Appendix D.

Endangered Species Act Section 7 Consultation

Biological Assessment

SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site

Cameron County, Texas

October 2021

Federal Aviation Administration

Office of Commercial Space Transportation

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Acronyms and Abbreviations

BA	Biological Assessment
BCO	Biological and Conference Opinion
CFR	Code of Federal Regulations
CWA	Clean Water Act
dB	decibel(s)
dBA	A-weighted decibel(s)
DOT	Department of Transportation
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FR	*Federal Register*
L_{Amax}	Maximum Overall Sound Pressure Level
LCH_4	liquid methane
LLCC	Launch and Landing Control Center
LN_2	liquid nitrogen
LOX	liquid oxygen
MBTA	Migratory Bird Treaty Act
MT	megaton(s)
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NOx	nitrous oxide
NPS	National Park Service
NWR	National Wildlife Refuge
OASPL	Overall Sound Pressure Level
PCE	Primary Constituent Elements
psf	pound(s) per square foot
SODAR	sound detection and ranging
SpaceX	Space Exploration Technologies Corporation
SPCC	Spill Prevention, Control, and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan
TCEQ	Texas Commission on Environmental Quality
TGLO	Texas General Land Office
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department
TxDOT	Texas Department of Transportation
U.S.	United States
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
UTRGV	University of Texas Rio Grande Valley
VLA	Vertical Launch Area

1 INTRODUCTION

The Federal Aviation Administration (FAA) Office of Commercial Space Transportation oversees, licenses, and regulates U.S. commercial launch and reentry activity, as well as the operation of non-federal launch and reentry sites, as authorized by the Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. 50901–50923. An FAA license or permit is required for any commercial launch or reentry, or the operation of any commercial launch or reentry site, by U.S. citizens anywhere in the world, or by any individual or entity within the United States. An FAA license or permit is not required for launch or reentry activity carried out by the federal government, such as National Aeronautics and Space Administration or Department of Defense launches. The FAA licensing and permitting evaluation consists of five major components: 1) a policy review, 2) a payload review, 3) a safety review, 4) a determination of maximum probable loss for establishing financial responsibility requirements, and 5) an environmental review.

In accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 United States Code [U.S.C.] 1531 et seq.), the FAA prepared this Biological Assessment (BA) to analyze the potential effects of issuing commercial space licenses or permits to SpaceX on ESA-listed species and designated critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). This BA is intended to support formal consultation between the FAA and USFWS as required by ESA Section 7 and 50 Code of Federal Regulations (CFR) § 402.14(c). This BA also supports informal consultation regarding species that may be affected but are not likely to be adversely affected by the FAA's Proposed Action.

<u>Consultation History</u>

In 2013, the FAA conducted ESA Section 7 consultation with the USFWS to address the potential effects to ESA-listed species and critical habitat from the proposed action of issuing SpaceX licenses or permits to conduct launches of Falcon 9, Falcon Heavy, and other reusable launch vehicles at a proposed launch site near Boca Chica Village, Texas (now referred to as the Boca Chica Launch Site). The action analyzed in the 2013 consultation included construction of the launch site, pre-flight activities, and launches. During the 2013 consultation, the FAA determined the proposed action *may affect and was likely to adversely affect* the following species and critical habitat: piping plover (*Charadrius melodus*) and piping plover critical habitat, red knot (*Calidris canutus rufa*), northern aplomado falcon (*Falco femoralis septentrionalis*), Gulf Coast jaguarundi (*Herpailurus yagouaroundi cacomitli*), ocelot (*Leopardus pardalis*), Kemp's ridley sea turtle (*Lepidochelys kempii*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and green sea turtle (*Chelonia mydas*). The FAA determined the proposed action *may affect but was not likely to adversely affect* the West Indian manatee (*Trichechus manatus*). The FAA determined the proposed action would have *no effect* on the South Texas ambrosia (*Ambrosia cheiranthifolia*) and Texas ayenia (*Ayenia limitaris*).

The USFWS issued a Biological and Conference Opinion (BCO) on December 18, 2013 which concluded FAA's Section 7 obligations. The USFWS concurred with the FAA's *not likely to adversely affect* determination for the West Indian manatee, and concluded FAA's proposed action would not jeopardize the continued existence of the remaining species and would not adversely modify piping plover critical habitat. The conference opinion was for the red knot, which was proposed for listing at the time. The FAA re-initiated consultation with the USFWS when the red knot was listed as threatened in 2015, and the USFWS confirmed its Conference Opinion as a Biological Opinion for the red knot. The BCO provided an incidental take statement and outlined conservation measures, reasonable and prudent measures, terms and conditions, and conservation recommendations. The FAA and SpaceX have updated the USFWS annually on the implementation of all the measures, terms and conditions, and recommendations outlined in the BCO.

SpaceX no longer plans to conduct launches of its Falcon launch vehicles at the Boca Chica Launch Site and has instead decided to use the launch site to conduct test operations and launches of its new launch vehicle, called the Starship/Super Heavy, which is currently being designed and constructed. SpaceX is also proposing to construct additional infrastructure at the launch site. The FAA's Proposed Action includes issuing a permit or license to SpaceX for Starship/Super Heavy launch operations, which includes the construction of launch-related infrastructure, as discussed below in Chapter 2. Some Starship/Super Heavy launch operations and the proposed infrastructure fall outside the scope of the 2013 consultation; the FAA is initiating Section 7 consultation on these elements.

As noted in Chapter 2, the Proposed Action includes the construction of two integration towers and a parking lot, which are used to support launches. SpaceX has started the construction of one of the integration towers and the parking lot. The FAA sent a letter to SpaceX in May 2021 reminding SpaceX that any actions SpaceX takes to construct integration towers at the Boca Chica Launch Site, or any other action in furtherance of the Starship/Super Heavy Launch Vehicle Program, would not affect any future FAA decisions in the environmental or licensing process. The FAA and SpaceX are aware that the USFWS does not consult on actions after-the-fact. As such, this consultation only addresses the operational elements of the constructed integration tower and parking lot. SpaceX is responsible for any take of ESA-listed species from its actions that are not covered under this consultation.

2 Project Description

2.1 Proposed Action

The FAA's Proposed Action is to issue one or more experimental permits and/or a vehicle operator license to SpaceX that would allow SpaceX to launch Starship/Super Heavy, including from the Boca Chica Launch Site. SpaceX's goal is to use Starship/Super Heavy for low Earth orbit, sun-synchronous orbit, geostationary transfer orbit, and interplanetary missions for cargo and humans.

This BA focuses on the Boca Chica Launch Site, including potential additional development at the site as explained below. The FAA may conduct environmental reviews of additional proposed launch and reentry sites if SpaceX further develops proposals. Such reviews would be part of additional ESA consultation with the USFWS, as applicable.

SpaceX's proposed Starship/Super Heavy program consists of testing operations (suborbital launches) and orbital launches. If SpaceX becomes more successful with test flights, the Starship/Super Heavy launch vehicle program would increase orbital launches and perform fewer testing operations.

Annual proposed launch operations include suborbital launches (see Section 2.1.3.3) and/or orbital launches (see Section 2.1.3.4). SpaceX's proposal also includes launch-related activities at the Boca Chica Launch Site, such as tank tests, static fire engine tests, expansion of the vertical launch area (VLA) and solar farm, and construction of additional infrastructure.

All elements of the Proposed Action and SpaceX's proposal are identified in Table 2-1. Detailed information about some of the launch-related infrastructure (e.g., exact location and design for project elements like the diverter and payload processing facility) is not currently available. Therefore, the BA makes assumptions about these unknowns using best available information and professional expertise. The analysis in this BA reflects the potential effects that may be expected to result from the Proposed Action and the assumptions. If SpaceX proposes modifications to the activities discussed below, and they fall outside the footprint of the proposed project or the scope of this BA, the FAA will reinitiate consultation.

Table 2-1. Elements of the Proposed Action

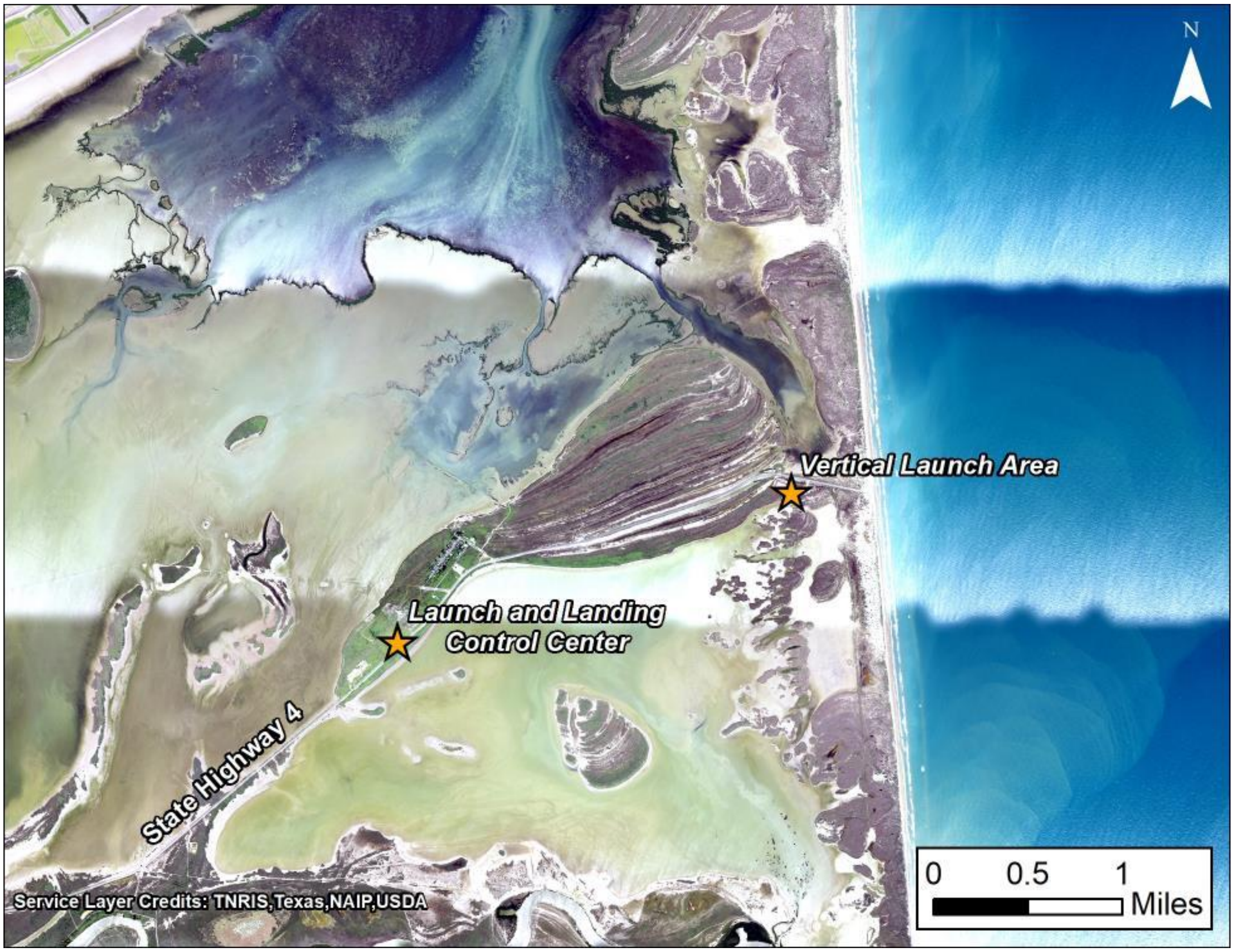
FAA Proposed Action	Elements of SpaceX's Proposal	Brief Description
Issuance of an Experimental Permit or Vehicle Operator License	Test and Launch Operations	• Starship Static Fire Engine Tests • Super Heavy Static Fire Engine Tests • Starship Suborbital Launch • Super Heavy Launch • Starship Land Landing • Super Heavy Land Landing
	Tank Tests	Test the structural capability of the launch vehicle stages
	Nominal Operational Closures	SpaceX anticipates the proposed operations would require 500 hours of annual closure
	Anomaly Response Closures	SpaceX anticipates debris cleanup would require up to 300 hours of annual closure to be used at the discretion of Cameron County, TPWD, and USFWS
	Related Infrastructure Construction	• Redundant Launch Pad (Launch Pad B) and Commodities (11 tanks) • Redundant Landing Pad • Integration Towers • Tank Structural Test Stands • Support Buildings and Parking Lots • Power Plant • Trenching • Payload Processing Facility • Natural Gas Pretreatment System • Liquefier • Expanded Solar Farm • State Highway 4 Pull-offs

2.1.1 Location

The Boca Chica Launch Site is located on SpaceX-owned land (approximately 47.4 acres) in Cameron County, Texas, near the cities of Brownsville and South Padre Island. The launch site consists of the VLA, which is controlled by the launch and landing control center (LLCC). The VLA is approximately 2.2 miles north of the U.S./Mexico border and the LLCC is approximately 1.3 miles north of the U.S./Mexico border (Figure 2-1). The launch site is in a sparsely populated coastal area adjacent to the Gulf of Mexico, characterized by sand and mud flats. State Highway (SH) 4, which provides the only access to the public Boca Chica Beach (Figure 2-2) and to Texas Park and Wildlife Department's (TPWD) Boca Chica Tract, provides access to the launch site and terminates directly adjacent to the VLA. The LLCC consists of a two-story building (referred to as Stargate) and is located west of the VLA along SH 4, adjacent to the SpaceX manufacturing and production area.

