resources that have Federal protected status (e.g., ESA, MBTA) are discussed in preceding sections. The predominant land cover category within the Study Area is bays and estuaries, followed by residential, freshwater marshes, commercial and services, lakes, mixed wetland hardwoods, and highways (SJRWMD, 2024). The IRL system makes up a large portion of the area affected by the 1-psf/100-dB ASEL contour around LC-39A, consisting of the Mosquito Lagoon, Banana River, and Indian River. Most of the non-Federal lands along the shorelines of the IRL system and the Atlantic Ocean are residential and commercial development. The St. Johns River and adjacent St. Johns River Water Management District Conservation Areas and the SJNWR cover much of the western portion of the Study Area around LC-39A, with vast areas of emergent and forested wetlands, as well as upland areas of oak scrub and pine flatwoods.

Over 280 species of wildlife have either been documented to occur or have the potential to occur within the St Johns River Upper Basin, including more than 50 fish species and large wading bird colonies. The *Upper St. Johns River Surface Water Improvement and Management Plan* and the SJNWR CCP provide additional information on the types of habitats and wildlife that occur within the western portion of the Launch Study Area (SJRWMD, 2007; USFWS, 2011).

The KSC ERD (NASA, 2020b) and SLD 45 INRMP (USSF, 2023b) provide the environment (upland/wetland), origin (native/exotic), and acreages of land cover types present on KSC and CCSFS, as well as descriptions for each land cover type. The MINWR CCP (USFWS, 2008) and the CANA Final GMP/EIS (NPS, 2014b) provide information on the habitats found at MINWR and CANA. Oak-palmetto scrub and flatwoods are the predominant upland communities at KSC, MINWR, and CCSFS. KSC contains approximately 20,000 acres (8,094 hectares) of scrub and flatwoods, and there are approximately 3,800 acres (1,538 hectares) of mowed ruderal herbaceous areas onsite, primarily around buildings and facilities, rights-of-way, solar array fields, and recreation areas. Wetlands found at KSC, MINWR, CCSFS, and CANA include freshwater marshes, hardwood and mixed swamps, estuarine and palustrine scrub-shrub wetlands, saltwater marshes, and mangrove swamps. These Federal lands are surrounded by the IRL system and the Atlantic Ocean. At KSC, long, narrow freshwater marshes are interspersed among bands of uplands. See Section 3.9, *Water Resources*, of the EIS for additional information on wetlands and waterbodies within the study area.

KSC, MINWR, CCSFS, and CANA support a rich diversity of fish and wildlife species. The IRL system supports amongst the highest biodiversity of any estuary in North America, with over 400 fish species (One Lagoon, 2019). Over 70 species of amphibians and reptiles have been documented at KSC, and almost 320 species of birds have been documented onsite. Terrestrial mammals found within the study area include bobcats (*Lynx rufus*), coyotes, river otters (*Lontra canadensis*), bats (various species), and raccoons (*Procyon lotor*), among others. Bottlenose dolphins (*Tursiops truncatus*) and manatees (*Trichechus manatus*) occur in adjacent waters of the IRL. The vascular fauna of KSC includes over 1,000 taxa, 20 percent of which are non-native species. Listings of the flora and fauna at KSC and adjoining Federal properties are available in the KSC ERD (NASA, 2020b), SLD 45 INRMP (USSF, 2023b), *MINWR CCP* (USFWS, 2008), MINWR Bird List (USFWS, 2019), and CANA Final GMP/EIS (NPS, 2014b).



During the last two decades, erosion along the KSC coastline near LC-39A and LC-39B has increased due to frequent storm surges from nor'easters, tropical storms, and hurricanes. Erosion is exacerbated by rising sea levels, which have exceeded 5 inches (13 centimeters) in the last 10 years. Recently, the area has been categorized as “critically eroded” by the FDEP, and crucial habitat for several protected species is at risk due to the loss of primary and secondary dunes and adjacent coastal strand and scrub. To address this shoreline erosion, over the past 10 years NASA has built a series of dunes to reinforce the natural coastal barrier system (NASA, 2020b).

### Marine Wildlife and Habitats

The marine portion of the study area refers to the ocean landing areas in the Atlantic, Pacific, and Indian Oceans, as well as the ocean areas within the 100 dB ASEL/1 psf contour (Figure 3.8-2). Wildlife and habitats in these areas are summarized below. The 2020 Falcon EA (FAA, 2020), *Tiered Environmental Assessment for SpaceX Starship Indian Ocean Landings* (FAA, 2024a), *Final Environmental Assessment for Kennedy Space Center Shoreline Protection Project* (NASA, 2015), and EISs/Overseas EISs prepared for U.S. Navy operations in the Atlantic Ocean and Pacific Ocean (DoN, 2018a; DoN, 2018b) provide additional detail. Marine resources that have Federal protected status (e.g., marine mammals and sea turtles) are discussed in preceding sections.

Marine habitats consist of the entire water column, seafloor, and various structured habitats. The nearshore and inner continental shelf offshore of KSC is composed mostly of sand and mud substrate interspersed with hard bottom areas that may support invertebrate and fish communities. Bottom habitats in the landing areas similarly consist primarily of soft sediments, with hard bottom habitat present in some areas. Artificial structures include shipwrecks and artificial reefs. Topographic features, such as the continental shelf break, slopes, canyons, and seamounts, may influence species occurrence due to hydrodynamic effects (e.g., currents and upwellings). Canyons occur along the continental shelf edge of the northern portion of the Atlantic Ocean landing area (Packer et al., 2017). Seamounts occur throughout the northern Pacific Ocean, southeastern Pacific Ocean, and Indian Ocean. Biotic habitats include floating macroalgae and invertebrate beds or structures. Deep-water corals occur in areas with appropriate substrate and physical conditions, forming mounds that support fish and invertebrate populations (SOI, 2024; MCBI, n.d.; USGS, n.d.). Extensive zones of deep-water corals occur within the Atlantic Ocean landing area at the Blake Plateau, *Oculina* Bank, and Stetson-Miami Terrace (refer to Appendix B.2, *Essential Fish Habitat Assessment (NMFS)*, for information on the location of deep-water corals). Many mammal, reptile, fish, invertebrate, and bird species occur in various habitats offshore of KSC and in the ocean landings areas. Marine invertebrates are abundant on the seafloor and occur in all water depths. Fishes are the most numerous and diverse vertebrate group in the oceans and occur throughout the water column and in all seafloor habitats. However, the density of large fish species near the surface is low. On the seafloor, hard bottom habitats support higher fish densities than areas of loose sediments. In addition, fish abundance generally decreases with depth. Seabirds, which forage on or in the open ocean, occur throughout the ocean landings areas. Abundance is typically greater near ocean features that concentrate prey (e.g., upwelling zones).

## 3.8.4 Environmental Consequences

### ***Analysis Methodology***

This section addresses the potential effects of the Proposed Action on biological resources, including effects related to construction, static fire tests, launches, landings, and daily operations at LC-39A, as well as expended vehicles, landings, and recoveries in Atlantic, Pacific, and Indian Ocean areas. Under the FAA's significance threshold, effects 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 (FAA, 2023b). The FAA has not established a significance threshold for non-listed species but has identified additional factors to consider when evaluating the context and intensity of potential effects (FAA, 2023b). These factors include whether the action would have the potential to cause any of 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 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), or ability to sustain the minimum population levels required for population maintenance

### 3.8.4.1 No Action

Under the No Action Alternative, the FAA would not issue SpaceX a new license or modify their existing license for operation of the Starship-Super Heavy at LC-39A. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Operations at the site would continue, consistent with existing conditions, including Falcon 9 and Falcon Heavy launches. There would be no additional construction or development associated with Starship-Super Heavy. The potential for noise, sonic boom overpressure, heat and vapor plumes, habitat damage, artificial lighting, near-surface explosions, and general disturbance to affect wildlife in the LC-39A launch area and in ocean landing areas, as applicable, would continue as evaluated in existing NEPA documents and regulatory consultations. There would be no significant effects to biological resources from the No Action Alternative.

### 3.8.4.2 Proposed Action

#### ***3.8.4.2.1 Stressors Associated with the Proposed Action***

Effect determinations and detailed discussions of potential effects to fish and wildlife species from the stressors summarized in Table 3.8-4 are provided in the USFWS Starship-Super Heavy LC-39A Revised BCA

and USFWS Addendum (Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*), NMFS Starship BA (Appendix B.6, *Endangered Species Act Section 7 Consultation (NMFS)*), and NMFS Increased Cadence BO (NMFS, 2025b). As of this draft of the EIS, the consultation process is ongoing; once completed, information in the USFWS Section 7 Biological Opinion will be integrated into the EIS.

**Table 3.8-4. Stressors Associated with the Proposed Action and Biological Resources Potentially Affected**

| Stressor                               | Stressor Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Construction, Operation, Both | Biological Resources Potentially Affected                                                                                                                                                                   |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vegetation Disturbance/<br>Destruction | Vegetation disturbance or destruction from construction would be limited to inside the perimeter fence of LC-39A where only poor-quality habitat (i.e., paved areas, ruderal vegetation) would be affected. Stormwater management measures would ensure that excess sediment from bare areas did not affect surrounding habitats or species.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Construction                  | Manatees<br>Sea turtles (juveniles in estuarine waters)<br>Southeastern beach mice<br>Monarch butterfly<br>Other terrestrial and estuarine species and habitats                                             |
| Noise and Visual Stimuli               | The Proposed Action would expose species to the noise and visual disturbance of construction, daily operations, static fire tests, launches, and landings. Some facilities, such as the ASU and liquefaction facilities, generate noise that would be audible outside the LC-39A boundary. Noise effects on wildlife may include masking of biologically relevant sounds, stress, behavioral changes (e.g., startle), interference with mating or reproduction, impaired ability to obtain adequate food, cover, or water, population decline, habitat loss, or, in relatively rare cases, physiological changes to the auditory system. Although transmission of in-air sound into water is typically limited, in-water noise can cause behavioral responses and if it reaches a sufficient level, it can cause temporary or permanent threshold shifts in hearing. During the brief periods that certain aquatic species are at the surface, they would be more vulnerable to effects from in-air noise. | Both                          | All federally listed animal species<br>Migratory birds<br>Bald eagles<br>Other terrestrial, estuarine, and marine animal species                                                                            |
| Vibrations                             | Some energy from launches, landings, and static fire tests, as well as from some construction and maintenance equipment, would manifest as vibrations. Animals may startle, freeze, and/or temporarily avoid the area, and some individuals may permanently abandon nests, roosting sites, and foraging areas. Depending on frequency and duration, vibrations also may result in physiological effects for certain species, and may affect burrows (e.g., collapse) or incubating eggs (i.e., cracks, addling).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Both                          | Audubon's crested caracaras<br>Eastern black rails<br>Everglade snail kites<br>Florida scrub-jays<br>Piping plovers<br>Red knots<br>Manatees<br>Southeastern beach mice<br>Tricolored bats<br>Indigo snakes |

**Table 3.8-4. Stressors Associated with the Proposed Action and Biological Resources Potentially Affected**

| Stressor                | Stressor Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Construction, Operation, Both | Biological Resources Potentially Affected                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               | Sea turtles<br>Migratory birds<br>Bald eagles<br>Other terrestrial animal species and habitats                                                                                                                                                                                                                                                                                                            |
| Sonic Booms             | Due to the typical co-occurrence of noise, vibrations, and sonic boom overpressures, it can be difficult to separate effects, but startle and freeze responses are likely, particularly during initial exposures to sonic booms. Some animals may vacate their nests either temporarily or permanently, leaving eggs or young exposed to the weather or predators. Sonic booms may also reduce foraging efficiency and feeding time, interrupt communication, interfere with predator/prey detection, and cause animals to avoid the area. | Operation                     | All federally listed animal species<br>Migratory birds<br>Bald eagles<br>Other terrestrial, estuarine, and marine animal species                                                                                                                                                                                                                                                                          |
| Strikes/Collisions      | Strikes by vehicles and equipment during construction and daily operations would result in some level of wildlife injuries and deaths, both onsite and on roads leading to the site. Collisions with new structures, particularly tall structures and lighted structures, or strikes by launch vehicles may result in the injury or death of birds and bats. Boat/barge strikes could injure or kill individual aquatic animals. Although unlikely, a direct strike by a landing in ocean areas could injure or kill a marine animal.      | Both                          | Audubon's crested caracaras<br>Eastern black rails<br>Everglade snail kites<br>Florida scrub-jays<br>Piping plovers<br>Red knots<br>Seabirds<br>Monarch butterfly<br>Manatees<br>North Atlantic right whales<br>Southeastern beach mice<br>Tricolored bats<br>Indigo snakes<br>Sea turtles<br>Marine mammals<br>Migratory birds<br>Bald eagles<br>Other terrestrial, estuarine, and marine animal species |
| Deluge Water and Plumes | The vegetation around the launch and landing areas affected by the plumes may be damaged or killed by elevated temperatures, exhaust, condensed water, and possibly small wildfires. Plume effects would not extend to dune or beach areas. Ponds at LC-39A would contain the spraying                                                                                                                                                                                                                                                     | Operation                     | Audubon's crested caracaras<br>Eastern black rails<br>Everglade snail kites<br>Piping plovers<br>Red knots                                                                                                                                                                                                                                                                                                |

**Table 3.8-4. Stressors Associated with the Proposed Action and Biological Resources Potentially Affected**

| Stressor                      | Stressor Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Construction, Operation, Both | Biological Resources Potentially Affected                                                                                                                                                                                                                                                                                                                         |
|-------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                               | deluge water within the fence line, so deluge water would not affect nearby estuarine waters. The several seconds of spraying deluge water within the boundaries of LC-39A may startle animals or compel them to cease foraging, resting, or other behaviors and move away from the disturbance. Because the engines of the Starship-Super Heavy use liquid oxygen and liquid methane as propellants, animals would not be exposed to contaminants in the vapor cloud, but individual animals caught within static fire test, launch, or landing plumes may be injured or die due to thermal stress.                                                                                                                                                     |                               | Seabirds<br>Manatees<br>Migratory birds<br>Other terrestrial and estuarine species                                                                                                                                                                                                                                                                                |
| Artificial Lighting           | Nighttime lighting during construction and operations, as well as light generated during night launches and landings, may disorient animals and interrupt normal behaviors. Artificial lighting may cause temporary or permanent abandonment of nesting, roosting, and foraging areas by birds, bats, and other animals. Tower lighting has the potential to disorient birds and bats, causing them to circle the lights to exhaustion or to fly into the lights. If there are inland man-made light sources visible from the beach, hatchling sea turtles may mistakenly crawl landward instead of toward the sea, resulting in mortalities from predators or from becoming too dry. Artificial lighting can also deter or disturb nesting sea turtles. | Both                          | Audubon's crested caracaras<br>Eastern black rails<br>Everglade snail kites<br>Florida scrub-jay<br>Piping plovers<br>Red knots<br>Seabirds<br>Southeastern beach mice<br>Tricolored bats<br>Sea turtles<br>Migratory birds<br>Other terrestrial and marine animal species<br>Loggerhead critical habitat (final)<br>Green sea turtle critical habitat (proposed) |
| Hazardous Materials           | Animal exposure to an accidental release of hazardous materials (e.g., equipment fuel spill) could result injury, sickness, or death. The main propellants used for launch operations, liquid oxygen and liquid methane, are both gaseous at room temperature and thus would not contaminate vegetation or habitats if released. A small amount of eroded steel from engine ignitions would be locally contained onsite or dispersed in vapor.                                                                                                                                                                                                                                                                                                           | Both                          | All terrestrial, estuarine, and marine species and habitats                                                                                                                                                                                                                                                                                                       |
| Invasive Species Introduction | Construction and operation activities may introduce or spread invasive non-native plant species from equipment, fill, or landscaping materials. Such                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Both                          | All terrestrial species and habitats                                                                                                                                                                                                                                                                                                                              |



**Table 3.8-4. Stressors Associated with the Proposed Action and Biological Resources Potentially Affected**

| Stressor                                        | Stressor Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Construction, Operation, Both | Biological Resources Potentially Affected                                                                                                                                           |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                 | introductions could degrade habitats by altering native species composition and structure.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                               |                                                                                                                                                                                     |
| Restricted Access for Management and Monitoring | Launch-related closures may limit access to certain areas on a periodic basis. If such closures affect natural resources management (e.g., prescribed burning, species monitoring, feral hog control), management effectiveness, species health, and regulatory compliance could suffer. Updates to the 2025 Memorandum of Understanding for Prescribed Burning (SLD 45, USFWS, and KSC, 2025) removed prescribed burn restrictions related to non-critical payload transport or mating operations and reduced the burn buffer around smoke-sensitive facilities to 0.5-miles (0.8-kilometers); these updates greatly increase the opportunity to burn certain ecologically sensitive units to meet regulatory burn requirements. The Starship-Super Heavy LC-39A Biological Opinion is expected to include monitoring requirements that must be met. | Operation                     | Florida scrub-jays<br>Southeastern beach mice<br>Manatees<br>Indigo snakes<br>Sea turtles<br>Migratory birds<br>Bald eagles<br>Other terrestrial and estuarine species and habitats |

Notes: ASU = air separation unit; LC-39A = Launch Complex 39A.

#### 3.8.4.2.2 Construction

##### Federally Protected Species

As discussed in the subsequent *Terrestrial and Estuarine Wildlife and Habitats* subsection, construction activities would not affect estuarine waters or the nearshore Atlantic Ocean near LC-39A that is habitat for federally protected species under NMFS jurisdiction and construction noise would not be of sufficient intensity to affect federally protected species in estuarine or nearshore areas. Thus, federally protected species under NMFS jurisdiction are not discussed further for construction.

The Proposed Action would not involve clearing habitat used by any federally protected species, but construction noise, vibrations, lighting, runoff, and traffic to LC-39A may affect listed species in surrounding areas. Table 3.8-4 summarizes potential effects from each of these stressors and provides a list of the federally protected species potentially affected by each of the stressors associated with the Proposed Action. See the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, for additional discussion of potential construction effects on federally protected species under USFWS jurisdiction in the Launch Study Area. See Table 5-4 in the USFWS Starship-Super Heavy LC-39A Revised BCA (Appendix B.1) for distances from the construction area to the closest federally listed species. Maps illustrating the locations of federally protected species in relation to the Proposed Action construction area are available in the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1 (Figure 5-12, Figure 5-15, and Figure 5-28).

Construction work and launches are common disturbances at LC-39A, and the proposed construction activities would result in similar noise, visual stimuli, and vibrations effects. The number of individual federally listed birds, beach mice, bats, and indigo snakes that may be disturbed may increase. Although most construction work would occur during the day, any additional nighttime construction may result in increased disruption to listed animals, particularly sea turtles, beach mice, birds, and bats, which could be disoriented by the lighting. The introduction of invasive species from construction activities could degrade listed species' habitat and foraging resources, and indigo snakes and beach mice could be struck by construction equipment and vehicles.

Per the USFWS Starship-Super Heavy LC-39A Revised BCA (Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*), NASA has made the following effect determinations for construction activities: no effect for the black-capped petrel, red-cockaded woodpecker, whooping crane, Florida panther, puma, American alligator, American crocodile, Atlantic saltmarsh snake, beautiful pawpaw, Carter's mustard, Lewton's polygala, papery whitlow-wort, pigeon wings, pygmy fringe-tree, Rugel's pawpaw, and sandlace; not likely to jeopardize for the proposed monarch butterfly and tri-colored bat; may affect, not likely to adversely affect for the Audubon's crested caracara, eastern black rail, Everglade snail kite, piping plover, rufa red knot, wood stork, West Indian manatee, hawksbill sea turtle, Kemp's ridley sea turtle, and leatherback sea turtle; and may affect, likely to adversely affect for the eastern indigo snake, green sea turtle, loggerhead sea turtle, and southeastern beach mouse.

The potential for effects from construction noise, vibrations, lighting, runoff, and traffic on federally listed species would be minimized by the implementation of conservation measures in the USFWS Starship-Super Heavy LC-39A Revised BCA, including pre-construction surveys, natural resources training for construction contractors and employees, wildlife crossing awareness signs, lighting restrictions, and measures to prevent invasive species spread. Thus, with the implementation of conservation measures and requirements resulting from permits and ESA Section 7 consultation, the effects on federally protected species from construction would be less than significant.

#### Critical Habitat

Effects determination conclusions for critical habitat from the USFWS Starship-Super Heavy LC-39A Revised BCA are summarized here; refer to Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, for detailed impact analyses. Construction activities associated with the Proposed Action would have no effect on the primary constituent elements (PCEs) or physical and biological features (PBFs) listed for designated critical habitat for the piping plover, manatee, or North Atlantic right whale, or proposed critical habitat for the rufa red knot or manatee (Table 3-4 in the USFWS Starship-Super Heavy LC-39A Revised BCA). However, lighting that continues after dusk could affect sea turtle critical habitat, as beaches and adjacent waters that are sufficiently dark that nesting turtles are not deterred from emerging and nesting turtles and hatchlings orient to the sea are listed as PCEs for sea turtle nesting and nearshore reproductive critical habitat (Figure 5-28 in the USFWS Starship-Super Heavy LC-39A Revised BCA). NASA has made the determinations for construction activities of may affect, likely to adversely affect for loggerhead sea turtle nesting critical habitat, and no destruction or adverse modification for green sea turtle proposed nesting critical habitat (Appendix B.1).

SpaceX will work with NASA and the USFWS to update the LC-39A Lighting Operations Manual to minimize lighting effects to the greatest extent practicable, including measures such as conducting construction work primarily during daylight hours whenever possible, particularly during sea turtle nesting season.

Thus, with the implementation of conservation measures and requirements resulting from permits and ESA Section 7 consultation, the effects on critical habitat from construction would be less than significant.

#### Essential Fish Habitat

As discussed in the Terrestrial and Estuarine Wildlife and Habitats subsection and the LC-39A Starship EFH Assessment in Appendix B.2, *Essential Fish Habitat Assessment (NMFS)*, there would be no effect to estuarine waters, substrates, or shoreline vegetation that are EFH and HAPC from construction activities at LC-39A because of requirements in construction permits, stormwater permits, and spill prevention plan. A map of EFH in relation to the construction areas is available in the LC-39A Starship EFH Assessment in Appendix B.2, Figure 3-1). Effects to EFH and HAPC from construction would not be significant.

#### State-Protected Species

Any state-listed species occurring in the vicinity of the proposed construction activities may be disturbed by increased noise, visual stimuli, and vibrations. Nighttime lighting may disrupt normal behaviors of listed animals, particularly birds and bats, which could be disoriented by the lighting. The introduction of invasive species from construction activities could degrade listed species' habitat and foraging resources, and animals could be struck by construction equipment and vehicles. No state-protected plants are known to occur within LC-39A, so no effects are anticipated. The types and mechanisms of potential effects associated with construction activities described in Table 3.8-4, the Terrestrial and Estuarine Wildlife and Habitats subsection, and the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, would generally apply to state-protected species as well; see these resources for additional discussion of potential effects.

Near construction activities, state-listed species may alter behaviors, suffer injury or death, or have their habitats altered due to noise, visual stimuli, lighting, vibrations, invasive species, and vehicle collisions. However, these effects on state-protected species from construction would not reach significant levels.

#### Migratory Birds and Bald Eagles

The types and mechanisms of potential effects associated with construction activities described in Table 3.8-4, the *Terrestrial and Estuarine Wildlife and Habitats* subsection, and the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, would generally apply to migratory birds and bald eagles as well (e.g., behavioral changes, injury, death, habitat modification due to noise, visual stimuli, lighting, vibrations, invasive species, direct physical impacts). Migratory birds may occur at the site at any time of year but are more likely to be seen during the spring and fall migration periods. Currently, there are two wading bird rookeries located within 1 mile (1.6 kilometers) of the construction area. The closest eagle nest is approximately 2.5 miles (4.0 kilometers) from the construction area, and the closest shorebird and seabird site is almost 3 miles (4.8 kilometers) away (Figure 3.8-6).

Construction would be limited to within the boundaries of the LC-39A site, which already is a busy launch complex that contains multiple facilities and infrastructure. Minimal habitat loss would occur, and this construction would not represent a new type of disturbance in the area. NASA personnel would determine the need for pre-construction nest surveys and would coordinate any required permits if nest removal is deemed necessary.

Migratory birds may be attracted to artificial lighting at night and become disoriented and fatigued. To reduce such occurrences, SpaceX would minimize unnecessary lighting, particularly during spring and fall migratory periods, and red obstruction lighting for towers would comply with FAA Advisory Circular No. 70/7460-1M, Change 1 ([AC 70/7460-1M Chg 1](#)) (FAA, 2024c).

Near proposed construction activities, limited numbers of migratory birds and eagles may alter behaviors or suffer injury or death. However, construction is limited to within the boundaries of LC-39A which is already an active launch complex, permits would be obtained if nest removal was deemed necessary, and SpaceX would implement measures to reduce effects from artificial lighting, so construction would not affect the ability of bald eagles or any other migratory bird species to sustain population levels. Thus effects on migratory birds and eagles from construction would not reach significant levels.

### General Wildlife and Habitats

#### *Terrestrial and Estuarine Wildlife and Habitats*

Construction would be limited to inside the perimeter fence of LC-39A (approximately 173 acres [70 hectares]), with an estimated construction footprint of 429,937 square feet (9.9 acres [4.0 hectares]) for the new tower, pond, ASU, liquefaction facility, power hub, and MegaPacks facility (see Table 5-3 of the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*). The St. Johns River Water Management District Land Cover classifies LC-39A as “Governmental-for KSC only”; it is a combination of buildings, structures, paved areas, and mowed grass (see Figure 2-2 in the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1). Thus, no quality wildlife habitat would be cleared for the Proposed Action.

Wildlife is sparse within the busy LC-39A complex due to the poor quality of available habitat, but injury or mortality due to vehicle or equipment strikes is possible, both at the construction sites and on roads to LC-39A. This is particularly true for small and less mobile species. Noise, vibrations, and lighting associated with construction may cause animals in the surrounding areas to startle, become disoriented, or to temporarily or permanently avoid activities near LC-39A. These behaviors may affect breeding, foraging, and resting, and in some cases could result in injury or death. Construction noise would not be of sufficient intensity to affect aquatic species in estuarine waters near LC-39A.

As described in Section 3.9, *Water Resources*, construction contractors would implement requirements in construction permits, stormwater permits, and the site spill prevention plan. The FAA expects that any accidental release of hazardous materials would affect a limited area, and that SpaceX’s immediate clean-up response would avoid or minimize effects on species and habitat. These measures would prevent erosion and stormwater transport of sediments and hazardous substances into surrounding terrestrial and estuarine habitats.

Overall effects to general terrestrial and estuarine wildlife and habitats from construction would be localized and temporary, limited to roadways and habitats within and surrounding LC-39A for the duration of the construction period, and would therefore be less than significant.

### *Marine Wildlife and Habitats*

Construction activities would not affect water column or bottom habitats in the nearshore Atlantic Ocean and construction noise would not affect fish or other wildlife offshore of KSC. Effects to marine wildlife and habitats from construction would not be significant.

#### **3.8.4.2.3 Operation**

##### Federally Protected Species

##### *Federally Protected Species in Study Area Around LC-39A and Contingency Landings PSF Contour*

Noise, sonic booms, vibrations, lighting, plumes, boat and vehicle traffic and other operations-related stressors listed in Table 3.8-4 would increase under the Proposed Action and would affect some individuals of certain federally protected species within the Launch Study Area. Table 3.8-4 summarizes potential effects from each of these stressors and provides a list of the federally protected species potentially affected by each of the stressors. See Table 5-4 in the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, for distances from the launch pad, landing pad, and newly constructed facilities to the closest federally listed species. The USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum in Appendix B.1 include figures showing federally listed species in relation to contours for plumes, noise, and sonic boom overpressures associated with static fire tests, launches, and landings (Figures 5-1 through 5-41 in the USFWS Starship-Super Heavy LC-39A Revised BCA and Figures 1 through 4 of the USFWS Addendum).

The proposed increase in daily operations would affect federally listed species to varying degrees, with the greatest effects anticipated close to LC-39A. Although ongoing operations at LC-39A are likely to deter listed birds, beach mice, bats, and indigo snakes from common use of the area, any of these animals that do occur near LC-39A during static fire tests, launches, and landings would experience brief, but intense, exposure to elevated noise, vibrations, and sonic boom overpressures, and in some cases heat and vapor clouds; effects may include behavioral changes, interference with foraging, resting, and reproductive activities, injury, or death. From LC-39A, noise levels exceeding 100 dB ASEL and/or sonic booms of greater than 1 psf may extend up to 30 miles (48 kilometers) (on land) and 56 miles (90 kilometers) (over or at the surface of the Atlantic Ocean), with the degree of effects greatest near LC-39A. Within the 1-psf contour around the Atlantic Contingency Landing Area, which runs 50 miles (80 kilometers) north and south of LC-39A, animals may be infrequently exposed to overpressures of up to 1.7 psf. Nighttime lighting may disrupt normal behaviors of listed animals, particularly sea turtles, birds, and bats, which could be disoriented by the lighting. Strikes by vehicles and equipment may result in injury or death of individual animals, such as indigo snakes.

Launch-related closures may limit access to certain areas on a periodic basis. If such closures affect natural resources management (e.g., prescribed burning, species monitoring, feral hog control), management effectiveness, species health, and regulatory compliance could suffer. Updates to the 2025 MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025) removed prescribed burn restrictions related to non-critical payload transport or mating operations and reduced the burn buffer around smoke-sensitive facilities to 0.5-miles (0.8 kilometers); these updates greatly increase the opportunity to burn certain ecologically sensitive units to meet regulatory burn requirements. Additionally, the Starship-Super Heavy LC-39A Biological Opinion is expected to include mandatory monitoring requirements for multiple species



(e.g., Florida scrub jay, sea turtles); these requirements will be added to the EIS once they are finalized. For additional detailed discussion of potential effects of operations on federally protected species under USFWS jurisdiction, see the USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*.

Vessel operations (surveillance vessels, tugs, and barges) would increase in the Launch Study Area in association with supplies and vehicle parts delivery, and landing and recovery operations. Current boat and barge traffic follow speed limits and other standard manatee protection measures, and no boat or barge strikes resulting in serious injury or death have been directly attributed to KSC operations. Proposed operations would also follow these measures. The USFWS created a sanctuary for manatees that covers most of the KSC boundary within the Banana River. All motorized boat traffic, except for NASA mission-essential activities, is prohibited from entering the sanctuary. Based on these measures, strike potential for manatees is considered discountable. Barges and vessels involved in recovery and other operations in the nearshore Atlantic Ocean would travel at low speed and would have a protected species observer onboard, substantially decreasing the potential to strike sea turtles, North Atlantic right whales, manatees, and other marine mammals. The Right Whale Ship Strike Reduction Rule (50 CFR §224.105) requires vessels that are 65 feet (20 meters) or more in length to travel at speeds of 10 knots or less in seasonal management areas within critical habitat. Currently, the nearest seasonal management area occurs north of Cape Canaveral, centered on the Florida-Georgia border.

The NMFS Increased Cadence BO (NMFS, 2025a), located in Volume II, Appendix B.6.2, evaluates the effects of operations on federally protected species in marine areas (refer to the *Federally Protected Species in Ocean Landings Study Area* subsection below) but does not address potential effects in estuarine waters adjacent to LC-39A (e.g., Banana River, Indian River). Federally protected species that occur in estuarine waters consist of the smalltooth sawfish, bottlenose dolphin, West Indian manatee, loggerhead sea turtle, green sea turtle, and (rarely) Kemp's ridley sea turtle. Submerged animals would not be affected by noise from launch, landing, or static fire events, or by overpressure from sonic booms, but sea turtles and marine mammals at the water's surface could detect noise or overpressure and react behaviorally or experience stress. The potential for effects would be highest in estuarine waters near launch and landing pads. Manatees regularly occur in the upper Banana River/Pintail Creek and connecting canals adjacent to LC-39A, where launch, landing, and static fire noise would be most intense. As part of a separate project, grating would be used to prevent manatees from accessing canals north of Saturn Causeway, preventing exposure to the highest noise levels; this is an area where manatees have become trapped in the past.

The potential for an individual sea turtle or marine mammal to be at the surface at the same time a launch, landing, or static fire event occurred would be low, although the overall probability is increased due to the presence of multiple animals that could surface at different times. The potential for effects would be very brief for individual events, ranging from less than 1 second for sonic booms to seconds to minutes for launch, landing, and static fire noise. Substantial effects on behavioral patterns would not be expected. Substrate vibration in estuarine waters could potentially be detected by smalltooth sawfish (a benthic species) and sea turtles on the bottom. However, as discussed in the NMFS Increased Cadence BO (NMFS, 2025a), most energy from launches is distributed in the air rather than through the ground. Effects on growth, survival, or reproduction would not be expected and would therefore be insignificant. Exposure to heat plumes would be very unlikely due to the limited extent of the plumes over estuarine waters and the low percentage of time that federally protected species occur at the surface.

Per the USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum (Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*), NASA has made the following effect determinations for operations: no effect for the whooping crane, Black Creek crayfish, Florida panther, puma, American alligator, American crocodile, beautiful pawpaw, Carter's mustard, Etonia rosemary, fragrant prickly-apple, Lakela's mint, Lewton's polygala, Okeechobee gourd, papery whitlow-wort, pigeon wings, pygmy fringe-tree, Rugel's pawpaw, sandlace, and tiny polygala; not likely to jeopardize for the proposed monarch butterfly and tri-colored bat; may affect, not likely to adversely affect for the Anastasia Island beach mouse, Atlantic saltmarsh snake, Audubon's crested caracara, band-rumped storm petrel, Bermuda petrel, black-capped petrel, eastern black rail, Everglade snail kite, Florida bonneted bat, Florida grasshopper sparrow, Hawaiian petrel, Newell's shearwater, piping plover, red-cockaded woodpecker, roseate tern, rufa red knot, short-tailed albatross, wood stork, and West Indian manatee; and may affect, likely to adversely affect the eastern indigo snake, Florida scrub-jay, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, loggerhead sea turtle, and southeastern beach mouse.

Conservation measures and requirements in the USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, and avoidance, minimization, and mitigation measures identified in the SpaceX IHA application (SpaceX, 2024b) and NMFS Increased Cadence BO (NMFS, 2025a) would reduce the potential for effects from noise, sonic booms, vibrations, lighting, plumes, boat and vehicle traffic, and other operations-related stressors listed in Table 3.8-4. Measures would include but not be limited to natural resources training for contractors and employees, wildlife crossing awareness signs, lighting restrictions, manatee observers, invasive species control, monitoring of select listed species (e.g., Florida scrub-jays, sea turtles), and continuation of management activities on NASA property at a level that maintains habitat for use by federally listed species. Thus, with the implementation of conservation measures and requirements resulting from permits and ESA Section 7 consultations, the effects of operations on federally protected species in the Study Area around LC-39A and the contingency landings 1-psf contour area would be less than significant.

#### *Federally Protected Species in Ocean Landings Study Area*

Potential effects on ESA-listed fish, sea turtle, seabird, marine mammal, and invertebrate species from landings and expended boosters and Starship vehicles in the ocean study area are discussed in detail in the NMFS Starship BA (SpaceX, 2024a), *Tiered EA for SpaceX Starship Indian Ocean Landings* (FAA, 2024a), and NMFS Increased Cadence BO (NMFS, 2025a). The NMFS Increased Cadence BO addresses Super Heavy and Starship operations in the Atlantic Ocean landing area (including the Starship contingency landing area), and Starship operations in the Pacific Ocean and Indian Ocean landing areas (Super Heavy operations in the Gulf of Mexico [non-U.S. waters] and Gulf of America are also addressed, but these locations are outside the Study Area). The Increased Cadence BO provides a comprehensive evaluation of the potential effects of all stressors associated with operations, including sonic booms and impulse noise generated during launches and landings (including the nearshore Atlantic Ocean in the immediate vicinity of LC-39A); direct impact by fallen objects; impacts from unrecovered debris; pollution (vessel and vehicle emissions, propellants); vessel presence, strike, and noise; aircraft overflight; in-air acoustic effects from vehicle landings and explosive events; vibration, heat, and debris from launches (including the nearshore Atlantic Ocean in the immediate vicinity of LC-39A); heat from vehicle landings and explosive events; and underwater acoustic effects from explosive events. The BO also encompasses vessel operations in nearshore marine waters between landing areas and shore (except for the Indian Ocean).

NMFS estimated underwater acoustic effects (hearing loss, hearing threshold shift, behavioral response, and physiological stress) for marine mammals and sea turtles in the Atlantic, northern Pacific, and Indian Ocean landing areas resulting from explosive events. NMFS estimated exposure of one individual of the green sea turtle (North Atlantic DPS) in the Atlantic landing area and a combined five individuals of the loggerhead sea turtle (Northwest Atlantic Ocean DPS) in the Gulf and Atlantic landing areas (the number of exposures per ocean basin was not provided). Therefore, NMFS concluded that landing operations in the Atlantic Ocean may affect, and are likely to adversely affect, the green sea turtle (North Atlantic DPS) and loggerhead sea turtle (Northwest Atlantic Ocean DPS). NMFS concluded that, because the number of exposures would not affect species distribution or population status or have a measurable effect on reproduction, landing operations in the Atlantic Ocean are not likely to jeopardize the continued existence of the green sea turtle (North Atlantic DPS) and loggerhead sea turtle (Northwest Atlantic Ocean DPS). For marine mammals and all other sea turtle species, NMFS concluded that exposures for some species in some areas would be more than insignificant (although less than one animal per species) but that, given the low number of exposures, small affected areas outside of which insignificant responses are expected, and anticipated low density of ESA-listed species, potential underwater acoustic effects from explosions would be extremely unlikely and therefore discountable. NMFS concluded that the effects of all other stressors on ESA-listed species in all landing areas would be discountable or insignificant because they would be either extremely unlikely to occur or so minor that they cannot be measured or meaningfully evaluated. Accordingly, NMFS concluded that stressors other than underwater acoustic effects on green and loggerhead turtles from explosions may affect, but are not likely to adversely affect, ESA-listed species in the Atlantic, Pacific, and Indian Ocean landing/expended areas.

As discussed in the NMFS Starship BA (SpaceX, 2024a) and *Tiered EA for SpaceX Starship Indian Ocean Landings* (FAA, 2024a), the types and potential for effects evaluated for ESA-listed marine mammals would be applicable to other marine mammals. SpaceX's IHA application under the MMPA (SpaceX, 2024b) evaluated the potential effects of increased cadence of all Starship-Super Heavy launch and reentry operations at Boca Chica, Texas, and KSC and CCSFS in Florida, on marine mammals in the ocean landings study areas. Using conservative operational assumptions and acoustic modeling inputs, as well as maximum species densities, SpaceX estimated Level A and/or Level B harassment (permanent and temporary loss of hearing sensitivity, respectively) for a small number of individuals of seven marine mammal species in the Atlantic Ocean landing area and one species in the Northeastern Pacific landing area from in-water noise caused by explosions. Analysis in the IHA application determined that sonic boom overpressure, impact by fallen objects, and habitat effects would be unlikely to result in take of marine mammals. NMFS reviewed the application and determined that the proposed activities are not likely to result in the incidental take of marine mammals and that no MMPA authorization is required. NMFS concluded that harassment would be unlikely because the activities would not likely cause injury or disrupt marine mammal behavioral patterns, particularly given the conservative assumptions used in the evaluation and the small number of estimated exposures. The additional Starship operations in the Atlantic Ocean Action Area would not be expected to change the conclusions of the IHA application due to the low expected number of landings and expenditures between 1 and 5 nautical miles offshore. Thus, with the implementation of measures, mitigations, and requirements resulting from permits and ESA Section 7 consultations, the effects of operations on federally protected species in the Ocean Study Area would be less than significant.

### Critical Habitat

As discussed for construction activities in Section 3.8.4.2.2, *Construction: Critical Habitat*, and the USFWS Starship-Super Heavy LC-39A Revised BCA and USFWS Addendum (Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*), proposed operational activities would have no effect on the PCEs or PBFs listed for designated critical habitat for the piping plover, Florida bonneted bat, manatee, or North Atlantic right whale, or proposed critical habitat for the rufa red knot or manatee (see Table 3-4 in the USFWS Starship-Super Heavy LC-39A Revised BCA). However, lighting from LC-39A and launch vehicle operations after dusk could affect the sea turtle critical habitat PCE of sufficient darkness for emerging, nesting, and hatchling sea turtles (Figure 5-28 in the USFWS Starship-Super Heavy LC-39A Revised BCA). Although SpaceX would work with NASA and the USFWS to update the LC-39A Lighting Operations Manual to minimize lighting effects to the greatest extent practicable, particularly during sea turtle nesting season, some degree of lighting or sky glow from the Proposed Action would be visible on certain portions of sea turtle critical habitat for multiple nights each year.

To evaluate compliance with the incidental take statement from the USFWS in the *USFWS Biological Opinion for the Kennedy Center Master Plan* regarding lighting effects on sea turtles, the KSC beach is monitored during nesting season to identify disorientation events (USFWS, 2017). These data are communicated to environmental managers at KSC, who then work with tenants and personnel as necessary to take corrective actions to minimize lighting issues. This monitoring would continue to provide information to KSC managers to be used in evaluating and addressing lighting effects to sea turtles. Such efforts would reduce the degree and duration of lighting effects, but safety and security requirements would still result in multiple nights with lighting likely sufficient to cause disorientation. Per the USFWS Starship-Super Heavy LC-39A Revised BCA, NASA has made the determination for operational activities of may affect, likely to adversely affect for loggerhead sea turtle nesting critical habitat and no destruction or adverse modification for green sea turtle proposed nesting critical habitat (Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*).

The NMFS Increased Cadence BO (NMFS, 2025a) addresses potential effects of Super Heavy and Starship operations in the Atlantic Ocean landing area (including the Starship contingency landing area), and Starship operations in the Pacific Ocean and Indian Ocean landing areas, on designated and proposed critical habitat for all applicable sea turtle, marine mammal, fish, and invertebrate species. The Increased Cadence BO evaluates the following stressors: sonic booms and impulse noise generated during launches and landings (including the nearshore Atlantic Ocean in the immediate vicinity of LC-39A); direct impact by fallen objects; unrecovered debris; pollution; vessel presence and noise; aircraft overflight; heat from launches (including the nearshore Atlantic Ocean in the immediate vicinity of LC-39A); heat from vehicle landings and explosive events; and underwater acoustic effects from explosive events. Underwater acoustic energy resulting from Super Heavy and Starship explosive events would negatively affect designated breeding critical habitat for the loggerhead sea turtle (Northwest Atlantic Ocean DPS) by disrupting normal functions, such as breeding, due to temporary or permanent hearing threshold shifts, or behavioral or startle responses that could cause individuals to leave the area. These effects would impair the PBF of concentrating reproductive individuals, at least temporarily. Because explosive events would not be continuous or regular in any specific portion of the breeding critical habitat, the effects would not appreciably diminish the conservation value of critical habitat as a whole. Therefore, NMFS concluded that explosive events are likely to adversely affect, but are not likely to destroy or adversely modify, designated breeding critical habitat for the loggerhead sea turtle (Northwest Atlantic Ocean DPS).

NMFS concluded that the effects of all other stressors on the PBFs of designated and proposed critical habitat for ESA-listed species in the Study Area would be discountable or insignificant because they would be either extremely unlikely to occur or so small as to be immeasurable. Accordingly, NMFS concluded that all stressors other than explosive events affecting loggerhead sea turtle breeding critical habitat may affect, but are not likely to adversely affect, designated and proposed critical habitat in the Study Area.

The NMFS Increased Cadence BO does not address potential effects on critical habitat in estuarine waters near LC-39A. Proposed critical habitat for the green sea turtle (North Atlantic DPS) occurs in the Banana River and Indian River, but does not extend to areas directly adjacent to LC-39A (e.g., Pintail Creek, the Turn Basin and Turn Basin canal) (Figure 3.8-4). The PBF associated with this area is benthic foraging/resting habitat, which consists of underwater refugia and food resources (i.e., seagrasses, macroalgae, and invertebrates) of sufficient condition, distribution, diversity, abundance, and density necessary to support survival, development, growth, and/or reproduction of juvenile, subadult, and adult turtles. As discussed previously, construction and operation activities would not affect estuarine water quality near LC-39A and would therefore not decrease the availability or condition of food resources. Fallen objects and debris would not be expected in these areas and would not affect refugia. Turtles at the water surface could detect noise and sonic booms from launches, landings, and static fire events, and turtles resting on the bottom could potentially detect substrate vibration caused by launches. These effects could result in behavioral or stress responses. Due to the brief duration of noise and overpressure, the limited amount of time that turtles occur at the surface, and the low potential for substantial substrate vibration, these stressors would not likely deter green sea turtles from using refugia and food resources in estuarine waters near LC-39A overall.