Figure 2-1. Regional Map

Figure 2-2. Location of Vertical Launch Area and Launch and Landing Control Center



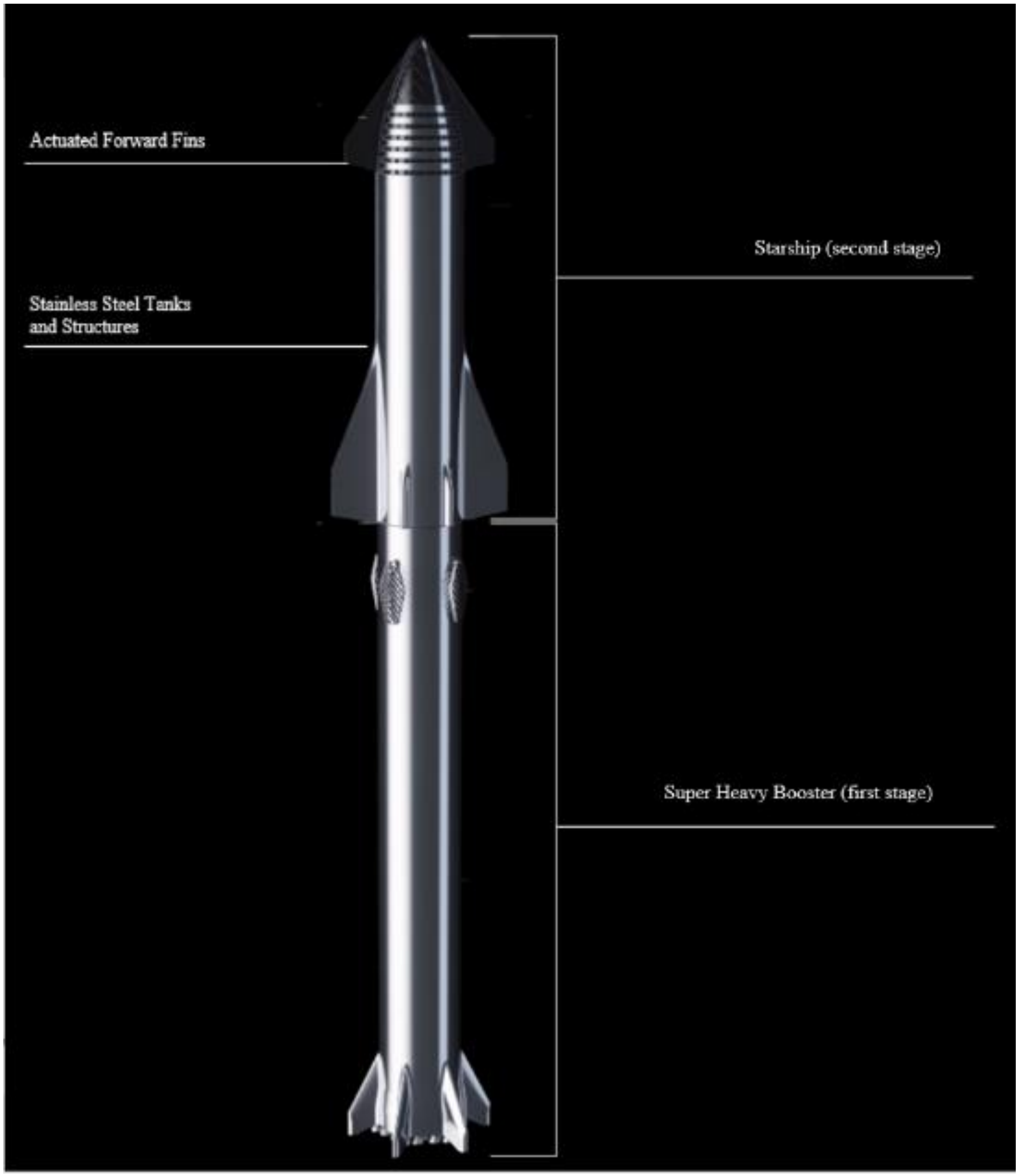
2.1.2 Launch Vehicle

Figure 2-3 shows a diagram of Starship/Super Heavy. The fully integrated launch vehicle is comprised of two stages: Super Heavy is the first stage (or booster) and Starship is the second stage. The fully integrated Starship/Super Heavy launch vehicle is expected to be approximately 400 feet tall and 30 feet in diameter. As designed, both stages are reusable, with any potential refurbishment actions taking place at SpaceX facilities. Both stages are expected to have minimal post-flight refurbishment requirements; however, they might require periodic maintenance and upgrades. Unlike the SpaceX Falcon launch vehicle, Starship/Super Heavy would not have separable fairings or parachutes.

Super Heavy is expected to be equipped with up to 37 Raptor engines, and Starship will employ up to six Raptor engines. The Raptor engine is powered by liquid oxygen (LOX) and liquid methane (LCH_4) in a 3.6:1 mass ratio, respectively. Super Heavy is expected to hold up to 3,700 metric tons (MT) of propellant and Starship will hold up to 1,500 MT of propellant. Super Heavy, with all 37 engines, will have a maximum lift-off thrust of 74 meganewtons, allowing for a maximum lift-off mass of approximately 5,000 MT. Starship, with six engines, will have a maximum lift-off thrust of 12 MN, allowing for a maximum lift-off mass of approximately 1,000 MT. Launch propellant and commodities are currently stored at the VLA in aboveground tanks (see Figure 2-5); this will not change under the

Proposed Action. Commodities include liquid nitrogen (LN_2), water, gaseous oxygen, gaseous methane, gaseous nitrogen, helium, hydraulic fluid, LOX, and LCH_4.

Figure 2-3. Starship/Super Heavy Design Overview



2.1.3 Operations

The Starship/Super Heavy program includes tank tests, pre-flight operations, suborbital launches, and orbital launches. SpaceX is still in the testing stages of the launch vehicle, including ongoing Starship prototype tests that have been approved under a separate license. SpaceX also will need to conduct similar tests of Super Heavy prototypes, which has not yet been approved under a separate license. In the early stages of the Starship/Super Heavy program, SpaceX would conduct more tests (tank tests, static fire engine tests, and suborbital launches) and fewer orbital launches annually. As discussed below, if SpaceX becomes more successful with tests, the program would shift to more orbital launches and fewer tests. While the number of each operation may vary each year through the proposed launch program, SpaceX would not exceed the number of annual operations described below per year (Table 2-2).

Table 2-2. Proposed Annual Operations

Operation	Time[a]	Program Development Phase	Operational Phase
Starship Static Fire Engine Test	Day	150 seconds	150 seconds
Super Heavy Static Fire Engine Test	Day	135 seconds	135 seconds
Starship Suborbital Launch	Day or Night	20	5
Super Heavy Launch[b]	Day or Night	3	5
Starship Land Landing[c]	Day or Night	23	10
Super Heavy Land Landing[c]	Day or Night	0	5

Notes:

[a] SpaceX is planning to conduct most launches (suborbital and orbital) between the hours of 7:00 a.m. and 7:00 p.m. However, there could be launch delays due to unforeseen issues with the launch vehicle, weather conditions, or certain missions that require launching at a specific time at night to achieve a particular orbital position. For conservative purposes, the environmental review is assuming 20 percent of annual operations involving engine ignition (i.e., static fire engine tests, suborbital launches, and orbital launches) would occur at night.

[b] A Super Heavy launch could be orbital or suborbital and could occur by itself or with Starship attached as the second stage of the launch vehicle.

[c] A Starship land landing means a landing at the VLA. Other landing options for Starship include landing on a floating platform in the Gulf of Mexico, Atlantic Ocean, or Pacific Ocean. Alternatively, SpaceX could expend Starship in the Gulf of Mexico, Atlantic Ocean, or Pacific Ocean.

[d] A Super Heavy landing is part of a launch, as it would occur shortly after takeoff. A land landing means a landing at the VLA. Other landing options for Super Heavy include landing on a floating platform in the Gulf of Mexico or expending the booster in the Gulf of Mexico.

SpaceX would conduct most launches (suborbital and orbital) between the hours of 7:00 a.m. and 7:00 p.m. However, there could be launch delays due to unforeseen issues with the launch vehicle, weather conditions, or certain missions that require launching at a specific time at night to achieve a particular orbital position. For conservative purposes, this assessment assumes 20 percent of annual operations involving engine ignition (i.e., static fire engine tests, suborbital launches, and orbital launches) would occur at night. The difference in operations during nighttime launch activity versus a daytime launch activity would be SpaceX requiring bright spotlighting for periods of time (sometimes days) when illuminating the launch vehicle on the launch pad. These spotlights are typically metal halide.

In addition to nighttime launch activity, SpaceX would need to perform ground support operations 24 hours a day, 7 days a week, throughout the year. White lighting would be needed to ensure the protection and safety of SpaceX personnel. The number of pole lights would be finalized during the site design process. SpaceX will coordinate with the USFWS, National Park Service (NPS), Texas Parks and Wildlife Division (TPWD), and Texas Historical Commission (THC) on updating its Facility Design and Lighting Management Plan.

SpaceX plans to use a portable sound detection and ranging (SODAR) device to collect weather data needed for launch and landing. The SODAR sends out a short sonic pulse every 15 minutes that can reach 92 decibels (dB) at the source and dissipates to 60 dB within 100 feet. SpaceX would locate the SODAR at its production and manufacturing area at least 500 feet away from any SpaceX property line and would operate at all times.

SpaceX would deploy weather balloons just prior to launch to measure weather data. The data, including wind speeds, is necessary to create the required wind profiles that are used to determine if it is safe to launch and land the vehicle. The weather balloons are made of latex with radiosondes attached to each balloon. Data from the balloons is gathered and transmitted to SpaceX via the radiosonde. Each radiosonde is relatively small (about the size of a milk carton) and is powered by a 9-volt battery. The latex balloon attached to each weather balloon typically has a diameter at launch of approximately four feet. When a balloon is deployed, it rises to approximately 12–18 miles into the air and then bursts. This bursting causes the balloon to shred into many pieces that fall back to Earth, along with the radiosonde, all which will land in the open marine waters. The radiosonde is expected to rapidly sink to the ocean floor. There are negligible environmental impacts from the use of these weather balloons.[1] This is similar to the National Weather Service's release of weather balloons, which occurs twice a day, every day of the year, from almost 900 locations worldwide to obtain weather data and conduct research (NOAA 2021).

2.1.3.1 Tank Tests

Prior to conducting a suborbital launch of a Super Heavy or Starship prototype, SpaceX must conduct tank tests to ensure the tank's reliability. This involves performing proof pressure tests prior to performing a static fire engine test to confirm the structural integrity of the launch vehicle. Proof pressure tests are broken into two main categories: pneumatic and 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 tests consist of loading the tank with a single propellant (typically LN_2, LOX, or LCH_4). The tanks are then pressurized past their rated limit to confirm their structural capability with appropriate factors of safety. These proof pressure tests are designed to not release any propellant to the environment. All propellant is recycled back into the ground system tanks after the test is completed.

In addition to the proof pressure tests, SpaceX may perform development tests on test tank articles to validate design improvements or characterize vehicle behavior. These development tests include hydrostatic and cryogenic burst tests, in which the tanks are filled with water, LN_2, or LOX, and pressurized to a specific limit or to deliberate failure to characterize the structural capability of the production vehicles. Burst testing includes the deliberate release of the test media (water, LN_2, or LOX) to the environment upon failure of the primary structure.

All tank tests could occur during the day or night. SpaceX is planning to conduct the tank tests described above for each Super Heavy and Starship prototype that is built until the test is successful. If a test is unsuccessful and results in damage to the test vehicle, a new test vehicle would be constructed and tested. Once tank tests are successful, SpaceX would conduct a static fire engine test.

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[1] By comparison, the National Weather Service releases weather balloons, which occurs twice a day, every day of the year, from almost 900 locations worldwide to obtain weather data and conduct research (NOAA 2021). NMFS has found that this activity produces negligible impact to the environment (NMFS 2017).

SpaceX is proposing to conduct approximately 10 tank tests a month. For the purposes of the environmental impact analysis, SpaceX estimates a 10 percent rate of anomalies during tank testing – this is a conservative, upper bound estimate intended to capture the maximum potential impact. An anomaly would result in an explosion and the spread of debris. The distance for which debris could spread is considered the blast danger area; SpaceX would determine this area prior to the test. The blast danger area for tank tests would be within the hard checkpoint area (Figure 2-4). Given the rates above, SpaceX estimates that one tank test each month may result in an anomaly and potentially an explosion. The probability of debris spreading outside of the launch pad boundary from an explosive anomaly during a tank test is low.

2.1.3.2 Pre-flight Operations

Pre-flight operations include mission rehearsals and static fire engine tests. The goal of mission rehearsals is to verify that all vehicle and ground systems are functioning properly, as well as to verify that all procedures are properly written. After final systems checkout, SpaceX would conduct a mission rehearsal without propellants on the launch vehicle (referred to as a *dry dress rehearsal*), followed by a mission rehearsal with propellants on the launch vehicle (referred to as a *wet dress rehearsal*) to verify full launch readiness.

After completing rehearsals, SpaceX would conduct static fire engine tests. The goal of a static fire engine test is to verify engine control and performance. A static fire engine test is identical to a wet dress rehearsal, except engine ignition occurs. During a static fire engine test, the launch vehicle engines are ignited for approximately 5–15 seconds and then shut down.

Prior to a fully integrated Starship/Super Heavy launch, SpaceX would perform a Starship static fire engine test prior to being integrated with Super Heavy. SpaceX would also perform a Super Heavy static fire engine test, either by itself or with Starship integrated. SpaceX is proposing to conduct up to 135 seconds per year of static fire duration for Super Heavy and up to 150 seconds per year of static fire duration for Starship per year during both phases of the program (Table 2-2). There may be occasions when a static fire engine test is attempted and is unsuccessful (e.g., the test results in a mishap). If an engine test is unsuccessful, SpaceX would attempt another.

During pre-flight 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 at the VLA. During Starship fuel loading for a static fire engine test of the integrated launch vehicle, SpaceX estimates approximately 7 metric tons of LCH_4 would be released to the atmosphere. During an off-nominal operation (i.e., if the vehicle lost pneumatics and could not reconnect to the ground systems), SpaceX may release the LCH_4 to the atmosphere. The amount of methane in the largest tank (Super Heavy) that would be released is approximately 814 tons. This represents the worst-case scenario and would be a rare, unplanned event.

2.1.3.3 Suborbital Launches

SpaceX is proposing to conduct Starship suborbital launches. During a suborbital launch, Starship would launch from the VLA and ascend to high altitudes and then throttle down or shut off engines to descend, landing back at the VLA or downrange either directly in the Gulf of Mexico or on a floating platform in the Gulf of Mexico. As SpaceX increases the suborbital launches capability, a sonic boom might be produced during descent; however, if a sonic boom was anticipated during the descent, SpaceX would land the Starship downrange in the Gulf of Mexico, no closer than 19 miles from shore. Sonic boom modeling for a Starship landing predicts that the sonic boom would not impact land (see Attachment 1 for the sonic boom report).

Following a suborbital launch, Starship would have LOX and LCH_4 (approximately 10 metric tons) remaining in the tank. SpaceX would vent remaining LOX to the atmosphere and remaining LCH_4 would likely be released to the atmosphere. The LCH_4 vented to the atmosphere would evaporate within hours. Due to risks to personnel, SpaceX is unable to reconnect the launch vehicle to ground systems when LCH_4 remains on the vehicle. In the future, SpaceX may recycle LCH_4 back into tanks at the VLA as technology and design develops. For the purposes of the environmental review, the FAA is assuming all residual LCH_4 is released to the atmosphere.

During the program's development, SpaceX is proposing to conduct up to 20 Starship suborbital launches annually. As the program progresses, SpaceX is proposing to conduct up to five Starship suborbital launches annually. Each launch would include a landing (Table 2-2).

2.1.3.4 Orbital Launches

SpaceX is proposing to conduct up to five Starship/Super Heavy orbital launches annually. Starship/Super Heavy missions would include Lunar and Mars missions, satellite payload missions, and the possibility of future human flight to the moon and Mars. From the Boca Chica Launch Site, orbital launches would primarily be to low inclinations with flight north or south of Cuba that minimize land overflight. Future launches may be to higher, 70-degree inclination with limited overflight of remotely populated portions of Mexico. There could be multiple launches in close succession required to support a single mission (e.g., Lunar resupply missions). SpaceX's launch manifest (i.e., scheduled launches) is still being developed at this time but would evolve as the Starship/Super Heavy program develops. SpaceX would not exceed five Starship/Super Heavy orbital launches annually. SpaceX estimates approximately 7 metric tons of LCH_4 would be released to the atmosphere during Starship fuel loading for an orbital launch of the integrated launch vehicle.

Starship/Super Heavy would launch from the VLA. During a launch, the exhaust plume would surround the launch pad and surrounding areas. The plume would extend radially from the center of the pad approximately 0.6 mile until reaching ambient temperature; this would occur shortly after launch and would dissipate within minutes. The highest heat levels are expected to occur directly around the launch mount and begin to dissipate within 300 feet, well within the limits of the VLA. Temperature of the plume outside of the VLA is not expected to exceed 300 degrees. The plume would appear clear and consist of heat (and steam if deluge water is used).

SpaceX is still determining whether a diverter would be used under the launch mount. A diverter is a metal structure placed on the launch pad underneath the rocket to divert the rocket plume laterally away from the ground. If a diverter is used, the plume would be focused in a single direction instead of extending radially from the center of the launch pad.

SpaceX is also still considering whether deluge water would discharge on the plume during a launch or test, but its use is a possibility under the Proposed Action. If water were used, most of the water would be vaporized. If treatment or retention of stormwater or wastewater is required, water would be contained in retention ponds adjacent to the launch mount (see Figure 2-6). The exact number, location, and size of the retention ponds within the VLA would be determined based on quantities of deluge water and final site plans; however, Figure 2-6 represents SpaceX's current understanding of stormwater and wastewater needs. SpaceX would develop appropriate sampling protocols and water quality criteria in coordination with the Texas Commission on Environmental Quality (TCEQ).[2] SpaceX would remove water containing contaminants that exceed the water quality criteria and haul it to an approved industrial wastewater treatment facility nearby. SpaceX would pump all other water not containing prohibited chemicals back to the water storage tanks at the VLA. If surface water discharge were required, SpaceX would apply for a TCEQ Texas Pollutant Discharge Elimination System (TPDES) permit prior to the discharge event. All water (including deluge and potable water) would be either delivered by truck or withdrawn from existing or new wells located adjacent to the launch pad.

Each Starship/Super Heavy orbital launch would include an immediate boost-back and landing of Super Heavy. Landing could occur at the VLA or downrange in the Gulf of Mexico (either on a floating platform or expended in the Gulf of Mexico), no closer than approximately 19 miles off the coast. During flight, Super Heavy's engines would cut off at an altitude of approximately 40 miles and the booster would separate from Starship. Shortly thereafter, Starship's engines would start and burn to the desired orbit location. After separation, Super Heavy would rotate and ignite to conduct the retrograde burn, which would place it in the correct angle to land. Once Super Heavy is in the correct position, the engines would be cut off. Super Heavy would then perform a controlled descent using atmospheric resistance to slow it down and guide it to the landing location (like current Falcon 9 booster landings at Cape Canaveral Space Force Station). Once near the landing location, Super Heavy would ignite its engines to conduct a controlled landing. Super Heavy would land vertically and go into an automated safing sequence (i.e., put the vehicle in a safe state).

If a Super Heavy landing occurred downrange in the Gulf of Mexico on a floating platform, Super Heavy would be delivered by barge to the Port of Brownsville and transported the remaining distance to the Boca Chica Launch Site over the roadways. A floating platform would be a mobile vessel that would not attach to the seafloor. Super Heavy landings would generate a sonic boom(s). For landings at the VLA, the sonic boom would impact parts of Texas. Based on the modeling for Super Heavy landings at the VLA, the sonic boom produced when landing downrange in the Gulf of Mexico would not impact land (see Attachment 1 for the sonic boom report). A maximum of five Super Heavy landings could occur each year (Table 2-2).

Similarly, each Starship/Super Heavy orbital mission would include a Starship landing after Starship completes its orbital mission. Starship landing could occur at the VLA or downrange in the Gulf of Mexico, Atlantic Ocean, or Pacific Ocean on a floating platform (Table 2-2). Starship would land vertically on the pad or on a floating platform and go into an automated safing sequence (i.e., put the vehicle in a safe state). As Starship slows down during its landing approach, a sonic boom(s) would be generated and impact parts of Texas when landing at the VLA. Based on the modeling for Starship landings at the VLA, the sonic boom produced when landing downrange would not impact land (see Attachment 1 for the sonic boom report). After Starship is in a safe state, a mobile hydraulic lift would raise Starship onto a transporter. If a Starship landing occurred downrange on a floating platform, it

[2] Texas Administrative Code, Title 30 Environmental Quality, Part 1 - Texas Commission on Environmental Quality, Chapter 307: Texas Surface Water Quality

would be delivered by barge to the Port of Brownsville and transported the remaining distance to the Boca Chica Launch Site over roadways. Following Starship landings at the VLA, it would be transported from the landing pad to the adjacent launch mount or to one of SpaceX's production locations for refurbishment.

Following an orbital launch, Starship and Super Heavy would have remaining LOX and LCH_4 in the vehicle. Remaining LOX would be vented to the atmosphere and remaining LCH_4 would likely be released to the atmosphere. Due to risks to personnel, SpaceX is unable to reconnect the vehicle to ground systems when LCH_4 remains on the vehicle. Super Heavy would have approximately 5 metric tons of LCH_4 onboard following an orbital flight. In the future, SpaceX may recycle LCH_4 back into tanks at the VLA as technology and design develops. For the purposes of the environmental review, the FAA assumes all residual LCH_4 is released to the atmosphere.