The potential for barges and other boats transiting between the Atlantic and Port Canaveral and the Turn Basin to affect green sea turtle proposed critical habitat would be low based on the overall low volume of boat traffic and required speed limits and other protection measures.

With the implementation of conservation measures and requirements resulting from permits and ESA Section 7 consultations, operations would have no effect on the PCEs or PBFs listed for designated critical habitat for the piping plover, Florida bonneted bat, manatee, or North Atlantic right whale, or proposed critical habitat for the rufa red knot or manatee. However, lighting and explosive events associated with operations are likely to adversely affect, but not destroy or adversely modify, designated critical habitat for loggerhead sea turtle (Northwest Atlantic Ocean DPS) breeding and nesting. In the context of the FAA significance threshold, effects on critical habitat from operations would be less than significant.

#### Essential Fish Habitat

As described in the associated LC-39A Starship EFH Assessment (Appendix B.2, *Essential Fish Habitat Assessment (NMFS)*), launch and landing operations would not adversely affect estuarine waters, underlying substrates, or vegetation. Adherence to established barge and vessel operating procedures would minimize the potential for fuel or oil spills in estuarine waters. Vessel operation, expended Starship and boosters, and fuel and debris from Starship and booster break up would have no substantial effect on water column or soft substrate EFH in the Super Heavy Atlantic Ocean Landing Area and Starship Atlantic Ocean Action Area. Expended items may adversely affect hard bottom habitat and deep-water corals. The potential for effects would be decreased by the limited distribution of these habitats and the low number and dispersed location of expended items (SpaceX intends for expenditures to be an infrequent occurrence given the goals of the reusable concept).



### State-Protected Species

The proposed increase in daily operations would affect state-protected species to varying degrees, with the greatest effects anticipated close to LC-39A. Although ongoing operations at LC-39A are likely to deter listed animals from common use of the area, any of these animals that do occur near LC-39A during static fire tests, launches, and landings would experience brief, but intense, exposure to elevated noise, vibrations, and sonic boom overpressures, and in some cases heat and vapor clouds; effects may include behavioral changes, interference with foraging, resting, and reproductive activities, injury, or death. From LC-39A, noise levels exceeding 100 dB ASEL and/or sonic booms of greater than 1 psf may extend up to 30 miles (48 kilometers) (on land) and 56 miles (90 kilometers) (Atlantic Ocean), with the degree of effects greatest near LC-39A. Within the 1-psf contour around the Atlantic Contingency Landing Area, which runs 50 miles (80 kilometers) north and south of LC-39A, animals may be infrequently exposed to overpressures of up to 1.7 psf. Nighttime lighting may disrupt normal behaviors of listed animals, particularly sea turtles, birds, and bats, which could be disoriented by the lighting. Strikes by vehicles, equipment, boats, and barges may result in injury or death of affected animals. The introduction of invasive species from construction activities could degrade listed species' habitat and foraging resources. No state-protected plants are known to occur within or near LC-39A, so no effects are anticipated.

The types and mechanisms of potential effects associated with operations described in Table 3.8-4 and the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, would generally apply to state-protected species as well; see these resources for additional information on operations effects.

State-listed species may alter behaviors, be injured or killed, or have their habitats altered due to operations noise, visual stimuli, vibrations, sonic booms, vapor plumes, lighting, invasive species, and collisions. However, the Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects, so effects from operations on state-protected species would not reach significant levels.

### Migratory Birds and Bald Eagles

Migratory birds may occur at the site at any time of year but are more likely to be seen during the spring and fall migration periods. The types and mechanisms of potential effects associated with operations described in Table 3.8-4, the *Terrestrial and Estuarine Wildlife and Habitats* subsection, and the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, would generally apply to migratory birds and bald eagles as well (e.g., behavioral changes, injury, mortality, or habitat modification due to noise, visual stimuli, lighting, vibrations, invasive species, and direct physical impacts). Of particular concern for operations activities with respect to eagles and migratory birds is the potential for take associated with effects to nests or eggs. Currently, there are two wading bird rookeries located within a mile of the launch and landing pads. The closest eagle nest is approximately 2.5 miles (4.0 kilometers) from the pads, and the closest shorebird and seabird site is almost 3 miles (5 kilometers) away from the pads (Figure 3.8-6). If a bald eagle or migratory bird were to establish a nest in a location that would interfere with operations and require removal, then SpaceX would notify NASA personnel to coordinate acquisition of the appropriate permits.

Although ongoing operations at LC-39A are likely to deter birds from common use of the area, any individuals that do occur near LC-39A during static fire tests, launches, and landings would experience

brief, but intense, exposure to elevated noise, vibrations, and sonic boom overpressures, and in some cases heat and vapor clouds; effects may include behavioral changes, interference with foraging, resting, and reproductive activities, injury, or death. At Vandenberg Space Force Base where there has been an increase in Falcon 9 launches starting in 2021, a statistical analysis of western snowy plover (*Charadrius nivosus nivosus*) data did identify a significant location-specific relationship between *breeding population count* and *modeled engine noise*, suggesting that western snowy plovers may be selecting habitat further from launch activities to reduce exposure to overpressure and noise associated with launches. However, the analysis did not find a significant relationship between snowy plover *hatch rate* and launch-related disturbances, or between *fledge rate* and launch-related disturbances (USSF, 2025b). To date, this presents the best available science on launch effects to an avian species, particularly with respect to hatch rates and fledge rates. At LC-39A, Starship noise, sonic booms, and vibrations would be more frequent and intense than current Falcon operations, which could lead to abandonment of nearby rookeries, some of which are within a mile of the pads (see Figure 3.8-6).

From LC-39A, noise levels exceeding 100 dB ASEL and/or sonic booms of greater than 1 psf may extend up to 30 miles (48 kilometers) (on land) and 56 miles (90 kilometers) (over or at the surface of the Atlantic Ocean), with the degree of effects greatest near LC-39A. Within the 1 psf contour around the Atlantic Contingency Landing Area, which runs 50 miles (80 kilometers) north and south of LC-39A, birds may be infrequently exposed to overpressures of up to 1.7 psf. Migratory birds may be attracted to artificial lighting at night and become disoriented and fatigued. To reduce such occurrences, SpaceX would minimize unnecessary lighting, particularly during spring and fall migratory periods, and red obstruction lighting for towers would comply with FAA Advisory Circular No. 70/7460-1M, Change 1 ([AC 70/7460-1M Chg 1](#)) (FAA, 2024c).

Migratory birds and eagles may alter behaviors, suffer injury or death, or have their habitats altered due to operations-related noise, visual stimuli, sonic booms, vibrations, vapor plumes, lighting, and collisions. However, as LC-39A is already an active launch complex, permits would be obtained if nest removal was deemed necessary, and SpaceX would implement measures to reduce effects from artificial lighting. The Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects. Therefore, effects from operations on eagles and other migratory bird species would not reach significant levels.

### General Wildlife and Habitats

#### *Terrestrial and Estuarine Wildlife and Habitats*

Terrestrial and estuarine wildlife may alter behaviors or suffer injury or death, and their habitats may be degraded or destroyed by noise and visual disturbance, vibrations, sonic booms, strikes and collisions, artificial lighting, vapor plumes, hazardous materials, invasive species, and restricted access associated with Starship-Super Heavy operations. The magnitude, frequency, and extent of potential exposures to such stressors would increase under the Proposed Action compared to the No Action Alternative, but the exact number and degree of exposures is difficult to determine due to factors such as timing and species mobility.

Due to the poor quality of available habitat and the busy activity level at LC-39A, wildlife within the complex is sparse, but injury or mortality due to vehicle or equipment strikes would be possible during operations at LC-39A or on transportation routes to LC-39A. NASA would maintain signs along these routes

warning about wildlife crossings and avoidance. Collision risks for manatees and other aquatic species from boats and barges would be reduced by required low speed limits in areas of concern, as well as other mitigations described in the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*. The new tall structures at LC-39A would not include glass windows and would be comprised of opaque surfaces, which are of less risk with respect to bird collisions.

Deluge ponds and existing vegetation are expected to contain the spraying water within the fence line, so no deluge water would reach estuarine waters due to overland flow. Metals and other constituents in the launch and landing plumes that are associated with ablation of steel components would quickly recondense near the launch and landing sites. The minute concentration of metal and chemical constituents that drift outside the LC-39A boundary in the plume would not be expected to affect estuarine waters or sediments. Per findings presented in the *Final Tiered EA for SpaceX Starship/Super Heavy Vehicle Increased Cadence at the SpaceX Boca Chica Launch Site in Cameron County, Texas* (FAA, 2025a), the amount of metal deposition from the vapor plume is expected to be minimal and monitoring would be conducted to ensure that levels do not exceed accepted levels over time.

Within the plume area around the launch and landing pads, 67 acres (27 hectares) of the 86 acres (35 hectares) are classified as “Governmental-for KSC only,” consisting of buildings, structures, paved areas, and mowed grass; the remaining areas are a combination of forests, bays, estuaries, reservoirs and mangrove swamps outside the fence line south and east of LC-39A (see Table 5-3 and Figure 2-1 in the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*). Heat associated with the plume may damage some natural habitats within the 0.2-mile launch and static fire plume area. Most animals would likely avoid the area due to the noise and disturbance associated with launch preparations, but less mobile species and eggs within the plume may be injured, killed, or damaged due to thermal stress.

As discussed in the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, deluge water and vapor plumes associated with launches and landings would not be expected to adversely affect estuarine waters as diverters would direct plumes at an upward angle. Substantial noise from launches, landings, and static fire tests, as well as sonic boom overpressures, would not be expected in the water column in most areas and would likely affect few animals relative to population sizes.

Effects from noise, vibrations, sonic booms, and lighting would extend further than those from plumes, in some cases extending up to 30 miles (48 kilometers) inland from LC-39A. Due to the typical co-occurrence of noise, vibrations, and sonic boom overpressures, it can be difficult to separate effects. They may cause animals in the surrounding areas to startle or freeze, become disoriented, or temporarily or permanently avoid breeding, foraging, and other activities near LC-39A. Species reactions would vary depending on the frequency of exposure and their proximity to the operational activity, with more intense reactions expected during initial exposures and closer to the activity. While the noise and vibrations associated with static fire tests and landings would last only a few seconds, and less than a minute for launches, the combination of the visual, auditory, and physical (i.e., vibrations) effects could cause physiological responses in some individuals due to fear or panic in addition to the behavioral responses. Examples of physiological responses include increased hormonal production and increased heart rate. Increased heart rates, which are an indicator of excitement or stress, occur naturally as a response to predation. Thus,

each test, launch, or landing may not, in and of itself, be detrimental. However, the threshold for the frequency at which harmful effects may occur would vary by species, and for some individuals the degree of physiological response may lessen over time with repeated exposure to launch, landing, and test events. There is also concern about potential harm to incubating eggs from vibrations (i.e., cracks, addling) associated with operations. However, this is difficult to assess due to the limited availability of scientific data on vibration impacts on animals in the wild. Potential burrow collapses are also of concern, but the exact conditions that might cause a collapse are unclear at this time.

Noise effects from general operations are also a concern. Operation of the ASU/liquefaction facilities would generate noise with similar characteristics to noise generated by other industrial facilities at LC-39A (e.g., LOX farm, methane farm, vaporization farm, LN<sub>2</sub> farm, water farm) that were analyzed in the 2019 NASA EA (NASA, 2019a) and found to have no significant noise impacts. Noise levels associated with similar facilities employing large compressors and other loud components generate noise levels of approximately 40 dBA at 1 mile (1.6 kilometers) (Stantec, 2023). Air inlets and exhaust vents would incorporate silencers to reduce exterior noise levels, and where practicable, loud equipment (e.g., compressors) would be enclosed within structures.

Artificial lighting at night at LC-39A has the potential to affect sea turtles during nesting season, as well as bats, southeastern beach mice, and other animals who may be disturbed or disoriented by the lights. Artificial lighting may cause temporary or permanent abandonment of nesting, roosting, and foraging areas by birds, bats, southeastern beach mice, and other animals. Some listed species may suffer from increased predation from this lighting, while others may be able to more easily locate their prey. Tower lighting has the potential to disorient birds and bats, causing them to circle the lights to exhaustion or to fly into the lights. Depending on the time of year, night lighting could affect light-based cues used by nesting and hatchling sea turtles, which orient toward light to reach the sea. Consequently, if there are man-made light sources coming from inland sources, the hatchlings may mistakenly crawl landward instead of toward the sea, resulting in mortalities from predators or desiccation. SpaceX would update the LC-39A Lighting Operations Manual to minimize negative effects to sea turtles, birds, bats, beach mice, and other species to the extent possible given safety and security concerns.

Table 3.8-4, Section 3.8.4.2.2, *Construction: Terrestrial and Estuarine Wildlife and Habitats*, and the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, provide additional information on the types of potential effects to general wildlife and habitats.

In summary, terrestrial and estuarine wildlife may alter behaviors or suffer injury or death, and their habitats may be degraded or destroyed by activities associated with Starship-Super Heavy operations. However, in the context of the FAA significance threshold, effects on terrestrial and estuarine wildlife and habitats from operations would be less than significant as the Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects.

#### *Marine Wildlife and Habitats*

Potential effects on habitats and wildlife in the ocean landing areas would be similar to those described for federally protected species, critical habitats, and EFH in the preceding subsections, and in the NMFS Starship BA (SpaceX, 2024a), *Tiered EA for SpaceX Starship Indian Ocean Landings* (FAA, 2025a), NMFS Increased Cadence BO (NMFS, 2025a), and SpaceX IHA application (SpaceX, 2024b). Water column habitat

would not be affected by landing or vessel operations. Expended Super Heavy and Starship debris would have a negligible effect on most bottom types (e.g., sand and mud). Direct impacts on hard structured habitat would have potentially greater effects on marine wildlife because this habitat type generally supports a greater diversity of large species (e.g., fish and sea turtles) and is comparatively rare in the open ocean. However, the rarity of occurrence decreases the potential for interaction with expended items. Hard bottom and deep-water corals are concentrated on portions of the Atlantic Ocean continental shelf, and there is a greater chance for items expended in this area to settle on hard substrate. The potential would be decreased by the limited distribution of these habitats and the dispersed locations and low number of expended items.

SpaceX modified the Pacific Ocean landing area boundary near the Hawaiian Islands to minimize the potential for effects on marine species and ecosystems such as coral reefs. The Pacific landing area occurs entirely outside the Hawaiian EEZ (200 nautical miles from land). In addition, SpaceX established an additional 50 nautical mile buffer around the Papahānaumokuākea National Marine Sanctuary, and therefore any landing activities would occur in international waters at least 250 nautical miles from the Northwestern Hawaiian Islands. With this boundary adjustment, adverse effects on marine species and habitats around the Hawaiian Islands would not be expected. The potential for debris from landing events to disperse over these distances and impact marine resources would be very low. Any residual propellant released into the water would evaporate or be diluted relatively quickly to negligible concentration by surface currents and ocean mixing. As described in detail in Appendix B.6.3, *Conference and Biological Opinion (April 2025)*, for operations in the Hawaii and Central North Pacific landing area, SpaceX will have a vessel in the area of highest likelihood of debris to identify large debris for salvage. SpaceX will sink or recover any detected debris before it can drift into the Papahānaumokuākea National Marine Sanctuary.

Sonic booms, near-surface explosions, and vessel and aircraft noise could affect marine wildlife at and near the water surface, but animal density there is low. Seabirds could be exposed to sonic boom overpressures, plumes, lighting, and noise, but the probability of exposure is considered low as seabird density near LC-39A and in the landing areas is low. Per the USFWS Starship-Super Heavy LC-39A Revised BCA in Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*, the number of birds attracted to lights on ships and platforms at sea as they forage at night is expected to be low, given the platform or ship is to be stationed offshore and the fact that most observed fallout from light occurs on land. During the day, it is not expected that lights would affect seabirds; however, birds may still forage or rest on or around ships or platforms. Noise from an approaching landing vehicle would likely flush any seabirds from the area and the birds would continue to forage elsewhere. The potential for expended items and debris to strike wildlife at the ocean surface would be discountable because of the low animal surface density and small number and size of the items relative to the open ocean surface area. Items that settle on the seafloor could strike benthic fish and invertebrates, but there would be no effect on populations. Vessel strikes would affect few marine animals relative to populations numbers due to the low density of marine species at the surface and low number of vessel operations.

In summary, marine animals may alter behaviors or suffer injury or death, and their habitats may be degraded or destroyed by activities associated with Starship-Super Heavy operations. However, in the context of the FAA significance threshold, effects on general marine wildlife and habitats would be less than significant as the Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects.



#### **3.8.4.2.4 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. The primary concerns for potential reasonably foreseeable effects for biological resources are associated with noise, vibrations, sonic booms, and artificial lighting. The increase in the number of strikes to wildlife from the Proposed Action, in context with other reasonably foreseeable actions, would not reach a level of significance. The Proposed Action would involve the development of only 9 acres of poor-quality habitat within the boundaries of LC-39A, and the heat plumes from static fire tests, launches, and landings would affect less than 20 acres of habitat outside of LC-39A. To prevent runoff into surrounding habitats, construction work would follow BMPs and permit requirements, and any deluge water that was not vaporized would be contained onsite. The minimal amount of habitat destruction and degradation associated with the Proposed Action would not substantially contribute to habitat effects within the study area.

Per the MOU for Prescribed Burning (SLD 45, USFWS, and KSC, 2025), CCSFS, KSC, and MINWR are committed to ensuring habitat used by the federally listed Florida scrub-jay and indigo snake is burned to maintain and improve the health of these species and other wildlife. While SpaceX would require up to 132 additional closures of a few hours each for static fire tests, launches, and landings, their operations and payloads are not smoke sensitive and prescribed burns could occur on the same day.

Increased numbers of static fire tests, launches, and landings from the Proposed Action and other reasonably foreseeable projects would correspondingly increase the frequency at which wildlife would be exposed to noise, sonic booms, and vibrations. Behavioral and stress reactions would be expected in some individuals, while others may habituate to these. 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. Monitoring is currently conducted for select species on and near KSC, MINWR, CCSFS, and CANA. These monitoring efforts, in concert with additional future monitoring, may be used to help assess long-term effects and adapt activities accordingly. Substantial noise from launches, landings, static fire events, and sonic booms would not be expected in the water column. Noise and sonic boom effects on aquatic and marine species would be limited to individuals at or near the surface. Although the probability of an aquatic or marine animal surfacing at the same time a sonic boom or maximum launch noise reached the water surface would be low, the combined number of launches at all sites would increase the potential.

While each facility at KSC and CCSFS is required to develop and follow a lighting management plan, there would still be an increase in the overall incidence of artificial light from new development and the increased launch tempo. Such lighting may affect the behavior of nesting and hatchling sea turtles, bats, birds, southeastern beach mice, and other animals. Current and future projects at KSC and CCSFS must either comply with the lighting requirements of existing ESA Section 7 programmatic consultations or with project-specific Section 7 consultations. Facilities also are developed to minimize features that attract migratory birds, such as appropriate lighting fixtures and flash frequency. It is expected that exterior lighting measures would be identified for all applicable projects during these consultations with the

USFWS and would be incorporated into applicable lighting management plans. Continued sea turtle monitoring would help to detect effects due to lighting, which would trigger actions to address these effects.

The Proposed Action would contribute to the number of droneship landings and expenditures in ocean landing areas, which may expose marine wildlife, including ESA-listed and MMPA-protected species, to engine noise and sonic booms. Although the total number of individuals potentially affected at or near the water surface by the Proposed Action and other reasonably foreseeable actions would increase, the potential for exposure would remain low overall due to the dispersed distribution and low density of animals at the surface in offshore waters. Landing operations for the Proposed Action and reasonably foreseeable actions would increase the potential for expended vehicles and debris to strike wildlife and to settle on sensitive habitats. Direct strikes at the surface would remain unlikely because of wildlife distribution and density. Vehicles and debris could strike species on the seafloor, but relatively large benthic species such as fish occur in low density, and most small species such as invertebrates occur in large numbers over large areas. Exceptions include rare species such as shallow-water and deep-water corals. The Proposed Action would increase the number of barge and support vessel operations and associated potential for vessel strikes of wildlife, including protected species, in estuarine, nearshore, and offshore waters. Adherence to ESA Section 7 conservation measures (e.g., speed restrictions and protected species observers) and standard operating procedures would minimize the potential for strikes.

Given the requirement for consultation and coordination with the USFWS and NMFS pursuant to the ESA and MMPA, the Proposed Action, in conjunction with other reasonably foreseeable actions, would not be likely to jeopardize the continued existence of any ESA-listed threatened or endangered species, result in the destruction or adverse modification of federally designated critical habitat for any species, or substantially affect marine mammal populations or stocks. With implementation of measures to minimize effects on bald eagles, migratory birds, and other wildlife species and habitats, species monitoring requirements, and construction BMPs and permit requirements, implementation of the Proposed Action, in conjunction with other reasonably foreseeable actions, would not be likely to cause long-term or permanent loss of plants or wildlife species; substantial habitat effects; or substantial adverse effects on wildlife populations. Therefore, the FAA expects that the effects to biological resources from implementation of the Proposed Action, in context with other reasonably foreseeable actions, would be less than significant.

## 3.8.5 BMPs, Mitigation, and Monitoring

### 3.8.5.1 Launch Study Area

Refer to the USFWS Starship-Super Heavy LC-39A Revised BCA (Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*), LC-39A Starship EFH Assessment (Appendix B.2, *Essential Fish Habitat Assessment (NMFS)*), and measures contained in the Increased Cadence BO (Appendix B.6, *Endangered Species Act Section 7 Consultation (NMFS)*) and SpaceX IHA Application (Appendix B.7, *Marine Mammal Protection Act Incidental Harassment Authorization (NMFS)*) for a complete list of the current mitigations, conservation measures, and monitoring being developed as part of consultations with the USFWS and NMFS for federally listed species and critical habitat, marine mammals, and EFH. These measures would decrease the potential for effects on habitats and species resulting from the stressors identified in

Table 3.8-4, including vegetation disturbance/destruction, noise and visual stimuli, vibrations, sonic booms, strikes/collisions, deluge water and plumes, artificial lighting, hazardous materials, invasive species introduction, and restricted access. **Note: Mitigations and monitoring are subject to change as the EIS and consultations proceed through agency review and coordination.**

### 3.8.5.2 Ocean Landings Study Area

Refer to the USFWS Starship-Super Heavy LC-39A Revised BCA (Appendix B.1, *Endangered Species Act Section 7 Consultation (USFWS)*), and measures contained in the Increased Cadence BO (Appendix B.6, *Endangered Species Act Section 7 Consultation (NMFS)*) and SpaceX IHA Application (Appendix B.7, *Marine Mammal Protection Act Incidental Harassment Authorization (NMFS)*) for a complete list of the current mitigations, conservation measures, and monitoring either finalized or being developed as part of consultations with NMFS and the USFWS for federally listed species and marine mammals in the ocean landings study area. These are subject to change as consultations proceed through agency review and coordination. The measures would decrease the potential for effects on marine species and habitats in the ocean landings areas associated with noise, sonic booms, explosive events near the ocean surface, direct strikes during Starship and Super Heavy landings, direct strikes from fallen objects and vessels, water quality effects, and aircraft overflights. **Note: Mitigations and monitoring are subject to change as the EIS and consultations proceed through agency review and coordination.**

## 3.8.6 Summary

Table 3.8-5 provides a summary of the significance determinations for Biological Resources under the Proposed Action and the No Action Alternative.

**Table 3.8-5. Significance Determinations for Biological Resources**

| Resource                                        | Proposed Action                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | No Action Alternative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Terrestrial and Estuarine Wildlife and Habitats | Terrestrial and estuarine wildlife may alter behaviors or suffer injury or death, and their habitats may be degraded or destroyed by noise and visual disturbance, vibrations, sonic booms, strikes and collisions, artificial lighting, vapor plumes, hazardous materials, invasive species, and restricted access associated with construction and Starship-Super Heavy operations. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, effects would still be less than significant because the Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects. | Terrestrial and estuarine wildlife may alter behaviors, or suffer injury or death, and their habitats may be degraded or destroyed by noise and visual disturbance, vibrations, sonic booms (from landings at other sites), strikes and collisions, artificial lighting, vapor plumes, hazardous materials, invasive species, and restricted access associated with Falcon operations. However, effects would be less than significant because the No Action Alternative would not result in any species extirpations, substantial habitat effects, or adverse population-level effects. |

**Table 3.8-5. Significance Determinations for Biological Resources**

| <b>Resource</b>              | <b>Proposed Action</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No Action Alternative</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Marine Wildlife and Habitats | Marine wildlife may alter behaviors, or suffer injury or death, and their habitats may be degraded by noise and visual disturbance, sonic booms, strikes and collisions, artificial lighting, hazardous materials, and restricted access associated with Starship-Super Heavy launches, expended boosters and landings, and vessel operations. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, effects would still be less than significant because the Proposed Action would not result in any species extirpations, substantial habitat effects, or adverse population-level effects. | Marine wildlife may alter behaviors, or suffer injury or death, and their habitats may be degraded by Falcon noise and visual disturbance, sonic booms, strikes and collisions, entanglement in and ingestion of parachutes and parafoils, hazardous materials, and restricted access associated with expended boosters and landings, and vessel operations. However, effects would be less than significant because the No Action Alternative would not result in any species extirpations, substantial habitat effects, or adverse population-level effects. |
| Federally Protected Species  | Federally protected species in the launch and ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, the effects would still be less than significant because the Proposed Action would not be likely to jeopardize the continued existence of a federally listed threatened or endangered species.                                                                                                                                                              | Federally protected species in the Falcon launch and ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. However, the effects would be less than significant because the ongoing actions would not be likely to jeopardize the continued existence of a federally listed threatened or endangered species.                                                                                                                                                                                 |
| Critical Habitat             | Critical habitat in the launch and ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine habitats. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative, but effects to critical habitat would still be less than significant because the Proposed Action would not likely result in the destruction or adverse modification of federally designated critical habitat.                                                                                                                                                                   | Critical habitat in Falcon launch and ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine habitats, but effects would be less than significant because the ongoing actions would not likely result in the destruction or adverse modification of federally designated critical habitat.                                                                                                                                                                                                              |

**Table 3.8-5. Significance Determinations for Biological Resources**

| <b>Resource</b>                 | <b>Proposed Action</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>No Action Alternative</b>                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Essential Fish Habitat          | EFH could be affected by hazardous materials and debris strikes from Starship-Super Heavy construction and operations. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, effects would still be less than significant because there would be no adverse effects on estuarine EFH or water column or soft substrate EFH in the Atlantic Ocean landing area, and the potential to adversely affect hard bottom and deep-water corals in the Atlantic Ocean landing area would be decreased by their limited distribution in the overall study area, relatively low number and dispersed location of expended items, and number of debris items that would burn up in the atmosphere. | EFH in estuarine and marine waters could be affected by hazardous materials and debris strikes from Falcon operations, but effects would be less than significant because the effects would not measurably reduce the quantity or quality of EFH.                                                                                                                       |
| State-Listed Species            | State-listed species in the launch and ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, the effects would still be less than significant because the Proposed Action would not result in any species extirpations or adverse population-level effects.                                                                                                                                                                                                                                                                                              | State-listed species in the Falcon launch and ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. However, the effects would be less than significant because the No Action Alternative would not result in any species extirpations or adverse population-level effects.                           |
| Migratory Birds and Bald Eagles | Migratory birds and bald eagles in the launch and (for migratory birds) ocean landing study areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. The magnitude, frequency, and extent of exposures to such effects would increase under the Proposed Action compared to the No Action Alternative. However, the effects would still be less than significant because the No Action Alternative would not result in any species extirpations or adverse population-level effects.                                                                                                                                                                                                                                                       | Migratory birds and bald eagles in the launch and (for migratory birds) ocean landing areas could be affected by the same stressors identified for terrestrial, estuarine, and marine wildlife. However, the effects would be less than significant because the No Action Alternative would not result in any species extirpations or adverse population-level effects. |

Note: EFH = essential fish habitat.



## 3.9 Water Resources

### 3.9.1 Definition of Resource and Regulatory Setting

Water resources include surface waters, groundwater, wetlands, and floodplains, 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 resource 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.

Appendix D.9, *Water Resources*, lists and describes the laws, executive orders, agency regulations, and other guidance that apply to water resources.

#### ***Wetlands***

USACE and USEPA define a wetland(s) as follows: Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Examples of wetlands include forested swamps, marshes, bogs, fens, seeps, and vernal pools. For regulatory purposes wetlands are separated into those that are “waters of the United States” and therefore subject to the Section 404 of the CWA (e.g., jurisdictional wetlands) and those that are not (non-jurisdictional wetlands). In carrying out Section 404, USACE uses 33 CFR Parts 320 through 330 to define wetlands under its jurisdiction. To conduct dredge or fill activities in these wetlands, USACE must issue a permit authorizing those activities.

#### ***Floodplains***

The Federal Emergency Management Administration defines a floodplain as any land area susceptible to being inundated by floodwaters from any source. Flooding occurs in a wide range of landscapes due to rainfall or storm surge. The Federal Emergency Management Administration designates floodplains nationwide, which are used for several purposes including setting insurance rates, requiring flood insurance policies, specifying building construction regulations, and use in models for flood warnings and evacuations.

A floodway is defined as “the channel of a river or other water course and the adjacent land areas that must be reserved to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.” During a flood, the floodway acts as a component of the waterway where water flows. The definition of the 1 percent (100-year) floodplain is land that is covered in water during a flood event that has a 1 percent chance of being equaled or exceeded each year. The 0.2 percent (500-year) floodplain is land that is covered in water during a flood event that has a 0.2 percent chance of being equaled or exceeded each year. These designations are based on modeling and estimates of 1 percent and 0.2 percent precipitation events for the area.

### **Surface Waters**

Surface waters include rivers, creeks, lakes, reservoirs, ponds, oceans, gulfs and seas. For Florida, water quality standards define the protection goals for surface waters by establishing designated uses (the public and aquatic life uses of the waterbodies), criteria by which to measure attainment of those uses and other policies to protect waterbodies from the effect of pollutants. Florida surface water classifications and designated uses are listed in Appendix D.9, *Water Resources*.

### **Groundwater**

Groundwater is water that is found in subsurface saturated zones. The upper area of the saturated zone is the water table. Groundwater fills the voids in underground formations such as sand, gravel, and rock. An aquifer is groundwater that flows naturally or can be pumped out of these materials. Aquifers are typically separated from one another by confining layers, areas of impermeable materials (no voids) such as clays, shales, or solid rock. Recharge of aquifers is primarily by rainfall. Rate of recharge depends on the amount of rain and the composition and permeability of the aquifer and overlying unsaturated zone.

Groundwater in Florida is classified under five categories (Class F-1 and Classes 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 outlined by Florida Administrative Code 62-520.410(1). Uses for these categories are described in Appendix D.9, *Water Resources*. In Florida, permits to discharge wastewater to groundwater are granted on whether the wastewater affects the quality of the receiving groundwater. Permits are not issued if a discharge activity results in an exceedance of maximum contaminants levels.

### **Wild and Scenic Rivers**

The National Wild and Scenic Rivers System was created by Congress in 1968 to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. Rivers may be designated by Congress or, if certain requirements are met, the Secretary of the Interior. Each river is administered by either a Federal or state agency.

## **3.9.2 Study Area**

The study area for water resources includes wetlands and floodplains on or adjacent to LC-39A, surface waters on and adjacent to LC-39A as well as ocean waters where landings or expenditures of Super Heavy-Starship would occur, and groundwater aquifers underlying KSC with the potential to be affected by the Proposed Action.

## **3.9.3 Existing Conditions**

### **Wetlands**

There are less than 100 square feet of wetlands within LC-39A, adjacent to the northernmost fence line. Wetlands occurring at KSC in the vicinity of LC-39A, as identified by the USFWS National Wetland Inventory, include freshwater emergent wetland and freshwater forested/shrub wetland (USFWS, 2024d). Figure 3.9-1 presents these wetlands.



Source: (USFWS, 2024d)

Figure 3.9-1. Wetlands Associated with LC-39A

### ***Floodplains***

Due to the low-lying nature of KSC, both the 100-year and 500-year flood zones have been designated within LC-39A. LC-39A was constructed using dredged sand fill (NASA, 2007). Elevations within LC-39A were determined by construction requirements. There are no natural elevations at LC-39A. There are no floodways within LC-39A. Flood zones are depicted in Figure 3.9-2. Flood risk at KSC stems primarily from large storms and future sea level rise.

### ***Surface Waters***

KSC is located within the Banana River sub-watershed (Hydrologic Unit Code 030802020101) of the IRL watershed (Hydrologic Unit Code 3080202) and is bounded to the east by the Atlantic Ocean and to the west by the Banana River. Figure 3.9-3 shows surface water features associated with LC-39A. Per Section 320 of the CWA, the IRL was nominated for inclusion in the National Estuary Program in 1990 and the IRL Estuary Program was initiated in 1991. Inclusion in the program requires the development of 10-year comprehensive plans to guide estuary science, restoration, and stewardship. The latest plan for the IRL spans 2020 to 2030, and water quality, along with habitat quality, living resources, healthy communities, and communication/collaboration, are designated “vital signs” that are evaluated for attainment of plan goals. Water quality “vital signs” include impaired waters, wastewater, stormwater, hydrology and hydrodynamics, sediments, atmospheric deposition, and contaminants of concern (COCs) (One Lagoon, 2019).

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 KSC, are listed as impaired waters (FDEP, 2024b). 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 total maximum daily load (TMDL) for dissolved oxygen and nutrients has been developed for the IRL and the Banana River Lagoon (Gao, 2009). A Basin Management Action Plan was created by Banana River Lagoon stakeholders (including KSC) in 2013 to restore seagrass in the IRL Basin through the watershed load reduction of total nitrogen and total phosphorus (Banana River Stakeholders, 2013). KSC has completed several projects to address the nutrient TMDL, including one at LC-39A (a non-contributing basin, where the stormwater is retained within the basin) (FDEP, 2021).

There are numerous grassy swales around each launch complex through which water discharges via culverts to swales that run along the perimeter access roads. At LC-39A, the access road swale discharges to receiving waters located around the periphery of the complex, including marsh areas, impounded wetlands, Pintail Creek, and Broadaxe Creek.

SpaceX, in support of a master drainage plan for activities at LC-39A, has obtained an ERP from the St. Johns River Water Management District (Permit No. 81270-11) for the construction and operation of a stormwater management system.

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.



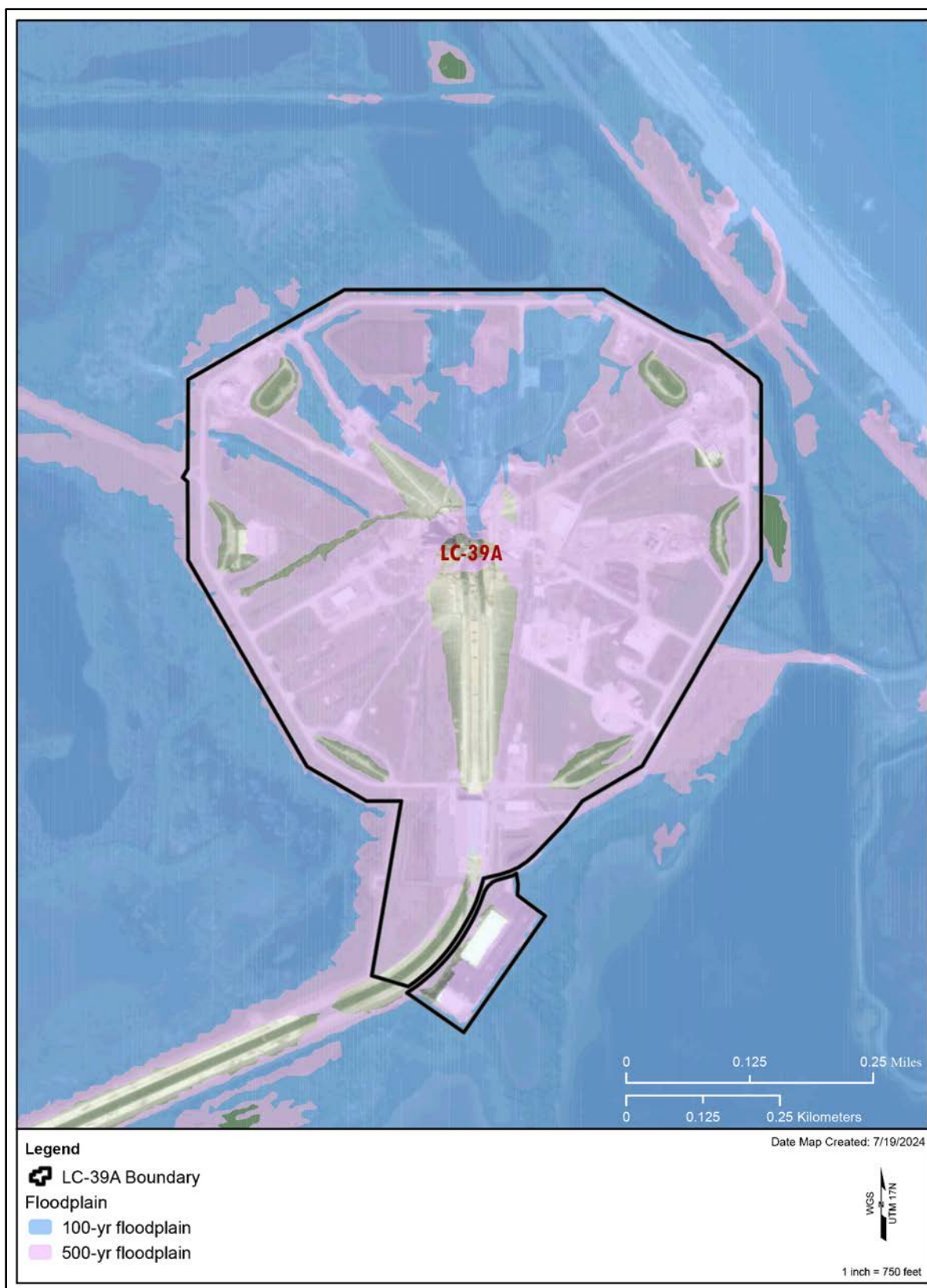


Figure 3.9-2. Floodplains Associated with LC-39A



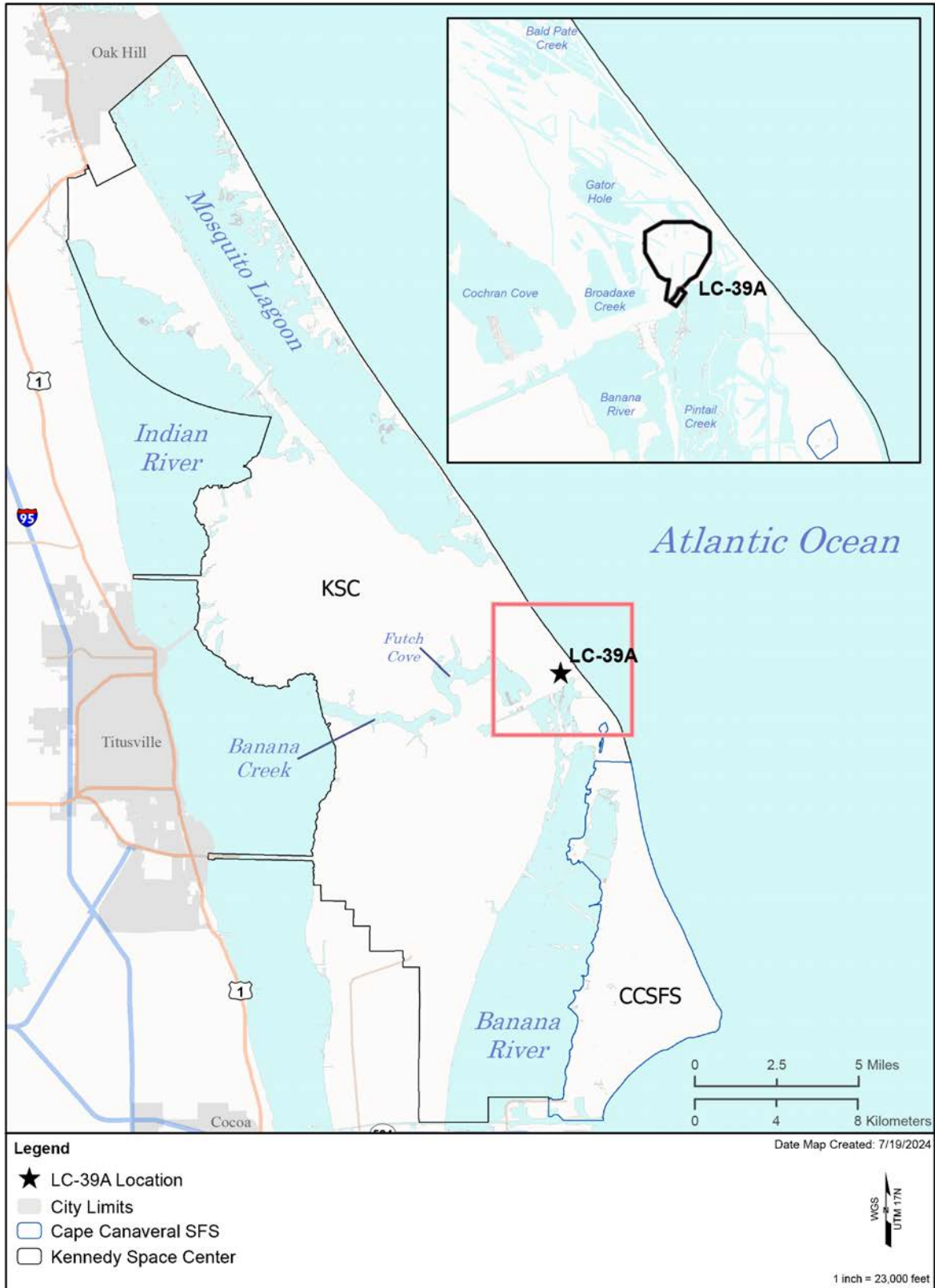


Figure 3.9-3. Surface Water Features Associated with LC-39A

Surface waters in the access restricted areas where landings are proposed include the Atlantic, Pacific, and Indian Oceans (GESAMP, 2009). Droneship landings are proposed to only occur in the Atlantic, whereas hard landings could occur in all three oceans. Water quality in the oceans is usually assumed to be good due to their massive sizes; however, it has been shown that ocean water quality can be as contaminated or more contaminated than coastal waters. For example, polychlorinated biphenyls (PCBs) and radioactive wastes are more concentrated in open ocean waters, dichlorodiphenyltrichloroethane (DDT) and its metabolites are equally concentrated, whereas chlorinated hydrocarbons and heavy metals are less concentrated (Davis, 1993). Sources of ocean contamination include atmospheric inputs (heavy metals, volatile organic compounds, CO<sub>2</sub>, sulfur dioxide, NO<sub>x</sub>, nutrients, persistent organic/bioaccumulative pollutants, and chlorofluorocarbons) and ship-based contamination (sewage, chemical spills, oil, exhaust emissions, ballast water, and trash dumping) (GESAMP, 2009). Recently, plastic pollution, specifically microplastics (plastic particles 1 nanometer to 5 nanometers in size) resulting from discarded materials, have become a major concern in the world's oceans. Microplastics are prevalent in temperate and tropical ocean waters and have been recorded both near population centers and also in far-removed areas due to long-distance transport of ocean surface waters (GESAMP, 2015).

### **Groundwater**

Groundwater at KSC consists of the surficial aquifer and the Floridan aquifer. Because there is a confining layer (Hawthorn Group) between the surficial aquifer and the Floridan aquifer, only the surficial aquifer has the potential to be affected by the Proposed Action. The surficial aquifer can be divided into four subsystems: Dune, Dune-Swale, West Plain, and Marsh that differ in area, amount of recharge, and degree of interaction with saline water of the IRL and Atlantic Ocean. The Dune (Barrier Island) subsystem, where LC-39A is situated, has a lens of freshwater less than 3 feet (0.91 meters) thick on top of intruded saline water from the ocean. Recharge to the surficial aquifer system is primarily from precipitation, with the most important areas include the primary dune and high ridges with permeable sands. From these areas groundwater flows east and west toward the lagoon systems and the ocean. Primary losses of groundwater are from evapotranspiration and seepage into area water bodies. The water table is highest late in the wet season (typically September-October) and drops as precipitation declines. Surficial aquifer groundwater quality is influenced by the intrusion of saline and brackish surface waters from the Atlantic Ocean and the IRL. The surficial aquifer is in a state of dynamic equilibrium with precipitation and the fresh/saline water boundary. When groundwater levels are low saline water moves inland, and when groundwater levels are high saline water is forced out, producing a dynamic system (Schmalzer et al., 2000).

Whereas the surficial aquifer at KSC is predominately classified as Class G-II, a potential potable water source, the surficial aquifer groundwater at LC-39A has been classified as Class G-III (due to proximity to the ocean and lack of potential as a future drinking water source). There are no USEPA-designated sole source aquifers at KSC (USEPA, 2024b). The surficial aquifer does not, nor is it planned to, supply potable water at KSC.

SpaceX currently operates under an FDEP industrial wastewater permit at LC-39A (FLA010307). This permit is for the treatment (settling) and discharge to groundwater of industrial wastewater produced at LC-39A via land application and percolation.

### **Wild and Scenic Rivers**

There are two designated Wild and Scenic Rivers in Florida: the Loxahatchee and the Wekiva, neither of which are in the study area. Therefore, Wild and Scenic Rivers are not discussed further in this document.

## **3.9.4 Environmental Consequences**

### **Analysis Methodology**

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. Potential effects to water quality could occur; however, most of these potential effects would be avoided and minimized through compliance with regulatory permit requirements (e.g., NPDES permits). Under the FAA's significance threshold identified in the FAA Order 1050.1F Desk Reference (FAA, 2023b), a significant effect 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 effect 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 effect to wetlands would occur if the action would adversely affect the wetland's water quality protective properties, substantially alter hydrology, substantially reduce storm and flood water retention, adversely affect habitats or timber, food, or fiber resources, promote deleterious development, or be inconsistent with state wetland strategies. A significant effect to floodplains would occur if the action would cause notable adverse effects on natural and beneficial floodplain values of the base floodplain (i.e., 100-year floodplain) (FAA, 2023b).

#### **3.9.4.1 No Action**

Under the No Action Alternative, the Proposed Action would not occur. There would be no additional construction and development at LC-39A, and no Starship-Super Heavy launches or landings would occur. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. There would be no modification of the stormwater system at LC-39A that may result in reduced stormwater discharge. Discharges from the stormwater system to surface waters would continue to occur in accordance with current permits. These discharges would not be expected to result in an exceedance of surface water qualities. Discharges to the surficial aquifer of industrial wastewater (deluge water) via retention ponds and land application would continue to occur in accordance with current permits. These discharges would not be expected to affect groundwater quality. There would be no alteration of floodplains/zones at LC-39A. Existing condition flood conditions and potential would not be affected.

Reasonably foreseeable effects to water resources could occur if the reasonably foreseeable actions were to inadequately address water resources in the study area. Reasonably foreseeable increased impervious surfaces at KSC, CCSFS, and throughout the local community could increase stormwater runoff and reduce water infiltration to the surficial aquifer. Significant effects to water resources would not be expected

because projects that involve ground disturbance would have construction requirements for managing stormwater runoff, such as implementation of a SWPPP and related BMPs (such as silt fences, covering soil stockpiles, using secondary containment for hazardous materials, revegetating the site in a timely manner, installing stormwater swales, retention ponds, etc.). Overall, the amount of infrastructure that may be located in flood zones within the study area due to reasonably foreseeable actions will likely increase, potentially exposing more infrastructure to flood risk. However, the scope of increased flooding potential (especially given anticipated increased rain events and sea level rise due to climate change) is entirely dependent on the extent of development and adequacy of stormwater management controls, and the stormwater generating events themselves. It is assumed that proper planning and design would ensure that any new infrastructure would be designed for the appropriate level of flood risk (e.g., flood-resistant design). Compliance with applicable state and Federal regulations and implementation of proper management of materials and wastes would also serve to minimize effects to water resources.

### 3.9.4.2 Proposed Action

#### 3.9.4.2.1 Construction

##### Wetlands

While there are no wetlands at the proposed construction locations within LC-39A, construction activities such as soil disturbance and grading can alter stormwater runoff, storage, and infiltration rates, which may result in increased sediment loads to wetlands outside of the construction locations. Increased sedimentation to wetlands could potentially harm/alter wetland plants, reduce wetland water retention capacity, and alter nutrient cycling. Permit requirements described in the *Surface Water* subsection below would be employed to manage stormwater discharges as well as control erosion during and after construction until the area is stabilized, therefore preventing effects to area wetlands. The proposed construction would not result in adverse effects to wetland water quality properties, hydrology, stormwater and floodwater retention, or habitat, and it would not promote deleterious development or be inconsistent with state wetland strategies. Therefore, the Proposed Action would not have significant effects on wetlands. Because there would be no work in or alteration of wetlands, E.O. 11990, *Protection of Wetlands*, and DOT Order 5660.1A, *Preservation of the Nation's Wetlands*, do not apply.

##### Floodplains

Proposed construction would necessarily take place in the 500-year floodplain. Construction in the 100-year floodplain would not occur. Any final construction site planning would place all construction outside of the 100-year floodplain. Because elevations at LC-39A are the result of construction, natural floodplain values would not be adversely affected by the Proposed Action. Due to its isolated location, only infrastructure at LC-39A would be affected by alterations in the 500-year floodplain resulting from the Proposed Action (e.g., there are no surrounding areas/infrastructure that would be affected). Development within a floodplain can include obstruction of flood flow, increase of flood flow velocities, and alteration of natural drainage. BMPs discussed for surface waters would also be applicable in addressing the increase of impervious surfaces effect on flooding. Because there is no development within the 100-year floodplain, E.O. 11988, *Floodplain Management*, and DOT Order 5650.2, *Floodplain Management and Protection*, do not apply. The Proposed Action construction would not cause notable effects on base floodplain values and, therefore, would not result in significant effects to floodplains.

### Surface Waters

There are no surface waters within the proposed construction footprints at LC-39A. Construction activities such as soil disturbance and grading can alter stormwater runoff, storage, and infiltration rates, which can result in increased sediment loads to area water bodies. 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 the use of silt fences, covering soil stockpiles, using secondary containment for hazardous materials, and revegetating the site in a timely manner. Hazardous materials (see Section 3.13, *Hazardous Materials, Solid Waste, and Pollution Prevention*) used in construction would not be discharged to surface or any other waters. Because the Proposed Action would alter the existing stormwater management system at LC-39A a new individual ERP, or revisions to the current permit, would be required from the St. Johns River Water Management District.

Proposed construction at LC-39A would result in an increase in impervious surfaces. 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. Development within LC-39A would conform to requirements for the issuance of permits notably the ERP requirement that the post-development peak rate of stormwater discharge cannot exceed pre-development peak rate (design is for a 24-hour, 25-year frequency storm).

Because a SWPPP would be employed to reduce stormwater pollution, including sedimentation during construction of the facilities associated with the Proposed Action, exceedance of water quality standards would not be expected from construction activities. Proposed construction would not affect CWA Section 303(d) impaired waters or TMDLs because these waters are impaired for nutrients, bacteria, and mercury, which result primarily from fertilizer runoff, septic systems, domestic wastewater treatment plant effluent, and in the case of mercury, atmospheric deposition from coal-fired power plants. Construction activities associated with the Proposed Action do not result in these pollutant sources. In addition, modeling performed for a LC-39A Master Drainage Plan, which incorporated future development, indicated that future stormwater discharges would be reduced compared to pre-development (e.g., preconstruction) conditions due to the incorporation of stormwater control structure BMPs required as a condition of ERP issuance (Kimley-Horn, 2022). The Proposed Action would not cause an exceedance of water quality standards; therefore, there would be no significant effects to surface waters.

### Groundwater

The SWPPPs developed for the construction NPDES permits would put in place BMPs to address and prevent spills that could potentially enter the surficial aquifer. In addition, KSC also implements a Spill Prevention, Control, and Countermeasure (SPCC) Plan. This plan ensures that all measures are taken to prevent and contain discharges and leaks of oil in accordance with all applicable state and Federal regulations. Therefore, no 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 deeper aquifers. The Proposed Action would not cause an



exceedance of groundwater quality standards or contaminate an aquifer used for public drinking water supply; therefore, there would be no significant effects to groundwater.

#### **3.9.4.2.2 Operation**

##### Wetlands

As described below in the *Surface Waters* and *Groundwater* subsections, industrial wastewaters would be subject to the conditions of a NPDES MSGP. Because SpaceX would implement the requirements of this permit, deleterious effects to wetlands are unlikely as all discharges would have to meet specific permit requirements. Regular freshwater influx to surficial aquifer via percolation ponds may nominally help maintain existing freshwater wetland vegetation by displacing saline water resulting from saltwater intrusion. Because the exhaust vapor cloud and plume is expected to be mostly confined to LC-39A, it would not be expected to affect wetlands plants via heat or introduce contaminants of the type and quantity that may affect nutrient cycling. Implementation of the SPCC Plan would prevent oil and other spills from reaching and affecting wetlands. As described above, post-construction stormwater discharges (e.g., during operations) would be reduced compared to existing conditions and thus more protective of wetlands and water quality. The proposed operations (including launch and RTLS) would not result in adverse effects to wetland water quality properties, hydrology, stormwater and floodwater retention, or habitat, and it would not promote deleterious development or be inconsistent with state wetland strategies. Therefore, the Proposed Action would not have significant effects on wetlands.

##### Floodplains

Because Starship-Super Heavy operations would not modify the physical features of any floodplains, effects to floodplains from operations are not anticipated and there would be no significant effects.

##### Surface Waters

SpaceX would be required to obtain an NPDES MSGP and develop a SWPPP for industrial activities at LC-39A. As part of the NPDES MSGP requirements, monitoring of discharges would be performed. These include quarterly visual examinations, analytical or benchmark monitoring of specific pollutants, and compliance monitoring (numeric effluent limitations). The potential for discharge of industrial wastewater either from the liquefaction facility, ASU, or deluge system into area surface waters in the event of an overflow of the proposed deluge water system at LC-39A is unlikely. Wastewater from the liquefaction process and ASU would be captured in retention/evaporation ponds (see Section 3.17, *Utilities and Infrastructure*). The majority of deluge water during a launch is anticipated to be vaporized by rocket exhaust. Proposed deluge water retention ponds would be sized to contain the remaining portion. SpaceX sampled deluge water from static fire Starship-Super Heavy testing events at the Boca Chica, Texas, launch site. Analysis revealed trace chemicals of similar types and concentrations found in the source water with no exceedances of applicable water quality thresholds (FAA, 2023a); similar constituents would be expected for operations at LC-39A. The Texas Commission on Environmental Quality determined after rounds of sampling conducted in March, April, and May of 2024, that deluge water discharges would not cause an adverse risk to the environment at Boca Chica (FAA, 2025a); the same would be expected at LC-39A.

The launch exhaust vapor cloud formed from the exhaust plume and evaporation and subsequent condensation of deluge water would not be expected to affect surface waters. Plume size for

Starship-Super Heavy launches at Boca Chica are modeled to be 0.6 miles in diameter. While the infrastructure at LC-39A would affect the size and direction of the plume differently than Boca Chica, the Boca Chica results provide some insight into how the vapor plume disperses, and the results at LC-39A would be expected to be somewhat similar. The majority of the plume would be over and just outside of LC-39A with a small portion over the Atlantic Ocean. The exhaust cloud would consist of steam/water vapor with trace amounts of CO and NO<sub>x</sub>. The amount of water condensing and entering area surface waters would be negligible compared to annual area rainfall and would not be expected to affect water quality.

Several aspects of the Proposed Action are potential sources of water quality pollutants. Starship-Super Heavy landing operations along with recovery activities are evaluated for the possible release of contaminants and hazardous constituents into ocean waters. RTLS operations are not expected to affect surface waters. Because the liquid propellants would turn into gases on release, there is no potential for spills. Starship-Super Heavy is constructed primarily of stainless steel, which is non-toxic and inert. Other debris includes thermal heat tiles composed of silica, which has similar properties to glass and is highly resistant to degradation. The heat tiles are considered inert. Impacts on water chemistry are not expected from water landings. Any chemical constituents introduced to ocean waters would not meaningfully affect existing ocean pollution status, and the vast quantities of water in the Atlantic, Pacific, and Indian Oceans would dilute any chemical constituents released into the water from a Starship-Super Heavy expenditure in the ocean.

Recovery operations have the potential to release small amounts of oil and gas into the water resulting from the operation of vessels. However, vessel operations would be conducted in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL) (International Maritime Organization, 1987), which prohibits certain discharges of oil, garbage, and other substances from vessels. The Proposed Action operations would not cause an exceedance of water quality standards; therefore, there would be no significant effects to surface waters.

#### Groundwater

Prior to operation, SpaceX would obtain a (or modify the existing) permit to discharge industrial wastewater resulting from the cooling towers to the surficial aquifer from the FDEP. An activity will not be permitted if contaminants reduce ground or surface water quality below the required FDEP classification standard. Minimum criteria require that all groundwater must not be contaminated by carcinogenic or toxic substance discharges, substances harmful to plants and animals, components that pose a serious danger to public health and welfare, and substances that constitute or create nuisance.

Groundwater quality would be monitored via wells as prescribed by the permit-required monitoring plan and program to ensure that groundwater quality parameters are not exceeded. Regular freshwater influx to surficial aquifer via percolation ponds may nominally help maintain existing freshwater lens by displacing saline water resulting from saltwater intrusion. Because industrial wastewaters generated by the Proposed Action (cooling towers and stormwater) would be tested to ensure compliance with applicable groundwater quality standards prior to discharge, the proposed operations would not be expected to cause an exceedance of groundwater quality standards. Similarly, RTLS operations are not expected to affect groundwater. Therefore, there would be no significant effects to groundwater from the Proposed Action.

### 3.9.4.2.3 Reasonably Foreseeable Effects

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. Reasonably foreseeable effects to water resources could occur if the reasonably foreseeable actions were to inadequately address water resources in the study area. Reasonably foreseeable increased impervious surfaces at KSC, CCSFS, and throughout the local community could increase stormwater runoff and reduce water infiltration to the surficial aquifer. Significant effects to water resources would not be expected because projects that involve ground disturbance would have construction requirements for managing stormwater runoff, such as implementation of a SWPPP and related BMPs (such as silt fences, covering soil stockpiles, using secondary containment for hazardous materials, revegetating the site in a timely manner, installing stormwater swales, retention ponds, etc.). In addition, due to the relative isolation of LC-39A (constructed with dredged materials accessible only by elevated causeways), alterations to the 500-year floodplain/zone within LC-39A would not be expected to interact or result in effects when considered in context with floodplain/zone alterations made at other locations. Overall, the amount of infrastructure that may be located in flood zones within the study area due to reasonably foreseeable actions will likely increase, potentially exposing more infrastructure to flood risk. However, the scope of increased flooding potential (especially given anticipated increased rain events and sea level rise due to climate change) is entirely dependent on the extent of development and adequacy of stormwater management controls, and the stormwater generating events themselves. It is assumed that proper planning and design would ensure that any new infrastructure would be designed for the appropriate level of flood risk (e.g., flood-resistant design). Compliance with applicable state and Federal regulations and implementation of proper management of materials and wastes would also serve to minimize effects to water resources.

Given these circumstances, the FAA expects that the implementation of the Proposed Action in conjunction with other reasonably foreseeable projects would not result in significant effects to water resources.

## 3.9.5 BMPs, Mitigation, and Monitoring

Per conditions of the permits required under the Proposed Action (St. Johns River Water Management District ERP Permit for Construction and Operation of a Stormwater Management System, FDEP NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities, and FDEP Permit to Discharge Process Wastewater from New or Existing Industrial Wastewater Facilities to Ground Water) SpaceX would conduct inspections, monitoring, and sampling as applicable during construction and operations to ensure permit compliance and therefore protection of water resources.

## 3.9.6 Summary

Because the Proposed Action would not cause an exceedance of a surface or groundwater quality standard, would not contaminate an aquifer used for public water supply, would not affect wetlands, and would not cause notable adverse effects on floodplains, the FAA has identified no significant effects to water resources.

## 3.10 Coastal Resources

### 3.10.1 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 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, 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). Under the CZMA, a Federal agency provides a state with a consistency determination for Federal agency activities affecting coastal uses or resources. A lead state agency performs Federal consistency reviews and is usually the same agency that implements or coordinates the state's CMP.

Florida's statewide CMP, administered 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. Federal lands, including KSC, are statutorily excluded from a state's coastal zone. The FAA has submitted the Draft EIS, along with a Coastal Consistency Determination (located in Appendix B.5, *Coastal Consistency Determination*) to the Florida State Clearinghouse for review as part of the Coastal Consistency Certification process. Per 15 CFR §930.40, NASA coordinated with the FAA and co-led the Consistency Determination for all the Federal activities involved.

### 3.10.2 Study Area

The study area for coastal resources is described in applicable resource sections of this document (e.g., coastal fish and wildlife resources in Section 3.8.2, *Biological Resources, Study Area*; and coastal water resources in Section 3.9.2, *Water Resources, Study Area*). Note, however, that the study area for each is limited to within 3 nautical miles of the Florida coast.

### 3.10.3 Existing Conditions

The existing conditions are described in applicable resource sections of this document (e.g., coastal fish and wildlife resources in Section 3.8.3, *Biological Resources, Existing Conditions*; and coastal water resources in Section 3.9.3, *Water Resources, Existing Conditions*).

## 3.10.4 Environmental Consequences

### ***Analysis Methodology***

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 (FAA, 2023b). Factors to consider include whether the action would have the potential to do the following:

- Be inconsistent with the relevant state coastal zone management plan(s)
- Affect a coastal barrier resources system unit (and the degree to which the resource would be affected)
- Affect coral reef ecosystems (and the degree to which the ecosystem would be affected)
- Cause an unacceptable risk to human safety or property
- Cause adverse effects to the coastal environment that cannot be satisfactorily mitigated

### 3.10.4.1 No Action

Under the No Action Alternative, the Proposed Action would not occur. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. There would be no additional construction and development at LC-39A, and no Starship-Super Heavy launches or landings would occur at LC-39A. Reasonably foreseeable actions would have reasonably foreseeable effects on Florida coastal uses and resources. Effects to coastal resources from the No Action Alternative are described in applicable sections of this document (e.g., coastal water resources in Section 3.9, *Water Resources*; coastal fish and wildlife resources in Section 3.8, *Biological Resources*; and coastal land use in Section 3.3, *Land Use*, etc.). Reasonably foreseeable actions identified in Table 2.2-2 actions are state, Federal, or involve Federal funds or permits and would therefore undergo a coastal consistency determination and would be subject to the same enforceable policies and regulations as the Proposed Action that protect coastal resources.

### 3.10.4.2 Proposed Action

The Proposed Action would result in effects to coastal biological resources and waters. These include the non-significant effects to biological and water resources provided in Section 3.8.4, *Biological Resources, Environmental Consequences*, and Section 3.9.4, *Water Resources, Environmental Consequences*, of this EIS. The Proposed Action would not occur on or affect coastal barrier systems. Starship-Super Heavy is designed to conduct precision landings. Landing and expenditure operations would not take place in intertidal areas, salt marshes, estuaries, coral reefs, national marine sanctuaries or NWRs. These areas would be eliminated from consideration as landing and expenditure locations during planning for each Starship-Super Heavy operation. Aside from construction within LC-39A, an already established and operational launch complex, the Proposed Action does not include any coastal construction. As discussed in Section 3.18, *Health and Safety*, the Proposed Action would not cause an unacceptable risk to human safety or property. Therefore, the Proposed Action would not result in significant effects to coastal resources.



While KSC is statutorily excluded from Florida's coastal zone, construction, operations, and launch and landing activities for the Starship-Super Heavy at LC-39A would have direct and/or indirect effects on Florida coastal uses and resources. The FAA has determined that the Proposed Action is consistent with the enforceable policies of the Florida CMP. Florida's enforceable policies and Proposed Action consistency analysis are presented in Appendix D.10, *Coastal Resources*.

#### **3.10.4.2.1 Reasonably Foreseeable Effects**

Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS (see Appendix C.1, *Noise Assessment and Noise Assessment Appendix*, for additional details), continued infrastructure development and improvements at KSC, and continued economic and community growth and development within the areas surrounding KSC. These actions all contribute to the existing and future environment. While KSC and CCSFS are statutorily excluded from Florida's coastal zone, the reasonably foreseeable actions at these locations would have reasonably foreseeable effects on Florida coastal uses and resources. These effects are presented in the applicable sections (e.g., air quality, noise, water quality, and biological resources) of this chapter. Like the Proposed Action, the reasonably foreseeable actions are Federal or involve Federal funds or permits and would therefore undergo a coastal consistency determination and would be subject to the same enforceable policies and regulations as the Proposed Action that protect coastal resources. The Proposed Action and identified projects would not affect coastal barrier resource systems or coral reef ecosystems. The Proposed Action and identified projects would not cause a combined unacceptable risk to human safety or property or cause unmitigable adverse effects to the coastal environment. Therefore, the FAA expects that implementation of the Proposed Action in conjunction with other reasonably foreseeable actions would not result in significant effects to coastal resources.

### **3.10.5 BMPs, Mitigation, and Monitoring**

No BMPs, mitigations or monitoring would be required for coastal resources other than those identified previously for biological and water resources.

### **3.10.6 Summary**

Coastal resources include all natural resources occurring within coastal waters and their adjacent shorelands as well as fish and wildlife and their respective habitats within these areas. As summarized in Section 3.8.6, *Biological Resources, Summary*, and Section 3.9.6, *Water Resources, Summary*, of this EIS, the Proposed Action would result in effects to coastal resources; however, the effects would not be significant. In addition, the Proposed Action would not affect coastal barrier resource system and coral reef ecosystems, or cause an unacceptable risk to human safety or property, or have unmitigable adverse coastal environmental effects.

Based on the above, the FAA has determined that the Proposed Action may affect a Florida coastal use or resource and therefore reviewed the action for consistency with the enforceable policies of the Florida CMP. The FAA's preliminary determination is that the Proposed Action is consistent with the enforceable policies of Florida's CMP. To facilitate SpaceX's compliance with the state's CMP for the proposed increase in annual launch operations and addition of landing operations at LC-39A, the FAA has submitted the Draft

EIS to the Florida State Clearinghouse for review and concurrence with the determination (see EIS Appendix B.5, *Coastal Consistency Determination*).

## 3.11 Air Quality

### 3.11.1 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 man-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.

USEPA established the NAAQS to regulate the following criteria pollutants: ozone, CO, NO<sub>2</sub>, sulfur dioxide, particulate matter less than or equal to 10 microns in diameter, particulate matter less than or equal to 2.5 microns in diameter, and lead (Pb) (USEPA, 2024c). The CAA 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 (FDEP, 2024c).

Ozone and some NO<sub>2</sub> 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 NO<sub>x</sub> 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, 2024d).

### 3.11.2 Study Area

The project study area for air quality includes Brevard County and the adjacent Atlantic coastline and nearshore waters, as this is the domain that would experience the highest project air quality effects. The transport of project emissions beyond this area would disperse to low ambient levels.

### 3.11.3 Existing Conditions

KSC is located in Brevard County, Florida. According to USEPA, Brevard County is currently in attainment for all NAAQS (USEPA, 2024e). Compliance with the NAAQS 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.

KSC operates under a Title V Operating Permit, as it is a major source of emissions (potential to emit greater than 100 tons per year of a regulated pollutant). The Title V permit requirements include annual inventorying of substantial stationary sources of air emissions, monitoring, and recordkeeping. The primary stationary sources of air emissions regulated by the Title V permit include boilers and generators. Additional details of the existing air quality conditions of the study area are available in Section 3.3 of the 2020 Falcon EA (FAA, 2020, p. 3).

For effect analysis of this Proposed Action, emissions generated during construction and operations were compared with Brevard County emissions obtained from USEPA's 2020 National Emissions Inventory (NEI) (USEPA, 2020). NEI data are the latest available; these are presented in Table 3.11-1. The county data include emissions amounts from point sources, area sources, and mobile sources. Point sources are stationary sources that can be identified by name and location. Area sources are point sources from which emissions are too low to track individually, such as a home or small office building, or diffuse stationary source, such as wildfires or agricultural tilling. Mobile sources are any kind of moving vehicle or equipment such as vehicles with gasoline or diesel engines, airplanes, or ships. Two types of mobile sources are considered: on-road and nonroad. On-road sources consist of vehicles such as cars, light trucks, heavy trucks, busses, engines, and motorcycles. Nonroad sources are aircraft, locomotives, diesel and gasoline boats and ships, personal watercraft, lawn and garden equipment, agricultural and construction equipment, and recreational vehicles (USEPA, 2016).

**Table 3.11-1. NEI 2020 Criteria Pollutant Emissions for Brevard County, Florida**

| Location       | CO (tpy) | NO <sub>x</sub> (tpy) | PM <sub>10</sub> (tpy) | PM <sub>2.5</sub> (tpy) | SO <sub>2</sub> (tpy) | VOCs (tpy) |
|----------------|----------|-----------------------|------------------------|-------------------------|-----------------------|------------|
| Brevard County | 89,676.2 | 8,867.99              | 6,407.05               | 3,997.31                | 332.54                | 33,352.43  |

Notes: CO = carbon monoxide; NEI = National Emissions Inventory; NO<sub>x</sub> = nitrogen oxides; PM<sub>10</sub> and PM<sub>2.5</sub> = particulate matter equal to or less than 10 or 2.5 microns, respectively; SO<sub>2</sub> = sulfur dioxide; tpy = tons per year; VOCs = volatile organic compounds.

Source (USEPA, 2020).

### 3.11.4 Environmental Consequences

#### **Analysis Methodology**

Air quality in the project area and immediately surrounding region would be affected by emissions from sources associated with launch operations including launch, landing, static fire testing, and support activities (e.g., trucks, boats, barges, and rescue vessels), ground disturbance (construction, trenching, architectural coatings, grating etc.), and ground support equipment at KSC.

The analysis estimated the magnitude of emissions that would occur from the proposed activities. The significance of project emissions was determined by qualitatively assessing their potential to contribute to an exceedance of a NAAQS, as directed in the FAA Order 1050.1F Desk Reference (FAA, 2023b). In addition, the analysis compared proposed emissions to applicable insignificance indicators for attainment areas (AFCEC/CZTQ, 2023a). In accordance with FAA Order 1050.1F, factors considered in assessing significance include whether the action would cause or contribute to a NAAQS violation, increase the frequency or severity of an existing violation, or delay timely attainment of a standard (FAA, 2023b).

The analysis of criteria pollutant emissions is limited to the evaluation of proposed SpaceX Starship-Super Heavy 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 (914 meters) 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 the Proposed Action emissions. The 3,000-foot above ground level ceiling was assumed to be the atmospheric mixing height above which any pollutant generated would not contribute to increased pollutant concentrations at ground level. While mixing heights can vary by location and time of day, the use of a 3,000-foot mixing height is consistent with USEPA guidance (USEPA, 1992) and represents a reasonable and standardized approach for evaluating potential ground-level air quality impacts from launch operations. This approach allows for consistent comparison of emissions and impact potential across similar analyses.

The following sections provide a description of air quality effects that would occur from the Proposed Action and No Action Alternative. Emissions from an alternative that cause an exceedance of any state or NAAQS would result in environmental effects.

Emissions associated with construction were estimated through the Air Conformity Applicability Model (ACAM) on a calendar-year basis. The ACAM analysis used the latest and most accurate emission estimation techniques available; all algorithms, emission factors, and methodologies used are described in detail in the DAF *Air Emissions Guide for Air Force Stationary Sources* (DAF, 2021a), the DAF *Air Emissions Guide for Air Force Mobile Sources* (DAF, 2021b), and the DAF *Air Emissions Guide for Air Force Transitory Sources* (DAF, 2021c). “Insignificance indicators” were used in the analysis to provide an indication of the significance of potential effects to air quality based on current ambient air quality relative to the NAAQS. These insignificance indicators are the 250 tons per year prevention of significant deterioration (PSD) major source threshold for actions occurring in areas that are “Clearly Attainment” (i.e., not within 5 percent of any NAAQS) and the General Conformity Rule de minimis values (25 tons per year for Pb and 100 tons per year for all other criteria pollutants) for actions occurring in areas that are “Near Nonattainment” (i.e., within 5 percent of any NAAQS). These indicators do not define a significant effect; however, they do provide a threshold to identify actions that are insignificant. Any action with net emissions below the insignificance indicators for all criteria pollutant is considered so insignificant that the action would not be expected to cause or contribute to an exceedance on one or more NAAQS.

ACAM Version 5.0.23a was utilized to calculate construction emissions to provide a level of consistency with respect to emissions factors and calculations (Solutio Environmental, 2022). ACAM provides a quantifiable air quality analysis for a proposed action by estimating emissions from activities expected in a study area.

A spreadsheet model was used to calculate the annual emissions associated with operations based on the operational assumptions described in Section 2.1.3, *Starship-Super Heavy Operations*. Details of emissions calculations are provided in Appendix C.2, *Air Quality Assessment*. The project Air Quality Technical Report presents details of operational emission source activity data and resulting air emission calculations for both the Proposed Action and No Action Alternative. Equations and emission factors can be found in Appendix C.2, *Air Quality Assessment*. The analysis compares the emissions associated with the Proposed Action to the 2020 NEI data for Brevard County, illustrating the percentage contribution to the regional air emissions that the Proposed Action emissions would represent.

The liquefaction plant, including the methane liquefier and ASU, is currently under design. Emissions from the plant would be dependent on its final design and operational characteristics. The facility will undergo permitting through the FDEP, ensuring compliance with all applicable Federal and state air quality regulations. This permitting process would include a detailed emissions evaluation to determine any applicable permit requirements and ensure operations do not contribute to an exceedance of the NAAQS. Until the liquefaction plant is constructed, LCH<sub>4</sub> and other necessary commodities would be transported to the site by contractors adhering to DOT and NASA transportation requirements.

#### **3.11.4.1 No Action**

Under the No Action Alternative, the FAA would not issue SpaceX a new license or modify their existing license for the Starship-Super Heavy launch vehicle at LC-39A and SpaceX would not construct launch, landing, and other associated infrastructure at LC-39A. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Under the No Action Alternative, the annual cadence for operations at KSC (and CCSFS) is anticipated to increase over time, and local development projects are anticipated to continue. As a result, implementation of the No Action Alternative would result in increased launch and development-related emissions within the region, the scope of which would be dependent on the number of launches and types of vehicles, and size of development projects. Development project emission would be considered short term and temporary. However, as launch licenses are approved or adjusted over time, air emissions analyses would be conducted by the FAA, NASA, or the DAF in associated NEPA documentation to identify any potentially significant effects.

#### **3.11.4.2 Proposed Action**

Air quality effects from the Proposed Action would occur from construction and operational activities. Construction would generate air pollutant emissions primarily from ground-disturbing activities such as grading, compacting, and trenching, and from the combustion of fuels in fossil-fuel-powered construction equipment. Fugitive dust emissions from ground disturbance would be the greatest during initial site preparation and would vary from day to day depending on the construction phase, level of activity, and prevailing weather conditions. Operational effects would occur from the Starship-Super Heavy Launch Vehicle preflight activities, vehicle flight testing, and launch and landing operations.

##### **3.11.4.2.1 Construction**

Emissions from the construction of the Proposed Action items at LC-39A were estimated with the use of the DAF ACAM (version 5.0.23a) (Solutio Environmental, 2022). Activity data developed for project construction were used as inputs to ACAM. Construction scenario assumptions, including phasing, equipment mix, and vehicle trips, were based on information provided by the applicant, relevant experience with similar projects when Proposed Action specifics were not known, and ACAM defaults.

Table 3.11-2 presents estimates of emissions associated with construction under the Proposed Action. These data show that total construction emissions would remain well below the annual insignificance indicator thresholds of 250 tons per year of a criteria pollutant and therefore would have a minor effect on air quality. This table also compares the emissions associated with construction of the Proposed Action



to the 2020 NEI data for Brevard County, illustrating the percentage contribution to the regional air emissions that the Proposed Action emissions would represent. These figures indicate that project construction activities would not contribute to an exceedance of a NAAQS and would result in less than significant air quality effects.

**Table 3.11-2. Criteria Pollutant Emissions Estimated for Construction of the Proposed Action**

| Activity                                  | Criteria Pollutant (tpy) |                 |               |                 |                  |                   |
|-------------------------------------------|--------------------------|-----------------|---------------|-----------------|------------------|-------------------|
|                                           | VOCs                     | NO <sub>x</sub> | CO            | SO <sub>x</sub> | PM <sub>10</sub> | PM <sub>2.5</sub> |
| Proposed Action Construction              | 3.35                     | 4.07            | 4.27          | <0.01           | 15.93            | 0.12              |
| Previously Approved Construction          | 3.08                     | 7.04            | 8.32          | 0.01            | 12.68            | 0.24              |
| <b>Total</b>                              | <b>6.43</b>              | <b>11.11</b>    | <b>12.59</b>  | <b>0.01</b>     | <b>28.61</b>     | <b>0.36</b>       |
| Brevard County NEI – Current              | 33,352.43                | 8,867.99        | 89,676.2      | 332.54          | 6,407.05         | 3,997.31          |
| <b>Percentage of Brevard County Total</b> | <b>0.01%</b>             | <b>0.1252%</b>  | <b>0.014%</b> | <b>0.003%</b>   | <b>0.4465%</b>   | <b>0.009%</b>     |
| Insignificance Indicator                  | 250                      | 250             | 250           | 250             | 250              | 250               |
| Exceed Threshold Indicator?               | No                       | No              | No            | No              | No               | No                |

Notes: % = percent; < = less than; CO = carbon monoxide; NEI = National Emissions Inventory; NO<sub>x</sub> = nitrogen oxides; PM<sub>10</sub> and PM<sub>2.5</sub> = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO<sub>x</sub> = sulfur oxides; tpy = tons per year; VOCs = volatile organic compounds; <0.01 = value less than 0.01.

Lead emissions would be less than 0.001 tpy.

#### 3.11.4.2.2 Operation

The proposed static fire, launch, and landing operations would occur in the same manner as those described in Section 2.1, *Proposed Action*. A spreadsheet model was used to calculate the annual emissions of criteria pollutants based on the operational assumptions described in Section 2.1.3, *Starship-Super Heavy Operations*. Details of emissions calculations, including those for truck operations, barge operations, and vessel rescue operations are provided in Appendix C.2, *Air Quality Assessment*.

The analysis compares the emissions associated with the Proposed Action to the 2020 NEI data for Brevard County, illustrating the percentage contribution to the regional air emissions that the Proposed Action emissions would represent. The analysis weighs the Proposed Action Alternative's annual net change in criteria pollutant emissions proportionally against (or relative to) regional emissions, using Brevard County's latest NEI.

Table 3.11-3 presents the estimates of annual air emissions that would occur from operations due to the No Action Alternative and Proposed Action scenarios. These data show that the increase in emissions from the Proposed Action would remain below insignificance indicator thresholds for all criteria pollutants except NO<sub>x</sub>. This table also compares the emissions associated with operations to the 2020 NEI data for Brevard County, illustrating the percentage contribution to the regional air emissions that the Proposed Action emissions would represent. Operational emissions associated with the Proposed Action are estimated at 374.55 tons of NO<sub>x</sub> per year. With the insignificance indicator being 250 tons per year, it is anticipated that operations would be considered potentially significant unless localized air-dispersion modeling could demonstrate that the emissions would not cause or contribute substantially to a projected air quality violation of an ambient air quality standard.

**Table 3.11-3. Criteria Pollutant Emissions Estimated for Operation of the Proposed Action**

| Scenario/Activity – Annual Number of Events | Criteria Pollutant (tpy) |                 |              |                 |                  |                   |
|---------------------------------------------|--------------------------|-----------------|--------------|-----------------|------------------|-------------------|
|                                             | VOCs                     | NO <sub>x</sub> | CO           | SO <sub>x</sub> | PM <sub>10</sub> | PM <sub>2.5</sub> |
| Super Heavy Launch – 44                     | 0.00                     | 148.6           | 4.69         | 0.00            | 0.00             | 0.00              |
| Starship Landing – 44                       | 0.00                     | 12.1            | 0.38         | 0.00            | 0.00             | 0.00              |
| Super Heavy Landing – 44                    | 0.00                     | 28.3            | 0.89         | 0.00            | 0.00             | 0.00              |
| Starship Static Fire Operations – 44        | 0.00                     | 34.5            | 0.39         | 0.00            | 0.00             | 0.00              |
| Super Heavy Static Fire Operations – 44     | 0.00                     | 106.1           | 3.35         | 0.00            | 0.00             | 0.00              |
| Truck Operations – 19,360                   | 0.12                     | 2.50            | 1.71         | 0.00            | 0.05             | 0.05              |
| Barge Operations – 44                       | 0.19                     | 4.89            | 0.53         | 0.16            | 0.10             | 0.09              |
| Vessel Rescue Operations – 50               | 1.61                     | 37.56           | 4.04         | 1.34            | 0.81             | 0.75              |
| <b>Annual Total – Proposed Action</b>       | <b>1.91</b>              | <b>374.55</b>   | <b>15.99</b> | <b>1.50</b>     | <b>0.96</b>      | <b>0.89</b>       |
| Brevard County – NEI                        | 33,352.4                 | 8,867.99        | 89,676.2     | 332.54          | 6,407            | 3,997.3           |
| <b>Percentage of Brevard County Total</b>   | <b>0.01%</b>             | <b>4.22%</b>    | <b>0.02%</b> | <b>0.45%</b>    | <b>0.02%</b>     | <b>0.02%</b>      |
| Insignificance Indicator                    | 250                      | 250             | 250          | 250             | 250              | 250               |
| Exceed Threshold Indicator?                 | No                       | Yes             | No           | No              | No               | No                |

Notes: % = percent; CO = carbon monoxide; NEI = National Emissions Inventory; NO<sub>x</sub> = nitrogen oxides; PM<sub>10</sub> and PM<sub>2.5</sub> = particulate matter with a diameter of less than or equal to 10 microns and 2.5 microns, respectively; SO<sub>x</sub> = sulfur oxides; tpy = tons per year; VOCs = volatile organic compounds.

Values of 0.00 are greater than zero but less than 0.005 tpy. Lead emissions would be less than 0.005 tpy.

The launch of SpaceX Starship-Super Heavy would reach the top of the mixing layer (3,000 feet [914 meters]) within 21 seconds and would emit at total of about 213.15 pounds (96.68 kilograms) of CO within this portion of the atmosphere. Reentry of the Starship and Super Heavy would take 20 seconds each and emit 17.4 pounds (7.89 kilograms) and 40.6 pounds (18.42 kilograms), respectively within the mixing layer. Static fire testing of Starship and Super Heavy would emit a total of 170.07 pounds (77.14 kilograms) of CO. In total, launch, landing, and static fire operations would amount to 9.71 tons (8.81 MT) of CO per year.

The launch of SpaceX Starship-Super Heavy would reach the top of the mixing layer (3,000 feet [914 meters]) within 21 seconds and would emit at total of about 6,754.65 pounds (3,063.86 kilograms) of NO<sub>x</sub> within this portion of the atmosphere. Reentry of the Starship and Super Heavy would take 20 seconds each and would emit 551.4 pounds (250.11 kilograms) and 1,286.6 pounds (583.59 kilograms), respectively within the mixing layer. Static fire testing would emit a total of 6,392.1 pounds (2,899.4 kilograms) of NO<sub>x</sub>. In total, launch, landing, and static fire operations would amount to 223.5 tons (200.1 MT) of NO<sub>x</sub> per year.

As illustrated, project operational emissions would not contribute to an exceedance of any NAAQS except NO<sub>x</sub>.

Airspace closures associated with the Proposed Action would lead to increased emissions from aircraft. This is mainly because aircraft would need to take pre-established alternative flight routes, which themselves are assessed by the FAA under separate NEPA analyses. This would result in the usage of more fuel. Increases in greenhouse gas (GHG) emissions would result from additional fuel usage. While the length of rerouting would be commensurate with the timing of the airspace closures, the emissions for

affected aircraft would not be substantial enough to notably influence the climate, considering the number of aircraft impacted.

#### **3.11.4.2.3 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. The study area for assessing reasonably foreseeable air quality effects from criteria pollutants includes Brevard County. Due to its lack of substantial emission sources and being adjacent to the Atlantic Ocean, Brevard County currently attains all NAAQS. The immediate area surrounding the project site at KSC is the focus of localized effects, as this area would experience the highest ambient effects from project emissions. Existing ambient air quality consists of present operations and activities at KSC, CCSFS, and within Brevard County in general. The nearest locations of substantial reasonably foreseeable project emissions that could combine with the Proposed Action and produce effects would occur within KSC and CCSFS.

As described in Section 3.11.4, *Environmental Consequences*, of this EIS, construction emissions would not result in significant adverse effects to air quality due to their temporary nature. Consequently, construction activities under the Proposed Action would not contribute to long-term incremental air quality effects from other reasonably foreseeable development actions within the study area.

The increase in operational emissions from the Proposed Action would remain below insignificance indicator thresholds for all criteria pollutants except NO<sub>x</sub>. Under the Proposed Action, the increase in operations is estimated to emit approximately 374.55 tons (339.68 MT) of NO<sub>x</sub> per year. With the insignificance indicator being 250 tons (227 MT) per year, operations would result in potentially significant air quality effects. The emissions from this Proposed Action in context with future launch activity at KSC and CCSFS would likely contribute to emissions that exceed significance thresholds for NO<sub>x</sub>.

### **3.11.5 BMPs, Mitigation, and Monitoring**

The following BMPs may be implemented to minimize potential adverse effects; any accepted BMPs would be identified in the ROD and incorporated into the license agreement:

For air quality, utilizing dust control measures such as staging construction activities to limit the extent of exposed areas, regularly watering soil to suppress dust, covering or watering exposed dirt or storage piles, covering truck loads prone to generating dust, and rinsing truck undercarriages before leaving the construction site would help minimize particulate matter emissions. These measures would reduce the potential for dust-related air quality effects by limiting the amount of particulate matter released into the atmosphere during periods of ground disturbance. The effectiveness of these measures would depend on the frequency of application and the extent of ground disturbance.

For NO<sub>x</sub> emissions, mitigation options are more limited, but reductions could be achieved by minimizing equipment use and idling times, utilizing cleaner-burning or lower-emission equipment where feasible, and scheduling activities to avoid peak air pollution periods. However, the primary source of increased NO<sub>x</sub> emissions is associated with additional launches and landings, and there are

few practical options for mitigation beyond exploring operational efficiencies. While these measures could reduce emissions to some extent, the overall effect remains tied to the operational requirements of the Proposed Action.

Monitoring would ensure that dust control measures and any NO<sub>x</sub>-related mitigations are effectively implemented. Regular site inspections would verify compliance, and adjustments to mitigation measures would be made as necessary to address site-specific conditions or evolving best practices.

### 3.11.6 Summary

Based on the analysis provided in Section 3.11.4.2.1, *Construction*, and Section 3.11.4.2.2, *Operation*, effects to air quality would be insignificant for all criteria pollutants except NO<sub>x</sub>. Emissions from construction activities would be minor and temporary, lasting only the duration of the construction phase. These emissions would remain well below insignificance indicator thresholds established for NEPA analysis, as shown in Table 3.11-2, and would not contribute to an exceedance of any NAAQS. Emissions sources during construction would be mobile and intermittent and pollutant emissions would not be large enough in a localized area to cause any exceedance of an ambient air quality standard.

For operational activities, emissions of all criteria pollutants except NO<sub>x</sub> are anticipated to remain below insignificance thresholds, as demonstrated in Table 3.11-3.

However, total NO<sub>x</sub> emissions—including both construction (11.11 tons per year) and operational (374.55 tons per year) sources—are estimated at 385.66 tons per year, exceeding the insignificance indicator threshold of 250 by approximately 54 percent. This level of NO<sub>x</sub> emissions represents 4.35 percent of the NEI total for Brevard County, which is 8,867.99 tons per year.