During early unmanned orbital launches, SpaceX may require expending Super Heavy or Starship in the ocean downrange no closer than 19 miles offshore. If this occurs, SpaceX would not recover Super Heavy or Starship. SpaceX expects each stage would break up upon impact with the water's surface. SpaceX expects most of the launch vehicle would sink because it is made of steel. Lighter items (e.g., items not made of steel, such as composite overwrapped pressure vessels) may float but are expected to eventually become waterlogged and sink. If there are reports of large debris, SpaceX would coordinate with a party specialized in marine debris to survey the situation and sink or recover as necessary any large floating debris.

2.1.3.5 Nominal Operational Closures

Ground Closures

Tanks tests, wet dress rehearsals, static fire engine tests, and launches (suborbital and orbital) would require restricting public access in the vicinity of the VLA and securing land and water areas as part of public safety requirements. The areas on land that would be closed to public access is referred to as the *closure area* (Figure 2-4.). The closure area includes an area of Boca Chica Beach, ranging from the Brownsville Shipping Channel south to the U.S./Mexico border. The Brownsville Shipping Channel would be temporarily restricted during orbital launches and some suborbital launches, but not restricted during tank tests, wet dress rehearsals, or static fire engine tests. SpaceX would coordinate with the Port of Brownsville to establish the times that activity in the shipping channel would be restricted. In the event of an anomaly, SpaceX would also inform the Port of any continued hazards and effects to channel restrictions.

For purposes of the environmental review, the FAA defines an operational closure as follows:

> A closure begins when local law enforcement, under the direction of an order from the Cameron County Commissioners Court, shuts down SH 4 and Boca Chica Beach for a tank test, wet dress rehearsal, static fire engine test, or launch. A closure ends when the operation is completed and local law enforcement opens SH 4 and Boca Chica Beach.

The FAA does not have a direct role in approving road and beach closures. Therefore, closures that are planned but not implemented (e.g., Cameron County revokes the closure) do not meet the FAA's definition of a closure for the purposes of the environmental review. For an operation requiring a closure, SpaceX would coordinate with Cameron County under the authority granted in the 2013 Memorandum of Agreement between the TGLO and Cameron County (TGLO 2013).

SpaceX will perform the following notifications prior to a planned closure in accordance with SpaceX's Closure Notification Plan:

- Provide a forecast of planned closures one to two weeks in advance of the closure on the County's website and/or send via email to the agency distribution list. Information about the proposed closure would be available on Cameron County's website.[3] The Cameron County judge issues a public notice of a Cameron County order to temporarily close Boca Chica Beach and SH 4 anywhere from a few hours to a few days after receiving SpaceX's request to close.
- Send closure notifications to the regulatory and public land-managing agencies as plans finalize (typically 24-48 hours prior to the closure). The agencies would continue to receive updates immediately when the closures go into place and when the closures end, as well as cancellations of requested closures. SpaceX personnel at the LLCC would send these notifications to ensure the most up-to-date information is distributed.
- Send real time status and updates on closures through a text message alert service. Subscribers can text "BEACH" to 1-877-591-2152 to receive updates.

If any agency needs to access an area within a planned closure window, the agency is encouraged to contact SpaceX directly to find the best opportunity to access the area and avoid any conflict in operations.

There may be certain operations, anomalies, or emergencies that require notification of closure to occur less than a week in advance of the activity. In those instances, SpaceX would notify Cameron County Commissioner's Court immediately with a closure request. SpaceX would also coordinate with U.S. Customs and Border Protection, Cameron County and State of Texas law enforcement agencies, the U.S. Coast Guard, and Houston Air Route Traffic Control Center to ensure public safety and allow for the issuance of Notice to Mariners (NOTMAR) and Notice to Airmen (NOTAM). In addition, SpaceX would coordinate with the Secretariat of Communications and Transportation–Mexico if any land or water closures in Mexico were required.

Prior to an operation requiring a closure, the public would be notified through local media and through the use of NOTMARs and NOTAMs. SpaceX would also inform the cities of Brownsville and South Padre Island; NPS, including Palo Alto Battlefield National Historical Park; USFWS, including Lower Rio Grande Valley National Wildlife Refuge (NWR); TPWD; Texas General Land Office (TGLO); and Texas Department of Transportation (TxDOT) of the operation and associated closure schedules. Given the proximity of the Lower Rio Grande Valley NWR to the launch site, SpaceX has committed to work with the USFWS to fund additional resources or personnel necessary to enforce the closures required for launch operations.

[3] See: https://www.cameroncounty.us/space-x/.

SpaceX proposes to limit public access at four pre-defined checkpoints on SH 4 to ensure that unauthorized persons remain out of the flight hazard area[4] (see Figure 2-4.). These checkpoints are similar to the checkpoints established during preparation of the FAA's 2014 Environmental Impact Statement (EIS) (FAA 2014) in coordination with the NPS and USFWS. The 2014 EIS and associated BA (FAA 2013) included two checkpoints: a soft checkpoint (located near the U.S. Customs and Border Patrol checkpoint) and a hard checkpoint (located near the LLCC). SpaceX is proposing a third checkpoint between those two checkpoints.

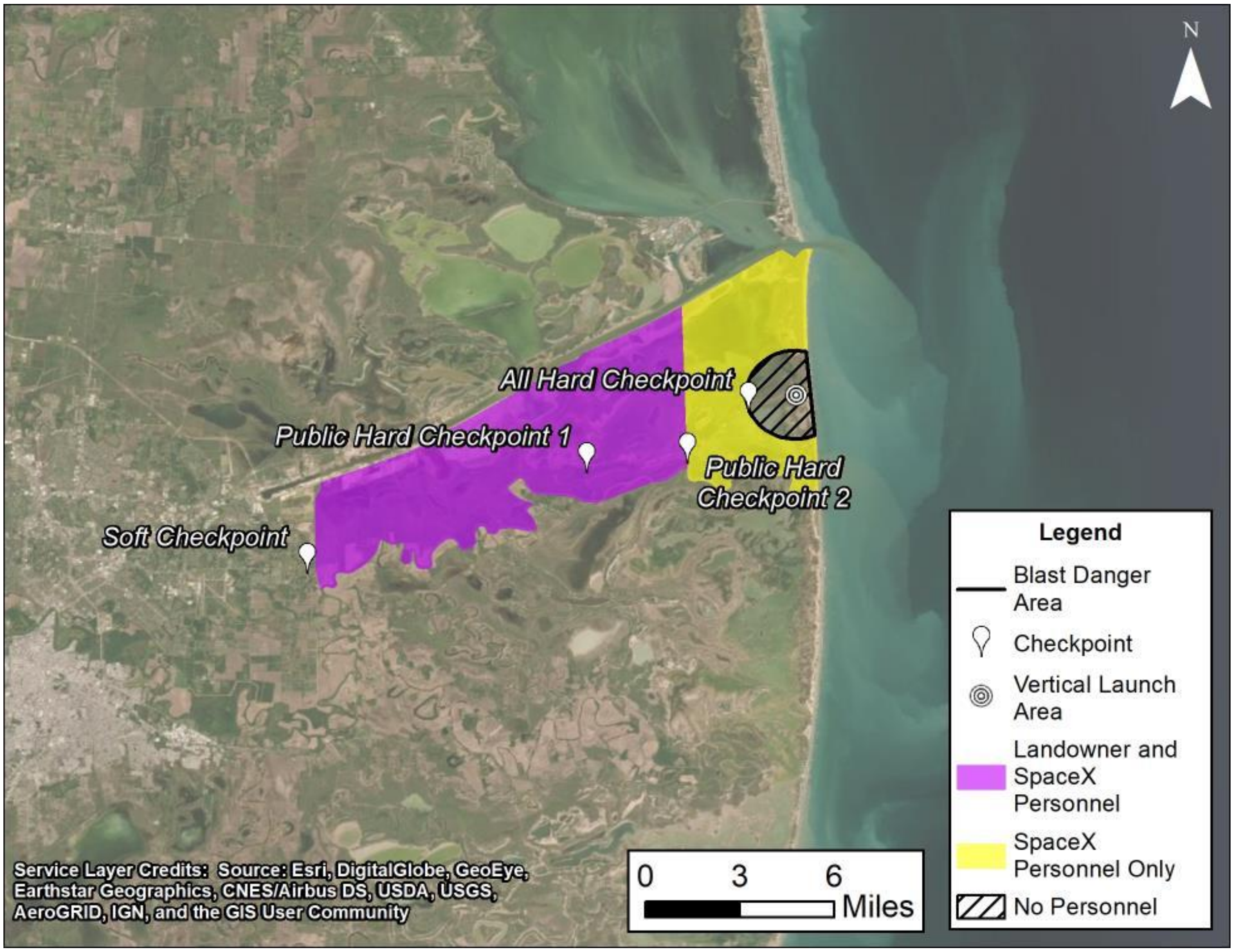
A soft checkpoint would be located at the intersection of Oklahoma Avenue and SH 4, just east of Brownsville. Government personnel, SpaceX personnel, and anyone with property beyond this soft checkpoint could pass, but the general public would be denied access. The second checkpoint (referred to as "public hard checkpoint 1") would be located at the intersection of Massey Way and SH 4. Only SpaceX personnel, government personnel, emergency personnel involved in SpaceX operations, and anyone with property beyond this checkpoint would be able to pass this checkpoint. The third checkpoint (referred to as "public hard checkpoint 2") would be located at the intersection of SH 4 and Richardson Avenue. Only SpaceX personnel and FAA launch support personnel would be able to pass this checkpoint. The final checkpoint (referred to as "all hard checkpoint") would be located just west of the LLCC. No one would be able to pass this checkpoint (Figure 2-4).

The 2013 Memorandum of Agreement between TGLO and Cameron County provides Cameron County with the authority to protect public safety and ensure that landowners and residents are absent from their property in the Safety Zone determined by the FAA flight safety analysis.

A closure for pre-launch operations, including tank tests, wet dress rehearsal, or static fire engine tests would be shorter than a closure for a launch (suborbital or orbital). Based on the closure definition above, the FAA has learned from SpaceX that SpaceX estimates the total number of closure hours for tank tests, wet dress rehearsals, static fire engine tests, and launches to be 500 hours per year for nominal operations. The FAA's environmental review assumes SpaceX would not exceed 500 hours of closure per year. As of May 24, 2013, House Bill 2623 was signed by Texas Governor Rick Perry to amend the Texas Natural Resources Code Chapter 61 (Sec. 61.132) to allow for the TGLO and/or the Cameron County Commissioners Court to temporarily restrict access to public beaches for space flight activities, including launches. Per House Bill 2623, if the primary launch date falls on the major summer holidays of Memorial Day, Fourth of July, Labor Day, and/or summer weekends between Memorial Day and Labor Day weekends, additional approval from the TGLO is required. Additional environmental review will be required should the FAA learn from Cameron County that it will close its roads and beach access in excess of 500 hours.

[4]Flight hazard area means any region of land, sea, or air that must be surveyed, controlled, or evacuated to ensure compliance with the safety criteria in 14 CFR § 450.101.

Figure 2-4. Closure Area



Waterway Hazard Warnings

All launch and reentry operations would comply with necessary notification requirements, including issuance of NOTMARs, as defined in agreements required for a launch 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 close shipping lanes; rather, the NOTMAR provides a notification regarding a temporary hazard within a defined area to ensure public safety during the proposed operations.

To comply with FAA's licensing requirements, SpaceX may enter into a Letter of Intent (LOI) with appropriate USCG Districts in order to safely operate the Starship/Super Heavy launch vehicle over open ocean. The LOI would describe the required responsibilities and procedures for both SpaceX and USCG during a launch, which can include a landing, or reentry operation resulting in the issuance of a NOTMAR.

The USCG publishes NOTMARs weekly and as needed, informing the maritime community of temporary changes in conditions or hazards in navigable waterways. Notices in international areas are published by the National Geospatial Intelligence Agency. Advance notice via NOTMAR and the identification of SHAs would assist mariners in scheduling around any temporary disruption of shipping activities in the area of operation. The Proposed Action would not require shipping lanes to be altered or closed. Launches and reentries would be infrequent, of short duration, and scheduled in advance to minimize interruption to ship traffic.