Additionally, the ground-level effect of launch vehicle emissions released above the atmospheric mixing layer would be negligible due to the inability of released pollutants to penetrate the mixing layer and mix downward to ground level. The FAA anticipates that launch and landing activities would result in NO<sub>x</sub> emissions above indicator thresholds and would be considered potentially significant unless localized air-dispersion modeling could demonstrate that the emissions would not cause or contribute substantially to a projected air quality violation of an ambient air quality standard.

## 3.12 Climate

### 3.12.1 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 (Intergovernmental Panel on Climate Change, 2023; Marvel et al., 2023).

GHGs are air pollutants that trap heat in the atmosphere. These emissions occur from natural processes and human activities. Earth's surface temperature is the resultant of all factors affecting incoming and outgoing radiation, and it changes as these factors change over time. Examples of GHGs from human activities include CO<sub>2</sub>, 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 CO<sub>2</sub> equivalent (CO<sub>2</sub>e). CO<sub>2</sub>e emissions are commonly expressed in units of metric tons.

It is important to note that the FAA has not set a significance threshold for climate, nor has it pinpointed specific factors to consider when determining the significance of GHG emissions. Currently, there are no universally accepted methods to determine significance for commercial space launch projects due to their minimal contribution to global GHG emissions. As such, FAA guidance will evolve in line with the maturing science or if new Federal mandates are introduced.

### 3.12.2 Study Area

The study area for climate is the same as that for air quality (Brevard County).

### 3.12.3 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 3.6, *Climate*, of the 2019 EA (NASA, 2019a, p. 59).

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) annual average temperature has risen about 2 degrees Fahrenheit (-17 degrees Celsius) and annual precipitation has decreased about 3 percent (for the 2002 to 2021 average, compared to the average for 1901 to 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 (152 millimeters) at the Trident Pier in Port Canaveral (Sweet et al., 2022).

The six primary GHGs, defined in section 202(a) of the CAA, are CO<sub>2</sub>, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. However, perfluorocarbons, sulfur hexafluoride, and nitrogen trifluoride are produced in relatively very small quantities and most often by very specific niche industries, such as electronic component manufacturers. It is likely that hydrofluorocarbons would be used in commercial heating, ventilation, and air-conditioning systems. However, no hydrofluorocarbons are planned for intentional release. Any release of hydrofluorocarbons would be accidental, minimal, and remedied quickly (especially in the hot and humid Florida climate). Additionally, USEPA's NEI database only tracks the most abundant GHGs (CO<sub>2</sub>, nitrous oxide, and methane). Therefore, analysis focuses on these three primary GHGs represented as CO<sub>2</sub>e based on their global warming potential. Although climate change is a global effect, the effects from this project are also evaluated in the context of



local and regional GHG emissions. GHG emissions for Brevard County, obtained from USEPA's 2020 NEI database, are summarized in Table 3.12-1.

**Table 3.12-1. NEI 2020 GHG Emissions for Brevard County, Florida**

| Location       | GHG Emissions (tpy) |                 |                  |                            |
|----------------|---------------------|-----------------|------------------|----------------------------|
|                | CO <sub>2</sub>     | CH <sub>4</sub> | N <sub>2</sub> O | Total in CO <sub>2</sub> e |
| Brevard County | 6,977,112.13        | 24,838.64       | 54.52            | <b>7,733,551.91</b>        |

Notes: CH<sub>4</sub> = methane; CO<sub>2</sub> = carbon dioxide; CO<sub>2</sub>e = carbon dioxide equivalent; GHG = greenhouse gas; N<sub>2</sub>O = nitrous oxide;

NEI = National Emissions Inventory; tpy = tons per year.

Source: (USEPA, 2020)

## 3.12.4 Environmental Consequences

### *Analysis Methodology*<sup>46</sup>

Unlike criteria pollutants, GHG emissions are not limited to lower atmospheric layers. Therefore, the analysis includes emissions from all phases of activity, regardless of altitude.

The analysis estimates annual GHG emissions from construction activities associated with the Proposed Action utilizing the DAF ACAM. Operation emissions were calculated in a spreadsheet model. Details of emissions calculations are provided in Appendix C.2, *Air Quality Assessment*. This approach is consistent with analysis approach recommended in the FAA Order 1050.1F Desk Reference (FAA, 2023b).

Regarding effects from proposed GHG emissions, the analysis uses the PSD threshold for GHGs of 75,000 tons per year of CO<sub>2</sub>e (or 68,039 MT 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<sub>2</sub>e) emissions below the insignificance indicator (threshold) are considered too insignificant on a global scale to warrant any further analysis (AFCEC/CZTQ, 2023a).

The liquefaction plant, including the methane liquefier and ASU, is an integral part of the Proposed Action but remains under design. GHG emissions associated with the plant would be dependent on its final design, operational processes, and energy sources. These emissions would be evaluated as part of the FDEP permitting process to determine applicable requirements and mitigation measures. SpaceX is committed to designing and operating the facility in compliance with all relevant Federal and state regulations to minimize its carbon footprint and support sustainability goals.

### 3.12.4.1 No Action

Under the No Action Alternative, the FAA would not issue SpaceX a new license or modify their existing license for the Starship-Super Heavy launch vehicle at LC-39A and SpaceX would not construct launch, landing, and other associated infrastructure at LC-39A. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Under the No Action Alternative, the annual cadence for operations at KSC (and CCSFS) is anticipated to increase over time, and local development projects are anticipated to continue. As a result, implementation of the No Action Alternative would result in

<sup>46</sup> On January 28, 2025, President Trump issued E.O. 14154, *Unleashing American Energy*, which directs Federal agencies to no longer consider the social cost of GHGs. Accordingly, the social cost of GHGs was not considered in this EIS.

increased launch- and development-related GHG emissions within the region, the scope of which would be dependent on the number of launches and types of vehicles, and size of development projects. As launch licenses are approved or adjusted over time, GHG analyses would be conducted by the FAA, NASA, or the DAF in associated NEPA documentation to identify any potentially significant effects.

### 3.12.4.2 Proposed Action

#### 3.12.4.2.1 Construction

GHG emissions from the construction of the Proposed Action items at LC-39A were estimated with the use of ACAM (version 5.0.23a) (Solutio Environmental, 2022). Activity data developed for project construction were used as inputs to ACAM. GHG emissions from the construction of the Proposed Action items are shown in Table 3.12-2 and have been estimated at 1,353 MT per year (CO<sub>2</sub>e) for personnel and construction activities. GHG emissions from the construction of the previously approved action items have been estimated at 1,933 MT per year (CO<sub>2</sub>e). Construction emissions would be temporary, only lasting the duration of the construction process, and would not be repeated on an annual basis. During this period, some of these emissions may be mitigated through implementation of construction BMPs, such as limiting idling time and spraying and/or covering unpaved roads and piles.

**Table 3.12-2. Construction-Related GHG Emissions (metric tpy)**

| Activity                         | GHG Pollutants (metric tpy) |                   |                   |                   | Threshold     | Exceedance |
|----------------------------------|-----------------------------|-------------------|-------------------|-------------------|---------------|------------|
|                                  | CO <sub>2</sub>             | CH <sub>4</sub>   | N <sub>2</sub> O  | CO <sub>2</sub> e |               |            |
| Proposed Action Construction     | 1,317                       | 0.03140643        | 0.11735438        | 1,353             | 68,039        | No         |
| Previously Approved Construction | 1,896                       | 0.05516654        | 0.11989608        | 1,933             | 68,039        | No         |
| <b>Total</b>                     | <b>3,213</b>                | <b>0.08657297</b> | <b>0.23725046</b> | <b>3,286</b>      | <b>68,039</b> | <b>No</b>  |

Notes: CH<sub>4</sub> = methane; CO<sub>2</sub> = carbon dioxide, CO<sub>2</sub>e = carbon dioxide equivalent; GHG = greenhouse gas; N<sub>2</sub>O = nitrous oxide; tpy = tons per year.

#### 3.12.4.2.2 Operation

Operation of the Proposed Action would generate GHG emissions through launches, landings, static fire testing, associated support activities, transportation of commodities via barge and truck, and vessel recovery at KSC. A spreadsheet model was used to calculate the annual GHG emissions based on the operational assumptions described in Section 2.1.3, *Starship-Super Heavy Operations*.

Details of emissions calculations for all operational activities, including emissions factors and assumptions are provided in Appendix C.2, *Air Quality Assessment*. The estimated operational GHG emissions are shown in Table 3.12-3. The analysis weighs the Proposed Action Alternative's annual net change in GHG emissions proportionally against (or relative to) regional emissions, using Brevard County's NEI.

**Table 3.12-3. Annual GHG Emissions for Operation of the Proposed Action**

| Scenario/Activity                                                                                                 | CO <sub>2</sub> e (mt) |
|-------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Proposed Action</b>                                                                                            |                        |
| Proposed Action Construction                                                                                      | 1,353                  |
| Previously Approved Construction                                                                                  | 1,933                  |
| SpaceX Starship-Super Heavy Launch Vehicle Operations<br>(includes pre-launch activities, launches, and landings) | 210,662.01             |

**Table 3.12-3. Annual GHG Emissions for Operation of the Proposed Action**

| <b>Scenario/Activity</b>                                      | <b>CO<sub>2</sub>e (mt)</b> |
|---------------------------------------------------------------|-----------------------------|
| Truck Operations – Transportation of Commodities <sup>1</sup> | 1,255.54                    |
| Barge Operations – Transportation of Commodities              | 232.22                      |
| Vessel Recovery Operations                                    | 1,918.97                    |
| <b>Annual Total – Proposed Action</b>                         | <b>217,354.74</b>           |
| <b>Annual Total – Brevard County’s NEI</b>                    | <b>7,733,551.91</b>         |
| <b>Percentage of Brevard County Total</b>                     | <b>2.81%</b>                |
| Insignificance Indicator                                      | 68,039                      |
| Exceed Threshold Indicator?                                   | Yes                         |

Notes: % = percent; CO<sub>2</sub>e (mt) = carbon dioxide equivalent metric tons; GHG = greenhouse gas, LCH<sub>4</sub>= liquid methane; LN<sub>2</sub> = liquid nitrogen; LOX = liquid oxygen.

<sup>1</sup>Includes delivery of LCH<sub>4</sub>, LN<sub>2</sub>, and LOX.

These data show that GHG emissions from the Proposed Action would exceed the GHG threshold indicator for CO<sub>2</sub>e by a significant amount. As a result, the FAA anticipates that GHG emissions from operations would be considered potentially significant.

#### **3.12.4.2.3 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. As identified in Section 3.12.4, *Environmental Consequences*, GHG emissions estimated for project construction and operational activities would exceed the GHG insignificance indicator threshold.

GHGs are nonhazardous to health at normal ambient concentrations and can only potentially cause warming of the climatic system at a cumulative global scale. Therefore, the action-related GHGs have no significant effect to local air quality. However, from a global perspective, individual actions with GHG emissions such as this each make a relatively small addition to global atmospheric GHG concentrations that collectively may have a large effect on climate change (AFCEC/CZTQ, 2023b).

Project GHG emissions, in combination with GHG emissions from reasonably foreseeable actions identified would result in effects to climate change.

As identified in Section 3.12.4, *Environmental Consequences*, climate change could affect implementation of the Proposed Action at KSC and the adaptation strategies needed to respond to future conditions. Operations at KSC have adapted to their changing climate. However, exacerbation of these conditions in the future could impede proposed activities during extreme events. Through implementation of their Climate Action Plans, 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 effects. Implementation of these measures would mitigate the effects of climate change to the Proposed Action, as well as other reasonably foreseeable actions.

### 3.12.5 BMPs, Mitigation, and Monitoring

The following BMPs may be implemented to minimize potential adverse effects; any accepted BMPs would be identified in the ROD and incorporated into the license agreement:

For climate effects, BMPs would focus on reducing GHG emissions from construction and operational activities associated with the Proposed Action, as well as enhancing resilience to potential climate change effects on project infrastructure and operations.

To minimize GHG emissions, construction and operational activities would comply with all applicable Federal, state, and local regulations, as well as relevant sustainability policies. Specific measures to reduce emissions during construction include using energy-efficient equipment, minimizing vehicle idling, and prioritizing the use of low-emission or alternative fuel machinery where feasible. These measures may help lower CO<sub>2</sub> and nitrogen oxide emissions, which are significant contributors to climate change, while supporting operational efficiency.

Operational emissions from launches represent a significant source of GHG emissions. Where feasible, the Proposed Action would minimize these emissions through measures such as optimizing launch operations, and improving efficiencies in ground support operations (e.g., reducing the number of static fires as the program progresses). While the inherent nature of launch activities limits the potential for substantial reductions in emissions, these measures would help to incrementally minimize the overall GHG footprint of the Proposed Action.

To address and ensure infrastructure resilience, construction activities and facilities may consider adaptive design features where practicable, such as elevating critical infrastructure, enhancing stormwater management systems to accommodate extreme rainfall, and fortifying structures to withstand high wind speeds associated with intensified storms. All facilities would be designed in accordance with Florida Building Code as required in the lease with KSC.

Monitoring would be essential to ensure the effective implementation of these BMPs and adaptation measures. During construction, GHG emissions from vehicles and equipment may be tracked to verify compliance with BMPs for emissions reductions. Operational monitoring would focus on tracking emissions associated with launch activities and evaluating the effectiveness of mitigation measures such as optimized scheduling or technological advancements. For climate adaptation, regular inspections of infrastructure would ensure that resilience measures remain effective against evolving climate conditions, with adjustments made as necessary.

By implementing these BMPs and monitoring their effectiveness, the Proposed Action would reduce its contribution to climate change while maintaining resilience to climate-related risks.

### 3.12.6 Summary

Regarding effects from proposed GHG emissions, the analysis used the PSD threshold for GHGs of 75,000 tons per year of CO<sub>2</sub>e (or 68,039 MT 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<sub>2</sub>e) emissions below the insignificance indicator (threshold) are considered too insignificant on a global scale to warrant any further analysis (AFCEC/CZTQ, 2023a).

Construction-related GHG emissions for the Proposed Action are estimated at 1,353 MT of CO<sub>2</sub>e, as detailed in Section 3.12.4.2.1, *Construction* (Table 3.12-2). These emissions would occur only during the construction period and are temporary in nature. Mitigation measures, such as limiting equipment idling, may help reduce these emissions. While construction emissions do not exceed the insignificance threshold, they contribute to the overall emissions associated with the Proposed Action.

The data presented in Section 3.12.4.2.2, *Operation*, (Table 3.12-3) illustrates that the GHG emissions from the Proposed Action would exceed the GHG insignificance indicator threshold of 68,039 MT per year. Annual operational GHG emissions are estimated at 210,662.01 MT of CO<sub>2</sub>e, with total emissions—including construction, trucks, barges, and vessel recovery—amounting to 217,354.74 MT of CO<sub>2</sub>e. This exceeds insignificance indicator threshold by approximately 319 percent and represents approximately 2.81 percent of the total annual emissions for Brevard County, indicating a substantial contribution to regional emissions.

In summary, the Proposed Action's GHG emissions exceed the insignificant indicator and are expected to contribute to cumulative global GHG emissions, some effects of which are identified in Section 3.12.3, *Existing Conditions*.

## 3.13 Hazardous Materials, Solid Waste, and Pollution Prevention

### 3.13.1 Definition of Resource and Regulatory Setting

This section defines hazardous materials, solid waste, and pollution prevention commonly associated with launch and landing operations and includes a discussion of regulatory requirements relative to this resource area. This section also includes a description of hazardous materials along with hazardous and solid wastes at LC-39A, as well as a discussion of the regulatory status of the site. In this document, regulatory status relates to any applicable land covenants, restrictions on land use, restrictions on groundwater use, restrictions on future land conveyance, zones of contamination, levels of contamination, potential areas of concern, munitions response areas, Resource Conservation and Recovery Act (RCRA) landfill areas, ongoing site environmental monitoring requirements, ongoing site maintenance requirements, access requirements and access restrictions, etc.

The FAA considers hazardous material, pollution prevention, and solid waste effects in NEPA documentation such as this EIS. FAA Order 1050.1F, Section 7, defines the terms *hazardous material*, *hazardous waste*, *hazardous substance*, and *solid waste* as follows.

**Hazardous material** is any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce. The term *hazardous materials* includes hazardous wastes and hazardous substances, as well as petroleum and natural gas substances and materials (see 49 CFR §172.101).

**Solid waste** is defined by the implementing regulations of RCRA generally as any discarded material that meets specific regulatory requirement and can include such items as refuse and scrap metal, spent



materials, chemical by-products, and sludge from industrial and municipal wastewater and water treatment plants (see 40 CFR §261.2 for the full regulatory definition).

**Hazardous waste** is a type of solid waste defined under the implementing regulations of RCRA. A hazardous waste (see 40 CFR §261.3) is a solid waste that possesses at least one of the following four characteristics: ignitability, corrosivity, reactivity, or toxicity as defined in 40 CFR Part 261 Subpart C, or is listed in one of four lists in 40 CFR Part 261 Subpart D, which contains a list of specific types of solid waste that USEPA has deemed hazardous. RCRA imposes stringent requirements on the handling, management, and disposal of hazardous waste, especially in comparison to requirements for nonhazardous wastes.

### ***Regulatory Setting***

Appendix D.13, *Hazardous Materials, Solid Waste, and Pollution Prevention*, lists and describes the laws, executive orders, Federal and state agency regulations, and other guidance (i.e., FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*) that apply to hazardous materials, solid waste, and pollution prevention.

The Federal statutes of most importance to analysis within this EIS are RCRA, Comprehensive Environmental Response, Compensation, and Liability Act (as amended by the Superfund Amendments and Reauthorization Act of 1986), and the Community Environmental Response Facilitation Act of 1992. The Emergency Planning and Community Right-to-Know Act (EPCRA), Pollution Prevention Act, and Hazardous Materials Transportation Act also apply to the Proposed Action. Federal, state, and local statutes, regulations, executive orders, and other requirements related to hazardous materials, solid waste, and pollution prevention are also included in this section. The FAA and Council on Environmental Quality guidance also encourage consideration of opportunities for pollution prevention in a proposed action and its alternatives.

KSC is designated as a Large Quantity Generator (LQG) of hazardous waste under USEPA generator Identification No. FL6800014585 by USEPA (USEPA, 2024f). SpaceX at LC-39A is registered as an LQG of hazardous waste under USEPA generator Identification No. FLR000212472 (USEPA, 2024g).

### **Florida-Specific Regulations**

Florida is authorized by USEPA to administer its own hazardous waste management and regulatory program under RCRA. The State of Florida has adopted and incorporated portions of Title 40 CFR Parts 260–273 into its Florida Administrative Code Chapter 62-730. Operation of solid waste landfill facilities in Florida are regulated by Florida Administrative Code Chapter 62-701.

## **3.13.2 Study Area**

The study area for hazardous materials, solid waste, and pollution prevention includes activities that utilize and store hazardous materials and generate hazardous and solid waste, in addition to areas adjacent to LC-39A that are associated with RCRA sites; KSC in general (including KSC operations); the local area from a capacity perspective in terms of treatment, storage, and disposal facilities (TSDFs) and landfills (for solid and hazardous wastes generated from the Proposed Action or alternatives); and the landing activities on the dronship and its vicinity in the event of an expenditure event.

### 3.13.3 Existing Conditions

#### **Contaminated Sites**

Activities associated with the Proposed Action overlap areas of known or suspected contaminants associated with historical usage. These areas are Solid Waste Management Units (SWMUs) and Potential Release Locations (PRLs).

Six SWMUs and one PRL have been identified within or adjacent to the Proposed Action project area with the potential for contaminated media due to past operations (Figure 3.13-1). The entire LC-39A has been designated as SWMU #008, the other sites, SWMU #46, #47, #48, #49, #50, #51, and PRL #237 are located on LC-39A and are managed under the footprint of SWMU #008. RCRA Facility Investigation activities were performed at LC-39A from early 1998 through mid-2000, with an RCRA Facility Investigation Addendum in 2003 (NASA, 2019a). COCs were identified in each medium. As a result of elevated concentrations of PCBs and polycyclic aromatic hydrocarbons detected in soils, a soil removal to achieve FDEP Industrial Soil Cleanup Target Levels was conducted as part of an Interim Measure (IM) in 2000 (NASA, 2019a).

A site-wide groundwater and soil investigation was conducted between 2011 and October 2012 to further evaluate contaminants resulting from former launch activities (NASA, 2019a). The investigation confirmed the presence of COCs in groundwater and soil at concentrations greater than FDEP Groundwater Cleanup Target Levels. The COCs in soil at LC-39A included arsenic, barium, copper, Pb, nickel, thallium, polycyclic aromatic hydrocarbons, total PCBs, dioxins/furans, and total recoverable petroleum hydrocarbons. An IM was conducted in 2014 and 2015 to mitigate human health risks associated with direct contact exposure to soil by removing soil with COCs concentrations greater than residential Soil Cleanup Target Levels. Following completion of the soil removal and confirmation that residential Soil Cleanup Target Levels were achieved for the COCs, no further action was recommended for soil at the site in the IM report dated October 2015 and approved by the FDEP in November 2015 (NASA, 2019a). Groundwater is the only medium of concern at LC-39A with the primary contaminants detected being trichloroethene, cis-1,2-dichloroethene, and vinyl chloride. The remedy for groundwater is air sparging (initiated in 2015) and long-term monitoring. Land Use Controls (LUCs) are in place to prohibit the use of groundwater at SWMU #008 (NASA, 2019a). Six other SWMUs are managed under SWMU #8:

- SWMU 046 – LC-39A Deluge Basin Area: The LC-39A Deluge Basin Area was located north of the launch pad. It received deluge wastewater from the pad during launch activities. The deluge wastewater was treated prior to discharge at a permitted spray field.
- SWMU 047 – LC-39A Compressed Air Building (J8-1659): Located east of the launch pad, the LC-39A Compressed Air Building houses equipment used to compress air in support of launch operations. Here, condensate/wastewater passed through an oil/water separator and was contained in an underground storage tank.
- SWMU 048 – LC-39A Hypergol Fuel Facility (J8-1906): The LC-39A Hypergol Fuel Facility was a one-story open structure located at the southwest corner of the launch complex. It housed an 8,000-gallon AST that contained monomethylhydrazine.

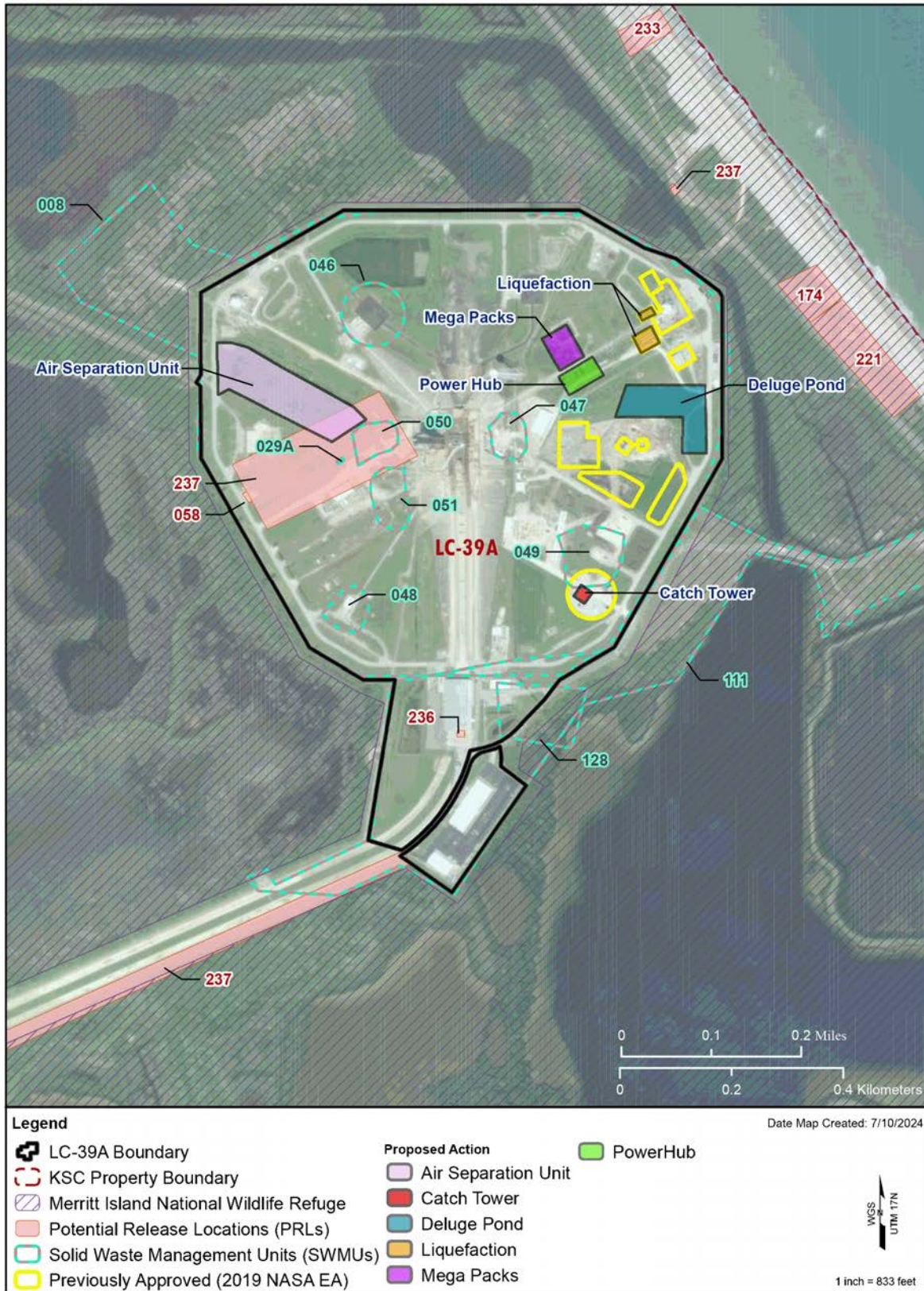


Figure 3.13-1. SWMUs and PRLs within the Proposed Action Footprint



- SWMU 049 – LC-39A Hypergol Oxidizer Facility (J8-1862): Located at the southeast corner of the launch complex, the LC-39A Hypergol Oxidizer Facility was a one-story open structure that housed an 8,000-gallon AST, which contained nitrogen tetroxide.
- SWMU 050 – LC-39A Environmental Control System (J8-1768): The LC-39A Environmental Control System facility was located west of the launch pad. It housed equipment used to control the environment in the space shuttle while it was on the launch pad.
- SWMU 051 – LC-39A Heating, Ventilation, and Air Conditioning (HVAC) Facility (J8-1707): Located west of the launch pad, the LC-39A HVAC facility was used to store water treatment chemicals such as corrosion inhibitors, anti-foulants, biocides, and fungicides that were used at the HVAC cooling tower.

Another contamination site located within the footprint of a project of the Proposed Action is PRL #237, which is located at the southeastern end of the proposed ASU. A center-wide perfluoroalkyl and polyfluoroalkyl substances (PFAS) investigation evaluated PFAS impacts associated with Sewage Treatment Facility #5. PRL #237 has identified PFAS-impacted groundwater at LC-39A.

### ***Hazardous Materials Use***

Categories of hazardous materials used in support of standard launch and test fire activities include petroleum products, oils, lubricants, volatile organic compounds, corrosives, refrigerants, adhesives, sealants, epoxies, and propellants. Numerous ancillary materials have been used for cleaning and processes at the complex, including flammable and non-flammable chlorinated solvents, PCBs, fire suppression chemicals such as Halon as well as Freon and water treatment chemicals used in HVAC operations. Asbestos is present as an insulating material in the launch structure flame trenches and in various adjoining facilities and structures. Paints at the launch complex are known to contain heavy metals and PCBs (NASA, 2011b). Multiple liquid propellant types would be accommodated at the Proposed Action site to include LN<sub>2</sub>, LOX, and LCH<sub>4</sub>. The fuel farms onsite that would support the liquid propellants would have a capacity to accommodate approximately 1.43 million gallons (5.41 million liters) of LN<sub>2</sub>, 1.8 million gallons (6.8 million liters) of LOX, and 1.43 million gallons of LCH<sub>4</sub>, at their respective fuel farms. SpaceX is responsible for the proper management of any hazardous materials stored at this location (SpaceX, 2018; SpaceX, 2024c).

Because KSC borders several navigable waterways and stores more than 1,320 gallons (4,997 liters) of oil above ground, the facility is subject to the SPCC regulations. The KSC facility-wide SPCC Plan (KSC-PLN-1919) (KSC, 2019) and the KSC site-specific plan (KSC-PLN-1920) (KSC, 2024b) outline the criteria established by KSC to prevent, respond to, control, and report spills of oil. Various types and quantities of oil are stored, transported, and handled to support the operations of KSC. The KSC SPCC Plan describes both the facility-wide and site-specific approaches for preventing and addressing spills, in addition, the SpaceX Emergency Action Plan describes procedures relating to spills and toxic releases at LC-39A (SpaceX, 2024d).

### ***Solid and Hazardous Waste***

The Brevard County Landfill (Permit No. SO05-0075133-010), a 190-acre (77-hectare) landfill located at 2260 Adamson Road in Cocoa, Florida, is utilized for general solid waste collection within the study area. The Brevard County Landfill is classified as a Class I as it receives an average of 20 tons (18 MT) or more of solid waste per day. The Brevard County Landfill receives general, nonhazardous household, commercial, industrial and agricultural waste at a rate of 3,500 tons (3,200 MT) or more per day and is

anticipated to be in operation until at least 2036 (Brevard County, 2024). The landfill is accessible from KSC via county-maintained roads that are suitable for travel by disposal vehicles. Solid wastes at KSC are typically placed in covered receptacles until disposed of offsite to minimize accidental entry into marine waters or contact with stormwater and prevent offsite deposition from wind. Solid wastes are salvaged or recycled to the maximum extent practicable, and the remaining solid waste disposed of at the Brevard County Landfill.

Construction and demolition (C&D) debris generated at KSC is disposed of at the KSC landfill, an unlined Class III landfill operating under a permit from the FDEP with permit restrictions to the types of waste it can receive (KSC, 2023). Approved waste allowed at the KSC landfill includes non-pressure-treated wood, certain spent blast media, clean soil, carpet and furniture, and C&D debris (defined as materials considered to be non-water soluble and nonhazardous in nature, including but not limited to steel, brick, glass, concrete, asphalt, pipe, gypsum wallboard, dry electrical equipment, and lumber). This also includes rocks, soils, tree remains, trees, and other vegetative matter, which normally results from land clearing or development from a construction project (KSC, 2022).

SpaceX is an LQG of hazardous waste (Environmental Protection Agency Identification No. FLR000212472). SpaceX uses Clean Harbors in Bartow, Florida, as the TSDF for waste produced at LC-39A and of a variety of other TSDF disposal sites based on availability.

### **Pollution Prevention**

KSC applies pollution prevention measures to the greatest extent possible. These measures may include purchase of environmentally friendly products; recycling cardboard containers and wooden pallets; incorporating energy-efficient building design for cooling, heating, and lighting; and using alternate power sources such as photovoltaic cells. Additionally, as part of security patrols during launches, KSC personnel may coordinate sweeps after each event to recover materials that have been discharged from rockets.

MARPOL is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes (International Maritime Organization, 2024). The Convention includes regulations aimed at preventing and minimizing pollution from ships, both accidental pollution and from routine operations, and currently includes six technical annexes—most relevant are Annex I (prevention of pollution by oil from operational measures as well as from accidental discharges); Annex IV (requirements to control pollution of the sea by sewage); Annex V (garbage and specifies the distances from land and the manner in which it may be disposed); and Annex VI (limits on sulfur oxide and NO<sub>x</sub> emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances).

## **3.13.4 Environmental Consequences**

### **Analysis Methodology**

This section describes the activities that may require the transportation, storage, and use of hazardous materials or generate solid waste during site preparation, construction, and operations activities. It also addresses potential effects associated with hazardous materials, solid waste, and pollution prevention as compared to the existing condition.



The FAA has not established a significance threshold for hazardous materials, solid waste, or pollution prevention in FAA Order 1050.1F; however, the FAA has identified factors to consider in evaluating the context and intensity of potential environmental impacts for hazardous materials, solid waste, or pollution prevention (FAA, 2023b). These factors are not intended to be thresholds; if these factors exist, there is not necessarily a significant impact; rather, the FAA must evaluate these factors in light of context and intensity to determine if there are significant impacts. Factors to consider that may be applicable to hazardous materials, solid waste, and pollution prevention include, but are not limited to, situations in which the proposed action or alternative(s) would have the potential to do the following:

- Violate applicable Federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management
- Involve a contaminated site (including, but not limited to, a site listed on the National Priorities List)
  - Contaminated sites may encompass relatively large areas. However, not all of the grounds within the boundaries of a contaminated site are contaminated, which leaves space for siting a facility on non-contaminated land within the boundaries of a contaminated site. An EIS is not necessarily required. Paragraph 6-2.3.a of FAA Order 1050.1F allows for mitigating impacts below significant levels (e.g., modifying an action to site it on non-contaminated grounds within a contaminated site). Therefore, if appropriately mitigated, actions within the boundaries of a contaminated site would not have significant impacts.
- Produce an appreciably different quantity or type of hazardous waste
- Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity
- Adversely affect human health and the environment

Therefore, analysis focuses on the following:

- Management, transportation, storage, and use of hazardous materials and waste for site preparation and operations, and whether proposed engineering controls (e.g., secondary containment) or operational controls (emergency response plans) would be adequate to address potential releases, and whether local emergency response resources would be available to respond to a potential release of hazardous materials
- Waste streams (both hazardous and solid) that would be generated by the Proposed Action and the No Action Alternative and whether waste disposal would result in effects to facility disposal capacity
- Environmental site investigations and site remediation that may be required and whether the Proposed Action would interfere with any ongoing remediation of identified contaminated sites
- How construction and operation of the proposed spaceport will conform to the existing restrictions of the site, including land use and groundwater use restrictions, covenants, required ongoing monitoring and maintenance requirements, maintenance of signage, etc.

The methodology used to evaluate the effect of these factors identified proposed activities and, using process knowledge or other available data, determined the type and quantity of waste (hazardous and

nonhazardous) that would likely be generated by the Proposed Action. Resulting waste types/quantities were then compared to proposed management measures to determine if applicable waste regulations would be met or if regional landfill capacities (in the case of solid wastes) would be exceeded.

To evaluate effects to existing contamination sites, the existing location of these sites was compared with the location of proposed activities. Site-specific conditions, including the existence of LUCs, were then analyzed against proposed activities to assess whether these activities could result in health effects to workers or releases of hazardous constituents to the environment.

Based on the above factors, the FAA has not identified any significant adverse effects associated with hazardous materials, solid waste, or pollution prevention. No National Priorities List properties are involved in the project, and landfill capacities would not be exceeded. As indicated in discussions below, there is the potential for effects to historical contamination sites. The contaminated sites could continue to be managed under the existing hazardous waste facility permit (Environmental Protection Agency Identification No. FLR000212472). Also, KSC, as the owner of the site, would be responsible for any restrictions placed on the site as part of state-approved corrective actions for the historical sites.

#### 3.13.4.1 No Action

Under this alternative, SpaceX would not construct a launch pad at LC-39A, perform launches and landings at LC-39A, or landings in the ocean. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Numerous types of hazardous materials are used to support the missions and general maintenance operations at KSC. Management of hazardous materials and the resultant hazardous waste is the responsibility of each individual or organization and is regulated under RCRA (40 CFR Parts 260–280) and Florida Administrative Code Rule 62-730. Outside of KSC, hazardous waste generating facilities are regulated under RCRA, USEPA, and FDEP requirements to ensure that environmental effects are minimized to the extent possible. Overall, there would be an increase in the quantity of hazardous and nonhazardous waste generated as a result of these actions. However, with the implementation of appropriate handling and management procedures for hazardous materials, hazardous wastes, and solid wastes generated during construction and operational activities, it is unlikely there would be significant onsite effects.

#### 3.13.4.2 Proposed Action

Construction activities associated with facilities are expected to occur over a 1- to 2-year period. Activities associated with operations are evaluated based on the site conducting up to 44 launches per year. Indirect effects are also identified and included in the analysis. Additional information on activities associated with the Proposed Action is provided in Section 2.1, *Proposed Action and Alternatives, Proposed Action*.

##### 3.13.4.2.1 Construction

###### Contaminated Sites

Areas associated with proposed activities traverse contamination areas, such as SWMU #008 and PRL #237. LUCs are in place at LC-39A to prohibit the use of groundwater at SWMU #8 due to the volatile organic compounds and PFAS that are present in the groundwater (see Section 3.13.3, *Existing Conditions*) until cleanup levels are achieved at the site. Controls include periodic inspection, condition certification,

and agency notification (KSC, 2017). While soils at SWMU #008 are at no further action, if any evidence of potential contamination is encountered during construction (stained/discolored soil, odors, sheen on groundwater, etc.), all work would cease and KSC and the FDEP would be immediately notified. Any dewatering activities at SWMU #008 will require a dewatering plan and coordination with the KSC Remediation Group and the FDEP. Regardless, all work on or near these areas would be coordinated with these same agencies. With implementation of these procedures (to include risk minimization practices previously discussed), no significant effects would be expected because of construction activities in these areas.

#### Hazardous Materials Use

Hazardous materials that are common to construction include diesel and gasoline to fuel the construction equipment; hydraulic fluids, oils, and lubricants; and welding gases, paints, solvents, adhesives, and batteries. Typical of most construction projects, the storage and use of these materials may result in minor, incidental spills of diesel fuel or oil to the ground during fueling of equipment, filling of fuel storage tanks, and handling of lubricants. Other incidental spills could be associated with equipment failures such as ruptured hoses. To prevent the release of hazardous materials to the environment, appropriate measures would be implemented to ensure hazardous materials are handled, stored, and used in compliance with Federal, state, and local regulations.

Hazardous materials would be brought onsite using DOT-approved trucks or containers and temporarily stored until needed (Table 3.13-1). Transportation would only be over approved roads by licensed carriers who will employ appropriate DOT placarding. In case of a hazardous materials incident during transportation (including loading, unloading, and temporary storage), the carrier would be required to immediately provide notification to the appropriate agency, such as the local police or fire department and the FDEP. Typical measures that would be implemented to minimize the potential for a hazardous material release would include the following:

- Implementing SPCC Plan prevention measures while loading and unloading fuel, such as preventing movement of transport vehicles during product handling operations and inspecting vehicle outlets for leakage before filling and truck departure
- Providing secondary containment for all bulk hazardous materials storage locations
- Storing bulk hazardous materials in approved containers that meet National Fire Protection Association industrial fire protection codes and required containment systems
- Storing hazardous materials in protected and controlled areas designed to comply with the SPCC Plan, RCRA Plan, and Hazardous Materials Management Plan
- Implementing appropriate storage container inspection and personnel training procedures

The use and management of hazardous materials for the construction phase of the Proposed Action are summarized in Table 3.13-1.

**Table 3.13-1. Hazardous Materials Management for Construction**

| <b>Material</b>                                                                   | <b>Storage Quantity</b>                       | <b>Use</b>                                                                     | <b>Management</b>                                                                                                                                       |
|-----------------------------------------------------------------------------------|-----------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fuel, hydraulic fluid and lubrication oils                                        | Containers up to 5 gallons each               | Construction equipment                                                         | Stored on impervious surface with spill cleanup materials available. Used oils would be collected for recycling.                                        |
| Welding gases                                                                     | Containers up to 150 pounds each              | Construction of launch structures and fabrication and maintenance of equipment | Consumed in welding operations. Cylinders would be removed from launch site by vendors.                                                                 |
| Diesel fuel, gasoline, propane                                                    | Up to seven tanks of up to 5,000 gallons each | Fuel for construction equipment                                                | Stored in aboveground tanks with secondary containment and periodic inspections.                                                                        |
| Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, etc. | Containers up to 5 gallons each               | Construction of launch site facilities and equipment, cleaning                 | Limited quantities stored onsite at any one time. Stored in a small, locked steel building in the shop areas at least 2,500 feet from any fuel storage. |

### Hazardous and Solid Wastes

Hazardous and nonhazardous solid wastes would be generated in small quantities during construction and include spent solvents, waste paint and solvents, used oil, spill cleanup materials, and Pb-acid batteries from construction equipment. These wastes would be stored in appropriate containers in accordance with applicable Federal and State of Florida regulations identified in Appendix D.13, *Hazardous Materials, Solid Waste, and Pollution Prevention*. Wastes that cannot be recycled would be disposed of by the contractor at licensed facilities in a manner approved by USEPA and the FDEP; consequently, no significant effects would be expected.

C&D debris would be generated during construction of the catch tower, the natural gas pretreatment system, the liquefier, the ASU, and the stormwater/deluge ponds. A total area of approximately 382,950 square feet (35,580 square meters) of building space is associated with these four projects. Using conventional construction methods, approximately 4.34 pounds (1.97 kilograms) of C&D debris would be generated for every square foot of building space (USEPA, 2003). This would equate to a total of approximately 831 tons (753 MT) of C&D debris generated over the entire construction process (the product of 382,950 [square feet] multiplied by 4.34 [psf], divided by 2,000). Building materials, such as asphalt and concrete, would not be expected to generate significant waste since they are produced in the needed quantities and can be recycled if the material or its placement does not meet specifications. In the case of paved surfaces, C&D debris would likely consist mostly of wooden forms that could be recycled.

Soil excavated during construction activities would be stockpiled for construction and landscaping uses within the LC-39A fence line, while woody debris from land-clearing activities could also be chipped or mulched onsite and used for landscaping. (Note: Because this is a RCRA-regulated site, any soils removed from their native locations are required to be fully characterized regarding potential contamination.) These soils would be shipped offsite for proper disposal in accordance with the characterization results. SpaceX would develop and implement a Construction Management Plan, which would detail the steps

necessary for the management of all waste generated resulting from construction activities. Other nonhazardous waste generated would be the result of construction site operations (e.g., food waste, office waste, packaging materials). The quantity of this type of waste would be minor, when compared to the C&D debris generated.

As discussed in Section 3.13.3, *Existing Conditions*, sufficient landfill capacity exists to accommodate the additional solid waste generated because of construction activities; consequently, no significant effects are expected associated with solid wastes.

#### Pollution Prevention

Construction projects would apply pollution prevention measures to the greatest extent possible. In addition to the release prevention measures described above, these measures would include purchase of environmentally friendly products, such as paints with a low volatile organic compounds content. Projects would also incorporate recycling to limit the quantity of solid waste generated. This may include recycling wooden pallets and using soils and woody debris from land-clearing activities for landscaping onsite.

#### **3.13.4.2.2 Operation**

##### Contaminated Sites

Starship-Super Heavy operations would not be expected to significantly affect the NASA KSC Remediation Program for managing SWMU or PRL sites, or for interfere with ongoing investigations at these locations. Future investigation and sampling operations by the KSC Remediation Program would be coordinated with users of LC-39A for the portion of the site located within the Proposed Action project area that is under investigation. Coordination with the KSC Environmental Program during construction, modification, and normal operations in this area would be required to prevent damage to any of the existing Remediation Program monitoring wells and treatment systems located within the Proposed Action project area.

##### Hazardous Materials Use

Hazardous materials would be used during launches, maintenance, and flight support activities (Table 3.13-2). Flight support operations at the vertical launch area would use products containing hazardous materials, including paints, solvents, oils, lubricants, acids, batteries, fuels, surface coating, and cleaning compounds. Some rocket propellants and materials used in maintaining launch vehicles are considered hazardous. The Raptor engine used by the Starship-Super Heavy is powered by LOX and LCH<sub>4</sub>.

These products would be supplied by conventional suppliers and delivered to the site by licensed vendors in approved tanker truck or other containers. Offsite storage would be maintained by the suppliers and is outside the scope of this EIS. Fuel and oxidizer loading/unloading operations would take place in designated areas located on impervious surfaces, with spill prevention and emergency response procedures in place (SpaceX, 2024c). Release of a toxic commodity is an unlikely event due to both tanker offloads and vehicle fueling operations being auto sequencing events. SpaceX would follow procedures for dealing with hazardous materials specified in the Hazardous Materials Management Plan (SpaceX, 2018). The risk of hazardous material releases due to leaking storage tanks, tanker trucks, delivery lines, or other infrastructure would be limited by proper handling practices, including separation distance requirements for incompatible energetic liquids, in compliance with 14 CFR §420.67 for liquid fuels.



**Table 3.13-2. Hazardous Materials Management for Operations**

| Material                                                                                           | Storage Quantity                                                                                           | Use                                                               | Management                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, and isopropyl alcohol | Containers up to 5 gallons (9 liters) each                                                                 | Maintenance of launch site facilities and equipment, and cleaning | Limited quantities are stored onsite at any one time in a small, locked steel building in the shop areas at least 2,500 feet (762 meters) from any fuel storage |
| Liquid oxygen                                                                                      | 1.8 million gallons (6.8 million liters) of existing tank storage                                          | Propellant                                                        | Stored in existing commodity tanks onsite. Consumed during launch                                                                                               |
| Liquid methane                                                                                     | 1.4 million gallons (5.3 million liters) of existing tank storage                                          | Propellant                                                        | Stored in existing commodity tanks onsite. Consumed during launch                                                                                               |
| Liquid nitrogen                                                                                    | 1.43 million gallons (5.41 million liters) of existing tank storage. New 10,000-gallon (40,000-liter) tank | System purges                                                     | Consumed onsite                                                                                                                                                 |

During Starship-Super Heavy fuel loading and landings on a launch pad or floating platform, liquid propellants, such as LOX and LCH<sub>4</sub>, would be released to the atmosphere and could cause a short-term flammable environment. Fuel and oxidizer loading/unloading (including venting) operations would take place in designated areas with spill prevention and emergency response procedures in place. Both tanker offloads and vehicle fueling operations are auto sequencing events. The SpaceX Emergency Action Plan procedures are as follows:

- At LC-39A, the SpaceX Environmental Health and Safety Manager is the Emergency Coordinator until the Fire Chief arrives (if required).
- As acting Emergency Coordinator, the Environmental Health and Safety Manager will perform the following actions (as applicable) in the event of a fire, explosion, or release of hazardous waste or hazardous waste constituents, which could threaten human health or the environment: activate internal facility alarms or communication systems, where applicable, to notify all facility personnel; and notify appropriate state or local agencies with designated response roles if their help is needed (SpaceX, 2024d).

As discussed in Section 3.9.4, *Water Resources, Environmental Consequences*, during an expendable scenario, all liquid fuel would likely be consumed during vehicle breakup and only inert structural debris would remain, which will either be recovered or sink to the ocean floor so as not to be a risk to maritime traffic. The amount of propellant, metals, or other substances that could leach or dissolve into the water or substrate after the vehicle sinks to the ocean floor would not result in detectable changes to water or sediment quality.

A launch anomaly<sup>47</sup> could result in debris and hazardous materials being distributed below the AHAs as shown in Figure 2.1-3. The size of AHAs can grow or shrink as reliability is either decreased or increased with results and analysis from each launch. If any anomalies occurred during the operation, SpaceX would respond to all accidental releases of polluting substances quickly and implement appropriate cleanup measures in accordance with applicable laws to minimize impacts to the environment. A near-surface ship explosion or a high-altitude breakup of the ship would create a debris field comprised of mostly heavyweight metals and some composite (e.g., carbon fiber) materials. If deposited in the water, most of these materials would sink rapidly through the water column, while some items may stay buoyant on the surface or suspended in the water column before sinking toward the seafloor.

Starship-Super Heavy is constructed primarily of stainless steel, which is non-toxic and inert. Other debris includes thermal heat tiles composed of silica, which has similar properties to glass and is highly resistant to degradation. The heat tiles are considered inert. Impacts on air quality or water chemistry are not expected. Glass is known to shatter or break apart into smaller pieces, with the sharp edges becoming rounded and smooth over time. It is likely that the heat tiles would similarly change if the same environmental conditions were present. Starship-Super Heavy's propellants are LOX and LCH<sub>4</sub>, which are non-hazardous rather than highly toxic hypergolic fuels. Residual propellant is anticipated to evaporate or be diluted quickly due to surface currents and ocean mixing.

Starship would have approximately 34 gallons (129 liters) of hydraulic fluid. In the event of an anomaly, hydraulic fluid may remain contained in the vehicle, ignite, or be released. Remaining hazardous materials, such as ordnance or chemicals, would be transported back to SpaceX in accordance with regulations for transport of hazardous substances.

As discussed in Section 3.9.4, *Water Resources, Environmental Consequences*, routine operations could result in minor or major leaks, spills, and inadvertent releases of fuel and other contaminants into the soil and groundwater. To minimize this potential, hazardous products would be used and stored at appropriate locations (i.e., storage areas with secondary containment) throughout the facility. As discussed previously, specific materials management plans would be developed that included strategies and procedures for storing, handling, and transporting hazardous materials (in addition to responding to onsite spills). This would include compliance with protocols for maintaining up-to-date Safety Data Sheets, as well as SPCC Plans and fueling plans. Containment areas surrounding the fuel storage tanks and any fueling facilities will be designed to ensure adequate containment or catchment of fuel (i.e., berms or diked areas) so that people and natural resources would not be affected by a fuel spill.

SpaceX would comply with EPCRA hazardous materials reporting requirements. Under EPCRA Sections 311 and 312 (Community Right-to-Know Requirements), facilities that handle or store any hazardous chemicals exceeding applicable reporting thresholds must submit Material Safety Data Sheets and annual inventory (Tier II) forms to state and local officials and local fire departments. Inventories for hazardous chemicals and EPCRA reporting would be required once the facility is operational.

#### Hazardous Waste Generation and Disposal

Hazardous wastes would also be generated during operations, although during successful launches all hazardous materials would be consumed, so no waste would be left requiring disposal. Spacecraft and

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<sup>47</sup> An anomaly is defined as "any condition during licensed or permitted activity that deviates from what is standard, normal, or expected, during the verification or operation of a system, subsystem, process, facility, or support equipment." 14 CFR § 401.7.

vehicle maintenance/refurbishment, propellant and fuel storage and dispensing, and facility and grounds maintenance are among those activities that may generate very small quantities of hazardous wastes. The sources of hazardous waste include waste fuel, waste oils, spent solvents, paint waste, and used batteries. The SpaceX operations and management entity would develop a hazardous waste management plan. The plan would lay out the steps for appropriate management of hazardous waste, such as establishment of satellite accumulation points and properly labeled DOT-approved containers. Wastes would be disposed of using designated hazardous waste accumulation facilities or private hazardous waste contractors, as needed.

The Proposed Action would increase the amount of hazardous materials and waste managed at this location. However, BMPs in place for the handling of hazardous materials and hazardous waste would result in minimal effects from the Proposed Action.

Launch failure resulting from rocket malfunction could result in debris and small amounts of hazardous materials and/or wastes being distributed in the immediate area of LC-39A or downrange. SpaceX would respond to all accidental releases of polluting substances quickly and implement appropriate cleanup measures in accordance with applicable laws (see Appendix D.13, *Hazardous Materials, Solid Waste, and Pollution Prevention*) to minimize effects to the environment. Starship would have approximately 34 gallons (129 liters) of hydraulic fluid, and the booster would have approximately 74 gallons (280 liters) of hydraulic fluid. In the event of an anomaly, hydraulic fluid may remain contained in the vehicle, ignite, or be released. Remaining hazardous materials such as propellant, ordnance, or chemicals would be transported back to a processing facility in accordance with DOT regulations for transport of hazardous substances (Title 49 CFR Parts 100–199) (FAA, 2022, p. 158).

#### Solid Waste Generation and Disposal

Operations would also generate nonhazardous solid waste such as packaging from supplies and maintenance activities that use nonhazardous materials. There would be approximately 77 full-time employees at the facility, with up to 300 staff present during launch operations. Based on an estimated generation rate of 9.2 pounds (4.2 kilograms) per worker per day (California Integrated Waste Management Board, 2007), the annual generation would be approximately 250 tons (227 MT), assuming an average annual staff of 150 personnel. For comparison, the Brevard County Landfill accommodates up to 3,500 tons (3,200 MT) per day of solid wastes; consequently, no adverse effects would be expected (see Table 3.13-3).

**Table 3.13-3. Hazardous and Solid Waste Management for Operations**

| <b>Waste</b>                                                                                           | <b>Source</b>                                                                             | <b>Management</b>                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Spent solvents, paper, waste oil, batteries, spill cleanup materials, antifreeze, and empty containers | Grounds maintenance, housekeeping, maintenance, and spill response (as needed) activities | Removed for appropriate offsite recycling or disposal                                                                                                                                                                                                                                     |
| Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, and isopropyl alcohol     | Maintenance of launch site facilities and equipment, and cleaning                         | Small amounts of spent solvents would be transported offsite for recycling or disposal. Waste generated from these materials would be managed by the contractor and disposed of at the local landfills or hazardous waste quantities may be disposed as allowed under Florida regulations |

### Pollution Prevention

As with construction, operational activities would also apply pollution prevention measures to the greatest extent possible. These measures may include purchase of environmentally friendly products; recycling cardboard containers and wooden pallets; incorporating energy-efficient building design for cooling, heating, and lighting; and using alternate power sources such as photovoltaic cells.

Effects from recoverable components from launch activities are planned to occur in broad ocean areas cleared of shipping or air traffic prior to launch. Rocket stages are designed for recovery. Efforts would be made to recover any stages that land in the ocean and not on the dronship as intended. Safeguards, including multiple system redundancies in case of damage upon reentry, are in place to minimize the release of toxic chemicals in the environment. All accidental releases of polluting substances would be responded to as soon as practicable and appropriate clean-up measures implemented in accordance with applicable laws to minimize effects to the environment. To avoid collision with marine vessels and further ensure public and environmental safety, a NOTMAR would be issued 3–6 days prior to reentry and recovery efforts. If expenditures occur outside U.S. territorial waters, SpaceX may utilize the Global Maritime Distress and Safety System to notify maritime traffic in international waters of locations of potential expenditures.

Large commercial vessels, such as the dronship that would be used for ocean landings, routinely discharge ballast water, gray and black water, bilge water, and deck runoff consistent with applicable international and national standards. Discharges of sewage (also known as black water) and gray water, which is the effluent generated from wash basins and showers on board ships, are regulated under MARPOL Annex IV (International Maritime Organization, 2024). Discharges of black water are prohibited except for specific conditions stipulated under the Annex. In addition to the international standards established under MARPOL Annex IV, the United States regulates vessel discharges of sewage, gray water, bilge water, and a variety of other vessel discharges through USEPA's CWA NPDES Program. Based on these requirements, effects from the dronship to the environment from the Proposed Action would be classified as minimal. As a result, no significant effects regarding pollution prevention would occur as a result of the Proposed Action.

#### **3.13.4.2.3 Reasonably Foreseeable Effects**

Under the Proposed Action, there would be an increase in the quantity of hazardous and nonhazardous waste generated at LC-39A. However, with the implementation of appropriate handling and management procedures for hazardous materials, hazardous wastes, and solid wastes generated during the construction and operation of the facility, there would be no significant onsite effects. Offsite effects from disposal of SpaceX-generated hazardous and nonhazardous waste would be negligible to minimal under the Proposed Action, due to the small quantities of waste in comparison to waste disposal capacity available in the region.

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. Numerous types of hazardous materials are used to support the missions and general maintenance

operations at KSC. Management of hazardous materials and the resultant hazardous waste is the responsibility of each individual or organization and is regulated under RCRA (40 CFR Parts 260–280) and Florida Administrative Code Rule 62-730. Hazardous waste generating facilities are regulated under RCRA, USEPA, and FDEP requirements to ensure that environmental effects are minimized to the extent possible. When considered in context with other foreseeable actions, the FAA does not anticipate that the Proposed Action would result in a noticeable incremental effect to hazardous materials use and hazardous waste generation in the region.

### 3.13.5 BMPs, Mitigation, and Monitoring

Implementation of hazardous materials and waste standard operating procedures (e.g., SPCC Plan) serve as management practices to minimize the potential for adverse impacts associated with hazardous substance releases to the environment. Potential measures that will be implemented to mitigate effects related to hazardous materials, solid waste, and pollution prevention include the following:

- Existing engineering and/or administrative controls (e.g., waste management plans) will be applied to construction and operation activities to reduce the hazards posed by the wastes encountered
- Employing source reduction strategies such as recovering, recycling, or composting waste materials, which will reduce waste that might otherwise be sent to landfills
- Recycling of construction debris associated with the Proposed Action to reduce waste streams
- SpaceX will follow all applicable regulations regarding hazardous materials
- Consider recommendations by Federal and state agencies responsible for managing any known contaminated sites

In addition, during construction activities in the vicinity of known contaminated sites, training will be implemented to help workers identify contaminated media (soil and groundwater) for proper disposal/treatment.

### 3.13.6 Summary

The Proposed Action would not violate applicable Federal, state, or local laws or regulations regarding hazardous materials and/or solid waste management. While the Proposed Action involves contaminated sites, not all the grounds within the project area are contaminated, which leaves space for siting project components on uncontaminated land within the boundaries of LC-39A. Ground-disturbing activities would be subject to any applicable LUCs associated with such sites (i.e., prohibiting the use of groundwater), and testing of excavated soils for potential contamination prior to offsite transport for disposal may be required. Overall, the siting of facilities to avoid contaminated sites to the greatest extent possible serves as a pre-planning mitigation to minimize potentially adverse effects. Additionally, the Proposed Action would not (1) produce an appreciably different quantity or type of hazardous waste from that already produced at KSC, (2) generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or exceed local capacity, and (3) adversely affect human health and the environment. Therefore, the FAA has determined that the Proposed Action would not result in significant adverse effects associated with hazardous materials, solid waste, and/or pollution prevention.



## 3.14 Natural Resources and Energy Supply

### 3.14.1 Definition of Resource and Regulatory Setting

This section describes the natural resources (such as water, metal, asphalt, aggregate, etc.) and energy supplies (such as coal or diesel for electricity; natural gas for heating; and fuel/propellants for construction equipment and space launch vehicles) that would be consumed under the alternatives evaluated in this EIS. Consumption of these resources would occur because of proposed construction and operational activities.

Appendix D.14, *Natural Resources and Energy Supply*, identifies and describes the statutes, regulations, and guidance related to natural resources and energy supply.

### 3.14.2 Study Area

The study area for natural resources and energy supply would include local and municipal sources of water and electricity, which would be supplied by providers and sources in Brevard County. Resources such as building materials, aggregate, and fuel supplies required for construction and operations would be transported to the site from suppliers in Florida or in adjacent states. Other fuel and fuel-related materials could be provided by suppliers in the southeastern and eastern United States.

### 3.14.3 Existing Conditions

Natural resources required for Starship-Super Heavy operations at LC-39A would include fuels, industrial gases, building materials, and aggregate (concrete) and asphalt. Wood is expected to be a minor material used during construction. Natural gas would be used for propellant generation.

#### ***Building Materials***

Building materials are readily available from multiple suppliers in Florida and adjacent states. Suppliers of building materials could include, but are not limited to:

- Pre-Engineered Steel Inc., Jacksonville, Florida (156 miles [251 kilometers] from the site)
- Metal Sales Manufacturing Corporation, Jacksonville, Florida (153 miles [246 kilometers] from the site)
- Southern Pine Lumber Company, Rockledge, Florida (20 miles [32 kilometers] from the site)

#### ***Aggregate and Asphalt Supply***

Construction of new facilities and infrastructure would require large amounts of concrete (sand and gravel [aggregate]) and asphalt. There are currently several aggregate and asphalt suppliers in the vicinity of the site, some of which include:

- Dewitt Custom Concrete – Stanford, Florida (67 miles [108 kilometers] from the site)
- Maschmeyer Concrete – Orlando, Florida (57 miles [92 kilometers] from the site)

- Preferred Materials – Orlando, Florida (57 miles [92 kilometers] from the site)

### **Energy Supply**

Resources required for the supply of energy include electricity and fuels. Florida Power and Light (FPL) provides power for KSC. FPL owns the transmission and KSC owns the distribution. The electric power distribution system at KSC is a combination of an FPL transmission system and two NASA-owned distribution systems. FPL transmits 115 kilovolts to KSC, which are distributed to two major substations. The C-5 substation serves the LC-39 Area, providing 13.8 kilovolts, and the Orsino substation serves the Industrial Area, providing 13.2 kilovolts, for a total of 25 percent of the electricity currently allocated to KSC.

The natural gas distribution infrastructure was built in 1994 and expanded in 1999 to the CCSFS. Natural gas is used as the main fuel source for heating plants at the VAB and at the Industrial Area, providing hot water for building heating and domestic hot water purposes. The VAB Utility Annex provides chilled and hot water for building heating and cooling for various facilities at LC-39A. The main pipeline runs through KSC property, but is owned by Florida City Gas, the local natural gas utility. The main 12-inch (305-millimeter) long natural gas pipeline enters KSC where NASA and Kennedy Parkways intersect. Florida City Gas is responsible for the gas main from its station off NASA Parkway up to and including meter stations to various facilities in the VAB and industrial areas of KSC. Contractors are responsible for operation and maintenance of the natural gas systems downstream of the meter stations (NASA, 2019a). Helium may also be used part of the launch propellant. In the short term, helium would be supplied using the existing NASA pipeline. Helium consumption and required ground storage is extremely minimal in comparison to other orbital-class vehicles. In the long term, SpaceX is planning to eliminate the need for helium as part of this program. SpaceX currently provides 2.5 MW of power from MegaPacks.

### **Propellants**

The Propellants and Life Support Branch in the Spaceport Integration and Services provides services in support of launch vehicles and payloads. The Propellants and Life Support infrastructure provides hypergolic fuels and oxidizers, cryogenic liquids, compressed gases, pressurants, and other specialty fluids and propellant commodities to KSC and CCSFS. These propellants and other gases are used to support the Atlas, Delta, and Falcon launch vehicles and payloads—both government and commercial (NASA, 2022).

## **3.14.4 Environmental Consequences**

### **Analysis Methodology**

During construction and operation of facilities for the SpaceX Starship-Super Heavy energy (electricity and fuels) and natural resources (water and construction materials) would be consumed. This section discusses the potential effects to energy and natural resources.

The FAA has not established a significance threshold for natural resources and energy supply in FAA Order 1050.1; however, the FAA has identified a factor to consider when evaluating the context and intensity of potential environmental impacts for natural resources and energy supply. This factor is not intended to be a threshold; if this factor exists, there is not necessarily a significant impact. This factor includes, but is not limited to, situations in which the proposed action or alternative(s) would have the potential to cause demand to exceed available or future supplies of these resources (FAA, 2023b).

For effect analysis, the expected amount of natural and energy resources needed for a project were evaluated and compared to the local context of supply and demand or compared to the capacity of the system to determine if the Proposed Action would cause demand to exceed available or future supplies of these resources.

#### 3.14.4.1 No Action

Under the No Action Alternative, the FAA would not issue SpaceX a new license or modify their existing license for launch operations discussed in Section 2.1, *Proposed Action and Alternatives, Proposed Action*. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Natural resources and energy supply would continue to be utilized for launch activities at KSC and CCSFS, as well as for development projects and associated activities throughout the region. Actions identified in Table 2.2-1 and Table 2.2-2 would involve the consumption of natural resources, fuel, and energy for launch, landing, and recovery operations. The FAA does not anticipate that consumption of these resources would exceed the regional capacity of these systems or consume unique resources.

#### 3.14.4.2 Proposed Action

##### **Construction**

Factors that may contribute to significant effects related to natural resources and energy include the use of unusual materials or materials that are in short supply. At this time, no unusual materials or materials that are in short supply would be used for the construction activities. No significant effects relating to natural resources, aggregate and asphalt supply, or energy would occur because of construction associated with the Proposed Action.

##### **Operation**

The demands of the Proposed Action on natural resources and energy at KSC and CCSFS has been analyzed in previous NEPA documents (FAA, 2022; NASA, 2024b; NASA, 2019a) and summarized here.

Electrical power capabilities at LC-39A were designed to support the Saturn V and Space Shuttle programs and has capacity for the Starship-Super Heavy vehicle launch requirements. Modifications included as part of the Proposed Action (Power Hub and MegaPacks) would facilitate distribution of power at LC-39A. KSC would see an increase of approximately 3.35 MW at peak Starship-Super Heavy loading, which includes the capacity of the 12 MegaPacks to reduce peak electrical demand. FPL generated over 200,000 MW in 2023.

Launch and landing operations would require the use of propellant. SpaceX is also proposing to construct onsite facilities for propellant generation and storage. Until generation facilities are operational, SpaceX would purchase LOX (1.8 million gallons [6.8 million liters] total volume) and LCH<sub>4</sub> (1.4 million gallons total volume). Storage tanks for LOX and LCH<sub>4</sub> are under construction as approved under the 2019 NASA EA. The LOX tank is 1.8 million gallons and the LN<sub>2</sub> tank is 1.43 million gallons (5.41 million liters). A 10,000-gallon (40,000-liter) AST would be constructed to store LN<sub>2</sub> for system purges. As part of the Proposed Action, SpaceX would also construct an ASU within the LC-39A fence line to generate LN<sub>2</sub> and

LOX to support launch activities. An ASU dehumidifies, liquefies, and separates air into its major components (oxygen and nitrogen). The liquid would then be transferred via pipeline to storage tanks at LC-39A.

The demand for propellant would be met without difficulty. The Proposed Action is not expected to significantly increase demand or use of natural resources and energy supply; therefore, it would not result in significant effects.

#### **3.14.4.2.1 Reasonably Foreseeable Effects**

The Proposed Action would involve the consumption of natural resources, fuel, and energy for launch, landing, and recovery operations. Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment and involve the consumption of similar materials and resources. The FAA does not anticipate that consumption of these resources would exceed the regional capacity of these systems or consume unique resources. Therefore, the FAA anticipates that reasonably foreseeable effects to natural resources and energy supply would not be significant.

### **3.14.5 BMPs, Mitigation, and Monitoring**

Monitoring of collected wastewater would be required for water quality prior to onsite reuse, offsite discharge, offsite disposal, or land application. FDEP permits for wastewater offsite disposal, discharge, or land application would include water quality monitoring requirements.

### **3.14.6 Summary**

Based on the analysis provided in Section 3.14.4.2, *Proposed Action*, significant effects to natural resources and energy are not anticipated because the Proposed Action would not exceed supply and demand or the capacity of required systems. Therefore, the FAA has determined that the Proposed Action would not result in significant adverse effects associated with natural resources and energy supply.

## **3.15 Farmlands**

### **3.15.1 Definition of Resource and Regulatory Setting**

Farmlands include prime farmlands, unique farmlands, and any ongoing farming areas, including pasturelands, croplands, and forests. Farmlands are defined as those agricultural areas considered important and protected by Federal, state, and local regulations. Important farmlands include all pasturelands, croplands, and forests (even if zoned for development) considered to be prime, unique, or of statewide or local importance.

The *prime farmlands* classification is defined as those having the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and must also be zoned

(or available) for these uses. In addition, prime farmland is defined by a combination of characteristics from the soil quality, growing season, and moisture supply that can produce economically sustained high yields of crops when treated and managed according to acceptable farming methods. It requires an adequate and dependable water supply from precipitation or irrigation, favorable temperature, and soils with acceptable acidity or alkalinity, acceptable salt and sodium content, few or no rocks, and permeable to water and air. The U.S. Department of Agriculture Natural Resources Conservation Service data shows that prime farmland is not excessively erodible or saturated with water for a long period and does not flood frequently or is protected from flooding (USDA NRCS, 2017).

The *unique farmlands* classification is used for those producing specific high-value food and fiber crops. Unique farmlands require a special combination of soil quality, location, growing season, and moisture supply needed to produce economically sustained high quality and/or high yields of a specific crop when treated and managed according to acceptable farming methods (USDA NRCS, 2017).

Other agricultural areas that produce food, feed, forage, fiber, and oilseed crops are of local or statewide importance. This classification can include pasturelands, croplands, and forests. Typically, these areas are adjacent to prime or unique farmlands and/or designated, zoned, or protected by state or local agencies (e.g., land use zoning for agricultural or farmland type land uses) (CEQ, 1980).

Although not considered prime farmlands under the regulatory classification as described above, for the purposes of analysis, aquaculture is considered a type of farmland within the context of this EIS. Aquaculture is defined as the farming of marine or freshwater organisms (finfish, reptiles, mollusks, and crustaceans), especially food fish or shellfish, at a medium to industrial scale (AgMRC, 2022). Important aquaculture areas include all state and local areas designated for aquaculture purposes and permitted sites for commercial and recreational aquaculture uses.

Appendix D.15, *Farmlands*, lists and describes the laws, executive orders, agency regulations, and other guidance that applies to farmlands.

### 3.15.2 Study Area

Consistent with the FAA 1050.1 Desk Reference (FAA, 2023b), Section 6.2, *Farmlands, Affected Environment*, the study area for farmlands is limited to the construction footprint of the Proposed Action (which is within the boundary of LC-39A).

### 3.15.3 Existing Conditions

The Florida Soil Survey Geographic Database was used to identify prime and unique farmlands within Brevard County. There are no prime or unique farmlands or open aquaculture areas within the study area (LC-39A) (NRCS, 2024)<sup>48</sup>. Construction activities would not result in loss of access to important farmland. Therefore, this resource category is not discussed further.

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<sup>48</sup> <https://fdacs.maps.arcgis.com/apps/webappviewer/index.html?id=57f7d4b7d900496d99891f22681c66d0>.



## 3.16 Transportation

### 3.16.1 Definition of Resource and Regulatory Setting

Transportation includes land, sea, and air routes with the means of moving passengers and goods. A transportation system can consist of any or all of the following and can be looked at on a local or regional scale: roadways, railways, waterways, and air. Elements of the transportation system consider conservation of energy and other resources, pollution prevention, harmonization with the community environment, and sensitivity to concerns of the traveling public. In this EIS, airspace coordination and potential effects associated with airspace closures due to launch/booster landings and Starship reentry and RTLS are discussed in Section 2.1.3.1, *Starship-Super Heavy Operations, Pre-Launch*.

Traffic is commonly measured through average daily traffic and design capacity. These two measures are used to assign a roadway with a corresponding level of service (LOS). The LOS designation is a professional industry standard used to describe the operating conditions of a roadway segment or intersection. The LOS is defined on a scale of A to F that describes the range of operating conditions on a particular type of roadway facility. Table 3.16-1 describes LOS operating conditions.

**Table 3.16-1. LOS Operating Conditions**

| LOS Operating Condition | Description                                           |
|-------------------------|-------------------------------------------------------|
| A – B                   | Free flow travel                                      |
| C                       | Stable traffic flow                                   |
| D                       | Traffic congestion                                    |
| E                       | Traffic breakdown conditions                          |
| F                       | Stop-and-go traffic/unacceptable congestion and delay |

Note: LOS = level of service.

### 3.16.2 Study Area

The study area includes the roads, rail lines, and waterways that provide access to KSC including gate access points, NASA Causeway, SR 528, SR 3, connectors (SR 401 and SR 405), and internal roadway networks.

### 3.16.3 Existing Conditions

#### 3.16.3.1 Roads

The KSC road network consists of 564 miles (908 kilometers) of roads, including 184 miles (296 kilometers) of paved roads, 380 miles (612 kilometers) of unpaved roads, and many other trails and access roads. Most paved roads on KSC are bituminous surface material constructed on a lime rock base and compacted soil sub-grade. Typical design standards for primary roads and highways include 12.1-foot (3.7-meter) wide lanes with sand stabilized turf shoulders. KSC's main arterials, Kennedy Parkway (SR 3) and NASA Parkway, are separated by 30-39-foot (9-12-meter) and 10-20-foot (3-6-meter) medians, respectively. Kennedy Parkway serves as the primary north-south arterial connecting the Industrial Area and the LC-39 area. It can be accessed from the north where it intersects with U.S. Highway 1 south of Oak Hill and from Titusville via SR 406/402. The southernmost entrance and exit for KSC is Kennedy Parkway on North Merritt Island (NASA, 2022).

KSC is on Merritt Island; therefore, bridges support all vehicular access to KSC. Bennett Causeway (SR 528) and Max Brewer Memorial Parkway (SR 406/402) were built and are maintained by the FDOT. Table 3.16-2 shows the characteristics of existing roadways, rail lines, and waterways in the vicinity of LC-39A. Figure 3.16-1 presents the transportation routes that provide access to LC-39A.

**Table 3.16-2. Transportation Routes for LC-39A**

| Road                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NASA Causeway             | In March 2025, the FDOT replaced the NASA Causeway Bridge over the Indian River with new twin high-level bridges that provides improved movement for oversized vehicles to launch sites. The new fixed bridge spans 4,025 feet (1,227 meters) over the Indian River Lagoon and 65 feet (20 meters) above the water (FDOT, 2024a).                                                                                                                                                                                                                                                  |
| Saturn Causeway           | Paved road between Kennedy Parkway and LC-39A.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| CR 402                    | CR 402 (formerly SR 402) is also known as A. Max Brewer Memorial Parkway (also referred to as Beach Road). Inside the boundaries of KSC it is called Kennedy Parkway. It is an east-west road within KSC, connecting KSC's main entrance to downtown Titusville and then south toward U.S. 1.                                                                                                                                                                                                                                                                                      |
| SR 528                    | This 41-mile (66-kilometer) expressway extends east from I-4 in the International Drive tourism area across SR 417 and I-95, extending beyond US 1, past Cocoa to Port Canaveral. It is owned and maintained by three agencies: CFX operates the 23 miles (37 kilometers) from near US 441 to SR 520; Florida's Turnpike Enterprise operates the westernmost 8 miles (13 kilometers) as the Beachline Expressway West; and the FDOT, District 5, operates the 9 miles (14 kilometers) east of SR 520 to the Bennett Causeway at US 1 (Central Florida Expressway Authority, 2021). |
| SR 3                      | SR 3 is locally known as both North Courtenay Parkway and North Kennedy Parkway (AARoads, 2024a). SR 3 extends south of SR 520 and north through KSC (also known as Kennedy Parkway on KSC) and ends at US 1 near Oak Hill.                                                                                                                                                                                                                                                                                                                                                        |
| SR 401                    | SR 401 is a four-lane arterial from the Canaveral Barge Canal north interchange with SR A1A/528 (Astronaut Boulevard) (AARoads, 2024b). It links SR 528 with Port Canaveral and the southern security gate of CCSFS (NASA, 2022).                                                                                                                                                                                                                                                                                                                                                  |
| SR 405                    | SR 405 loops west from US 1 in downtown Titusville to US 1 again in south Titusville, across from the NASA Causeway to KSC. It also links KSC to I-95 (AARoads, 2024c).                                                                                                                                                                                                                                                                                                                                                                                                            |
| Roberts Road              | As a part of the development of the existing SpaceX Roberts Road Operations Area, Roberts Road was paved from Kennedy Parkway to the western boundary of the existing operations area. The roadway farther to the west remains unpaved (NASA, 2024b).                                                                                                                                                                                                                                                                                                                              |
| Phillips Parkway          | The road runs the full length of CCSFS and extends into KSC. Outside the south gate, the road is known as SR 401. Between the CCSFS south gate and the industrial area, it is a four-lane divided highway with a grass median (CCSF Museum, 2024).                                                                                                                                                                                                                                                                                                                                 |
| Turn Basin                | At LC-39A, the Turn Basin provides a direct water connection between the Atlantic Ocean and space launch processing activities. The dockage area is 1,800 feet (549 meters) long and 1,700 feet (518 meters) wide. It used to receive fuel tanks and other elements too large to travel over open roadways. The Turn Basin maintains a depth of 10-15 feet (3-5 meters) at the cargo transfer point and deepens to approximately 25 feet (8 meters) near the middle (NASA, 2022).                                                                                                  |
| Canaveral Barge Canal     | Port Canaveral provides waterway access to KSC through this canal that links the port with the Intracoastal Waterway in the Indian River (NASA, 2022).                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Roy D. Bridges Jr. Bridge | This bridge connects NASA Kennedy Space Center's Industrial Area to CCSFS's Industrial Area (NASA, 2003).                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

**Table 3.16-2. Transportation Routes for LC-39A**

| Road                    | Description                                                                                                                                                                                                                                                                                                                             |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Jay Jay Railroad Bridge | This is the main thoroughfare for transporting heavy equipment and supplies to and from the KSC. Spent solid rocket boosters, rocket frames, and other equipment for the space program are normally shipped by rail and this bridge (Marinas.com, 2024). It connects the Florida East Coast Railroad to the KSC spur line (NASA, 2022). |

Notes: CCSFS = Cape Canaveral Space Force Station; FDOT = Florida Department of Transportation; I = Interstate; KSC = Kennedy Space Center; LC-39A = Launch Complex 39A; NASA = National Aeronautics and Space Administration; SpaceX = Space Exploration Technologies Corp.; SR = State Road; US 1 = United States Highway 1.

Table 3.16-3 lists annual average daily traffic on roadway segments near each of these access points for 2023.

**Table 3.16-3. AADT for Roadways Providing Access to KSC**

| Road          | Classification                 | From                  | To                       | 2023   | LOS (2023) |
|---------------|--------------------------------|-----------------------|--------------------------|--------|------------|
| NASA Causeway | Rural principal arterial-other | US 1                  | Space Commerce Way       | 13,558 | D          |
| SR 528        | Urban principal arterial-other | US 1                  | Courtenay Parkway (SR 3) | 39,271 | D          |
| SR 528        | Urban principal arterial-other | N. Courtenay Parkway  | N. Banana River Drive    | 37,751 | D          |
| SR 528        | Urban principal arterial-other | N. Banana River Drive | SR 401                   | 36,048 | D          |
| SR 3          | Urban principal arterial-other | S. Ramps SR 528       | N. Ramps SR 528          | 30,651 | D          |
| SR 3          | Urban principal arterial-other | N. Ramps              | Hall Road                | 21,688 | D          |
| SR 3          | Urban principal arterial-other | Hall Road             | N. Tropical Tr.          | 15,388 | D          |
| SR 3          | Rural principal arterial-other | N. Tropical Tr.       | Space Commerce Way       | 9,251  | C          |
| SR 405        | Urban principal arterial-other | Sisson Road           | US 1                     | 12,463 | D          |
| SR 401        | Urban minor arterial           | SR 528                | CCSFS                    | 11,636 | D          |

Notes: AADT = annual average daily traffic; CCSFS = Cape Canaveral Space Force Station; KSC = Kennedy Space Center; LOS = level of service; N. = North; NASA = National Aeronautics and Space Administration; S. = South; SR = State Road; Tr. = Trail; US 1 = United States Highway 1.

Source: (Space Coast TPO, 2023)

The Brevard County Master Plan has a Chapter 9 – Transportation Element (Brevard County, 2022). This element establishes the goal for LOS. Under Policy 1.3, the LOS standards include the following:

- Brevard County arterial and collector roadways within the urban area boundary: LOS E
- Brevard County arterial and collector roadways within the rural area: LOS D
- State arterial roadways (excluding Florida Intrastate Highway System) within and outside the urban area boundary: as adopted by the FDOT
- LOS standards for the Florida Intrastate Highway System (I 95 and SR 528) established by the FDOT
  - In general, the standards are LOS E within the urban area boundary and LOS D outside the urban area boundary (Brevard County, 2022).



Source: (NASA, 2019a).

Note: The Shuttle Landing Facility is also known as the Launch and Landing Facility.

Figure 3.16-1. Transportation Routes that Provide Access to LC-39A

The FDOT has a Spaceport Office that developed and administers the Spaceport Improvement Program. FDOT improvement projects underway near KSC include the following:

- NASA Causeway Bridge (Project 440424-1) – The FDOT is replacing the NASA Causeway Bridge over the Indian River to support future growth and improve public and commercial mobility. The current NASA Causeway consists of twin bascule bridges constructed in 1964, which are being replaced with new twin high-level bridges that will provide improved movement for oversized vehicles to launch sites. In June 2023, the eastbound bridge was opened to the public. The westbound bridge opened in March 2025 (FDOT, 2024a).
- Widening SR 528 (Project 407402-3) – This project widens SR 528 from four to six lanes from east of SR 524 (Industry Road) to east of SR 3 (North Courtenay Parkway). The project includes reconstructing the interchanges at US 1 and SR 3 and reconstructing the bridge over the Indian River. A shared-use trail is also planned on the north side of SR 528. The right-of-way phase began in late 2023. The project is not yet funded for construction (FDOT, 2024b).
- Widening SR 528 (Project 407402-4) – This project widens SR 528 from four to six lanes from east of SR 3 (North Courtenay Parkway) to SR 401 (Port Canaveral Interchange) by adding a lane in each direction in the median. The project also plans to reconstruct the interchanges at Banana River Drive, SR 401, and George King Boulevard and reconstruct the bridge over the Banana River. Right-of-way acquisition is expected to begin in the summer of 2025 (FDOT, 2024c).

Transport of rocket components and payloads over roadways in and around KSC is a common occurrence. In addition to transport via Saturn Causeway, the Crawlerway is also used. It is a unique dual-lane roadway for carrying crawler-transporter vehicles and their loads to LC-39A and LC-39B. The LC-39 area Turn Basin and dredged channel in the Banana River provide a direct water connection between the Atlantic Ocean and space launch processing activities at KSC (Figure 2.1-12). Due to the intermittent nature of use of the Turn Basin, it is difficult to determine the average annual barge traffic within KSC boundaries. Payload operations require the transportation of launch vehicles across KSC to the launch complex for final integration or stowage.

KSC has access to three runway facilities: the Shuttle Landing Facility or Launch and Landing Facility, and two other runways nearby, including the Skid Strip located at CCSFS, operated by the DAF, and the Space Coast Regional Airport located just west of KSC in south Titusville. The FAA has established the SLD 45 Eastern Range Special Use Airspace to manage and control airspace above KSC and CCSFS launch facilities (NASA, 2022). Airspace and safety criteria for the Shuttle Landing Facility or Launch and Landing Facility is in accordance with Federal Aviation Regulation Part 77 Airport Aeronautical Surfaces/Airspace, and safety criteria for the Skid Strip is in accordance Unified Facilities Criteria 3-260-01.

Local roadways can be affected by launch activities. Each year, more than 1.5 million guests visit KSC. The Visitor Complex opens at 9:00 a.m. daily and closing times vary by season at 5:00 p.m. or 6:00 p.m. (NASA, n.d.). The Visitor Complex is open every day except Christmas and certain launch days and may offer launch tickets for rocket launches. Tickets may be purchased ahead of time or day of if the viewing locations are not sold out. Other viewing areas are located outside KSC (e.g., shores of IRL, Playalinda Beach at CANA, Exploration Tower in Port Canaveral, U.S. Astronaut Hall of Fame in Titusville, and Cocoa Beach Pier) (Space Coast Office of Tourism, 2024). High-profile launches can bring hundreds of thousands of spectators, with the high end estimated to be 250,000. However, with more frequent launches, crowd estimates may be reduced (Florida Today, 2024).



### 3.16.3.2 Maritime Vessel Traffic and Navigation

Waterbodies off the coast of Florida are shared spaces and used by recreational, commercial, and military maritime traffic. Port Canaveral is a deep-water seaport that provides cruise, cargo handling, ship berthing, and recreational facilities. Fiscal year 2024 reported 13 homeport ships, 911 cruise ship calls, and 7.6 million passenger movements. The port projects fiscal year 2025 to homeport 16 ships, have 1,030 cruise ship calls, and generate 8.4 million multi-day passenger movements (Port Canaveral, 2024). Figure 3.16-2 shows the shipping fairways, vessel traffic north and south of LC-39A where a water landing could occur in the Atlantic Ocean, and 2023 vessel counts from around KSC and the Atlantic Ocean. Figure 3.16-3 shows vessel transit data closer to Port Canaveral. As expected, the area has high transit counts exiting and entering Port Canaveral.

## 3.16.4 Environmental Consequences

### ***Analysis Methodology***

Effects to traffic and maritime transportation are analyzed by considering the possible changes to existing traffic conditions and the capacity of area roadways from proposed increases in construction, commuter traffic, and road closures. In addition, proposed highway improvement projects that would be implemented regardless of the Proposed Action are considered to assess effects. Maritime transportation analyses consider potential effects to shipping lanes and commercial maritime traffic.

Airspace analyses consider potential impacts to air traffic routes, flight delays, and other potential issues associated with temporary airspace closures resulting from launches, landings, and Starship RTLS. Within FAA Order 10501.F, the FAA has not established any significance determination criteria for transportation-related effects. Analyses in this EIS therefore focus on the context and intensity of potential effects to transportation to determine significance.

### 3.16.4.1 No Action

Under the No Action Alternative, the Proposed Action would not occur and there would be no Proposed Action-related changes to the existing traffic and transportation patterns at and near LC-39A to support SpaceX. There would be no new SpaceX construction at LC-39A with additional workers and construction equipment and no change in personnel numbers. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. These actions all contribute to the existing and future environment. Such projects include roadway or other transportation improvements as needed to maintain or improve LOS with consideration of multiple development projects and anticipated transportation needs.