Airspace Closures

All launch and reentry operations would comply with the necessary notification requirements, including issuance of NOTAMs, as defined in agreements required for a launch license to be issued by the FAA. A NOTAM provides notice of unanticipated or temporary closures to components of, or hazards in, the National Airspace System (FAA Order 7930.2S, Notices to Airmen [NOTAM]). The FAA issues a NOTAM at least 72 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 (AHAs) would assist pilots in scheduling around any temporary disruption of flight activities in the area of operation. Launches and reentries would be infrequent, of short duration, and scheduled in advance to minimize interruption to air traffic.

To comply with the FAA's licensing requirements, SpaceX has entered into a Letter of Agreement (LOA) with the Houston ARTCC, Miami ARTCC, Corpus Christi TRACON, ATO Space Operations, Merida ACC, Monterrey ACC, and SENEAM to accommodate the flight parameters of Starship and Super Heavy. 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. The Proposed Action would not require the FAA to alter the dimensions (shape and altitude) of the airspace. However, temporary closures of existing airspace may be necessary to ensure public safety during the proposed operations.

The FAA conducts 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 3–5 days prior to launch or reentry. 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. Prior analyses have concluded that most commercial space launch operations result in minor or minimal impacts on commercial and private users of airspace. This is largely due to the FAA's ability to manage the airspace for all users.

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 define the temporarily closed airspace that would be defined and published through a NOTAM prior to the launch/reentry. FAA Air Traffic Organization Space Operations Office uses the Aircraft Hazard Area information to produce an Airspace Management Plan, which describes the launch/reentry information and any associated impacts to the National Airspace System.

Airspace controlled by the FAA may be restricted through the activation of airspace closures. The most common type of airspace closures are Temporary Flight Restrictions (TFRs) and altitude reservations (ALTRVs). The FAA generally uses TFRs to protect airspace over land up to 12 nautical miles offshore and ALTRVs to protect oceanic airspace beyond 12 nautical miles offshore. 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. The length of the window is primarily intended to account for the time needed for the operator to meet its mission objectives. The location and size of the closure area is defined to protect the public. For a launch or reentry, typically the keep-out must begin at the time of launch and ends when the mission has been completed, terminated, or cancelled.[5]

Airspace closures are immediately released once the mission has successfully cleared the area and no longer imposes a risk to the public. The actual duration of airspace closure is normally much less than the original planned closure, especially if the launch or reentry window is relatively long and the launch or reentry occurs at the beginning of the window. The FAA typically begins to clear airspace and reroute aircraft in advance of a launch or reentry and directs aircraft back into the released airspace after the mission to recover to normal flow and volume.

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 bigger to account for the increased likelihood of a vehicle failure, relative to a mature rocket. Subsequent launches of that launch vehicle will include smaller hazard areas compared to the initial launch. The airspace closures for SpaceX's ground testing (tank tests and static fire engine tests) would be localized to an area near the pad and may extend up to approximately 13,000 feet in altitude. The size of airspace closures for Starship suborbital flights are expected to be smaller than an orbital launch.

2.1.3.6 Personnel Levels

Launch operations related to the Starship/Super Heavy launch program would result in an increase of permanent and temporary personnel. SpaceX expects a maximum of 450 full-time employees or contractors would be onsite at any given time, 24 hours a day, 7 days a week, to support the Starship/Super Heavy launch program.

To minimize potential impacts to wildlife from vehicles and reduce the number of vehicles traveling along SH 4, SpaceX provides a shuttle from Brownsville to the launch site for employees. The SpaceX employee shuttle operates multiple morning and evening trips between Peninsula Commons and Stargate. Four shuttle runs are conducted in the morning between 5 AM and 10 AM, and 5 shuttle runs are conducted in the evening between 5 PM and 11 PM.

2.1.3.7 Anomalies

A Starship/Super Heavy test operation or launch could fail (referred to as an anomaly). An anomaly on the launch pad represents the greatest risk to the environment. If this occurs, a number of possible outcomes could result, the most likely being a fire on the launch pad. An explosion on the launch pad

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[5] Orbital Starship/Super Heavy launches may have separate closures (in both location and time of occurrence) for the launch and landing/reentry elements of the mission. Airspace closures typically occur either 30 minutes prior to de-orbit burn or at the start of de-orbit burn for reentries. For the first launch, the closure would be initiated at the time of the launch.

would spread debris. As part of evaluating a license or permit application, 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, the FAA expects the debris would be contained within the FAA-approved hazard area, which would be contained within the "all hard checkpoint" area shown in Figure 2-4 (black dashed area represented as "no personnel").

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 SpaceX Anomaly Response Plan. SpaceX would contact Cameron County Emergency Management and Brownsville Fire Department. The USCG would be contacted to report any impact to safety of waterways. SpaceX would also coordinate with the Cameron County judge, the Cameron County Commissioner, and the Cameron County Fire Marshal to provide information on the anomaly. SpaceX would adhere to its Fire Mitigation and Response Plan to prevent and respond to any fires.

SpaceX has established a communication process with TPWD, TGLO, and USFWS through an agreed upon point of contact for coordination of access to agency land, debris removal from agency land, and the status of closures to ensure safety following an anomaly. Should an anomaly that impacts agency land occur, SpaceX would adhere to the post-response site restoration and impact mitigation protocols identified in the September 2021 Memorandum of Agreement (MOA) between TPWD and SpaceX.

Immediately following an anomaly, it may be required to continue to restrict public access in the vicinity of the VLA to address any impacts and ensure public safety. SpaceX would request an extension of the closure from Cameron County. The closure would be released when the area is deemed safe for the public by SpaceX and Cameron County. This determination by SpaceX and Cameron County would be made with input provided by public land-managing agencies (i.e., TPWD, TGLO, and/or USFWS).

SpaceX estimates up to 300 anomaly-response hours would be needed for addressing impacts specifically from anomalies. These hours would not count towards the nominal operational closure hours and would be used, as needed, to address debris removal on public land. The hour count for nominal operations would stop when the launch operation is complete and the area is deemed safe for SpaceX or emergency personnel to enter. The anomaly-response hour count would start at that point to address debris removal and last until the area is deemed safe for the public and the closure is released.

The closure area for an anomaly would be smaller than the closure area established for the launch (Figure 2-4). After securing the area, SpaceX would inform local law enforcement that they can open SH 4 up to the "all hard checkpoint." The area within the "all hard checkpoint" (Figure 2-4) would remain closed until SpaceX, in collaboration with Cameron County, determines the area is safe to open.

If SpaceX suspects debris falls on foreign land, SpaceX will contact the U.S. Department of State. The State Department would lead any international coordination, and SpaceX would provide assistance upon request.

During a suborbital or orbital launch, the launch vehicle would be equipped with either a thrust termination or a destructive flight termination system, or both. In the event the vehicle varied from the planned trajectory, the applicable system would be initiated and the vehicle would break up.

2.1.4 Construction

SpaceX is proposing additional construction, including expanding the solar farm near the LLCC, adding infrastructure and facilities at the VLA, parking lots, a liquid natural gas pretreatment system, a liquefier, a payload processing facility, and trenching and pull-offs along SH 4. Construction activities are anticipated to occur intermittently over a period of 2 years. At the VLA, SpaceX is proposing to construct a redundant launch pad and commodities, a redundant landing pad, two integration towers, tank structural test stands, additional support buildings, and a power plant. Under the Proposed Action, the VLA would be expanded by 23.2 acres to a total of approximately 40 acres of land developed within the parcel.

The FAA has informed SpaceX that any actions SpaceX takes to construct integration towers at the launch site, or any other action in furtherance of the Starship/Super Heavy launch vehicle program, will not prejudice any FAA environmental or licensing decisions. This means that the FAA does not have the authority to prevent an applicant from constructing infrastructure on private property, but its presence will not impact the FAA's environmental or licensing decisions. The FAA's environmental review assumes the integration towers do not exist at the launch site.

This new infrastructure and facilities would result in expansion of the VLA footprint to SpaceX's property boundary, excluding the dune buffer zone, which is 1,000 feet from the mean high tide line. Since publishing the 2014 EIS (FAA 2014) and associated documents, SpaceX has surveyed the property boundary of the VLA. The updated parcel boundary is shown in Figure 2-5. Figure 2-6 shows the proposed VLA layout, including existing and proposed license-related infrastructure. Figure 2-7 shows the overall layout of the SpaceX facilities, including the VLA, the LLCC, and other infrastructure within the scope of the FAA-licensed activities, as well as infrastructure related to non-licensed SpaceX activities in the private production and manufacturing area. The proposed infrastructure and facilities at the launch site are discussed in the following sections.