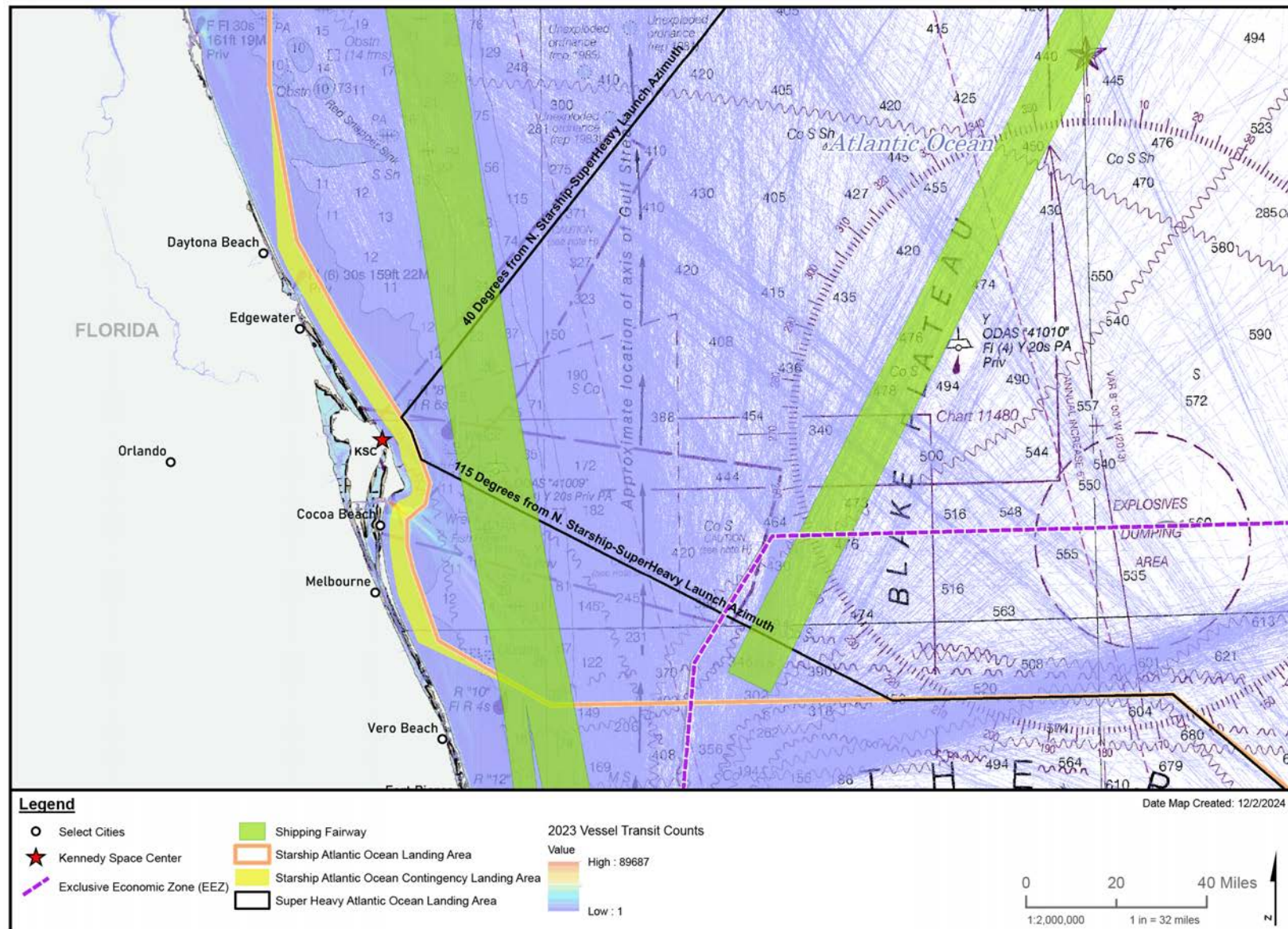


Figure 3.16-2. Fairways and 2023 Vessel Transit Counts

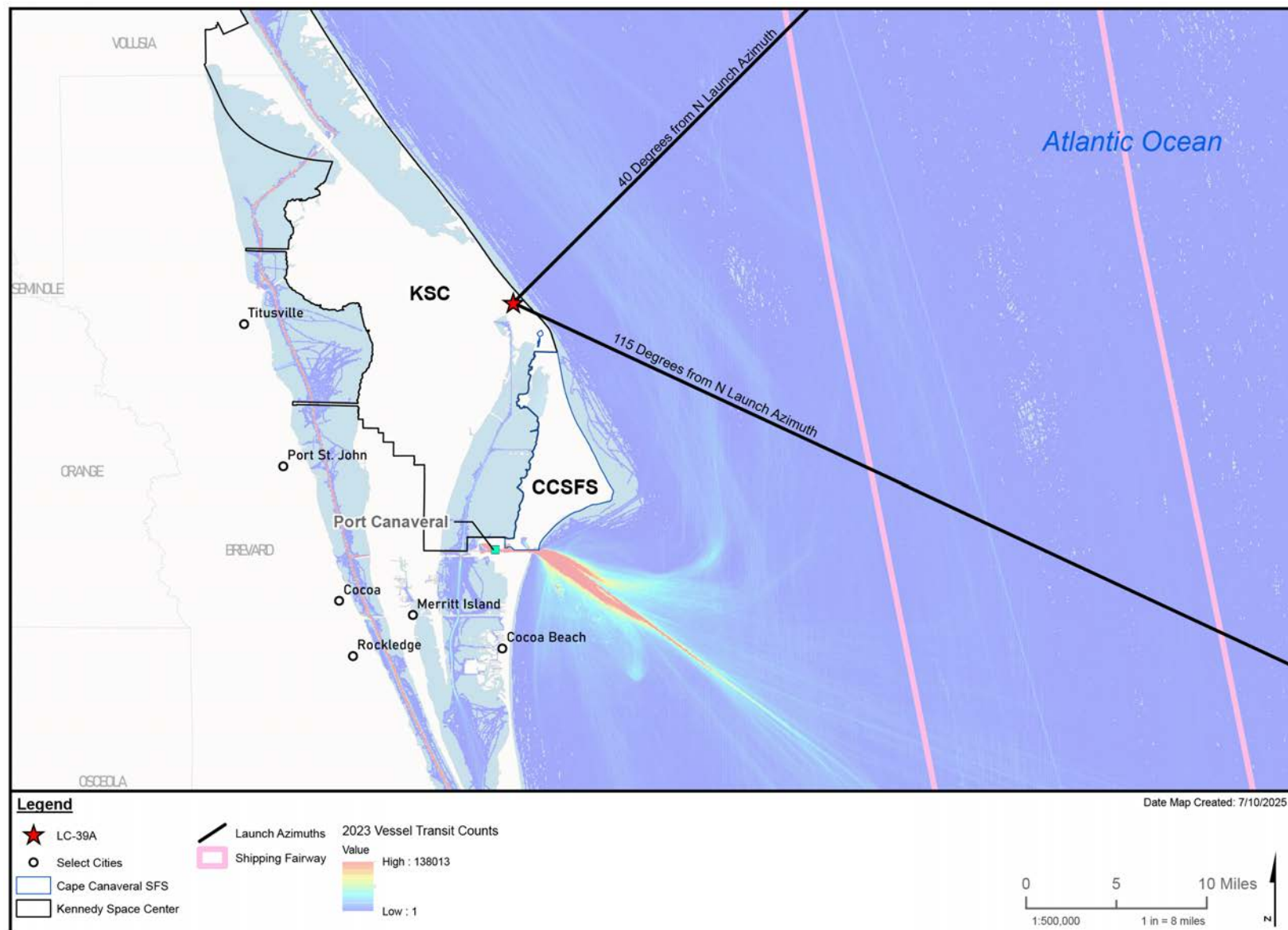


Figure 3.16-3. 2023 Vessel Transit Counts Entering and Exiting Port Canaveral



Local roadways and transportation corridors would continue to be affected by current traffic conditions and ongoing and planned roadway improvements. In addition, the FDOT has a Spaceport Office that developed and administers the Spaceport Improvement Program. The goal of the program is to improve aerospace transportation facilities. The program embraces Florida leading the growth and development of the aerospace industry. The Spaceport Improvement Program is designed to stimulate private sector investment and commercial spaceport development and acknowledges the importance of quality of life for Floridians continuing as a direct result of infrastructure improvements (FDOT, 2023)). Vessel traffic is also projected to increase when considering the reasonably foreseeable actions along with NASA, other commercial space providers, and Port Canaveral goals.

### 3.16.4.2 Proposed Action

#### 3.16.4.2.1 Construction

SpaceX estimates that there would be a temporary increase in jobs of up to 175 with a peak of 300 construction workers at LC-39A. In 2021, NASA reported that there were 12,312 total employees (NASA, 2021b). Assuming that all construction workers would travel to LC-39A using a single occupancy vehicle, this represents 0.02 percent of the workforce. In addition, construction workers would typically access KSC prior to the 9:00 a.m. opening of KSC to visitors. As a result, existing roadway networks would be able to accommodate the additional traffic. This increased traffic would be temporary with construction to be completed within 24 months.

#### 3.16.4.2.2 Operation

##### Roads

Once construction is complete, the SpaceX staff could increase by approximately 50 up to a peak of 100 workers with some supporting both Falcon and Starship-Super Heavy operations. This could add up to 200 trips per day assuming all would use a single-occupancy vehicle to access LC-39A five days per week. This would be a small increase in employees representing only 0.01 percent of the total NASA employees.

Truck trips to support launches would provide necessary commodities and are shown in Table 3.16-4.

**Table 3.16-4. Operational Transportation of Commodities per Launch**

| Product                          | Tanker Truck Trips                                                        |
|----------------------------------|---------------------------------------------------------------------------|
| LOX                              | 270                                                                       |
| LN <sub>2</sub>                  | 80                                                                        |
| LCH <sub>4</sub>                 | 90                                                                        |
| Trucks per year (includes water) | 19,350                                                                    |
| Average per day (12-hour day)    | 53                                                                        |
| Static fire                      | Propellant offloaded back to storage but would require delivery via truck |

Notes: LCH<sub>4</sub> = liquid methane; LOX = liquid oxygen; LN<sub>2</sub> = liquid nitrogen.

The estimates shown in Table 3.16-4, multiplied by 44 launches per year would be 19,350 trucks per year. During a 12-hour period for operations occurring 365 days per year, this would be approximately 53 trucks per day (or 4-5 trucks per hour). However, there could be more or fewer trucks per hour depending on launch frequency and specific commodity needs.

Transportation of Starship-Super Heavy, cargo, and payloads to LC-39A would occur over roadways and waterways and involve accessing the site from the south by Kennedy Parkway to Saturn Causeway as the primary route of transportation. Saturn Causeway would be widened from the VAB to Phillips Parkway as described in the Roberts Road SpaceX Operations Expansion EA (NASA, 2024b). Alternative routes include transportation from the CCSFS Gate on Phillips Parkway to the LC-39A site or Roberts Road Operations Area if components require processing. Figure 3.16-4 shows the potential routes via Roberts Road or the Turn Basin.

There would be a pull-off for opposite flowing traffic with an estimated wait time of 5 minutes. Traffic following Starship-Super Heavy, cargo, and payloads to LC-39A would need to wait until arrival at LC-39A or pause to pass with an expected wait time of 15 minutes.

KSC is an active spaceport and transport of rocket components and payloads over roadways in and around KSC is typical. The Crawlerway is a unique dual-lane roadway for carrying crawler-transporter vehicles and loads to LC-39A and LC-39B. The LC-39 area Turn Basin and dredged channel in the Banana River provide a direct water connection between the Atlantic Ocean and space launch processing activities at KSC. Starship-Super Heavy would be delivered by barge from SpaceX facilities at Boca Chica, Texas, and Cidco Road in Cocoa, Florida, through the Turn Basin. Both Saturn Causeway and the Crawlerway would be used to transport the vehicles to the launch pad. Components would also be delivered via barge to the launch pad. Any components needing refurbishment would be delivered via barge from the Turn Basin and transported to the Roberts Road facility, Mobile Service Structure Park Site, or Crawlerway.

Starship or Super Heavy boosters would be moved on roadways using a mobile transporter like the transports performed for Falcon. The route would be SR 3 to Saturn Causeway, which leads directly to LC-39A. Payload operations would transport launch vehicles across KSC to the launch complex for final integration or stowage, and the payloads could be fueled with propellants. Potentially, there may be Self-Contained Atmospheric Protection Ensemble support for fuel/oxidizer spills as well as security for transportation.

Table 3.16-5 presents the anticipated road closures for static fire tests and launches and reentries.

**Table 3.16-5. Anticipated Road Closures for Static Fire Tests and Launches and Reentries**

| Event             | Roadway Closures                                                                                                                                                                                               | Maritime Closures                                                                                                                                                                                                                                                                                                        | Airspace Closures |
|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Static Fire Tests | <ul style="list-style-type: none"> <li>Road closures would be established around T minus 2 hours.</li> <li>Roads would be opened after propellant is offloaded, estimated to be 1 hour in duration.</li> </ul> | <ul style="list-style-type: none"> <li>None</li> <li>For booster static fires, the access restricted area could extend into the ocean and a clear area would be needed.</li> <li>Area surveyed prior to commencing propellant loading</li> <li>Delay the operation if a vessel was actively inside the access</li> </ul> | None              |



**Table 3.16-5. Anticipated Road Closures for Static Fire Tests and Launches and Reentries**

| Event              | Roadway Closures                                                                                                                                                                                                                                                                                                                                                                                                                      | Maritime Closures                                                                                            | Airspace Closures                                                                                                                                                                                                                                              |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                       | restricted area during operation.                                                                            |                                                                                                                                                                                                                                                                |
| Launch and Reentry | <ul style="list-style-type: none"> <li>Road closures would be established at T minus 3 hours and opened after launch.</li> <li>In the event of a scrub, road closures would remain until propellant is offloaded.</li> <li>Duration is dependent on percentage of propellant loaded.</li> <li>Approximately 3.5 hours per attempt.</li> <li>If propellant is not loaded before scrub, then closures may be opened earlier.</li> </ul> | <ul style="list-style-type: none"> <li>Mandatory surveillance area cleared at T minus 15 minutes.</li> </ul> | <ul style="list-style-type: none"> <li>Airspace must be cleared for launch.</li> <li>Approximate minimum 40-minute, and up to 2-hour closure for launches.</li> <li>Approximate minimum 40-minute, and up to 1-hour closure for Starship reentries.</li> </ul> |

#### Maritime Vessel Traffic and Navigation

Vessel transits to and from Port Canaveral are considered high as expected. The Port currently operates and is accustomed to periodic RNA closures.

Figure 3.18-1 in Section 3.18.3 *Health and Safety, Existing Conditions*, shows the RNAs that currently exist with temporary closures mostly affecting northbound traffic and only the southeast launch hazard area potentially affecting southbound traffic. Closures would be adjusted based on the types and quantities of propellant onboard, rocket reliability, flight trajectory, and types of debris expected if the flight were terminated. Without this information, it was assumed that existing RNAs would be typical of the closures expected. Launch and reentry closures would occur more frequently compared to current conditions and would be assumed to occur 50 percent at night and 50 percent during the day. In addition, the State of the Port, 2024 (Port Canaveral, 2024) has a goal to support SpaceX and other commercial space providers with maritime assets. Since the Port is accustomed to RNAs, with proper coordination and scheduling, the Proposed Action would not significantly affect vessel traffic.

Barge traffic in the Turn Basin, under Alternative 1, would result in an increase in vessel traffic compared to current conditions. Preliminary estimates indicate that approximately 40 barges per year associated with Starship-Super Heavy would use the Turn Basin and 5 would use Port Canaveral to transport supplies and vehicle parts.



Figure 3.16-4. Vehicle Transportation Route

## Airspace

### Launches and Super-Heavy (Booster) Landings

The FAA conducted a NAS assessment of the notional launch and Super Heavy booster landing AHAs,<sup>49</sup> (see Figure 2.1-3 and Figure 2.1-4) based on 2024 commercial aircraft data; the launch and Super Heavy booster landing AHAs could affect a minimum of 10 commercial aircraft per hour, during the lowest period of midnight hours, or up to a maximum of 200 commercial aircraft per hour, during peak daily travel periods. This EIS assumes that half of the launches (22 launches of 44 total and 22 Super Heavy landings of 44 total) would occur during the day (7:00 a.m. to 10:00 p.m.) and half would be at night (10:00 p.m. to 7:00 a.m.). Table 3.16-6 shows the approximate number of commercial aircraft impacted per hour and per year for total Proposed Action operations. Domestic flights that normally take coastal routes are expected to be rerouted via inland routes, which would cause an increase in congestion and flight travel time.

**Table 3.16-6. Potential Commercial Aircraft Impacted by Starship-Super Heavy Launches and Super Heavy Landings**

| Operations/Year | Timing                          | Aircraft/Hour | Minimum AHA Duration | Maximum AHA Duration | Number of Aircraft Impacted/ Launch | Number of Aircraft Impacted/ Year |
|-----------------|---------------------------------|---------------|----------------------|----------------------|-------------------------------------|-----------------------------------|
| 22              | Lowest Period of Midnight Hours | 10 (minimum)  | 40 minutes           | 2 hours              | 7 to 20                             | 154 to 440                        |
| 22              | Peak Daily Travel Periods       | 200 (maximum) | 40 minutes           | 2 hours              | 133 to 400                          | 2,933 to 8,800                    |

Note: AHA = Aircraft Hazard Area.

Integrating Starship-Super Heavy launch operations from KSC LC-39A and Super Heavy booster landings into the NAS would require the FAA to conduct ground stops commensurate with the timing of the AHA and miles in trail (distance between aircraft) for spacing and volume control, as well as rerouting of aircraft around the AHA. Due to the length of the launch and Super Heavy booster landing AHAs, certain flights, especially international, may elect to delay the departure time due to the inability to accept a reroute caused by fuel constraints or the flight time of the reroute.

According to the NAS assessment, the average expected flight delay for launches<sup>50</sup> would last approximately 40 minutes and could last up to 2 hours. General aviation operations would be similarly impacted by the launch and Super Heavy booster landing AHAs; however, general aviation operations typically have more flexibility for flight planning than commercial flights, due to the nature of connecting commercial flights. The launch and Super Heavy booster landing AHA could also affect airways within the flight regions of Canada and the Bahamas.

<sup>49</sup> It is assumed that the Super Heavy booster lands within approximately 10 minutes of the launch time, so the AHA issued for launch would also include the booster landing operation.

<sup>50</sup> The delay could be greater incrementally based on any delay of the start of the launch within the assumed 2-hour launch window.



### Starship RTLS

The FAA conducted a NAS assessment of the notional reentry AHAs based on 2024 commercial aircraft data. The reentry AHAs could affect a minimum of 30 commercial aircraft per hour, during the lowest period of midnight hours, and up to a maximum of 600 commercial aircraft per hour, during peak daily travel periods (see Table 3.16-7). This EIS assumes that half of the Starship reentries (22 of 44 total reentries) would occur during the day, and half would occur at night. Table 3.16-7 shows the approximate number of commercial aircraft impacted per hour and per year for total Proposed Action operations. The utilization of ground stops and Airspace Flow Programs<sup>51</sup> could be necessary to control the southbound traffic from the United States, as AHAs would shut off traffic to Central Florida, South Florida, and international destinations.

**Table 3.16-7. Potential Commercial Aircraft Impacted Starship Reentries**

| Operations/<br>Year | Timing                             | Aircraft/Hour | Minimum<br>AHA<br>Duration | Maximum<br>AHA<br>Duration | Number of<br>Aircraft<br>Impacted/<br>Reentry | Number of<br>Aircraft<br>Impacted/<br>Year |
|---------------------|------------------------------------|---------------|----------------------------|----------------------------|-----------------------------------------------|--------------------------------------------|
| 22                  | Lowest Period of<br>Midnight Hours | 30 (minimum)  | 40 minutes                 | 1 hour                     | 20 to 30                                      | 440 to 660                                 |
| 22                  | Peak Daily Travel<br>Periods       | 600 (maximum) | 40 minutes                 | 1 hour                     | 400 to 600                                    | 8,800 to<br>13,200                         |

Note: AHA = Aircraft Hazard Area.

Integrating Starship reentry and landings into the NAS would require miles in trail (distance between aircraft) for spacing and volume control, as well as rerouting of aircraft around the AHA. Ground stops may be required for volume control. Due to the length of the Starship reentry AHAs, certain flights, especially international, may elect to delay the departure time due to the inability to accept a reroute caused by fuel constraints or the flight time of the reroute. The average expected flight delay for Starship reentries would be approximately 40 minutes<sup>52</sup> and could be up to an hour. General aviation operations would be impacted similarly by the Starship reentry AHAs. The Starship reentry AHAs could also affect airways within the flight regions of Mexico, El Salvador, Belize, Guatemala, Honduras, and Cuba.

Integrating the proposed Starship reentry operations would potentially require ground stops at multiple Core 30<sup>53</sup> airports in Florida, as well as numerous other international, regional, and general aviation airports. The FAA would manage such operations in a way that minimizes disruption to existing aviation operations and ensures safety for all airspace users. Successful integration requires close collaboration between space operators, the FAA, commercial airlines, general aviation, and defense stakeholders. Key factors contributing to feasibility include enhanced real-time communication systems and well-defined scheduling and deconfliction procedures. Although temporary airspace closures may impact other

<sup>51</sup> An Airspace Flow Program is a traffic management tool that assigns specific arrival slots and corresponding Expect Department Clearance Times to manage capacity and demand for a specific area identified by the flight constraint area.

<sup>52</sup> The delay could be incrementally greater based on any delay of the start of the reentry within the assumed 1-hour reentry window.

<sup>53</sup> [aspm.faa.gov/aspmhelp/index/Core\\_30.html](https://aspm.faa.gov/aspmhelp/index/Core_30.html). Affected airports in Florida could include Fort Lauderdale/Hollywood International Airport, Orlando International Airport, Tampa International Airport, and Miami International Airport.

stakeholders, mitigation strategies such as pre-coordinated reroutes, dynamic scheduling, and time-based traffic flow management could reduce operational burdens.

#### **3.16.4.2.3 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. These actions all contribute to the existing and future environment. Such projects include roadway and/or other transportation improvements as needed to maintain or improve LOS with consideration of multiple development projects and anticipated transportation needs. In addition, the FDOT has a Spaceport Office that developed and administers the Spaceport Improvement Program. The goal of the program is to improve aerospace transportation facilities. The program embraces Florida leading the growth and development of the aerospace industry. The Spaceport Improvement Program is designed to stimulate private sector investment and commercial spaceport development and acknowledges the importance of quality of life for Floridians continuing as a direct result of infrastructure improvements (FDOT, 2023). Vessel traffic is also projected to increase when considering the Proposed Action along with NASA, other commercial space providers, and Port Canaveral goals.

### **3.16.5 BMPs, Mitigation, and Monitoring**

The following BMPs may be implemented to minimize potential adverse effects; any accepted BMPs would be identified in the ROD and incorporated into the license agreement:

#### **Construction**

- Consider scheduling construction equipment and commodity transportation outside of peak gate traffic hours to reduce traffic congestion during the morning and evening peak conditions.

As part of the licensing process and associated requirements the following actions would occur:

#### **Operations**

- Implement public notification requirements prior to launches or landings as presented in the noise mitigation section (Section 3.2.5, *Noise and Noise-Compatible Land Use, Best Management Practices, Mitigation, and Monitoring*).
- The FAA would issue NOTAMs to alert pilots of potential hazards along a flight route. These notifications would alert pilots to potential hazards to manage aircraft flight paths.
- The FAA, in coordination with the USCG, would issue NOTMARs to advise mariners about navigational hazards and conditions (e.g., temporary closures). These notifications would alert mariners to potential hazards to manage vessel navigation.
- Continued coordination with Port Canaveral would reduce any conflicts with cargo and cruise ship scheduling.



- The FAA would conduct close collaboration between space operators, the FAA, commercial airlines, general aviation, and defense stakeholders. Key factors contributing to feasibility include enhanced real-time communication systems and well-defined scheduling and deconfliction procedures. Although temporary airspace closures may impact other stakeholders, mitigation strategies such as pre-coordinated reroutes, dynamic scheduling, and time-based traffic flow management could reduce operational burdens.

### 3.16.6 Summary

While there could be temporary road closure and traffic effects associated with heavy and slow-moving construction vehicles at KSC and on the local roads, these effects would be temporary and typical for the local transportation system within and around an active spaceport. Therefore, the FAA does not anticipate significant effects to transportation systems during construction activities under the Proposed Action with construction workers representing only a 0.02 percent increase in the number of employees and vehicles accessing LC-39A.

During operations, the number of employees could increase along with associated vehicle traffic; therefore, commuter traffic could increase under the Proposed Action compared to the No Action Alternative. These increases would be small (0.01 percent increase in employees) compared to the number of employees located at KSC. Increases in the number of launches under the Proposed Action, however, would change the frequency of transport of rocket components, payloads, and commodities over roadways in and around KSC and CCSFS. In addition, more launches would result in more frequent road closures. As an active spaceport, road closures would be expected.

Visitors driving to KSC and surrounding areas to view launches would continue to generate traffic effects. It is unknown if more frequent launches would generate less tourist interest, but high-profile launches and reentries would likely still attract viewer interest and associated traffic congestion. Roadways are operating at an acceptable LOS and current and planned improvement projects would result in better traffic flow. As a result, while traffic effects could occur due to more frequent road closures and launches, the FAA does not expect these effects to significantly affect current LOS.

Vessel transits to and from Port Canaveral are considered high as expected. The Port currently operates and is accustomed to periodic RNAs. The State of the Port (Port Canaveral, 2024) identifies a goal to work with SpaceX and other commercial space providers to assist with maritime assets. With proper coordination and scheduling, the Proposed Action would not significantly affect vessel traffic.

Air traffic would be impacted by launches, booster landings, and Starship RTLS. The average expected flight delay for launches would last approximately 40 minutes and could last up to 2 hours. General aviation operations would be similarly impacted by the launch and Super Heavy booster landing AHAs. The launch and Super Heavy booster landing AHA could also affect airways within the flight regions of Canada and the Bahamas. Due to the length of the Starship reentry AHAs, certain flights, especially international, may elect to delay the departure time due to the inability to accept a reroute caused by fuel constraints or the flight time of the reroute. The average expected flight delay for Starship reentries would be approximately 40 minutes and could be up to an hour. General aviation operations would be impacted similarly by the Starship reentry AHAs. The Starship reentry AHAs could also affect airways within the flight regions of Mexico, El Salvador, Belize, Guatemala, Honduras, and Cuba. The FAA would manage such

operations in a way that minimizes disruption to existing aviation operations and ensures safety for all airspace users. Successful integration requires close collaboration between space operators, the FAA, commercial airlines, general aviation, and defense stakeholders. Key factors contributing to feasibility include enhanced real-time communication systems and well-defined scheduling and deconfliction procedures. Although temporary airspace closures may impact other stakeholders, mitigation strategies such as pre-coordinated reroutes, dynamic scheduling, and time-based traffic flow management could reduce operational burdens.

## 3.17 Utilities and Infrastructure

### 3.17.1 Definition of Resource and Regulatory Setting

To describe the existing conditions for utilities and infrastructure within the study area, this section describes the following:

- Drinking and industrial use water supply sources, distribution systems, and wastewater treatment facilities
- The utility resources (e.g., power, communications, etc.) needed for the construction, operation, and maintenance of the Proposed Action and identify where the suppliers are located
- The potential/proposed physical location(s) of infrastructure that would be needed to implement the Proposed Action
  - This would include locations in which land disturbance would be needed to construct surface or subsurface infrastructure.

### 3.17.2 Study Area

The study area for utilities and infrastructure is the construction footprint at LC-39A and local utility distribution systems.

### 3.17.3 Existing Conditions

#### ***Water/Wastewater***

Potable water at KSC is provided and treated by the City of Cocoa municipal potable water distribution system. The City of Cocoa's primary source of water is the Floridan aquifer wellfield located in east Orange County. Water is drawn from the aquifer and treated at the Claude H. Dyal Water Treatment Plant. From the treatment plant the water is supplied to KSC via a water distribution system that supplies both KSC and CCSFS including a supply line to LC-39A. Aquifer storage wells are maintained by the City of Cocoa for storage during low usage, and additional water supply is available from the Taylor Creek Reservoir. Additional onsite storage is located at KSC for use in fire suppression, launch activities, and potable water. SpaceX currently has approximately 50 personnel at LC-39A. An average daily use of 115 gallons (435 liters) per day (St. Johns River Water Management District, 2024) results in a conservative daily use estimate of 5,750 gallons (21,766 liters) per day.

KSC maintains a Non-Transient, Non-Community Public Water System (System No. 3054024) for potable water, fire suppression, and various industrial uses (e.g., heating, air conditioning, and vehicle launch/processing operations). Water is purchased from the City of Cocoa then enters the KSC system. Water is tested and chlorinated, as needed to meet safety and health standards. Testing results are submitted to the FDEP, the Florida Department of Health, and/or USEPA. KSC's water system is operated by Kennedy's Base Operations & Support Services contract. There are two main Central Utility Plants at KSC. Primary water metering at KSC is accomplished at three water distribution system interconnects:

1. The City of Cocoa at the W-1 pump station on SR 3
2. CCSFS at the NASA Causeway
3. A location near SLC-41 (KSC Environmental Program, 2024)

The drinking water interconnect for the facilities within LC-39A is the backflow preventer east of the Crawlerway and north of the gate (NASA, 2019a). The VAB Utility Annex provides chilled and hot water for building heating and cooling for various facilities in the LC-39A area.

KSC and CCSFS have a combined wastewater collection and treatment system. The Regional Waste Water Treatment Plant Facility 54730, located on CCSFS, services all of CCSFS and KSC including SpaceX facilities. Lift stations across CCSFS and KSC pump sewage through underground sewers from facilities to the Waste Water Treatment Plant. The facility is permitted at 0.8 million gallons (3 million liters) per day. In 2018, an average of 0.45 million gallons (1.7 million liters) per day was used.

The system consists of a series of gravity mains, force mains, and lift stations that collect and pump domestic wastewater to the CCSFS Regional Wastewater Treatment Facility. In addition, there are several On-Site Treatment and Disposal Systems or "septic systems" throughout KSC that typically support remote locations, small offices, or temporary facilities. These facilities are connected by a collection system of almost 100 miles (161 kilometers) of sewer mains, approximately 50 miles (80 kilometers) of which are located on KSC property (NASA, 2023).

Industrial wastewater at KSC is either disposed of under an industrial wastewater permit with the FDEP or is discharged to the domestic wastewater system. SpaceX obtained an industrial wastewater permit from the FDEP (Permit No. 05-FLA010307) to construct and operate an industrial wastewater treatment and disposal system for their operations located at LC-39A (NASA, 2019a). Launch deluge and pad washdown water at LC-39A flows into two concrete flumes that access the east and west lined treatment tanks with a holding capacity of 704,146 gallons (2,665,483 liters). Wastewater settles and attenuates pH in the containment tanks before being applied to a 2.2-acre (0.9-hectare) bermed spray irrigation field (NASA, 2019a).

### **Communications**

The KSC communications system provides conventional telephone services, transmission of voice data and video, and operations and maintenance of KSC's cable plant. There are three major distribution and switching stations with one located in the Industrial Area and two in the VAB Area. These three stations provide service for over 18,500 telephones on KSC (NASA, 2019a).

**Stormwater, Electricity and Natural Gas, and Emergency Services**

Stormwater is discussed in Section 3.9, *Water Resources*, electricity and natural gas are described in Section 3.14, *Natural Resources and Energy Supply*, and emergency services is presented in Section 3.18, *Health and Safety*.

## 3.17.4 Environmental Consequences

**Analysis Methodology**

Similar to Section 3.14, *Natural Resources and Energy Supply*, the FAA has not established a significance threshold for utilities and infrastructure. supply in FAA Order 1050.1; however, the same factors used for natural resources and energy supply are considered in this section. For effect analysis, the expected amount of natural and energy resources needed for a project were evaluated and compared to the local context of supply and demand or compared to the capacity of the system to determine if the Proposed Action would cause demand to exceed available or future supplies of these resources.

This section analyzes the magnitude of anticipated increases in infrastructure demands considering current levels, existing management practices, and supplier capacity. Effects are evaluated by whether they would do the following:

- Use a substantial proportion of the remaining system capacity
- Reach or exceed the current capacity of the system
- Require development of facilities and sources beyond those existing or currently planned

### 3.17.4.1 No Action

Under the No Action Alternative, the Proposed Action would not occur and there would be no change to the existing infrastructure at LC-39A for SpaceX or availability/capacity of supporting utilities. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action. Reasonably foreseeable actions would all require an increase in utilities including drinking and industrial water use, domestic and industrial wastewater collection and treatment, emergency response, and communications enhancements. However, each project is analyzed separately to determine utility loads and typically includes infrastructure improvements to ensure that existing infrastructure availability and capacity would not be negatively affected. As an example, the EIS for Starship-Super-Heavy operations at SLC-37 on CCSFS estimates approximately 105 million gallons (397 million liters) per year of potable water use (USSF, 2025a). As a result, the FAA anticipates that the No Action Alternative, with consideration of new, more efficient utilities with an increased capacity would not pose significant adverse effects on utilities and infrastructure.

### 3.17.4.2 Proposed Action

#### 3.17.4.2.1 Construction

Under the Proposed Action infrastructure to support Starship-Super Heavy launches and landings would be as described in Section 2.1.4, *Proposed Action and Alternatives, LC-39A Infrastructure*.

Construction of these infrastructure improvements would be temporary and would provide additional capacity required to support Starship-Super Heavy operations. As a result, the Proposed Action would not affect capacity of existing utilities, use a substantial proportion of the remaining system capacity, or require development of facilities and sources beyond those existing or currently planned. Therefore, construction of infrastructure improvements would not pose a significant effect on utilities.

#### 3.17.4.2.2 Operation

Operations under the Proposed Action would result in increased need for utilities, including water, wastewater treatment and disposal, emergency response, and communications. All of these utilities and infrastructure are currently available in the general vicinity of LC-39A, and tie-ins could be established without significantly affecting the local area. Some utility ducts would be needed but could be routed along roadways and other easements. There would be an increase in permanent personnel numbers; therefore, additional drinking water and domestic wastewater treatment would be required.

**Water/Wastewater.** Estimated water use and wastewater generation amounts are shown in Table 3.17-1.

**Table 3.17-1. Estimated Water Use and Wastewater Generation**

| Process                                 | Water                                  |                   |                            | Wastewater                                                 | Treatment                                |
|-----------------------------------------|----------------------------------------|-------------------|----------------------------|------------------------------------------------------------|------------------------------------------|
|                                         | Event                                  | Gallons per Event | Gallons per Year (million) |                                                            |                                          |
| Drinking Water                          | -                                      | -                 | 2.0                        | Not Applicable                                             |                                          |
| Deluge System                           | Static Fire                            | 300,000           | 26.4                       | 92% evaporation                                            | Reuse or evaporation and retention ponds |
|                                         | Launch                                 | 400,000           | 17.6                       |                                                            |                                          |
|                                         | Landing                                | 68,000            | 6.0                        |                                                            |                                          |
| Future ASU Cooling Tower                | 20,000 gallons per hour operating 24/7 |                   | 175.2                      | 2,000 gallons per hour operating 24/7 (48,000 gallons/day) | Evaporation and retention ponds          |
| Future Liquefaction - methane liquefier | 8,000 gallons per hour operating 24/7  |                   | 70                         | 800 gallons per hour operating 24/7 (19,200 gallons/day)   | Evaporation and retention ponds          |
| Total per Year                          |                                        |                   | 297.2                      |                                                            |                                          |

Notes: % = percent; ASU = air separation unit. Assume that ASU and methane liquefier operate 24 hours/day, 7 days/week.

Water use would be dependent on the facility's specific design and operations that are not currently available.

The Proposed Action would increase the water required for LC-39A operations by approximately 297 million gallons (1,124,267,300 liters) annually, or approximately 813,700 gallons (3.1 million liters) per day. The potable water supply is provided by the City of Cocoa, which processes approximately 8.2 billion gallons (31 billion liters) of water a year with average flows of 22.7 million gallons (85.9 million liters) a day. The city's treatment plants have a capacity to treat 60 million gallons (227 million liters) a day from groundwater sources and 12 million gallons (45 million liters) from surface water sources. The Proposed Action would therefore result in an increase of approximately 3.6 percent of the city's usage



and well within the current and projected capacity for the City of Cocoa. It is anticipated that all water would be supplied by pipeline.

LC-39A is located within the St. Johns Water Management District. The largest category of water use in the district is residential use (565.5 million gallons per day). Landscape irrigation accounts for approximately 50 percent of that use and as a result the district, along with many of the regions municipalities, have placed restrictions on irrigation (St. Johns River Water Management District, 2025). The Proposed Action's anticipated water use is approximately 0.1 percent of residential water use in the district.

SpaceX does not anticipate the use of the CCSFS wastewater facility. Wastewater from the ASU, liquefaction facility, and deluge system would be captured in retention ponds. No sewage treatment facilities are proposed for use at LC-39A aside from the use of temporary sanitary facilities.

The liquefaction facility and ASU would generate approximately 67,200 gallons of wastewater per day and would be collected in the proposed 1.5 acres (0.6 hectares) of retention/evaporation ponds identified in Section 2.1.4, *Proposed Action and Alternatives, LC-39A Infrastructure*. Although design parameters have not been finalized, it is anticipated that the ponds would be between 3-4 feet given the water table. A 1.5-acre, 3-foot-deep pond can hold approximately 1.5 million gallons; it would take approximately 22 days to fill up at the wastewater generation rate. A 1.5-acre, 4-foot-deep pond can hold approximately 2 million gallons; it would take approximately 30 days to fill up at the wastewater generation rate. These numbers do not account for varying amounts of rainwater or a variable evaporation rate.

The deluge system would capture the water in an approximately 2.8-acre pond proposed for construction. The pond would be concrete- or plastic-lined to prevent groundwater infiltration and have berms to prevent stormwater/rainwater inflow. Pond water would be pumped and filtered into storage tanks for reuse. Any filtered materials would be handled according to permit conditions. Approximately 92 percent of deluge water would be vaporized during operations. SpaceX plans to reuse deluge water that is retained onsite (i.e., not evaporated). The system would pump and filter water from the deluge pond into storage tanks for reuse. In the event SpaceX is unable to reuse the deluge water, it may be hauled offsite, discharged, or land applied. Prior to any discharge or land application, SpaceX would apply for any applicable FDEP permits.

**Communications.** The existing communications systems would be expected to accommodate any proposed increase in demand. SpaceX is not proposing any needed upgrades to support Starship-Super Heavy operations.

#### **3.17.4.2.3 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2. Reasonably foreseeable actions would all require an increase in utilities including potable water use, domestic and industrial wastewater collection and treatment, emergency response, and communications enhancements. However, each project typically includes infrastructure improvements to ensure that existing infrastructure availability and capacity would not be negatively affected. As an example, the combined estimate for potable water use from the City of Cocoa under the Proposed Action (approximately 297 million gallons/year) and proposed Starship-Super Heavy operations

at CCSFS SLC-37 (approximately 105 million gallons/year) (USSF, 2025a) is approximately 400 million gallons/year. This represents an average of 1.1 million gallons/day; which is approximately 5 percent of the city's current average flow of 22.7 million gallons/day and 1.5 percent of the city's processing capacity of 72 million gallons/day. As a result, the FAA anticipates that the Proposed Action would not pose significant adverse effects on utilities and infrastructure in context with new, more efficient utilities and increased capacity and demand.

### 3.17.5 BMPs, Mitigation, and Monitoring

Mitigation and monitoring would be required as specified in permit conditions for utilities. For example, the FDEP issues NPDES Multi Sector General Permits to regulate stormwater discharges associated with certain industrial activities and requires compliance with effluent limitations, inspection requirements, and other conditions. Monitoring of collected wastewater would be required for water quality prior to onsite reuse, offsite discharge, offsite disposal, or land application. FDEP permits for wastewater offsite disposal, discharge, or land application would include water quality monitoring requirements.

### 3.17.6 Summary

There could be potential minor short-term effects during construction of the utility improvement projects, but those would likely be short term and not significant. During operations, the Proposed Action would result in greater utility demands compared to the No Action Alternative; however, the Proposed Action includes construction projects to support the increased demand. Water use associated with Proposed Action operations at LC-39A would require approximately 297 million gallons per year; given the context of the City of Cocoa, this is a small percentage of current annual use and capacity. SpaceX would construct onsite bulk storage for water and commodities and would reuse or recycle as appropriate. Based on the analysis of potential effects presented above, the FAA does not anticipate significant effects to utilities and infrastructure distribution systems and service capacity from implementation of the No Action Alternative or the Proposed Action.

## 3.18 Health and Safety

### 3.18.1 Definition of Resource and Regulatory Setting

This discussion of public health and safety includes consideration for any activities, occurrences, or operations that have the potential to affect the safety, well-being, or health of members of the public and employees. A safe environment is one in which there is no, or optimally reduced, potential for death, serious bodily injury or illness, or property damage. This section identifies potential hazards and standard operating procedures during the following:

- Construction
- Operations and maintenance activities associated with fueling, testing, training, and launch activities (includes risks to the public, employees, contractors, and civilians from potentially hazardous activities such as flight operations, flight trajectory and dispersion, and launch failures)
- Emergency services and response

**Construction.** Public health and safety during construction is generally associated with the safety of personnel within or adjacent to the construction zones. SpaceX would comply with Federal regulations including 29 CFR Part 1926, *Safety and Health Regulations for Construction*, appropriate KSC safety protocol (KNPR 8715.7, *KSC Construction Contractor Safety and Health Practices Procedural Requirements*), and internal safety procedures.

**Operations and Maintenance.** Pursuant to 51 U.S.C. Subtitle V, Chapter 509, Commercial Space Launch Activities (Chapter 509), the FAA Office of Commercial Space Transportation licenses or permits commercial space launch and reentry operators and sites. The FAA exercises this authority consistent with public health and safety, property safety, and the national security and foreign policy interests of the United States. In 1998, Congress amended Chapter 509 (formerly Chapter 701) to establish procedures for the issuance of “safety approvals” for launch vehicles, reentry vehicles, safety systems, processes, services, or personnel that may be used in conducting licensed commercial space launch or reentry activities. The safety approval process verifies that acceptable performance criteria have been met and addresses the following:

- Potential hazards and risks to public safety posed by the Proposed Action
- Engineering and safety analyses, system tests, quality assurance procedures, manufacturing processes, and test plans and results
- Adequacy and reliability of the various analyses and procedures used in the safety element’s demonstration
- Test results that show a measure of proficiency and experience for personnel involved in training

In addition, range safety regulations for KSC are contained in NASA NPR 8715.5B, Range Flight Safety Program and KSC 4360, which state that Range Safety organizations review, approve, and monitor conditions and place safety holds on all prelaunch and launch operations when necessary. The objective of the Range Safety Program is to ensure that the public, personnel, environment, and area resources are provided an acceptable level of safety, and that all aspects of prelaunch and launch operations adhere to public laws.

**Emergency Services and Response.** NASA provides fire suppression and detection systems to protect personnel and equipment and are equipped to respond to launch vehicle emergencies. KSC, CCSFS, the City of Cape Canaveral, and Brevard County have a mutual-aid agreement in the event of an emergency (NASA, 2019a).

### 3.18.2 Study Area

The study area includes LC-39A plus the areas in and around KSC that could be affected by launches, test operations, and transport. For this EIS, the health and safety study area includes the construction footprint and land area closures, RNAs, safety zones, and operational controls established during launches and landings.

### 3.18.3 Existing Conditions

**Construction.** All personnel involved with operational programs at KSC follow appropriate safety protocols, including OSHA and KSC regulations and training requirements. The handling, processing, storage, and disposal of hazardous materials or hazardous wastes from operations and maintenance

activities are accomplished in accordance with all applicable Federal and state requirements. A description and subsequent analyses of the management of hazardous materials, toxic substances, and hazardous waste is provided in Section 3.13, *Hazardous Materials, Solid Waste, and Pollution Prevention*.

**Operations.** Operational safety refers to the actual use of LC-39A during testing and training, launches and landings, and potential risks to inhabitants or users of adjacent or nearby land, water, and air. Safety measures as required by the FAA and NASA are implemented through designated safety zones. These zones separate the hazardous procedures from other operations and from the general public. For example, once a launch vehicle is erected on a launch pad, a safety arc, calculated based upon the potential hazards of that vehicle (e.g., the types and quantities of propellant onboard, rocket reliability, flight trajectory, and types of debris expected if the flight were terminated) would be activated around the launch pad. Operational controls (e.g., evacuation areas, temporary road closures, etc.) are established within and at the perimeter of the safety arc to minimize the potential hazards associated with the operations of the launch range. The KSC Safety Office reopens a hazard area following a launch or landing. The duration of the closure is launch-specific to protect public safety but typically it is 3 hours. Note that in the event of a launch incident or failure, the Safety Office may need days before deeming the area safe enough for personnel to enter.

Operations are coordinated with the FAA, NASA, the DAF, USCG, and other organizations as required to clear potential hazard areas. If necessary, NOTMARs and NOTAMs depicting the hazard areas are published at least 48 hours prior to an operation. Current airspace and water closures are described below.

**Airspace.** The FAA closes airspace for launches at KSC. A flight trajectory analysis is completed prior to each flight to define the flight safety limits. Launch vehicles with Flight Termination Systems are terminated by destruction of the vehicle if the flight is deemed erratic or crosses the established destruct boundary. All stages are required to be equipped with Flight Termination Systems unless the maximum range of the vehicle is within established launch range boundaries or the vehicle is determined to be inherently safe. Flight termination boundaries are designed to protect the public and personnel by ensuring that vehicle destruction occurs within a predetermined safety zone (NASA, 2019d).

Safety considerations for launches also include dispersion of hazardous materials from either a normal or terminated flight and may include rocket exhaust products or propellants. These materials cannot be limited to a predefined hazard area because they are influenced by atmospheric conditions. Distance-focusing overpressure analyses determine the risk to the public based on the potential for a shock wave to strengthen after reflecting off temperature gradients in the atmosphere. The potential effects are analyzed real-time during launch countdown using industry-accepted computer models. The extent of potential hazard could change with the weather; therefore, the areas requiring clearance are subject to change (NASA, 2019d).

**Water.** Federal regulations for RNAs and LAAs and safety zones and security zones are described in 33 CFR Part 165. The USCG defines RNAs as “water areas within a defined boundary for which regulations for vessels navigating within the area have been established.” RNAs differ from safety zones. Generally, a safety zone is an area of water or land that requires limited public access for safety reasons for a defined time. Regulations for safety zones are contained within 33 CFR Part 147. Regulations in 33 CFR

§165.775 describe the existing RNAs for offshore Cape Canaveral, Florida (Figure 3.18-1). These areas are based on the farthest north and south trajectories of typical rocket launches originating from Cape Canaveral. Restrictions may be enforced anywhere within the boundaries of the RNAs. Restrictions would be based on the risk assessment of the Captain of the Port Jacksonville and informed by the mission-specific launch exclusion areas provided by SLD 45. As shown, there are five launch hazard areas that cover rocket launches. The Captain of the Port of Jacksonville or a designated representative may restrict vessel movement such as transiting, anchoring, or mooring within these RNAs to protect vessels from hazards associated with rocket launches. These restrictions are temporary in nature and will only be enacted and enforced prior to and just after a launch. The Captain of the Port of Jacksonville may activate restrictions within any single area or a combination of areas or establish other areas within the RNA boundary area. Additionally, KSC regularly distributes notices of launch-related hazard areas to local watermen, marinas, and marine transportation companies. Risk criteria have been established by NASA to protect the public, mission essential and critical operations personnel, and property from risks associated with operations.

The CCSFS also coordinates efforts to make sure commercial aircraft are clear of restricted areas during launch countdowns, provides weather forecasts, and partners with the USCG to patrol water within the launch safety zone. Waters within the launch safety zone are patrolled jointly by the USCG and the DAF.

KSC also follows KNPR 1820.3 Rev. E, *KSC Hearing Loss Prevention Program*, to provide requirements for the evaluation and control of workplace noise hazards and prevention of employee hearing loss.

**Emergency Services.** KSC has a Comprehensive Emergency Management Plan (KNPR 8715.2 Rev. B). The Plan establishes uniform requirements for the effective preparation for, mitigation of, response to, and recovery from a variety of emergency situations. It establishes requirements and responsibilities for response to major emergencies where multiple emergency response forces and supporting agencies are involved.

NASA fire stations operate 24/7, fire and ambulance services are staffed by cross-trained paramedic/firefighters, and there are centralized monitoring and dispatch facilities. Mutual-aid agreements are used to support emergency events, as needed. During launch activities, communication with multiple entities is key and includes KSC, Brevard County Emergency Management, the Florida Marine Patrol, the USCG, and the state coordinating agency, the Division of Emergency Management. Launch surveillance areas are monitored to ensure that the risk to people, aircraft, and surface vessels is within acceptable limits. Control areas and airspace are closed to the public as required to maintain safety (NASA, 2019a).

NASA provides fire suppression and detection systems to protect personnel and equipment and are equipped to respond to launch vehicle emergencies. KSC, CCSFS, the City of Cape Canaveral, and Brevard County have a mutual-aid agreement in the event of an emergency (NASA, 2019a).



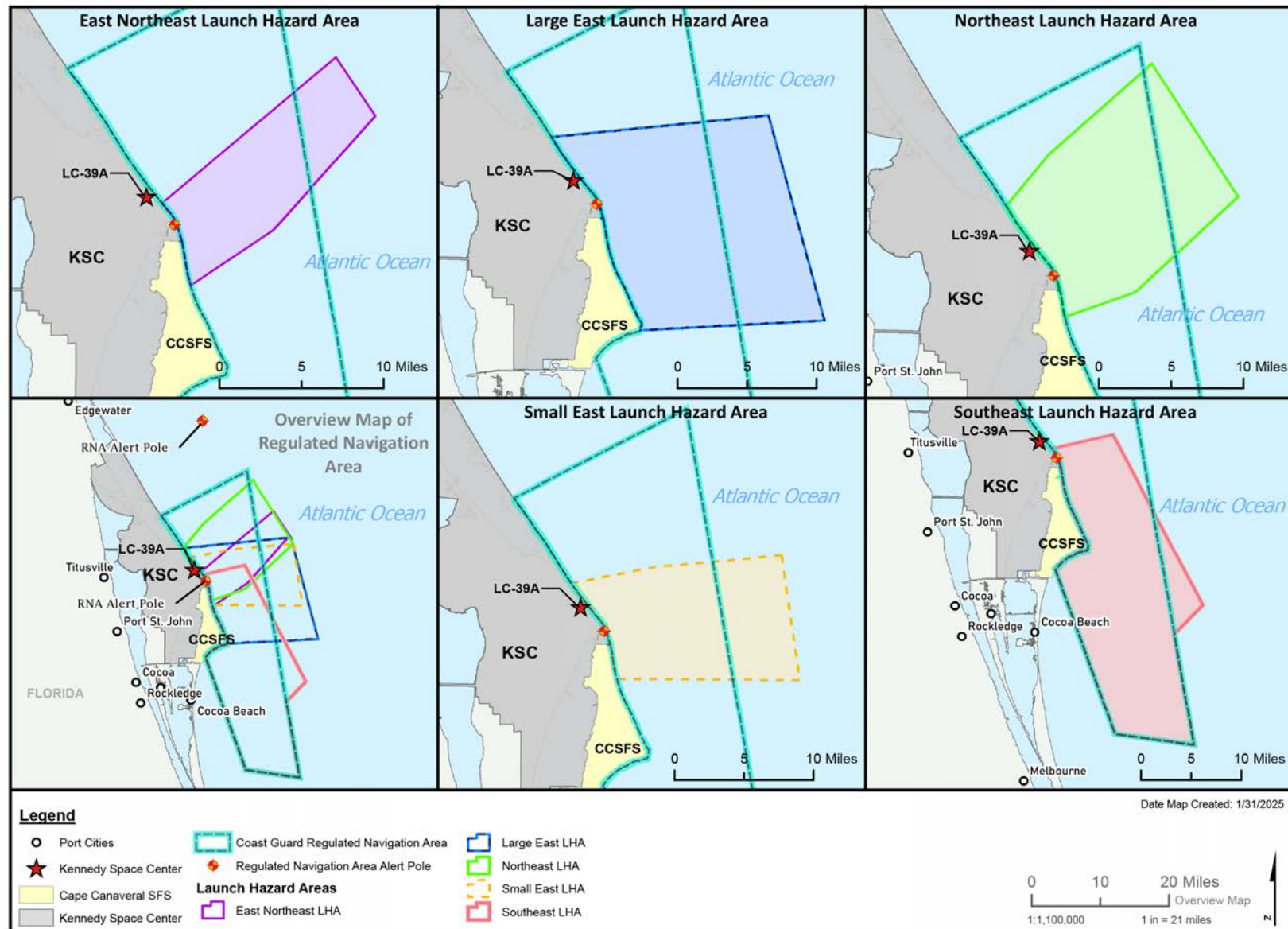


Figure 3.18-1. RNAs Established at Cape Canaveral

Emergency medical services for personnel at KSC are provided by the KSC Occupational Health Facility staff. Additional health care services are available at nearby public hospitals in Titusville, Rockledge, and Cocoa Beach.

## 3.18.4 Environmental Consequences

### ***Analysis Methodology***

Within FAA Order 10501.F, the FAA has not established any significance determination criteria for health and safety-related effects. Analyses in this EIS therefore focus on the context and intensity of potential effects to health and safety to determine significance.

This section evaluates the public and employee health and safety associated with new construction and additional launches and reentry operations. An effect on public health and safety would be significant if the Proposed Action resulted in the following:

- A substantial increase in the risks associated with safety of employees, contractors, or the general public
- Introduction of a new health and safety risk that KSC, NASA, CCSFS, or SpaceX are not prepared to respond to
- Ability of emergency services to respond to an emergency event

### 3.18.4.1 No Action

The No Action Alternative would not result in changes to health and safety protocols and would maintain current conditions including the number of SpaceX Falcon launches per year. There would not be any Starship-Super Heavy launches and landings at LC-39A. Under the No Action Alternative, other NASA, CCSFS, and commercial providers would continue to conduct launches, which are projected to increase over time. No Action effects analysis considers potential effects associated with reasonably foreseeable actions (Table 2.2-1 and Table 2.2-2) without consideration of the Proposed Action, because these actions would still occur under the No Action.

Increased launches would incrementally increase the potential for health and safety effects given that health and safety risks are an inherent component of launch and landing activities. However, the probability of an off-nominal event is very low. The FAA, NASA, and SpaceX conduct robust risk assessments and implement health and safety processes to identify and minimize risk.

As mentioned, the Space Coast set a new launch record in 2024 with 98 orbital missions from KSC and CCSFS (Erwin, 2025) with the pace expected to increase in 2025 to more than 150 for the year (Neale, 2025). Assuming all projects and launches move forward, this presents a proposed significant increase in operations at KSC and CCSFS. This increase correlates to a potential increase in risk associated with off-nominal events. The effects of an off-nominal event are directly related to the size and type of launch vehicle, as well as the trajectory of the vehicle and location of the event. As a result, effects to health and safety are difficult to anticipate considering the different launch providers, associated vehicles, and launch locations. However, the FAA believes that implementation of standard health and safety protocols, along

with Federal, state, and local agency coordination and emergency response capabilities minimize the risk of health and safety effects to less than significant.

### 3.18.4.2 Proposed Action

#### 3.18.4.2.1 Construction

Proposed construction activities could present safety risks to construction personnel and contractors. To minimize risks to safety and human health, all construction activities would be performed by qualified personnel who are trained to safely operate the appropriate equipment. Additionally, all activities would be conducted in accordance with Federal OSHA regulations, NASA requirements, and SpaceX internal safety procedures. Appropriate signage, signal lights, and fencing would be placed to alert pedestrians and motorists of project activities, as well as any changes in traffic patterns. Health and safety plans would be submitted by contractors for approval by SpaceX and the NASA Safety Office prior to work onsite. A safety briefing would be held at the pre-construction meeting. Therefore, the FAA anticipates that health and safety effects associated with construction under the Proposed Action would be minimal.

#### 3.18.4.2.2 Operation

Under the Proposed Action, SpaceX would conduct 44 launches per year with the booster returning to the launch pad while the Starship conducts its mission and returns. This would result in 132 total events (44 launches, 44 returns/landings for Starship and 44 returns/landings for Super Heavy). This presents a 46 percent increase in SpaceX operations at KSC. Starship-Super Heavy could land vertically at the catch tower or other landing location, such as floating platform. By comparison, the Space Coast set a new launch record in 2024 with 98 orbital missions (Erwin, 2025) from KSC and CCSFS, with the pace expected to increase in 2025 to more than 150 for the year (Neale, 2025).

Health and safety risks for each type of rocket launch and reentry project are distinct and need to be evaluated separately. The FAA, NASA, CCSFS, USCG, and SpaceX would manage safety risks to protect human health and safety as is current practice. Additionally, SpaceX's license application or license modification must also meet FAA safety, risk, and financial responsibility requirements under 14 CFR Chapter III. To receive a safety approval, SpaceX must verify to the FAA's satisfaction that acceptable performance criteria have been met. SpaceX would be required to conduct the following:

- Address potential hazards and risks to public safety posed by use of the approved safety element.
- Provide engineering and safety analyses, system tests, quality assurance procedures, manufacturing processes, and test plans and results.
- Validate the adequacy and reliability of the various analyses and procedures used in the safety element's demonstration.
- Submit test results that show a measure of proficiency and experience for personnel involved in training (FAA, 2012).

To evaluate safety, the FAA uses established Federal launch range practices that are considered best engineering practice and that have been demonstrated to adequately safeguard public health and safety and the safety of property, such as described in *Space Systems Command Manual 91-710, Range Safety*

*User Requirements Manual, Space Systems Command Instruction 91-710, Launch and Range Safety Program, and Range Commanders Council 319, Flight Termination Systems Commonality Standard.* For subsystems and components, publicly available industry consensus standards maintained by organizations such as the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the American Institute of Aeronautics and Astronautics (FAA, 2012).

NASA has Range Flight Safety Requirements (NASA STD 8719.25) with specific risk criteria established to protect the public, mission essential and critical operations personnel, and property from risks associated with operations (NASA, 2021c). For launches and reentries, restricted-access hazard arcs would be established around LC-39A to separate the hazardous procedures from other operations and from the general public. Once a launch vehicle is on the launch pad, a hazard arc is calculated based upon the potential hazards of that vehicle (e.g., the types and quantities of propellant onboard, rocket reliability, flight trajectory, and types of debris expected if the flight were terminated) and is activated around the launch pad. Operational controls (e.g., evacuation areas, temporary road closures, etc.) are established within and at the perimeter of the hazard arc to minimize the potential hazards associated with the operations of the launch range.

As a result of Starship-Super Heavy launches and reentries, closures to airspace, land areas, and water areas would occur.

A Starship/Super Heavy operation could result in a deviation from what is expected (referred to as an anomaly). An anomaly on the launch pad could cause a fire on the launch pad and/or an explosion onsite or elsewhere that spreads debris. While anomalies are unexpected, as part of evaluating a new license or modification of their existing vehicle operator license, the FAA evaluates SpaceX's debris analysis to ensure the hazard area is of sufficient size to ensure public safety. In the event of an anomaly, SpaceX would evaluate the level of response based on the situation and notify the appropriate emergency personnel and land-managing agencies according to the requirements in a site-specific anomaly [or emergency] response plan.

**Land Areas.** Figure 2.1-5 shows a representative LC-39A Starship-Super Heavy hazard arcs for test access and launch/landings. As discussed in Section 3.3, *Land Use*, midday (or later) launches or tests could result in day-long closures of portions of MINWR or CANA. Launch scrubs could also affect the length and/or number of closures; however, the extent of these occurrences cannot be quantified at this time. As shown, the test access restriction is confined to KSC/CCSFS property and would only affect portions of KSC/MINWR that are not accessible to the public. Refuge land management activities in this area would be coordinated with KSC as described in Section 3.3, which would deconflict safety issues for refuge personnel. The launch/landing restricted access extends to publicly accessible portions of CANA and MINWR, including Playalinda Beach. Given that CANA is open 365 days per year, portions that include Playalinda Beach could be closed up to 60.5 days (or approximately 17 percent) of the year (see Section 3.3.4.2.2, *Land Use, Operation*), more or less depending on scheduling of launches/landings and the occurrences of scrubbed launches. This may be inconvenient to those wishing to visit the park during these times and may be exacerbated where launches/landings are scheduled during high-use times such as holidays and weekends. However, the area has been launching and would continue to launch spacecraft as the primary mission, and effects from additional launches/landings would be expected. Advance notification to the public of launch schedules would help visitors plan accordingly.

**Airspace.** Airspace coordination, AHAs, and airspace closures associated with integrated launches, booster landings, and Starship RTLS are discussed in detail in Section 2.1.3.1, *Starship-Super Heavy Operations, Pre-Launch*. Figure 2.1-3 and Figure 2.1-4 show potential notional ranges of Starship-Super Heavy launch/booster landing and Starship RTLS airspace AHAs. As shown, the potential closed airspace is large and could cause disruptions to commercial, military, and private aircraft flights. Although the closures would eventually decrease in size with proven reliability, this could have a significant effect. The location and size of airspace closures for commercial space operations also vary with each mission type and are influenced by multiple factors, including vehicle hardware reliability. The size of airspace closures shrink as reliability is established with results and analysis from each launch. For the initial launch of a new launch vehicle (e.g., Starship-Super Heavy), the hazard areas and associated airspace closures are larger, to account for the increased risk of a vehicle failure, compared to a mature rocket. Subsequent launches of the vehicle would include smaller hazard areas than the initial launch. The airspace closures for SpaceX pre-launch testing (tank tests, wet dress rehearsals, and static fire engine tests) would be localized to an area near the pad and may extend up to approximately 13,550 feet (4,130 meters) in altitude and 2.6 miles (4.2 kilometers) from the center of LC-39A. SpaceX may also reduce the cadence of the static fires of the Starship or Super Heavy vehicles, not requiring a static fire of each engine test per launch operation. The hazard area would likely be opened within 3.5 hours following a launch/landing. However, in the event of an incident or failure, the hazard area could be extended for days before it is safe for personnel to enter. The FAA would prepare an Airspace Management Plan, which is completed approximately 3 to 5 days prior to launch or reentry and describes the launch/reentry information. This plan helps the FAA determine whether the proposed launch or reentry would result in an unacceptable limitation on air traffic. The FAA strives to reduce the duration and size of closures, reopen airspace as soon as it is safe, reroute aircraft only directly affected by operations, track space vehicles in near-real time during flight, and respond quickly to any missions experiencing an anomaly.

**Water Areas.** As shown in Figure 3.18-1 in Section 3.18.3, *Existing Conditions*, Cape Canaveral has established RNAs that are published in the Federal Register. These RNAs or variations of the RNAs would continue to be established during launches and landings of Starship-Super Heavy. All water restrictions would be published in NOTMARs to inform the maritime community. Due to the increase in frequency of launches and landings, the restrictions would occur more often but would not alter the size of restricted area compared to current conditions. The restrictions would be temporary and interested parties would be notified. USCG patrols would also confirm that ships would not be in the area. As a result, although the restrictions would occur more frequently with Starship-Super Heavy launches and landings, the area has been and would continue to launch spacecraft as the primary mission. Therefore, the effects of additional launches/landings would not be significant due to the short duration of closures and with half of the launches/landings occurring at nighttime to minimize effects to selected users. The *State of the Port* (2024) (Port Canaveral, 2024), identifies supporting SpaceX and other commercial providers with maritime assets. With coordination, the Proposed Action would not significantly affect vessel traffic.

As discussed in the 2019 EA, CCSFS SLD 45 range safety regulations ensure that the public, launch area personnel, and affected land area are protected, and that pre-launch, launch, and landing operations adhere to public laws. Range Safety uses models to predict launch hazards to the public and on-site personnel prior to every launch. These models calculate the risk of injury resulting from toxic gases, debris, and blast overpressure both from nominal launches and launch failures. Launches are postponed if



predicted risk of injury exceeds acceptable limits. Range safety organizations review, approve, monitor, and impose safety holds, when necessary, on all pre-launch, launch, and landing operations.

SpaceX would comply with regulatory standards and safety precautions. Table 2.1-1 identifies the security measures that SpaceX would establish on the day of the launch or reentry. This table also shows the hours of anticipated closures for tests, launches, and reentries to protect safety. Approximate times of closure include up to 396 hours per year for tests and 462 hours per year for launches and reentries. This equates to approximately just under 10 percent total for a year with 4.5 percent for tests and 5.3 percent for launches and reentries. Note that half of the closure times would be during the day, while half would occur at nighttime.

The potential effects associated with noise are discussed in Section 3.2.4, *Noise and Noise-Compatible Land Use, Environmental Consequences*, and the potential for structural damage is addressed in Section 3.3.4, *Land Use, Environmental Consequences*.

#### **3.18.4.2.3 Reasonably Foreseeable Effects**

Reasonably foreseeable effects consider the Proposed Action in context with other reasonably foreseeable actions. Reasonably foreseeable actions applicable to the analysis include continued launch activity at KSC and CCSFS continued infrastructure development and improvements at KSC and continued economic and community growth and development within the areas surrounding KSC as identified in Table 2.2-1 and Table 2.2-2.

Increased launches would incrementally increase the potential for health and safety effects given that health and safety risks are an inherent component of launch and landing activities. However, the probability of an off-nominal event is very low. The FAA, NASA, and SpaceX conduct robust risk assessments and implement health and safety processes to identify and minimize risk.

As mentioned, the Space Coast set a new launch record in 2023 with 72 orbital missions from KSC and CCSFS with the pace expected to increase in 2024 from 53 launches to date to an estimated 111 total for the year (Orlando Sentinel, 2024). Assuming all projects and launches move forward, this presents a proposed significant increase in operations at KSC and CCSFS. This increase correlates to a potential increase in risk associated with off-nominal events. The effects of an off-nominal event are directly related to the size and type of launch vehicle, as well as the trajectory of the vehicle and location of the event. As a result, effects to health and safety are difficult to anticipate considering the different launch providers, associated vehicles, and launch locations. However, the FAA believes that implementation of standard health and safety protocols, along with Federal, state, and local agency coordination and emergency response capabilities minimize the risk of health and safety effects, and the Proposed Action would not significantly contribute to these risks in context with other reasonably foreseeable actions.

### **3.18.5 BMPs, Mitigation, and Monitoring**

Overall, SpaceX and NASA employees would follow KNPR 1820.3 Rev. E, *KSC Hearing Loss Prevention Program*, to provide requirements for the evaluation and control of workplace noise hazards and prevention of employee hearing loss. To further minimize occupational health and safety risks, the following BMPs would be implemented:

**Construction**

- Adhere to applicable OSHA and KSC standards and procedures to reduce the potential for construction worker accidents.
- Clearly mark work areas with appropriate signage and secure against unauthorized entry to protect public safety.
- Conduct proposed construction activities in accordance with Federal, state, and local regulations to minimize safety hazards and contact with hazardous materials, wastes, and substances.
- Clearly mark any changes to traffic patterns using standard construction traffic control measures to reduce confusion and potential for accidents, and communicate changes to personnel.
- Develop and implement a health and safety plan to further minimize potential effects to health and safety of employees. Ensure planning and mandatory training addresses not only typical construction-related hazards, but also environmental hazards such as heat exhaustion and stroke, lightning strikes, and insect- and animal-related hazards.

**Operations**

As part of the licensing process and associated requirements the following actions would occur:

- SpaceX would meet FAA safety, risk, and financial responsibility requirements under 14 CFR Chapter III, *Commercial Space Transportation, Federal Aviation Administration, Department of Transportation*.
- SpaceX would provide engineering and safety analyses, system tests, quality assurance procedures, manufacturing processes, and test plans and results.
- The FAA and SpaceX would validate the adequacy and reliability of the various analyses and procedures used in the safety element's demonstration.
- SpaceX would submit test results that show a measure of proficiency and experience for personnel involved in training (FAA, 2012).
- SpaceX would work with the FAA, NASA, CCSFS, and the USCG, and other organizations as required to clear potential hazard areas.
- SpaceX would submit a Flight Safety Data Package to the FAA in advance of the launch or reentry. The package would include the launch/reentry trajectory and associated AHAs. These AHAs define the temporarily closed airspace that would be defined and published through a NOTAM prior to the launch/reentry to inform pilots of the hazards.
- The FAA would conduct an analysis of the effects on airspace efficiency and capacity for each licensed launch operation. This analysis is documented in an Airspace Management Plan, which is completed approximately 3 to 5 days prior to launch or reentry and describes the launch/reentry information and any associated effects to the NAS. This information helps the FAA determine whether the proposed launch or reentry would result in an unacceptable limitation on air traffic. If that were the case, the FAA may need to work with the operator to identify appropriate mitigation strategies, such as shortening the requested launch/reentry window or shifting the launch/reentry time, if possible.

The FAA often provides data to launch operators to avoid operations during days with high aviation traffic volume.

- SpaceX would work with the FAA to issue NOTAMs as required to assist pilots with scheduling around any temporary disruption of flights. The most common type of airspace closures are Temporary Flight Restrictions and altitude reservations. The FAA generally uses Temporary Flight Restrictions to protect airspace over land up to 12 nautical miles (22 kilometers) offshore and altitude reservations to protect oceanic airspace beyond 12 nautical miles (22 kilometers) offshore.
- SpaceX would work with the FAA and the USCG to issue NOTMARs as required to assist mariners with scheduling around any temporary disruption of vessel activities.
- SpaceX may enter into an LOA with the appropriate Air Route Traffic Control Center(s), Terminal Radar Approach Control Facility(s), and Air Traffic Organization Space Operations, as applicable, to accommodate the flight parameters of the Starship-Super Heavy vehicle. The LOA outlines procedures and responsibilities applicable to operations, including notification of launch activity; communication procedures prior to, during, and after a launch; planning for contingencies/emergencies; NOTAM issuance; and any other measures necessary to protect public health and safety.
- SpaceX would surveil the area prior to commencing propellant loading and would delay the operation if a vessel was actively inside or heading toward the access restricted area during the operation.

As discussed in Section 3.2.5, *Noise and Noise-Compatible Land Use, Best Management Practices, Mitigation, and Monitoring*, several mitigation measures would be used to reduce noise including the following:

- SpaceX would employ the water deluge system during all Starship-Super Heavy launches. The water deluge system reduces noise and vibrations generated during launch.
- SpaceX would conduct public and agency notifications prior to each Starship-Super Heavy launch and landing event to minimize the likelihood of people being surprised by noise associated with these events. Statements including scheduled dates and times for upcoming launches would be provided to news outlets and local law enforcement.
- SpaceX would conduct public outreach efforts to increase public familiarity with SpaceX missions. Increased familiarity with the vehicle and mission parameters generally reduces feeling of anxiety, which would reduce the likelihood of negative reactions to noise generated by Starship-Super Heavy operations.

### 3.18.6 Summary

In summary, under the Proposed Action, health and safety risks could occur from Starship-Super Heavy based on the number of launches and reentries. Closures for tests, launches, and reentries would be implemented for safety. Approximate times of closure include up to 396 hours per year for tests and 462 hours per year for launches and reentries. Based on the number of hours in a year, this equates to approximately just under 10 percent total for a year with 4.5 percent for tests and 5.3 percent for launches and reentries. Note that half of the closure times would be during the day, while half would occur at nighttime.

The FAA, NASA, and SpaceX would implement protective measures to include these closures to ensure risks to personnel and the public are minimized to the extent practicable. The protective measures include activation of the hazard arc; issuance of NOTMARs and NOTAMs; activation of scheduling procedures to prevent potential effects to personal, commercial and recreational vessels, and aircraft; relocation of personnel prior to launch and reentry; and temporary road closures during launches and landings. Given the safety factors put in place during operational activities, the FAA does not anticipate significant adverse health and safety effects. Under the No Action Alternative, SpaceX Falcon launches would continue along with NASA, CCSFS, and other commercial providers. The number of launches is projected to increase over time and could also affect public health and safety.

### 3.19 Summary of Environmental Effects and Alternative Comparison

A summary of effects and alternatives comparison is provided in the Executive Summary (Section [ES.8](#), *Summary of Environmental Consequences*) located at the beginning of this EIS.

## Chapter 4. Other Environmental Considerations

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As required by FAA Order 1050.1F Section 7.1-1(g)(1), the FAA must identify any unavoidable adverse effects, and irreversible or irretrievable commitments of resources, and address the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity associated with implementation of the Proposed Action or reasonable alternative(s).<sup>54</sup>

### 4.1 Unavoidable Adverse Effects

For the Proposed Action analysis identified unavoidable adverse effects associated with soil disturbance, air quality, water quality, and biological resources within and adjacent to LC-39A from development activities (ground disturbance). However, these adverse effects have been shown to not be significant based on the context (already developed site) and intensity (short term and temporary) of these activities; furthermore, implementation of BMPs and permitting requirements for ground-disturbance activities would further minimize these effects.

Unavoidable adverse effects from operational activities have been identified across multiple resource areas (e.g., land use and access restrictions, effects to biological resources), some of which have been identified as potentially significant (noise and air quality in particular). While some of these effects could be minimized through implementation of mitigations, or by reducing the scope of the Proposed Action, these effects are inherent to the Proposed Action and cannot be avoided (i.e., a rocket inherently produces noise and air emissions).

### 4.2 Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and natural resources such as minerals and water) that cannot be replaced within a reasonable timeframe. Building construction material, such as

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<sup>54</sup> FAA Order 1050.1F provides for an evaluation of cumulative impacts. The term cumulative effects (impacts) was defined in CEQ's NEPA-implementing regulations. 40 CFR §1508(i)(3) (2024). However, on February 25, 2025, the CEQ published an interim final rule to remove these regulations in accordance with E.O. 14154, *Unleashing American Energy*. See 90 Federal Register 10610 (February 25, 2025). The rule became effective on April 11, 2025. On February 19, 2025, the CEQ issued a memorandum titled *Implementation of the National Environmental Policy Act* that provided guidance to Federal agencies on how to implement NEPA. The memo provides, "Federal agencies should analyze the reasonably foreseeable effects of the proposed action consistent with section 102 of NEPA, which does not employ the term "cumulative effects;" NEPA instead requires consideration of "reasonably foreseeable" effects, regardless of whether or not those effects might be characterized as "cumulative." Based on the CEQ memo and on and the U.S. Supreme Court's recent decision in *Seven County Infrastructure Coalition v. Eagle County, Colorado*, 145 S. Ct. 1497 (U.S. 2025), this EIS does not include a discussion of cumulative impacts, and cumulative impacts will not be considered by the FAA in its decision-making. Reasonably foreseeable effects are discussed within each resource area.



gravel and gasoline usage for construction equipment, would constitute the consumption of nonrenewable resources.

Implementing the Proposed Action requires a commitment of natural, physical, human, and fiscal resources. In all these categories, irreversible and irretrievable commitments of resources would occur, with these commitments similar in nature across the Proposed Action and No Action (given ongoing and reasonably foreseeable actions). LC-39A is currently designated as a launch site and has been for decades; implementation of the Proposed Action would not change this designation. Although it is possible for land to revert to its former state if the facilities were abandoned and destroyed, the likelihood of such an occurrence for established facilities would be extremely unlikely.

Considerable amounts of gases (such as helium), fossil fuels, water, and construction materials such as steel, cement, aggregate, and bituminous material would be expended under the Proposed Action. However, these physical resources should generally be in sufficient supply during the Proposed Action; therefore, their commitment would not have an adverse effect on the resources' local, regional, or national continued or future availability.

Some biological resources (plants and some small mammals) within LC-39A where the natural vegetational cover has already been disturbed would be further disturbed and irreversibly and irretrievably lost with construction of the proposed project, and some areas of wildlife habitat outside of LC-39A may be lost due to degradation. However, based on the amount of actual disturbance footprint compared to the amount of buffer area and remaining open areas at and surrounding the launch site, the loss would be minimal. Significant or sensitive habitat areas would be avoided and effects to sensitive species would be mitigated as discussed in the EIS and ESA Section 7 consultation.

In terms of human resources, labor would be used in preparation, fabrication, construction, and operations related to the project. Labor is generally not considered to be a resource in short supply, and commitment to the project would not have an adverse effect on the continued availability of these resources. Project construction would require a substantial expenditure of funds. It is anticipated that businesses, employees, and residents of the local area would benefit from improved economics resulting from implementation of the Proposed Action.

## 4.3 Short-Term Uses and Long-Term Productivity

Effects that narrow the range of beneficial uses of the environment are of particular concern. Choosing one option may reduce future flexibility in pursuing other options or committing a resource to a certain use may eliminate the possibility for other uses of that resource.

Under the Proposed Action the only "short-term" uses would be associated with construction activities, given that the Proposed Action involves long-term use of LC-39A to support Starship-Super Heavy operations. Development of LC-39A would involve temporary, short-term effects associated with ground disturbance and vehicle air emissions, which would be minimized by implementation of best practices and permitting requirements identified in each respective section and would end once construction is complete. Therefore, there would be no effects associated with short-term uses (i.e., development activities) that would adversely affect maintenance and enhancement of the long-term productivity of KSC or the study area.

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## **Chapter 6. List of Agencies, Organizations, and Persons with Which the FAA Coordinated**

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The FAA made the EIS available via the Federal Docket, as well as on the FAA website. Notifications were sent via email using a distribution list, which included the public, local and Federal agencies, and other stakeholders (e.g., airlines, pilots, and maritime organizations). A summary of these notifications is included in Appendix A.1, *Public Scoping*. The FAA also coordinated with foreign government stakeholders potentially affected by airspace closures, including Canada, Mexico, Belize, El Salvador, Guatemala, Honduras, and Cuba, and other Caribbean nations such as the Bahamas.

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## Chapter 7. References

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- AARoads. (2024a). *State Road 3 - Courtenay Parkway*. Retrieved July 23, 2024, from <https://www.aaroads.com/guides/fl-003/>.
- AARoads. (2024b). *State Road 401*. Retrieved July 23, 2024, from <https://www.aaroads.com/guides/fl-401/>.
- AARoads. (2024c). *State Road 405 South*. Retrieved July 26, 2024, from <https://www.aaroads.com/guides/fl-405-south/>.
- AFCEC/CZTQ. (2023a). *Level II, Air Quality Quantitative Assessment, Insignificance Indicators*. Air Force Civil Engineering Command Headquarters Environmental Quality Technical Support Branch.
- AFCEC/CZTQ. (2023b). *DAF Greenhouse Gas GHG & Climate Change Assessment Guide*. Air Force Civil Engineer Center, Compliance Technical Support Branch. December.
- AgMRC. (2022). *Aquaculture*. Retrieved from Agricultural Marketing Resource Center: <https://www.agmrc.org/commodities-products/aquaculture>. Revised March 2022.
- ANSI/ASA. (2013). *American National Standards Institute / Acoustical Society of America S12.9-2013/Part 3 Quantities and Procedures for Description of Environmental Sound - Part 3: Short-term Measurement With an Observer Present*.
- Banana River Stakeholders. (2013). *Final Banana River Lagoon Basin Management Action Plan*.
- Bendus, R. F. (2013). *Adverse Effect on Launch Complex 39A (LC39A) Due to Placement in an Abandoned State*. On file, Florida Division of Historical Resources, Tallahassee, Florida.
- Benson, L. R. (2013). *Quieting the boom: the shaped sonic boom demonstrator and the quest for quiet supersonic flight*. NASA. Retrieved from <https://www.nasa.gov/wp-content/uploads/2020/03/QuietingtheBoom-ebook.pdf>.
- BLS. (2024a). *Local Area Unemployment Statistics Unemployment Rates for States, 2022 Annual Averages*. Retrieved from U.S. Bureau of Labor Statistics: <https://www.bls.gov/lau/laucnty23.txt>. April 19.
- BLS. (2024b). *Local Area Unemployment Statistics*. Retrieved from Unemployment Rates for States, 2023 Annual Averages: <https://www.bls.gov/lau/lastrk23.htm>. March 1.
- Bradley et al. (1990). Bradley, F., Book, C., & Bowles, A. E. *Effects of Low-Altitude Aircraft Overflights on Domestic Turkey Poults*. Report No. HSD-TR-90-034. U.S. Air Force Systems Command, Noise and Sonic Boom Impact Technology Program.
- BREA. (2023). *The Economic Contribution of Port Canaveral Florida 2023*. Retrieved from Business Research & Economic Advisors: <https://www.portcanaveral.com/PortCanaveral/media/Communications/2023/CPA-2023-Economic-Analysis-Presentation.pdf>.

- Brevard County. (2022). *Brevard County Planning and Development Comprehensive Plan and Studies Transportation Element*. Retrieved July 24, 2024, from <https://www.brevardfl.gov/PlanningAndDevelopment/PlanningAndZoning/ComprehensivePlanAndStudies>.
- Brevard County. (2024). *Increasing Landfill Capacity*. Retrieved from Brevard County: <http://brevardfl.gov/Newsletter/increasing-landfill-capacity>. July 10.
- Bureau of Economic and Business Research. (2024). *Projections of Florida Population by County, 2025-2050, with Estimates for 2023*. College of Liberal Arts and Sciences. University of Florida. Retrieved from [https://bebr.ufl.edu/wp-content/uploads/2024/01/projections\\_2024.pdf](https://bebr.ufl.edu/wp-content/uploads/2024/01/projections_2024.pdf).
- California Integrated Waste Management Board. (2007). *Estimated Solid Waste Generation Rates for Commercial and Industrial Establishments. Commercial: Auto dealer, services, repair and service stations and Industrial: Transportation, Communication, Utilities*.
- Caretta, J., Oleson, E., Forney, K., Weller, D., Lang, A., Baker, J., . . . Brownell, R. (2023). *U.S. Pacific Marine Mammal Stock Assessments: 2022*. National Marine Fisheries Service.
- CCSF Museum. (2024). *Phillips Parkway*. Retrieved July 23, 2024, from <https://ccspacemuseum.org/facilities/phillips-parkway/>.
- Central Florida Expressway Authority. (2021). *Toll 528 Martin G. Anderson Beachline Expressway*. Retrieved July 23, 2024, from <https://www.cfxway.com/for-travelers/expressways/528/>.
- CEQ. (1980). *Memorandum on Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act*. Council on Environmental Quality. Retrieved January 23, 2017, from [https://energy.gov/sites/prod/files/Analysis\\_Agricultural\\_Lands.pdf](https://energy.gov/sites/prod/files/Analysis_Agricultural_Lands.pdf). August 11.
- CEQ. (2023). *National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*. Council on Environmental Quality. February 26.
- CHABA. (1992). *Hazardous Exposure to Impulse Noise (Committee on Hearing, Bioacoustics, and Biomechanics Report)*.
- City of Cape Canaveral. (2021). *City of Cape Canaveral Comprehensive Plan*.
- City of Cocoa. (2020). *City of Cocoa Comprehensive Plan 2020-2030 Vol 1 Goals, Objectives, & Policies*.
- City of Oak Hill. (2021). *Oak Hill Development Info*. Retrieved from <https://responsibledevelopment.com/assets/Oak-Hill-Development-Info.pdf>. Last updated December 2021
- City of Titusville. (2018). *City of Titusville Comprehensive Plan*. Titusville: City of Titusville.
- Cranis, P. (2024). *Economic impact of Tourism on Brevard in 2023 was \$4.6 Billion, Visitor Spending \$2/95 Billion*. Retrieved from <https://spacecoastdaily.com/2024/04/peter-cranis-economic-impact-of-tourism-on-brevard-in-2023-was-4-6-billion-visitor-spending-2-95-billion/>. April 27.
- DAF. (2021a). *Air Emissions Guide for Air Force Stationary Sources*. Air Force Civil Engineer Center.

- DAF. (2021b). *Air Emissions Guide for Mobile Sources*. Air Force Civil Engineer Center.
- DAF. (2021c). *Air Emissions Guide for Transitory Sources*. Air Force Civil Engineer Center.
- DAF. (2022). *Climate Action Plan*. U.S. Department of the Air Force. Retrieved from <https://www.safie.hq.af.mil/Programs/Climate/>.
- DAF. (2025). *Sonic Boom*. Retrieved February 28, 2025, from U.S. Department of the Air Force: <https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104540/sonic-boom/>.
- Davis, J. W. (1993). Contamination of Coastal versus Open Ocean Surface Waters, A brief meta-analysis. *Marine Pollution Bulletin*, 26(3), 128-134.
- DNWG. (2024). *DoD Noise Working Group (DWG) Technical Bulletin: Sonic Boom*.
- DoN. (2018a). *Atlantic Fleet Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement*. Department of the Navy.
- DoN. (2018b). *Hawaii-Southern California Environmental Impact Statement/Overseas Environmental Impact Statement*. Department of the Navy.
- DoN. (2019). *Final Supplemental Environmental Impact Statement/Overseas Supplemental Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar*. Department of the Navy, Chief of Naval Operations.
- Ellis et al. (1991). Ellis, D. H., Ellis, E. H., & Mindell, D. P. Raptor Responses to Low-level Jet Aircraft and Sonic Booms. *Environmental Pollution*, 74, 53-83.
- Epsmark, Y. (1972). Behavior reactions of reindeer exposed to sonic booms. *Deer*, 2(7), 800-802.
- Erwin, S. (2025). *Space Force marks Florida's record-breaking launch year*. Retrieved March 31, 2025, from Space News: <https://spacenews.com/space-force-marks-floridas-record-breaking-launch-year/>. January 1, 2025.
- European Industrial Gases Association. (2017). *Environmental Impacts of Air Separation Units*. Brussels: Doc 94/17, revision of Doc 94/11.
- FAA. (2012). *Safety Approval Guide for Applicants, Version 1.1*. Washington.
- FAA. (2020). *Final Environmental Assessment and Finding of No Significant Impact for SpaceX Falcon Launches at Kennedy Space Center and Cape Canaveral Air Force Station*. Federal Aviation Administration.
- FAA. (2021). *United States 2021 Aviation Climate Action Plan*. Federal Aviation Administration. Retrieved from [https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation\\_Climate\\_Action\\_Plan.pdf](https://www.faa.gov/sites/faa.gov/files/2021-11/Aviation_Climate_Action_Plan.pdf).
- FAA. (2022). *Final Programmatic Environmental Assessment for the SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site in Cameron County, Texas. June*. Retrieved from [https://www.faa.gov/sites/faa.gov/files/2022-06/PEA\\_for\\_SpaceX\\_Starship\\_Super\\_Heavy\\_at\\_Boca\\_Chica\\_FINAL.pdf](https://www.faa.gov/sites/faa.gov/files/2022-06/PEA_for_SpaceX_Starship_Super_Heavy_at_Boca_Chica_FINAL.pdf)



- FAA. (2023a). *Written Re-evaluation of the 2022 Final Programmatic Environmental Assessment for the SpaceX Starship/Super Heavy Launch Vehicle Program at the Boca Chica Launch Site in Cameron County Texas*. Federal Aviation Administration. November.
- FAA. (2023b). *1050.1F NEPA Desk Reference (a companion guide to FAA Order 1050.1F, Environmental Impacts: Policies and Procedures) Version 3*. October. Federal Aviation Administration.
- FAA. (2024a). *Tiered Environmental Assessment for SpaceX Starship Indian Ocean Landings*. Federal Aviation Administration. March.
- FAA. (2024b). *Digital Obstacle File (DOF)*. Retrieved from Aeronautical Information Services: [https://www.faa.gov/air\\_traffic/flight\\_info/aeronav/digital\\_products/dof/](https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dof/).
- FAA. (2024c). *Advisory Circular AC 70/7460-1M, CHG 1 Obstruction Marking and Lighting*. Federal Aviation Administration. October 29, 2024. Retrieved from [https://www.faa.gov/documentLibrary/media/Advisory\\_Circular/AC\\_70-7460-1M\\_Change\\_1\\_FINAL.pdf](https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_70-7460-1M_Change_1_FINAL.pdf).
- FAA. (2025a). *Final Tiered Environmental Assessment for SpaceX Starship/Super Heavy Vehicle Increased Cadence at the SpaceX Boca Chica Launch Site in Cameron County, Texas*. Federal Aviation Administration. Retrieved from <https://www.faa.gov/media/94346>.
- FAA. (2025b). *Draft Environmental Assessment for SpaceX Falcon 9 Operations at Space Launch Complex 40, Cape Canaveral Space Force Station*. Federal Aviation Administration. March.
- FAA. (2025c). *Addendum 2 to the Endangered Species Act Section 7 Conference and Biological Opinion on SpaceX Starship-Super Heavy Increased Launch Cadence and Operations in the North Atlantic Ocean, Gulf of Mexico, North Pacific Ocean, South Pacific Ocean, and Indian Ocean Authorized by the Federal Aviation Administration*. Federal Aviation Administration. March 10, 2025.
- FAA. (2025d). *Addendum 3 to the Endangered Species Act Section 7 Conference and Biological Opinion on SpaceX Starship-Super Heavy Increased Launch Cadence and Operations in the North Atlantic Ocean, Gulf of Mexico, North Pacific Ocean, South Pacific Ocean, and Indian Ocean Authorized by the Federal Aviation Administration*. Federal Aviation Administration. March 28, 2025.
- FAA. (2025e). *Addendum 4 to the Endangered Species Act Section 7 Conference and Biological Opinion on SpaceX Starship-Super Heavy Increased Launch Cadence and Operations in the North Atlantic Ocean, Gulf of Mexico, North Pacific Ocean, South Pacific Ocean, and Indian Ocean Authorized by the Federal Aviation Administration*. Federal Aviation Administration. April 1, 2025.
- FDEP. (2021). *Indian River Lagoon Basin, North Indian River Lagoon Basin Management Action Plan*. Tallahassee, FL: Florida Department of Environmental Protection.
- FDEP. (2022). *Florida Conservation Lands (FNAI Managed Areas)*. Retrieved from FDEP EOpen Data Portal: [https://services.arcgis.com/9Jk4ZI9KofTtvg3x/ArcGIS/rest/services/FL\\_Conservation\\_Lands\\_web/FeatureServer/8](https://services.arcgis.com/9Jk4ZI9KofTtvg3x/ArcGIS/rest/services/FL_Conservation_Lands_web/FeatureServer/8). September.

- FDEP. (2023a). *Florida Coastal Access Guide: Brevard County*. Retrieved September 2024, from Florida Department of Environmental Protection: <https://floridadep.gov/rcp/coastal-access-guide/content/brevard-county>. Last updated September 20, 2023.
- FDEP. (2023b). *Statewide Land Use Land Cover*. Retrieved from Florida Department of Environmental Protection: <https://geodata.dep.state.fl.us/datasets/FDEP::statewide-land-use-land-cover/about>. June 19.
- FDEP. (2024a). *GIS - FDEP Geospatial Open Data - Ports*. Retrieved February 4, 2025, from Florida Department of Environmental Protection: <https://geodata.dep.state.fl.us/datasets/FDEP::ports-pt/explore>.
- FDEP. (2024b). *Biennial Assessment 303(d) 2022-2024 - data for central Florida*. Florida Department of Environmental Protection. Retrieved September 5, 2024, from <https://publicfiles.dep.state.fl.us/DEAR/DEARweb/WAS/303d%20List/2022-24/Final/ML/2022-2024-Central-cml-final.xlsx>.
- FDEP. (2024c). *Air Quality 101*. Retrieved July 29, 2024, from Florida Department of Environmental Protection: <https://floridadep.gov/air/air/content/air-quality-101>. July 21.
- FDOT. (2023). *Spaceport Improvement Program Project Handbook 2023-2024*. Tallahassee.
- FDOT. (2024a). *440424-1 NASA Causeway Bridge*. Florida Department of Transportation. Retrieved July 26, 2024, from <https://www.cflroads.com/project/440424-1>.
- FDOT. (2024b). *407402-3 SR 528 from East of SR 52 4 (Industry Road) to East of SR3*. Retrieved July 19, 2024, from <https://www.cflroads.com/project/407402-3>.
- FDOT. (2024c). *407402-4 SR 528 from East of SR 3 to Port Canaveral Interchange*. Retrieved July 26, 2024, from <https://www.cflroads.com/project/407402-4>.
- FDOT. (2024d). *District 5 Five Year Work Program FY25-FY29*. Florida Department of Transportation. July.
- Federal Reserve. (2024a). *Market Hotness: Median listing Price in Brevard County*. Retrieved from Federal Reserve Bank of St. Louis, Economic Research Division: <https://fred.stlouisfed.org/series/MELIPRCOUNTY12009>. June.
- Federal Reserve. (2024b). *Market Hotness: Median Listing Price in Volusia County, FL*. Retrieved from Federal Reserve Bank of St. Louis, Economic Research Division: <https://fred.stlouisfed.org/>.
- Fenton, R., & Methold, R. (2016). *MOD Shoeburyness and Pendine noise and vibration study criteria for the assessment of potential building damage effects from range activities*. Lewes, East Sussex, UK: Southdowns Environmental Consultants.
- FGDL. (2017). *GIS - Hospital Facilities in Florida - 2017*. Retrieved September 6, 2024, from Florida Geographic Data Library: [https://fgdl.org/meta/GC\\_HOSPITALS.xml](https://fgdl.org/meta/GC_HOSPITALS.xml).
- FGDL. (2018). *GIS - Group Care Facilities in Florida - March 2018*. Retrieved July 9, 2024, from Florida Geographic Data Library: <https://fgdl.org/meta/GROUPCARE.xml>.