Figure 2-5. Survey-Verified Vertical Launch Area Parcel

Figure 2-6. Proposed Vertical Launch Area Layout

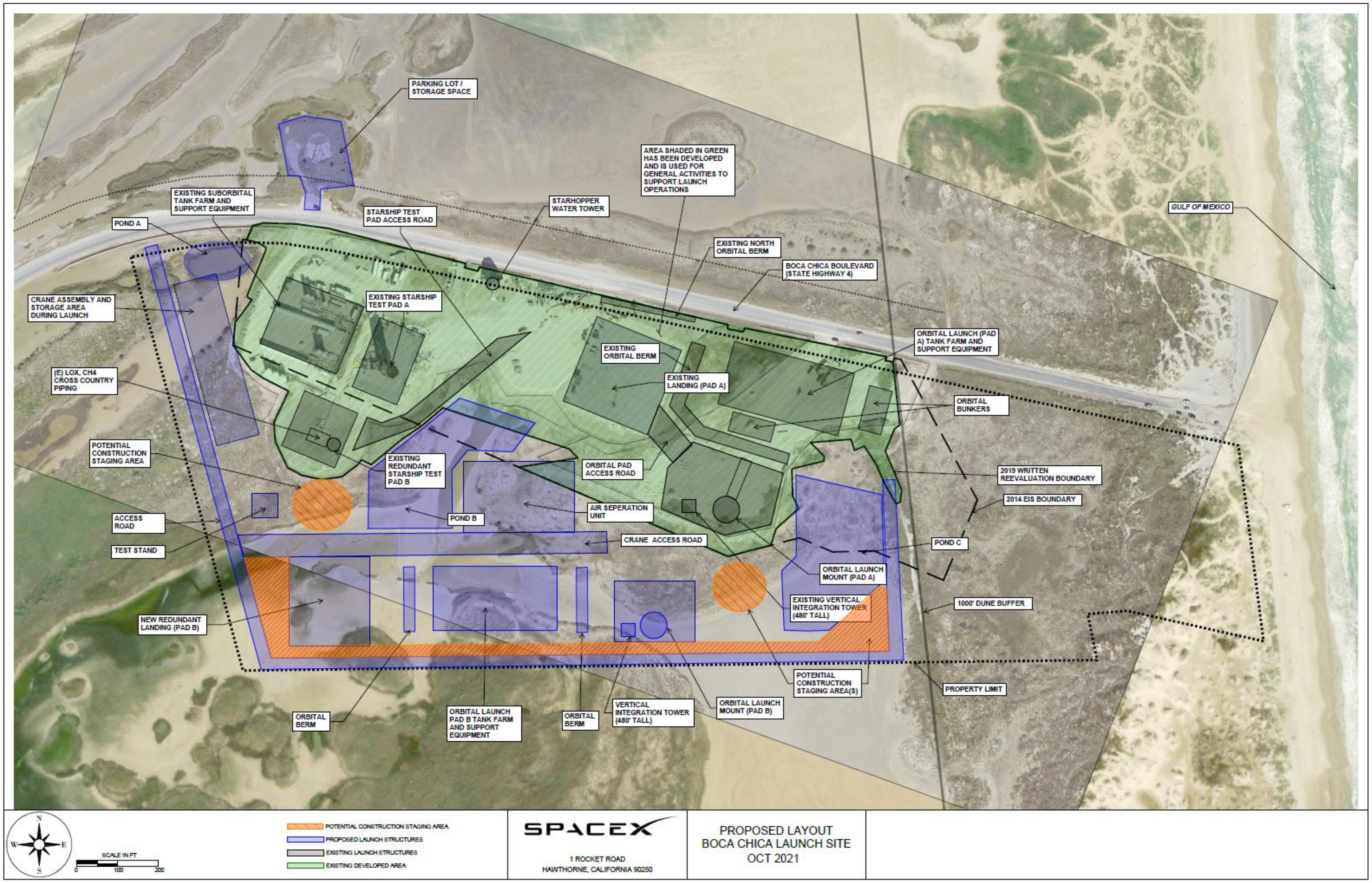
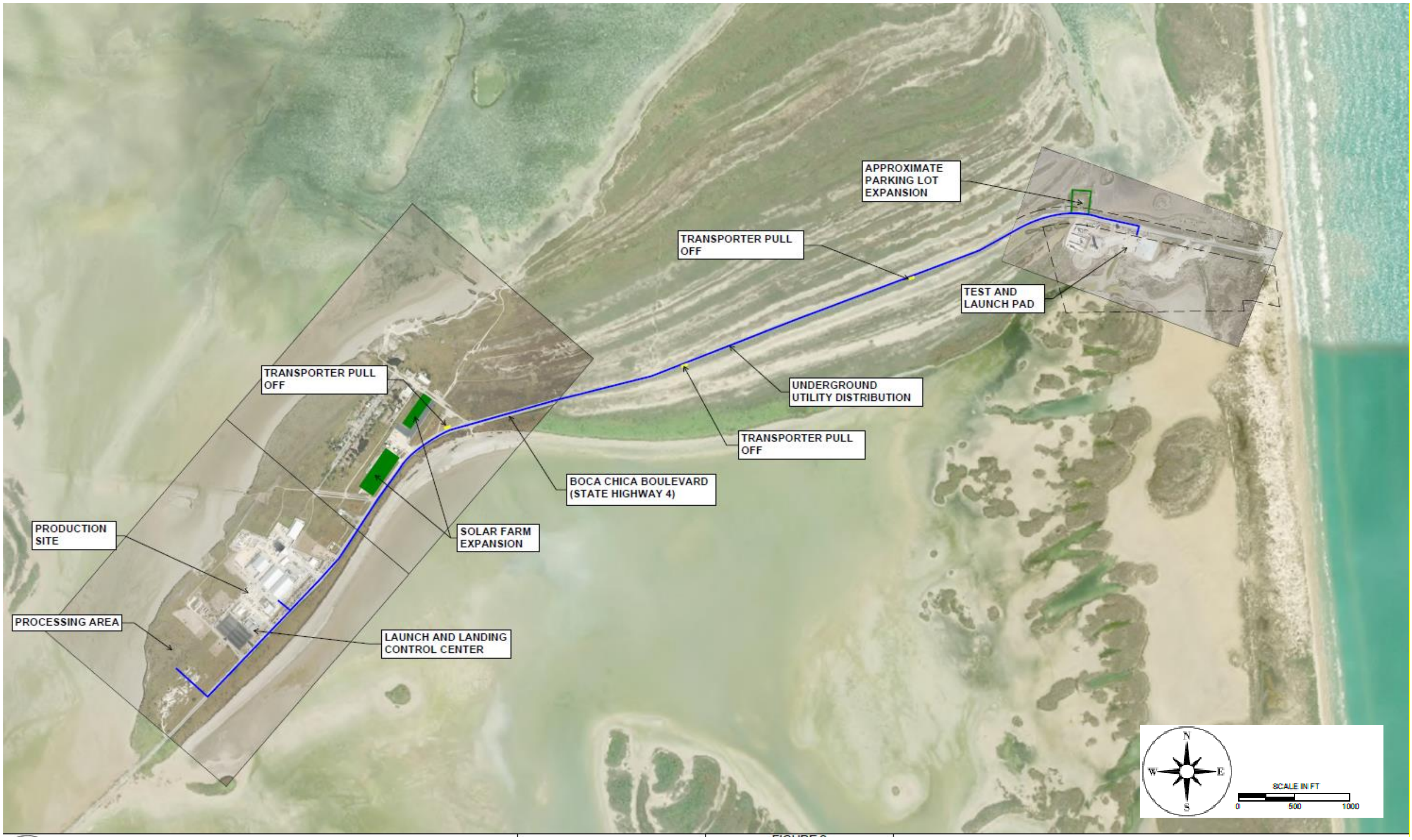


Figure 2-7. Site Overview



2.1.4.1 Redundant Launch Pad and Commodities

SpaceX is proposing to construct a redundant launch pad (denoted as "Launch Mount ('Pad B')" in Figure 2-6) adjacent to the existing launch pad (denoted as "Launch Mount ('Pad A')" in Figure 2-6). Pad B would be approximately 65 feet high with a similar footprint and layout as Pad A. SpaceX would expand the existing commodity farm. SpaceX is proposing to install approximately 11 commodity tanks, each approximately 100 feet tall, near Pad A and proposed Pad B. The tanks would hold LOX, LN_2, water, helium, gaseous nitrogen, gaseous methane, and LCH_4.

2.1.4.2 Redundant Landing Pad

SpaceX is proposing to add a second landing pad in the southwest corner of the VLA. The pad would have similar dimensions as the existing landing pad (approximately 226 feet long by 226 feet wide). The redundant landing pad would be used when another launch vehicle is occupying the other landing pad or if the other landing pad is damaged by an anomaly.

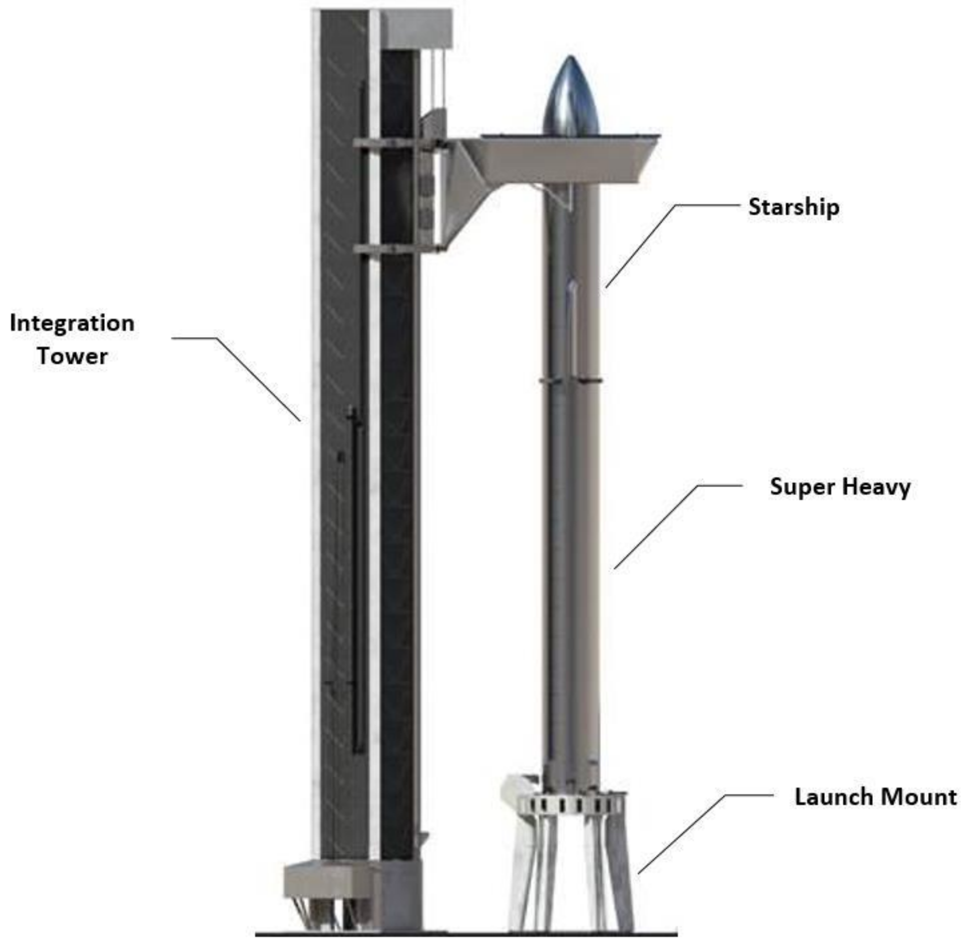
2.1.4.3 Integration Towers

SpaceX is proposing to construct two permanent integration towers to integrate the Starship/Super Heavy launch vehicle. Each tower would be approximately 480 feet tall with a 10-foot lightning rod on top and include black cladding. SpaceX would construct one integration tower adjacent to Pad A and another adjacent to proposed Pad B. The launch vehicle would be integrated vertically on the launch pad. Super Heavy would be mated to the launch mount, followed by Starship mated to Super Heavy. Figure 2-8 shows an integration tower and Starship/Super Heavy on a launch mount. Until the integration towers are constructed and operational, SpaceX would use a 450-foot-tall crane to integrate Starship/Super Heavy. SpaceX would store the crane in the northwest section of the VLA (Figure 2-6) when not in use. The crane would stay up most of the time and would be lowered to approximately 250 feet during launches. Following construction of the integration towers, the crane would remain at the VLA and would be used to move large articles, such as vehicles and tanks.

2.1.4.4 Tank Structural Test Stands

SpaceX currently performs structural tank tests, which includes pneumatic, hydrostatic, and cryogenic testing (Section 2.1.3.1), at the VLA on a concrete pad with temporary infrastructure. SpaceX is proposing to add infrastructure to the existing tank structural test stand and construct another structural test stand. The footprints for the tank structural test stands would be approximately 60 feet long by 60 feet wide and would be 10–20 feet tall.

Figure 2-8. Launch Mount, Launch Vehicle, and Integration Tower



2.1.4.5 Support Buildings and Parking Lots

SpaceX is proposing to construct additional support buildings at the VLA. The buildings would be below 30 feet in height. SpaceX is also proposing to construct parking lots for personnel working at the launch site. The parking lots would be built in combination with existing parking areas to accommodate the staff supporting tests and launches. One of the proposed parking lots, which has been cleared and graded, would be located across from the VLA along SH 4 on SpaceX-owned land that was not previously assessed in the 2013 BA (FAA 2013). Parking lot construction materials could include permeable material, asphalt, road base, or concrete.

2.1.4.6 Power Plant

SpaceX is proposing to construct a power plant to generate power for activities at all SpaceX facilities, including the VLA. The power plant would be located at the VLA (Figure 2-6) or at SpaceX's processing area (Figure 2-7). SpaceX has not determined the exact location, but it would not be outside the footprint analyzed in this document. The power plant would be approximately 5.4 acres in size. Power for the power plant would be generated using a large natural gas turbine and a steam turbine running in a combined cycle, and a small natural gas turbine and a steam turbine running in a combined cycle. The power plant would be comprised of multiple structures, including air intake, compressors, expanders, reflux tanks, surge tank, cold box, and cooling tower. Some of these structures would be less than 30 feet tall; however, some structures would be up to 150 feet tall. The power plant would operate 24/7, and lighting would be minimal at the facility. All lighting plans would be coordinated with the USFWS, TPWD, THC, and NPS and included in the Facility Design and Lighting Management Plan.

2.1.4.7 Trenching

As previously described in the 2013 BA (FAA 2013), installation of conduit for underground utilities would require trenching along SH 4. Proposed utilities include water and communication lines. SpaceX would coordinate any modifications to SH 4 with TxDOT and USFWS as needed.

2.1.4.8 Payload Processing Facility

SpaceX is proposing to construct a payload processing facility at SpaceX's manufacturing and production area (Figure 2-7). In 2013, SpaceX proposed constructing two payload processing facilities, each up to 14,670 square feet in size and 65–85 feet tall. SpaceX is now proposing to construct one payload processing facility up to 22,000 square feet in size and up to 240 feet tall. SpaceX has not determined the exact location of the facility within the manufacturing and production area.

2.1.4.9 Natural Gas Pretreatment System

SpaceX is proposing to construct a natural gas pretreatment system at the processing area (Figure 2-7) or at the VLA (Figure 2-6). SpaceX would process natural gas brought to the site for use as propellant and for power generation. The natural gas pretreatment system would remove impurities such as water, carbon dioxide (CO_2), and hydrocarbons heavier than methane from the extracted natural gas to create a stream of pure gaseous methane. Following pretreatment, methane would be liquefied for transportation. The natural gas pretreatment system would include a main de-ethanizer that would be approximately 200 feet tall and 16 feet in diameter and include smaller cylinders approximately 6 feet tall.

2.1.4.10 Liquefier

SpaceX is proposing to construct a liquefier in tandem with two heat exchangers at the processing area (Figure 2-7) or at the VLA (Figure 2-6). The heat exchangers would use cryogenic liquid nitrogen produced by the liquefier from compression and expansion of nitrogen to supercool gasses into liquid states for storage and transportation. One heat exchanger would be used for methane and the other for oxygen. Each liquefier would be approximately 12,300 square feet in size, with multiple structures including the two heat exchangers up to 26 feet tall.

2.1.4.11 Expanded Solar Farm

SpaceX is proposing to expand the solar farm to a total of 7 acres. Figure 2-9 shows the proposed layout of the solar farm, which includes the previously approved area and the proposed expansion area. The 5.4-acre area in green in the figure was assessed in the 2013 BA (FAA 2013) and subsequent Written Re-evaluations. SpaceX has constructed approximately 2 acres of solar farm (shown in white in the figure). SpaceX is proposing to expand the solar farm by approximately 1.7 acres into land not previously assessed (shown in blue in the figure). The solar farm consists of solar arrays and batteries for power storage. In conformity with the existing solar arrays, the new solar arrays would be about 6.5 feet tall and composed of non-highly reflective materials. Any new batteries would be housed in small structures, approximately 13 feet tall and 970 square feet in size.

Figure 2-9. Proposed Solar Farm Layout

2.1.4.12 Pull-offs along State Highway 4

SpaceX would transport Starship or Super Heavy from the SpaceX manufacturing and production area to the VLA along SH 4. Due to the large size of the vehicles and transporter, SpaceX, in coordination with local law enforcement, must stop traffic to allow for the passage of the transporter. SpaceX proposes to add three pull-offs along SH 4 to allow traffic to pull onto a widened shoulder so the transporter can pass. The proposed locations of the three pull-offs are shown in Figure 2-7. The pull-offs would be approximately 75 feet long by 30 feet wide and would be within the SH 4 right-of-way. The transporter moves at 2 miles per hour. The proposed locations of the three pull-offs would create a maximum wait time of about 20 minutes for drivers instead of necessitating a closure of SH 4 in both directions. SpaceX would coordinate construction of the pull-offs with TxDOT and Cameron County.

2.2 Proposed Conservation Measures to Avoid, Minimize, and Mitigate Potential Effects to Listed Species and Critical Habitat

The following sections describe conservation measures that the FAA would ensure SpaceX would implement to avoid, minimize, and mitigate potential effects on ESA-listed species and critical habitat. Some of these measures are required by other laws that are applicable to the proposed construction and operations (e.g., Clean Water Act). These conservation measures would be referenced as a term and condition of any FAA license issued to SpaceX.

2.2.1 Construction Measures

1) Prior to entry and exit into unpaved areas of the VLA, SpaceX would ensure heavy equipment traverses over a construction shaker or rumble plates or rock bed located at the VLA to remove any sediment and dirt for purposes of preventing the introduction and spread of non-native plant species. The equipment would be inspected to ensure that hydraulic fittings are tight, hydraulic hoses are in good condition (and replaced if damaged), and there are no petroleum leaks.

2) SpaceX would provide all construction personnel with an environmental worker-education briefing that would include, but not be limited to, the following:

    a. Wildfire prevention measures, including restricting smoking to areas clear of vegetation, ensuring no fires of any kind are ignited, and equipping vehicles with spark arrestors and fire extinguishers.

    b. Information regarding noxious/invasive weeds; the spread of noxious/invasive weeds would be limited by routine inspections of the area and removal of any such species.

    c. Requirements for safe handling and disposal of hazardous wastes.

    d. Proper disposal of all organic and inorganic litter and garbage (including cigarette butts). Such material would be disposed of in covered containers. The construction contractor would dispose all trash and debris off site daily.

    e. Requirements for safe handling and disposal of hazardous wastes.

    f. Employee shuttle use to reduce traffic along SH 4.

3) If proposed construction activities occur during the avian breeding season (February 15 through August 31), SpaceX would ensure construction activities occur in accordance with the Migratory Bird Treaty Act (MBTA) to avoid impacts to nesting migratory birds within the project area. Specifically, a biologist would check the proposed areas of construction activities, including laydown areas, for nests (in shrubs and on the ground) once before the construction phase has begun. If the biologist finds an active nest, construction workers would not directly or indirectly disturb the nest or adjacent areas until the biologist determines the nest is no longer in use.

4) To comply with the MBTA, project design and any above-ground utility upgrades would incorporate raptor protection measures, as applicable. For example, structures would be equipped with devices to discourage nest building and perching (e.g., monopole technology and visual fright devices).

5) SpaceX would educate its personnel on the potential for vehicle collisions with ocelots and jaguarundis and encourage personnel to utilize the employee shuttle and, if a personal or company vehicle must be used, encourage personnel to reduce speeds along SH 4. Vehicles would be restricted to existing paved and unpaved roads, parking areas, and authorized construction sites. Vehicle operators within the VLA would not exceed 25 miles per hour.

2.2.2 Operational Measures

6) SpaceX would educate its personnel on the potential for vehicle collisions with ocelots and jaguarundis and encourage personnel to utilize the employee shuttle and, if a personal or company vehicle must be used, encourage personnel to reduce speeds along SH 4. SpaceX-owned or -operated vehicles would be restricted to existing paved and dirt roads and parking areas. SpaceX vehicle operators would not exceed 25 miles per hour near the VLA.

7) SpaceX would continue to partner with Sea Turtle Inc. to provide sea turtle survey data within the action area to the USFWS annually.

8) In coordination with NWR staff, SpaceX would identify further options that would assist in protecting refuge lands and species habitats from impacts that may occur from public intrusions prior to closures. For example, vehicle barriers, in the form of short, spaced posts, sufficiently close together to prevent a truck or all-terrain vehicle from entering, but wide enough apart to allow for terrestrial animals to pass. This could be done alongside SH 4 or other identified roads where the footprint is already disturbed.

9) SpaceX would coordinate with the USFWS to fund additional resources or projects to enforce the closures required for launch operations.

3 ACTION AREA

The action area is defined in 50 CFR § 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the Proposed Action, the action area is defined by those areas exposed to noise (engine noise and sonic booms) during Starship/Super Heavy launches (which includes landings) and the closure area. These areas represent the largest geographical area for which effects to ESA-listed species and critical habitat could occur.

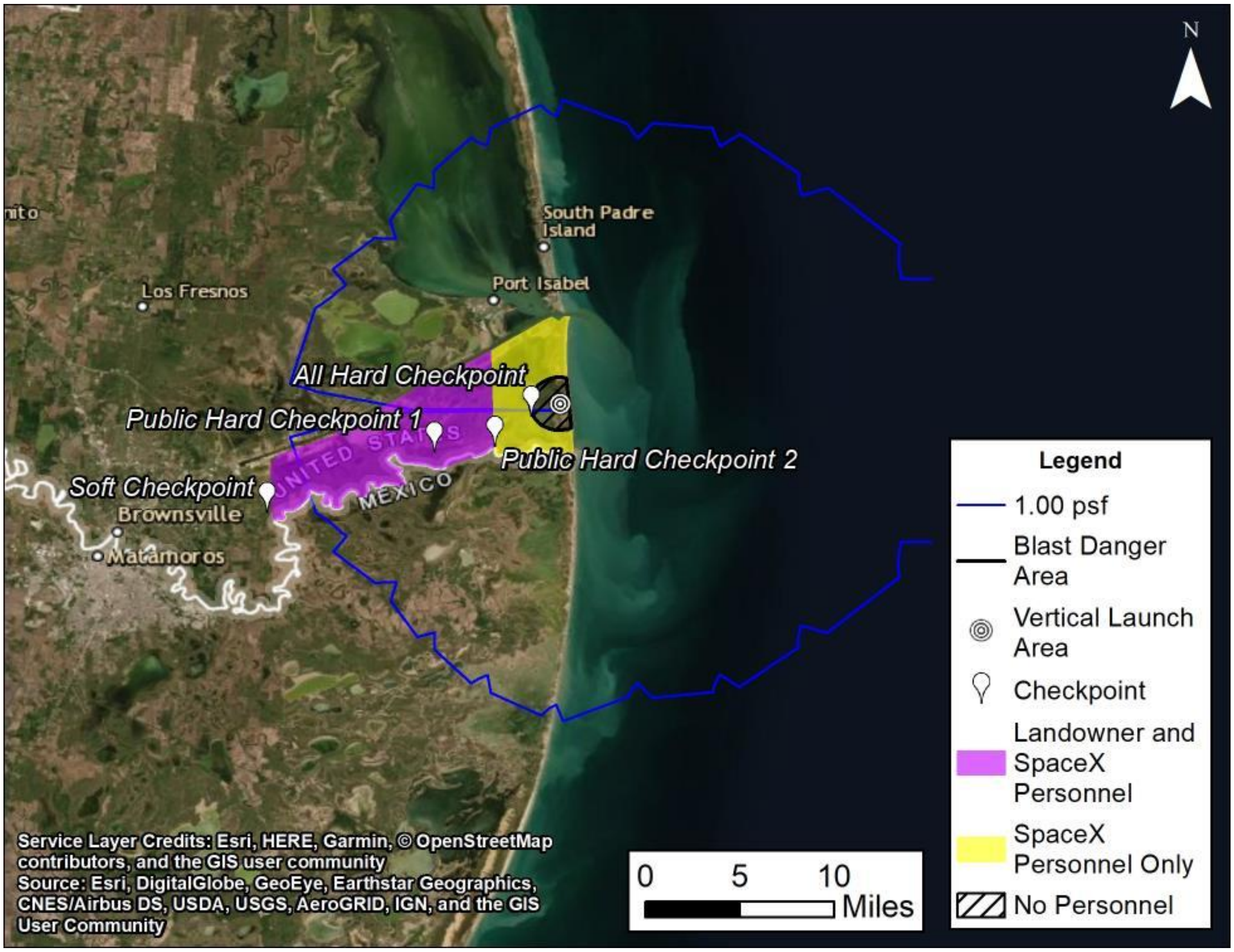
In accordance with the 2013 BA (FAA 2013), the engine noise component of the action area is defined by the 105 decibel (dB) maximum A-weighted sound level (L_{Amax}). Based on noise modeling conducted for the project, the 105 dB L_{Amax} is estimated to extend approximately 5 miles from the launch pad over land.

The sonic boom component of the action area includes those areas exposed to overpressures greater than 1 pound per square foot (psf). An overpressure of 1 psf is like a clap of thunder; overpressures less than 1 psf are not expected to adversely affect animals. Sonic booms would be generated during Super Heavy and Starship landings at the VLA (see Figures 5-2 and 5-3). The sonic boom modeling shows that a Super Heavy landing at the VLA would affect the greatest land area. Modeled overpressures for a Super Heavy booster landing that are greater than 1 psf extend about 13 miles from the launch pad (Figure 5-3). Beyond 13 miles, modeled overpressures are less than 1 psf.