- FGDL. (2023a). *GIS - Parks and Recreational Facilities Boundaries in Florida - December 2023*. Retrieved August 1, 2024, from Florida Geographic Data Library: [https://fgdl.org/meta/GC\\_PARKSBND.xml](https://fgdl.org/meta/GC_PARKSBND.xml).
- FGDL. (2023b). *GIS - School Facilities (Public and Post-Secondary) in Florida - 2023*. Retrieved July 9, 2024, from Florida Geographic Data Library: [https://fgdl.org/meta/GC\\_SCHOOLS.xml](https://fgdl.org/meta/GC_SCHOOLS.xml).
- FHWA. (2012). *Section 4(f) Policy Paper*. Washington, DC: U.S. Department of Transportation Federal Highway Administration, Office of Planning, Environment, and Realty, Project Development and Environmental Review.
- FICAN. (1997). *Federal Interagency Committee on Aviation Noise (FICAN): 1997 Annual Report*.
- Florida Department of Law Enforcement. (2023). *Criminal Justice Agency Profile (CJAP) Statewide Ratios*. Retrieved from <https://www.fdle.state.fl.us/CJSTC/Publications/CJAP/Statewide-Ratios#2021ratios>.
- Florida Geographic Data Library. (2018). *Fire Department and Rescue Station Facilities*. Retrieved from [https://fgdl.org/meta/GC\\_FIRESTAT.xml](https://fgdl.org/meta/GC_FIRESTAT.xml). May.
- Florida Geographic Information Office. (2025). *Florida Statewide Parcels. Electronic File*. Retrieved January 6, 2025, from <https://hub.arcgis.com/datasets/FGIO::florida18>.
- Florida Health. (2022). *2022 Physician Workforce Annual Report*.
- Florida Today. (2024). *A Driver's Guide to Watching a Rocket Launch from Florida's Space Coast*. Retrieved August 2, 2024, from <https://www.floridatoday.com/story/tech/science/space/2024/05/21/rocket-launch-driving-guide-cape-canaveral-florida-watch-spacex-starlink-nasa/73182481007/>.
- FNAI. (2025). *Rare Species and Communities We Track. Searchable Field Guides and Tracking List Tool*. Retrieved April 1, 2025, from Florida Natural Areas Inventory: <https://www.fnai.org/species-communities/tracking-main>.
- FRA. (2012). *High-Speed Ground Transportation Noise and Vibration*. Washington, DC: Federal Railroad Administration, U.S. Department of Transportation. DOT/FRA/ORD-12/15. Retrieved from [https://railroads.dot.gov/sites/fra.dot.gov/files/fra\\_net/2680/20120220\\_FRA\\_HSR\\_NV\\_Manual\\_FINAL\\_102412.pdf](https://railroads.dot.gov/sites/fra.dot.gov/files/fra_net/2680/20120220_FRA_HSR_NV_Manual_FINAL_102412.pdf).
- FTA. (2018). *Transit Noise and Vibration Impact Assessment Manual; FTA Report No. 0123*.
- FWC. (2015). *GIS - Eagle Nesting Locations Florida 1998 - 2017*. Retrieved July 22, 2024, from Florida Fish and Wildlife Conservation Commission: [https://atoll.floridamarine.org/arcgis/rest/services/FWC\\_GIS/OpenData\\_FWSppLoc/FeatureServer/30](https://atoll.floridamarine.org/arcgis/rest/services/FWC_GIS/OpenData_FWSppLoc/FeatureServer/30).
- FWC. (2023). *GIS - Florida Shorebird Nesting Database (FSD)*. Retrieved July 22, 2024, from Florida Fish and Wildlife Conservation Commission: <https://geodata.myfwc.com/datasets/myfwc::florida-shorebird-database/about>.

- FWC. (2024). *GIS - Waterways Florida - Boat routes and waterways*. Retrieved February 4, 2025, from Florida Fish and Wildlife Conservation Commission: <https://geodata.myfwc.com/datasets/myfwc::waterways-florida/about>.
- Gallaway et al. (2010). Gallaway, T.; Olsen, R.; Mitchell, D. The economics of global light pollution. *Ecological Economics*, 69(3), 658-665.
- Gao, X. (2009). *TMDL Report Nutrient and Dissolved Oxygen TMDLs for the Indian River Lagoon and Banana River Lagoon*. Tallahassee, FL: Florida Department of Environmental Protection.
- GESAMP. (2009). *Pollution in the Open Ocean: A review of assessments and related studies*. Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection. Rep. Stud. GESAMP No. 79, 64 pp.
- GESAMP. (2015). *Sources, fate and effects of microplastics in the marine environment: a global assessment*. Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection. P. J. Kershaw (editor). GESAMP Reports and Studies, 90.
- Guest, S. B., & Slone, R. M. (1972). *Structural Damage Claims Resulting From Acoustic Environments Developed During Static Test Firing of Rocket Engines*. San Antonio, TX: NASA Space Shuttle Technology Conference - Dynamics and Aeroelasticity; Structures and Materials. Technical Memorandum.
- Haber et al. (1989). Haber, J., Nakaki, D., Taylor, C., Knipprath, G., Koppam, V., & Legg, M. *Effects of Aircraft Noise and Sonic Booms on Structures: An Assessment of the Current State-of-Knowledge*. Canoga Park, CA: BBN Systems and Technologies Corp. Prepared for Air Force Systems Command, Brooks Air Force Base, Texas.
- Haber, J., & Nakaki, D. (1989). *Noise and Sonic Boom Impact Technology: Sonic Boom Damage to Conventional Structures*. Canoga Park, CA: BBN Systems and Technologies Corp. HSD-TR-89-002. Prepared for Air Force Systems Command, Brooks Air Force Base, TX.
- Hayes et al. (2023). Hayes, S., Josephson, E., Maze-Foley, K., Rosel, P., McCordic, J., & Wallace, J. *U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments 2022*. National Marine Fisheries Service.
- Higgins, T. (1965). Sonic Boom Research and Design Considerations in the Development of a Commercial Supersonic Transport (SST). *The Journal of the Acoustical Society of America*, 38, 914.
- Intergovernmental Panel on Climate Change. (2023). *Climate Change 2023: Synthesis Report*. Geneva, Switzerland. Retrieved from <https://www.ipcc.ch/report/ar6/syr>.
- International Maritime Organization. (1987). Regulations for the prevention of pollution by garbage from ships (Annex V of MARPOL 73/78). *Message from the President of the United States transmitting Annex V, an optional annex to the 1978 protocol relating to the International Convention for the Prevention of Pollution from Ships*. Washington: U.S. Government Printing Office.
- International Maritime Organization. (2024). *History of MARPOL*. Retrieved from <https://www.imo.org/en/KnowledgeCentre/ConferencesMeetings/Pages/Marpol.aspx>. July 16.

- IRL. (2024). *Checklists*. Retrieved from Indian River Lagoon Species Inventory:  
<https://irlspecies.org/checklists/index.php>.
- Kimley-Horn. (2022). *Drainage Report SLC-39A Master Drainage Plan Cape Canaveral, Florida*. Tallahassee, Florida.
- Klepeis, N. E., Nelson, W. C., Ott, W. R., Robinson, J. p., Tsang, A. M., Switzer, P., . . . Engelman, W. H. (2001). *The National Human Activity Pattern Survey (NHAPS) A Resource for Assessing Exposure to Environmental Pollutants*.
- KSC. (2017). *Interim Land Use Control Implementation Plan*. Kennedy Space Center: NASA.
- KSC. (2019). *Spill Prevention, Control and Countermeasures Plan*. Kennedy Space Center. KSC-PLN-1919\_Rev G. April.
- KSC. (2022). *Kennedy Space Center Environmental Requirements, KNPR 85000.1*. NASA John F. Kennedy Space Center.
- KSC. (2023). *KSC Landfill*. Retrieved from Kennedy Space Center Environmental:  
<https://public.ksc.nasa.gov/environmental/kslandfill/>. May 17.
- KSC. (2024a). *Integrated Cultural Resources Management Plan (ICRMP) FY 2024-2029*. NASA Kennedy Space Center.
- KSC. (2024b). *App B: Kennedy Space Center (KSC) Site-Specific Spill Prevention, Control and Countermeasures Plan*. Kennedy Space Center. KSC-PLN-1920. Revision June 2024.
- KSC Environmental Program. (2024). *Drinking Water*. Retrieved July 18, 2024, from  
<https://public.ksc.nasa.gov/environmental/drinkingwater/>.
- Leal et al. (2021). Leal, P. B., Schrass, J. A., Giblette, T. N., Hunsaker, D. F., Shen, H., Logan, T. S., & Hartl, D. J. Effects of atmospheric profiles on sonic boom perceived level from supersonic vehicles. *AIAA Journal*, 59(12), 5020-5028.
- Maglieiri et al. (1966). Maglieri, D. J., Huckel, V., Maglieri, D. J., & Parrott, T. L. *Ground measurements of shock-wave pressure for fighter airplanes flying at very low altitudes and comments on associated response phenomena*. Washington, D.C.: NASA Technical Note TN-D-3443. July.
- Manci et al. (1988). Manci, K. M., Gladwin, D. N., Villella, R., & Cavendish, M. *Effects of Aircraft Noise and Sonic Booms on Domestic Animals and Wildlife: A Literature Synthesis*. Ft. Collins, CO: U.S. Fish and Wildlife Service National Ecology Research Center.
- Marinas.com. (2024). *Jay Jay/NASA Railroad Bridge*. Titusville. Retrieved July 23, 2024, from  
[https://marinas.com/view/bridge/l6u26\\_Jay\\_Jay\\_NASA\\_Railroad\\_Bridge\\_Titusville\\_FL\\_United\\_S](https://marinas.com/view/bridge/l6u26_Jay_Jay_NASA_Railroad_Bridge_Titusville_FL_United_S)  
tates.
- Marvel et al. (2023). Marvel, K., Su, W., Delgado, R., Aarons, S., Chatterjee, A., Garcia, M. E. ... Vose, R.S. Chapter 2, Climate Trends. In A. R. Crimmins, C. W. Avery, D. R. Easterling, K. E. Kunkel, B. C. Stewart, & T. K. Maycock, *Fifth National Climate Assessment*. Washington, DC: U.S. Global Change Research Program. Retrieved from <https://doi.org/10.7930/NCA5.2023.CH2>.



- MCBI. (n.d.). *Seamount Map of the Indian Ocean*. Retrieved September 2024, from Marine Conservation Biology Institute: [https://marine-conservation.org/archive/mcbi/Indian\\_Ocean.pdf](https://marine-conservation.org/archive/mcbi/Indian_Ocean.pdf). Undated pdf.
- Meredith, M. (2024). *As tourism booms in Brevard, the county is expected to add 1,400 new hotel rooms*. Retrieved from WESH Orlando: <https://www.wesh.com/article/brevard-county-hotel-rooms-tourism/60934582>. May 29.
- Mid-Florida Marketing and Research. (2023). *The 2023 Economic Impact of Tourism on Volusia County*. Retrieved from [https://assets.simpleviewinc.com/simpleview/image/upload/v1/clients/daytonabeach/2023\\_Economic\\_Impact\\_Tourism\\_DSJ\\_a07ff659-6d6a-4aec-975c-708e03154ab8.pdf](https://assets.simpleviewinc.com/simpleview/image/upload/v1/clients/daytonabeach/2023_Economic_Impact_Tourism_DSJ_a07ff659-6d6a-4aec-975c-708e03154ab8.pdf).
- MINWR. (2025). *Site Pass Selection Merritt Island National Wildlife Refuge*. Retrieved from <https://www.fws.gov/refuge/merritt-island/visit-us>
- Narisada, K., & Schreuder, D. (2004). *Light Pollution Handbook*. Springer Dordrecht. Astrophysics and Space Science Library Series.
- NASA. (2003). *Roy D. Bridges Bridge*. Retrieved September 5, 2024, from NASA public domain image. Kennedy space center. - PICRYL - Public Domain Media Search Engine Public: <https://garystockbridge617.getarchive.net/amp/media/roy-d-bridges-bridge-febb0d>.
- NASA. (2007). *NASA Facts: Building KSC's Launch Complex 39*.
- NASA. (2009). *Programmatic Agreement Among the NASA, John F. Kennedy Space Center, ACHP, and the Florida State Historic Preservation Officer Regarding Management of Historic Properties at the Kennedy Space Center, Florida*.
- NASA. (2011a). *Environmental Assessment for Launch of NASA Routine Payloads. August*.
- NASA. (2011b). *Final Environmental Baseline Survey Report for Pad 39A and Associated Structures, KSC, FL*. Kennedy Space Center, FL: Innovative Health Applications, LLC.
- NASA. (2015). *Final Environmental Assessment for Kennedy Space Center Shoreline Protection Project*. National Aeronautics and Space Administration.
- NASA. (2016). *Kennedy Space Center Master Plan Final Programmatic Environmental Impact Statement. November*. National Aeronautics and Space Administration.
- NASA. (2017). *Kennedy Space Center Master Plan Executive Summary 2012-2032*.
- NASA. (2019a). *Final Environmental Assessment for the SpaceX Starship and Super Heavy Launch Vehicle at Kennedy Space Center (KSC)*.
- NASA. (2019b). *Finding of No Significant Impact NASA Environmental Assessment for the SpaceX Starship and Super Heavy Booster at Kennedy Space Center, Florida*. National Aeronautics and Space Administration. September. Retrieved from <https://netpublic.grc.nasa.gov/main/SpaceX%20Starship%20FONSI.pdf>.
- NASA. (2019c). *Final Environmental Assessment for Launch Complex 48, Kennedy Space Center, FL. May*.

- NASA. (2019d). *Wallops Flight Facility Site-wide Programmatic EIS Final*. Wallops Island.
- NASA. (2020a). *Kennedy Space Center Vision Plan and Programmatic Environmental Assessment*.
- NASA. (2020b). *Environmental Resources Document, John F. Kennedy Space Center*. National Aeronautics and Space Administration.
- NASA. (2021a). *Climate Action Plan*. Retrieved from <https://www.sustainability.gov/pdfs/nasa-2021-cap.pdf>.
- NASA. (2021b). *KSC A Multi-User Spaceport Economic Impact Scorecard FY 2021*. Retrieved July 30, 2024, from [https://www.nasa.gov/wp-content/uploads/2022/06/economic\\_impact\\_scorecard\\_fy21.pdf](https://www.nasa.gov/wp-content/uploads/2022/06/economic_impact_scorecard_fy21.pdf).
- NASA. (2021c). *Range Flight Safety Requirements*.
- NASA. (2021d). *Draft Environmental Assessment for Space Florida Shuttle Landing Facility Construction of Developable Land at the John F. Kennedy Space Center, Kennedy Space Center, Florida. 2021*.
- NASA. (2022). *Master Plan. Utilities*. Retrieved July 18, 2024, from <https://public.ksc.nasa.gov/masterplan/utilities/>.
- NASA. (2023). *Domestic Wastewater: Utilities*. Retrieved July 18, 2024, from <https://public.ksc.nasa.gov/environmental/domesticwastewater/>.
- NASA. (2024a). *Kennedy Space Center Master Plan*. Retrieved from <https://public.ksc.nasa.gov/masterplan/>. July 25.
- NASA. (2024b). *Final Supplemental Environmental Assessment for the Roberts Road SpaceX Operations Area Expansion & Supporting Infrastructure on Kennedy Space Center*.
- NASA. (2024c). *Programmatic Environmental Assessment for the Implementation of a 15-Year Development Plan at the Kennedy Space Center Visitor Complex and Launch Complex 39 Viewing Gantry*.
- NASA. (2025). GIS data provided by James T Brooks (NASA) on Mar 4, 2025.
- NASA. (n.d.). *KSC Visitor Complex Fact Sheet*. Retrieved August 2, 2024, from [https://www3.nasa.gov/centers/kennedy/pdf/146690main\\_kscvc.pdf](https://www3.nasa.gov/centers/kennedy/pdf/146690main_kscvc.pdf).
- National Academy of Sciences. (1977). *Guidelines for Preparing Environmental Impact Statements on Noise*. Washington, D.C.: Committee on Hearing, Bioacoustics and Biomechanics, Assembly of Behavioral and Social Sciences, The National Research Council.
- National Research Council. (1981). *Assessment of Community Response to High-Energy Impulsive Sounds*.
- NCHRP. (2012a). *A Model for Identifying and Evaluating the Historic Significance of Post-World War II Housing*. Washington, DC: Transportation Research Board. National Cooperative Highway Research Program Report 723. Retrieved from [https://dahp.wa.gov/sites/default/files/nchrp\\_PostWWIIHousingEval.pdf](https://dahp.wa.gov/sites/default/files/nchrp_PostWWIIHousingEval.pdf).

- NCHRP. (2012b). *NCHRP 25-25/Task 72: Current Practices to Address Construction Vibration and Potential Effects to Historic Buildings Adjacent to Transportation Projects*. National Cooperative Highway Research Program. Prepared by: Wilson, Ihrig & Associates, Inc., ICF International, and Simpson, Gumpertz & Heger, Inc. Retrieved from [https://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25\(72\)\\_FR.pdf](https://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP25-25(72)_FR.pdf)
- Neale, R. (2025). *Space Force: Up to 156 orbital rockets may launch during 2025 from Florida's Space Coast*. Retrieved March 31, 2025, from Florida Today: <https://www.floridatoday.com/story/tech/science/space/2025/01/18/space-force-forecasts-up-to-156-rockets-launch-2025-cape-canaveral-florida-spacex-blue-origin-ula/77746745007/>. January 18.
- Nixon, C. W., Hille, H. K., Sommer, H. C., & Guild, E. (1968). *Sonic Booms Resulting From Extremely Low-Altitude Supersonic Flight: Measurements and Observations on Houses, Livestock, and People; AMRL-TR-68-52*. Aerospace Medical Research Laboratory.
- NMFS. (2022). *Programmatic Concurrence Letter for Launch and Reentry Vehicle Operations in the Marine Environment and Starship/Super Heavy Launch Vehicle Operations at SpaceX's Boca Chica Launch Site, Cameron County, TX*. Silver Spring, MD: National Marine Fisheries Service.
- NMFS. (2025a). *Conference and Biological Opinion on SpaceX Starship-Super Heavy Increased Launch Cadence and Operations in the North Atlantic Ocean, Gulf of Mexico (non-U.S. waters), Gulf of America, North Pacific Ocean, South Pacific Ocean, and Indian Ocean Authorized by the Federal Aviation Administration*. National Marine Fisheries Service, Office of Protected Resources. April 18.
- NMFS. (2025b). *Conference and Biological Opinion on SpaceX Starship-Super Heavy Increased Launch Cadence and Operations in the North Atlantic Ocean, Gulf of Mexico, North Pacific Ocean, South Pacific Ocean, and Indian Ocean Authorized by the Federal Aviation Administration*. Office of Protected Resources. National Marine Fisheries Service. January 17.
- NOAA. (2014). *GIS - Loggerhead sea turtle Designated Critical Habitat - Northwest Atlantic Ocean DPS*. Retrieved June 14, 2024, from National Oceanic and Atmospheric Administration: <https://www.fisheries.noaa.gov/national/endangered-species-conservation/critical-habitat#critical-habitat-designations-maps-and-gis-data>.
- NOAA. (2016). *GIS - North Atlantic Right Whale Designated Critical Habitat*. Retrieved July 18, 2024, from National Oceanic and Atmospheric Administration: <https://noaa.hub.arcgis.com/datasets/0d9ce8ded5b9484eb762f79ac88a57aa/about>.
- NOAA. (2022). *Understanding Ocean Acoustics*. Retrieved February 28, 2025, from National Oceanic and Atmospheric Administration Office of Ocean Exploration and Research: <https://oceanexplorer.noaa.gov/explorations/sound01/background/acoustics/acoustics.html>. Revised August 26, 2022.
- NOAA. (2023a). *GIS - Green Sea Turtle Proposed Critical Habitat - North Atlantic DPS*. Retrieved June 13, 2024, from National Oceanic and Atmospheric Administration:

- <https://www.fisheries.noaa.gov/national/endangered-species-conservation/critical-habitat#critical-habitat-designations-maps-and-gis-data>.
- NOAA. (2023b). *GIS - AIS Vessel Transit Counts 2023*. Retrieved December 2, 2024, from National Oceanic and Atmospheric Administration: <https://catalog.data.gov/dataset/ais-vessel-transit-counts-20231>.
- NOAA. (2024). *GIS - 200 Nautical Mile Exclusive Economic Zone (EEZ)*. Retrieved December 3, 2024, from National Oceanic and Atmospheric Administration: <https://www.arcgis.com/home/item.html?id=8a109d684eb0421bb589ccc6c7b955cd#overview>.
- NOAA Fisheries. (2022a). *Fisheries One Stop Shop (FOSS) - Commercial Landings-Year: All Species*. Retrieved from <https://www.fisheries.noaa.gov/foss/f?p=215:200:5853782349477:.....>.
- NOAA Fisheries. (2022b). *Fisheries One Stop Shop (FOSS) - Commercial Landings: Year/Species*. Retrieved from <https://www.fisheries.noaa.gov/foss/f?p=215:200:13218446284922:.....>.
- NOAA Fisheries. (2022c). *Recreational Landings-Year for Spanish mackerel*. Retrieved from <https://www.fisheries.noaa.gov/foss/f?p=215:200:8767918365840:.....>.
- NOAA Fisheries. (2022d). *Recreational Landings-All Species*. Retrieved from Fisheries One Stop Shop (FOSS): <https://www.fisheries.noaa.gov/foss/f?p=215:200:8767918365840:.....>.
- NOAA Fisheries. (2025). *Find A Species*. Retrieved April 2, 2025, from <https://www.fisheries.noaa.gov/find-species>.
- Nocerino et al. (2021). Nocerino, E. S., Smallwood, J., & Yarborough, E. B. *Rocket Engine Noise Effects on Cultural Resources: Addendum to the Section 106 Compliance Report for the Blue Origin Orbital Launch Site Project, Vandenberg Space Force Base, Santa Barbara, California*. Prepared by Applied Earth Works, Inc. for Tetra Tech, November 2021.
- NPS. (1995). *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*. National Park Service. Retrieved from [https://www.nps.gov/subjects/nationalregister/upload/NRB-15\\_web508.pdf](https://www.nps.gov/subjects/nationalregister/upload/NRB-15_web508.pdf).
- NPS. (2014a). *National Register of Historic Places*. Retrieved from NPS Data Store: <https://irma.nps.gov/DataStore/Reference/Profile/2210280>.
- NPS. (2014b). *Final General Management Plan/Environmental Impact Statement for Canaveral National Seashore, Florida*. National Park Service.
- NPS. (2024a). *Annual Park Recreation Visitation (1904-Last Calendar Year)*.
- NPS. (2024b). *Identifying, Evaluating, and Documenting Traditional Cultural Places*. Issued by the National Register of Historic Places and National Historic Landmarks Program, National Park Service. Retrieved from <https://irma.nps.gov/DataStore/DownloadFile/713282>.
- NPS. (2024c). *The Power of Night Interpretive Handbook*. Retrieved from National Park Service, Natural Resource Stewardship and Science Directorate, Natural Sounds and Night Skies Division: [https://www.nps.gov/subjects/nightskies/upload/FINAL\\_NPS\\_The\\_Power\\_of\\_Night\\_Handbook\\_lowres\\_508.pdf](https://www.nps.gov/subjects/nightskies/upload/FINAL_NPS_The_Power_of_Night_Handbook_lowres_508.pdf).

- NPS. (2025). *Economic Analysis of Lost Visitor Use at Canaveral National Seashore from Proposed SpaceX Operations*. National Park Service. June 9.
- NRCS. (2024). *Web Soil Survey*. Retrieved from Soil Survey Staff, Natural Resources Conservation Service, U.S. Department of Agriculture: <https://websoilsurvey.nrcs.usda.gov/>. August 14.
- One Lagoon. (2019). *Looking Ahead to 2030: A 10-Year Comprehensive Conservation and Management Plan for the Indian River Lagoon, Florida*. Retrieved from [https://onelagoon.org/wp-content/uploads/IRLNEP\\_Final-Draft-CCMP-REVISION\\_2018-12-07\\_LowRes\\_\\_20200204.pdf](https://onelagoon.org/wp-content/uploads/IRLNEP_Final-Draft-CCMP-REVISION_2018-12-07_LowRes__20200204.pdf).
- Orlando Sentinel. (2024). *Space Coast Launch Schedule*. Retrieved July 30, 2024, from <https://www.orlandosentinel.com/2024/07/30/space-coast-launch-schedule/>.
- Packer et al. (2017). Packer D. B., Nizinski, M. S., Bachman M.S., Drohan A.F., Poti M., & Kinlan B. P. State of the Deep-Sea Coral and Sponge Ecosystems off the Northeast United States. In T. F. Hourigan, P. J. Etnoyer, & S. D. Cairns, *The State of Deep-Sea Coral and Sponge Ecosystems of the United States: 2015* (pp. 9-1 – 9-65). Silver Spring, MD: NOAA Technical Memorandum NMFS-OHC-X.
- Pallone, G. (2024). *Brevard County heads into storm season with a new Emergency Operations Center*. Retrieved from Spectrum News 13: <https://baynews9.com/fl/tampa/news/2024/05/29/new-brevard-emergency-operations-center-opens>. May 29.
- Port Canaveral. (2019). *Port Canaveral 30 Year Strategic Vision Plan*.
- Port Canaveral. (2023). *Port Canaveral 2023 Economic Contribution to Florida*.
- Port Canaveral. (2024). *State of the Port*. Retrieved from portcanaveral.com. November 26, 2024.
- Rylander, R. (1974). The sonic boom—Effects on humans. *Sozial-und Präventivmedizin (International Journal of Public Health)*, 19(3), 217-220.
- SAFMC. (2018). *The Economic Contribution of Fisheries for Species Managed by the South Atlantic Fishery Management Council*.
- SAFMC. (2025). *About the Council*. Retrieved March 31, 2025, from South Atlantic Fishery Management Council: [safmc.net/about](https://safmc.net/about).
- Schmalzer et al. (2000). Schmalzer, P. A., Hensley, M. A., Mota, M., Hall, Carlton R., & Dunlevy, C. A. *Soil, Groundwater, Surface Water, and Sediments of Kennedy Space Center, Florida: Background Chemical and Physical Characteristics*. NASA/Technical Memorandum 2000-208583. Kennedy Space Center, FL: Dynamac Corporation.
- SJRWMD. (2007). *Upper St. Johns River Basin Surface Water Improvement and Management (SWIM) Plan*. St. Johns River Water Management District.
- SJRWMD. (2024). Land Cover Land Use 2020 Geospatial Open Data. St. Johns River Water Management District. Published October 4, 2017. Updated July 30, 2024. Retrieved September 11, 2024, from [https://data-floridaswater.opendata.arcgis.com/datasets/1a670e2a082342768ad51df948639434\\_0/explore?location=28.818623%2C-81.414600%2C9.93](https://data-floridaswater.opendata.arcgis.com/datasets/1a670e2a082342768ad51df948639434_0/explore?location=28.818623%2C-81.414600%2C9.93).



- SLD 45, USFWS, and KSC. (2025). *Memorandum of Understanding between Space Launch Delta 45, United States Fish and Wildlife Service, and John F. Kennedy Space Center for Prescribed Burning on the MINWR, KSC, and CCSFS (KCA-4205 Rev C)*.
- Smith, R. C., & Hutto, G. L. (1972). *Sonic Booms and Sleep: Affect Change as a Function of Age (FAA-AM-72-24)*. Oklahoma City, OK: FAA Civil Aeromedical Institute.
- SOI. (2024). *Seamounts of the Southeast Pacific*. Retrieved September 2024, from Schmidt Ocean Institute: <https://schmidtocan.org/cruise/seamounts-of-the-southeast-pacific/>.
- Solutio Environmental. (2022). *USAF Air Conformity Applicability Model (ACAM). Version 5.0.23a*. Retrieved from <https://aqhelp.com/acam.html>.
- Sommer, H. C., & Nixon, C. W. (1973). *Primary Components of Simulated Air Bag Noise and Their Relative Effects on Human Hearing*. Wright Patterson AFB, OH: Aerospace Medical Research Laboratory.
- Space Coast Economic Development Commission. (2024). *Space Coast Industry Profile: Locate & Expand on Florida's Space Coast*. Retrieved from <https://spacecoastedc.org/data-downloads/industry-profile/>.
- Space Coast Office of Tourism. (2020). *Press Release: Putting the Space in Space Coast – The Economic and Tourism Impact of Launches*. Retrieved from Florida's Space Coast Office of Tourism: <https://www.visitspacecoast.com/blog/putting-the-space-in-space-coast-the-economic-and-tourism-impact-of-launches/>. May 2020.
- Space Coast Office of Tourism. (2024). *Launching Viewing Venues*. Retrieved August 2, 2024, from <https://www.visitspacecoast.com/landing-page/launches/launch-venues/>.
- Space Coast TPO. (2023). *2023 Segments Functional Classification, Maximum Acceptable Volume, and LOS*. Melbourne. Retrieved July 26, 2024, from <https://www.spacecoasttpo.com/what-we-do/performance-measures/traffic-counts>.
- Space Commerce. (2023). *Space Florida: \$5.9 Billion Economic Impact on Florida's Economy*. Retrieved from SpaceRef: <https://spaceref.com/space-commerce/space-florida-5-9-billion-economic-impact-on-floridas-economy/>. January 23.
- Space Florida. (2017). *Cape Canaveral Spaceport Master Plan*. Prepared for Florida Department of Transportation Aviation and Spaceports Office.
- Space Florida. (2024). *Florida Spaceport System Maritime Intermodal Transportation Study Feasibility Phase, Port Canaveral, Florida*.
- SpaceX. (2018). *SPX - Hazardous Materials Management Plan*. SpaceX.
- SpaceX. (2024). *GIS - SpaceX 2024 shipping fairway*. Data provided by SpaceX.
- SpaceX. (2024a). *Biological Assessment of SpaceX Starship-Super Heavy Launch Vehicle and Reentry Operations to Support Endangered Species Act Section 7 Consultation with the National Marine Fisheries Service*. Space Exploration Technologies (SpaceX).

- SpaceX. (2024b). *Incidental Harassment Authorization Application for SpaceX Starship-Super Heavy Launch Vehicle and Reentry Operations*. Space Explorations Technologies Corporation.
- SpaceX. (2024c). *RCRA Contingency Plan - Launch Complex 39A (LC-39A)*. SpaceX.
- SpaceX. (2024d). *CPE - LC-39A Emergency Action Plan (EAP)*. SpaceX.
- St. Johns River Water Management District. (2024). *Annual report shows average daily water use is 115 gallons per person*. Retrieved 12 18, 2024, from St. Johns River Water Management District: <https://www.sjrwmd.com/2021/07/annual-report-shows-average-daily-water-use-is-115-gallons-per-person/>.
- St. Johns River Water Management District. (2025). *Watering Restrictions Frequently Asked Questions*. Retrieved 3 6, 2025, from <https://www.sjrwmd.com/wateringrestrictions/faqs/#1490894877386-eab451c4-bc1b>.
- Stantec. (2023). *Bear Head Energy Green Hydrogen and Ammonia Production, Storage and Loading Facility, Acoustic Assessment Report*.
- Stantec. (2023). *Bear Head Energy Green Hydrogen and Ammonia Production, Storage and Loading Facility, Acoustic Assessment Report*. Prepared for Bear Head Energy Inc. Retrieved from <https://novascotia.ca/nse/ea/bear-head-energy/bhe-ea-registration-appendix-e.pdf>. February 10.
- Straam Group. (2024). *DRAFT Vibration Monitoring Report - DRAFT Dune Data for Starship Super Heavy Launch March 14th, 2024*.
- Sutherland, L. C. (1990). *Assessment of Potential Structural Damage from Low Altitude Subsonic Aircraft*. Oak Ridge, TN: Wyle Laboratories Report WR 89-16(R), submitted to Martin Marietta Energy Systems, Inc.
- Sweet et al. (2022). Sweet, W. V., Hamlington, B. D., Kopp, R. E., Weaver, C. P., Barnard, P. L., Bekaert, D., ... & Zuzak, C. *Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines*. Silver Spring, MD: National Oceanic and Atmospheric Administration, National Ocean Service. NOAA Technical Data Report NOS 01. Retrieved from <https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nos>.
- The International Union of Geodesy and Geophysics. (1967). *Resolutions of the Union and of the Associations*. Retrieved from <https://iugg.org/wp-content/uploads/2022/03/zurich.pdf>.
- TRC. (2024). *Results of the Relocation of Previously Recorded Archaeological Sites at the Kennedy Space Center, Brevard County, Florida*. On file with the National Aeronautics and Space Administration Kennedy Space Center.
- Tribou, R. (2024). *Space Coast Launch Schedule*. Retrieved from Orlando Sentinel: <https://www.orlandosentinel.com/2024/08/04/space-coast-launch-schedule/>. August 7.
- U.S. Bureau of Economic Analysis. (2023). *CAEMP25N Total full-time and part-time employment by NAICS Industry*. Retrieved from <https://apps.bea.gov/itable/>. November 16.

- U.S. Census Bureau. (2022a). *DP04: Selected Housing Characteristics - American Community Survey 5-Year Estimates, 2018-2022*. Retrieved July 2024
- U.S. Census Bureau. (2022b). *DP03 Selected Economic Characteristics - American Community Survey 5-Year Estimates, 2018-2022*.
- U.S. Census Bureau. (2022c). *S0101 American Community Survey 5-year Estimates 2018-2022*.
- U.S. Census Bureau. (2024a). *Hispanic or Latino Origin by Race. American Community Survey, ACS 5-Year Estimates Detailed Tables, Table B03002, 2022*. Retrieved July 19, 2024, from [https://data.census.gov/table/ACSDT5Y2022.B03002?q=B03002&g=040XX00US12\\_050XX00US12009,12009\\$1400000\\_1500000US120090671001](https://data.census.gov/table/ACSDT5Y2022.B03002?q=B03002&g=040XX00US12_050XX00US12009,12009$1400000_1500000US120090671001).
- U.S. Census Bureau. (2024b). *QuickFacts Orange County, Florida; Titusville City, Florida; Rockledge city, Florida; Cocoa Beach city, Florida; Cocoa City, Florida; Cape Canaveral City, Florida*.
- U.S. Census Bureau. (2024c). *QuickFacts Volusia County, Florida; Brevard County, Florida; Florida; United States*.
- University of Florida GeoPlan Center. (2021). *City Limits - Derived From Florida Parcel Data - 2021*. Retrieved from FGDL Current Data Catalog: [https://fgdl.org/zips/geospatial\\_data/archive/par\\_citylm\\_2021.zip](https://fgdl.org/zips/geospatial_data/archive/par_citylm_2021.zip).
- USACE. (1989). *Blasting Vibration Damage and Noise Prediction and Control*. U.S. Army Corp of Engineers. Technical Letter No.1110-1-142.
- USDA NRCS. (2017). *Technical References*. Retrieved January 23, 2017, from Soil Survey Manual: [https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?&cid=nrcs143\\_014052](https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/nri/?&cid=nrcs143_014052).
- USEPA. (1992). *Procedures for Emission Inventory Preparation Volume IV: Mobile Sources*. U.S. Environmental Protection Agency. Retrieved from [https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/bakup/19921201\\_oaqps\\_epa-420\\_r-92-009\\_ei\\_preparation\\_mobile\\_sources.pdf](https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/bakup/19921201_oaqps_epa-420_r-92-009_ei_preparation_mobile_sources.pdf).
- USEPA. (2003). *Estimates of Construction and Demolition for Commercial and Industrial Activities*. U.S. Environmental Protection Agency: Washington, D.C.
- USEPA. (2016). *Air Pollutants Emissions Overview*. Retrieved July 29, 2024, from U.S. Environmental Protection Agency: <https://www3.epa.gov/airquality/emissns.html>. Last updated June 8, 2016.
- USEPA. (2020). *2020 National Emissions Inventory (NEI) Data*. Retrieved July 29, 2024, from U.S. Environmental Protection Agency: <https://awsedap.epa.gov/public/single/?appid=20230c40-026d-494e-903f-3f112761a208&sheet=5d3fdda7-14bc-4284-a9bb-cfd856b9348d&opt=ctxmenu,currsl>.
- USEPA. (2024a). *Effects of NO2*. Retrieved 2024, from U.S. Environmental Protection Agency: <https://www.epa.gov/no2-pollution/basic-information-about-no2#:~:text=Breathing%20air%20with%20a%20high,more%20about%20Visibility%20and%20Haze>. Webpage last updated July 16.

- USEPA. (2024b). *Map of Sole Source Aquifer Locations*. Retrieved from United States Environmental Protection Agency: <https://www.epa.gov/dwssa/map-sole-source-aquifer-locations>. July 23.
- USEPA. (2024c). *National Ambient Air Quality Standards*. Retrieved July 29, 2024, from U.S. Environmental Protection Agency: <https://www.epa.gov/criteria-air-pollutants/naaqs-table>. Last updated February 7, 2024.
- USEPA. (2024d). *Summary of the Clean Air Act*. Retrieved August 25, 2024, from U.S. Environmental Protection Agency: <https://www.epa.gov/laws-regulations/summary-clean-air-act>. Last updated July 31, 2024.
- USEPA. (2024e). *Florida Nonattainment/Maintenance Status for Each County by Year for All Criteria Pollutants (Green Book)*. Retrieved August 25, 2024, from U.S. Environmental Protection Agency: [https://www3.epa.gov/airquality/greenbook/anayo\\_fl.html](https://www3.epa.gov/airquality/greenbook/anayo_fl.html). Last updated July 31, 2024.
- USEPA. (2024f). *EPA RCRA ID: John F Kennedy Space Center*. Retrieved from U.S. Environmental Protection Agency: [https://ordspub.epa.gov/ords/cimc/f?p=CIMC:RCRA:::P14\\_RCRA\\_HANDLER\\_ID:FL6800014585](https://ordspub.epa.gov/ords/cimc/f?p=CIMC:RCRA:::P14_RCRA_HANDLER_ID:FL6800014585). July 9.
- USEPA. (2024g). *Generator ID: Space Exploration Technologies LLC SLC-39A*. Retrieved from U.S. Environmental Protection Agency: <https://rcrapublic.epa.gov/rcrainfoweb/action/modules/hd/showhdcurent/false/FL/null/null/FLR000212472>. August 14.
- USFWS. (1977). *USFWS Threatened & Endangered Species Active Critical Habitat Report - West Indian Manatee Designated Critical Habitat*. Retrieved June 13, 2024, from U.S. Fish and Wildlife Service: <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>.
- USFWS. (2008). *Merritt Island National Wildlife Refuge Comprehensive Conservation Plan*. U.S. Fish and Wildlife Service.
- USFWS. (2011). *St. Johns National Wildlife Refuge Comprehensive Conservation Plan*. U.S. Fish and Wildlife Service.
- USFWS. (2017). *USFWS Biological Opinion for the Kennedy Center Master Plan*. Jacksonville, FL: U.S. Fish and Wildlife Service.
- USFWS. (2019). *USFWS Merritt Island National Wildlife Refuge (MINWR) Bird List*.
- USFWS. (2021). *Birds of Conservation Concern 2021, Migratory Bird Program*.
- USFWS. (2023a). *GIS - USFWS Threatened & Endangered Species Active Critical Habitat Report - Loggerhead designated nesting beach Critical Habitat*. Retrieved from U.S. Fish and Wildlife Service: <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>.
- USFWS. (2023b). *GIS - USFWS Threatened & Endangered Species Active Critical Habitat Report - Green sea turtle Proposed nesting beach Critical Habitat*. Retrieved September 11, 2024, from U.S. Fish and Wildlife Service: <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>.

- USFWS. (2023c). *GIS - USFWS Threatened & Endangered Species Active Critical Habitat Report - Rufa Red Knot Proposed Critical Habitat*. Retrieved June 13, 2024, from U.S. Fish and Wildlife Service: <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>.
- USFWS. (2024a). *Florida bonneted bat designated critical habitat GIS, citation page 89 Federal Register 16624-16681*. Retrieved April 18, 2025, from U.S. Fish and Wildlife Service: <https://ecos.fws.gov/ecp/species/8630>. March 7, 2024.
- USFWS. (2024b). *GIS - USFWS Threatened & Endangered Species Active Critical Habitat Report - West Indian Manatee Proposed Critical Habitat*. Retrieved February 3, 2025, from U.S. Fish and Wildlife Service: <https://ecos.fws.gov/ecp/report/table/critical-habitat.html>.
- USFWS. (2024c). *Dark Skies Initiative*. Retrieved from U.S. Fish & Wildlife Service: <https://www.fws.gov/project/dark-skies-initiative>. August 8.
- USFWS. (2024d). *USFWS National Wetlands Inventory*. Retrieved from U.S. Fish and Wildlife Service: <https://www.fws.gov/program/national-wetlands-inventory/data-download>. May 1.
- USFWS. (2025). *Piping plover designated critical habitat GIS, citation page 74 Federal Register 23600*. Retrieved April 21, 2025, from U.S. Fish and Wildlife Service: <https://ecos.fws.gov/ecp/species/6039>. May 19, 2009.
- USGS. (n.d.). *The Hawaiian Emperor Seamount Chain*. Retrieved September 2024, from U.S. Geological Survey: <https://www.usgs.gov/media/images/hawaiian-emperor-seamount-chain>. Undated page.
- USSF. (2023a). *Identification of Historic Properties and Finding of No Effect, SpaceX Increased Launch Cadence, Vandenberg Space Force Base*. March. U.S. Space Force.
- USSF. (2023b). *Space Launch Delta 45 (SLD 45) Integrated Natural Resources Management Plan (INRMP)*. U.S. Space Force.
- USSF. (2024a). *Spaceports of the Future – Infrastructure*. U.S. Space Force. Society of American Military Engineers Presentation. February.
- USSF. (2024b). *Environmental Assessment for Eastern Range Planning and Infrastructure Development, Cape Canaveral Space Force Station, Florida*. Final, January. U.S. Space Force.
- USSF. (2024c). *Supplemental Environmental Assessment (SEA) for the Relativity Space Terran R Launch Program Cape Canaveral Space Force Station (CCSFS), Florida*. U.S. Space Force.
- USSF. (2024d). *Environmental Assessment for Stoke's Nova Launch Program at Cape Canaveral Space Force Station, Florida (Draft)*. U.S. Space Force.
- USSF. (2025a). *SpaceX Starship-Super Heavy Cape Canaveral Space Force Station Environmental Impact Statement (Draft)*. U.S. Space Force.
- USSF. (2025b). *Draft Statistical Analysis for Vandenberg Western Snowy Plover*. United States Space Force. Prepared for Space Launch Delta 30, Vandenberg Space Force Base, California. March.



- Waymer, J. (2025). *Merritt Island refuge relocates visitor services to trailer while renovates visitor center*. Retrieved from Florida Today: [floridatoday.com/story/news/local/environment/2025/01/17/merritt-island-national-wildlife-refuge-relocate-visitor-center-renovation/77772887007/](https://www.floridatoday.com/story/news/local/environment/2025/01/17/merritt-island-national-wildlife-refuge-relocate-visitor-center-renovation/77772887007/). January 18.
- White, R. W. (1972). *Effects of Repetitive Sonic Booms on Glass Breakage*. Huntsville, AL: Wyle Laboratories. Report No. FAA-RD-72 43. April.
- Wilbur Smith Associates. (2002). *Port Canaveral Land Use Plan for the Commercial/Industrial “Cove” Area Final Report*. Cape Canaveral.

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