The closure area (Figure 2-4) includes those areas that would be closed to the public during tanks tests, wet dress rehearsals, static fire engine tests, and launches (suborbital and orbital). Most of the closure area is subsumed by the overall action area defined by the engine noise and sonic boom, except for a small area by the soft checkpoint (see Figure 3-1).

Figure 3-1 shows the action area. In summary, the action area is delineated by the closure area and areas that would be exposed to sonic booms with modeled overpressures of at least 1 psf (which includes the area exposed to engine noise levels of 105 dB L_{Amax}).

Figure 3-1. Action Area



The existing conditions in the action area are like the conditions described in the 2013 BA except for the presence of SpaceX's facilities. The launch site is located in a sparsely populated coastal area adjacent to the Gulf of Mexico and ecologically unique public lands owned by TPWD and USFWS Lower Rio Grande Valley NWR. The area is characterized by marsh and barrier island plant communities, shallow open water, algal flats, and unvegetated tidal flats. Uplands consist of low, newly forming sand dunes with their anchoring vegetation amidst bare sand flats. The open water areas are fringed with black mangroves and vegetated with seagrasses. Small, ecologically unique clay hills, known as "lomas," support a diverse group of rare plants and terrestrial wildlife.

The Boca Chica Tract of the Lower Rio Grande Valley NWR comprises one of the last undeveloped, pristine coastal areas in Texas. Roughly measuring about 11,000 acres in size, it encompasses wind-tidal flats, mangrove forests, oyster beds, bays, beaches, dunes, including more than 8,000 acres of highly productive wetlands near the mouth of the Rio Grande (Turner 1988). Over 175 plant species and 344 wildlife species have been documented on/nearby Boca Chica Tract including 184 species of birds, 14 species of mollusks, 23 species of crab and shrimp, 61 species of fish, 40 species of reptiles and amphibians, and 22 species of mammals (Chaney and Pons 1987). The wind-tidal flats of the Boca Chica Tract are also known to be important migration stopover sites for peregrine falcons (*Falco peregrinus*) (Maechtle 1987). Additionally, the Boca Chica Tract supports the highest concentrations of breeding snowy plovers (*Charadrius alexandrines*) and Wilson's plovers (*Charadrius wilsonia*) in the Lower Laguna Madre Region of Texas (Zdravkovic 2005).

The action area also includes developed areas in and around Port Isabel, Laguna Heights, South Padre Island, and along the Brownsville Ship Channel. These developed areas provided limited or no habitat for ESA-listed species.

Changes to existing conditions since 2013 include alterations to the existing natural and physical conditions at the VLA and LLCC. Since completion of the 2013 consultation, SpaceX conducted soil surcharging[6] and pad area development at the VLA. Infrastructure at the VLA includes the launch pad, commodity storage areas, landing pad, launch mount, redundant suborbital test pad, and crane staging area (Figure 3-2). The LLCC consists of the Stargate building, where command and control of operations at the launch pad occurs. The solar farm area has also been developed and currently consists of solar arrays and batteries for power storage. The solar arrays are 6.5 feet (2 m) tall and composed of non-highly-reflective materials.

Figure 3-2. Current Vertical Launch Area Layout

The action area is located within the Lower Rio Grande Valley region. The USFWS currently recognizes 11 biotic communities in this region. The action area is located within the loma/tidal flats biotic community. This community is characterized by wooded islands in tidal flats that are periodically

[6] Soil surcharging is essentially laying soil on top of soil to compact the lower layer of soil to make it more conducive for foundations.

inundated by water from South Bay to the Gulf of Mexico. Lomas are formed from silt or clay particles deposited by wind on tidal flats. Dunes often form around the tidal flats. Typical plants found in loma/tidal flats include sea ox-eye (*Borrichia frutescens*), saltwort (*Batis maritima*), and glasswort (*Salicornia virginica*) on vegetated portions of the flats, and gulf cordgrass (*Spartina spartinae*), Berlandier's fiddlewood (*Citharexlyum berlandieri*), texas ebony (*Pithecellobium ebano*) and yucca (*Yucca treculeana*) on higher lomas (Jahrsdoerfer and Leslie 1988; USFWS 1997).

Vegetation communities in Texas were first mapped in detail in 1984 by McMahan et al. (1994). The action area is located within the Gulf Prairies and Marshes Ecoregion. Prior to European settlement, this ecoregion consisted of a mosaic of tallgrass coastal prairie, riparian bottomland hardwood forests, ephemeral freshwater wetlands, canebrake swamps, extensive coastal forests, chenier woodlands, freshwater tidal wetlands, brush mottes and corridors, barrier islands, estuaries, saltwater marshes, hypersaline lagoons, lomas and associated Tamaulipan Thornscrub habitats (The Nature Conservancy 2002). Within the ecoregion, most of the VLA is located within marsh/barrier islands subtype 3 (smooth cordgrass-marsh saltgrass-sea ox-eye marsh), which is generally dominated by sea ox-eye, black rush (*Juncus roemerianus*), saltwort, black mangrove (*Avicennia germinanus*), glasswort, seashore paspalum (*Paspalum vaginatum*), and shoalgrass (*Halodule beaudettei*). On the eastern area of the Boca Chica Launch Site, from the high tide mark to leeward marshes, is an area of sand dunes that is characterized by marsh/barrier island subtype 4 (Seaoats- seacoast bluestem grassland). This vegetation type is generally dominated by beach croton (*Croton punctatus*), single-spike paspalum (*Paspalum monostachyum*), Pan American balsamscale (*Elionurus tripsacoides*), flat sedge (*Cyperus* spp.), sea purslane (*Sesuvium portulacastrum*), bulrush (*Scirpus* spp.), beach morning-glory (*Ipomoea imperati*), goatfoot morning-glory (*Ipomoea pes-caprae*), sea rocket (*Cakile edentula*), and lime pricklyash (*Zanthoxylum fagara*) (McMahan et al. 1984).

The wetlands at and around the VLA are comprised of scrub shrub and emergent wetlands, both of which are categorized as high marsh areas and unvegetated salt flats. Upland vegetation is typified by pricklypear (*Opuntia engelmannii*), honey mesquite (*Prosopis glandulosa*), little bluestem (*Schizachyrium scoparium*), gush bluestem (*Andropogon glomeratus*), giant reed (*Arundo donax*) (a non-native invasive species), cuman ragweed (*Ambrosia cumanensis*), and golden tickseed (*Coreopsis tinctoria*). Wetland vegetation is primarily comprised of saltgrass (*Distichlis spicata*), shoregrass (*Monanthocloe littoralis*), glasswort, shoreline sea purslane, sea ox-eye, and gulf cordgrass (*Spartina spartinae*) (USACE 2012, 2021). Other species observed during field surveys as part of the 2013 consultation include black mangrove and turtleweed (*Batis maritima*). Vegetation observed in the sand dunes in 2012 included beach croton, sea purslane, and beach morning-glory (USACE 2012). In 2020, vegetation observed in the sand dunes as part of conducting wetland delineations included camphor daisy (*Rayjacksonia phyllocephala*), *Prosopsis reptans,* and saltgrass (USACE 2021). Recent biological surveys (as required by the 2013 BCO) conducted by the University of Texas Rio Grande Valley (UTRGV) found that the most species-diverse areas surrounding the VLA are the transitional salt flats (35 species) and the dunes (23 species); however, the average percent cover of any particular species rarely exceeded 5 percent (UTRGV 2019). Within each vegetation zone, bare area was the dominant ground cover, comprising 98 percent of cover in the mudflats, 82 percent in the transitional zones, and 74 percent in the dunes. Annual biological monitoring as required by the 2013 BCO has revealed that changes in species composition and vegetation coverage between the 2018 and 2019 sampling periods were small, and generally similar in magnitude to the changes observed between 2016 and 2018 (UTRGV 2019). These changes in species cover are well within the normal range of spatial and temporal variability for tidal flats, salt prairies, and coastal dunes in south Texas.

4 ESA-Listed Species and Critical Habitat in the Action Area

According to the USFWS's Information for Planning and Consultation system (USFWS 2021a), there are 14 ESA-listed species and critical habitat for the piping plover occurring in Cameron County, Texas (Table 4-1). The interior least tern (*Sterna antillarum athalassos*) was considered in FAA's 2013 BA but delisted on February 12, 2021 (86 *FR* 2564). The eastern black rail (*Laterallus jamaicensis* ssp. *jamaicensis*), which was not considered in the 2013 BA, was listed as threatened on November 9, 2020 (85 *FR* 63764) and is considered in this BA due to its potential occurrence in Cameron County.

The South Texas ambrosia historically occurred in Cameron, Jim Wells, Kleberg, and Nueces counties in South Texas. South Texas ambrosia occurs in Gulf coastal grasslands and mesquite shrublands in southern Texas on clay loam to sandy loam soils (USFWS 2010b; TPWD 2012a). Grasslands and mesquite shrublands with clay loam to sandy loam soils are not present within the action area. Since this species is no longer found within Cameron County and suitable habitat does not occur within the action area where construction would occur, the FAA has determined the Proposed Action would have *no effect* on the South Texas ambrosia. This species is not discussed further in this BA.

The Texas and Tamaulipan populations of Texas ayenia occur in Texas ebony-anacua/brasil (*Ebenopsis ebano-Ehretia anacua/Condalia hookeri*) forest association and the Texas ebony-snake-eyes (*Phaulothamnus spinescens*) shrubland association. It is found in a wide range of alluvial soil types, from fine sandy loam to heavy clay (USFWS 2010c; TPWD 2012b). These habitat associations or soil types do not occur within the action area where construction would occur. Two populations of the Texas ayenia have been found in Cameron County, Texas. One population was found in Harlingen in 2001 in Wood Municipal Park. The second population was found near the Arroyo Colorado north or Rio Hondo on privately-owned property. In addition, three pilot introduction populations have been established in Lower Rio Grande Valley NWR in Cameron County (USFWS 2010c; TPWD 2012b). Suitable habitat for this species does not occur within the action area where construction would occur. Therefore, the FAA has determined the Proposed Action would have *no effect* on the Texas ayenia. This species is not discussed further in this BA.

For the remaining 12 species in Table 4-1, this section provides updates to the information provided in the FAA's 2013 BA (FAA 2013) (e.g., information from new USFWS 5-year reviews of species) and provides information regarding the presence of the species and critical habitat in the action area. Refer to the 2013 BA (FAA 2013) for a description of each species' physical description, listing history, threats, ecology, and historical distribution.

Table 4-1. ESA-Listed Species and Critical Habitat for Cameron County, Texas

Species	ESA Status	Critical Habitat
Birds		
Eastern black rail (*Laterallus jamaicensis ssp. jamaicensis*)	T	No
Northern aplomado falcon *(Falco femoralis septentrionalis)*	E	No
Piping plover *(Charadrius melodus)*	T	Yes
Red knot *(Calidris canutus rufa)*	T	Proposed
Mammals		
Gulf Coast jaguarundi *(Herpailurus yagouaroundi cacomitli*)	E	No
Ocelot *(Leopardus pardalis)*	E	No
West Indian manatee *(Trichechus manatus)*	T	No
Reptiles[1]		
Green sea turtle *(Chelonia mydas)*	T	No
Hawksbill sea turtle *(Eretmochelys imbricata)*	E	No
Kemp's ridley sea turtle *(Lepidochelys kempii)*	E	No
Leatherback sea turtle *(Dermochelys coriacea)*	E	No
Loggerhead sea turtle *(Caretta caretta)*	T	No
Flowering Plants		
South Texas ambrosia (*Ambrosia cheiranthifolia*)	E	No
Texas ayenia (*Ayenia limitaris*)	E	No

Source: USFWS 2021a
Notes:
E = endangered; T= threatened.
[1] Sea turtles are under joint jurisdiction between the USFWS (nesting stage) and National Marine Fisheries Service (marine stage). This BA only addresses the nesting stage.

4.1 Eastern Black Rail

The eastern black rail (*Laterallus jamaicensis jamaicensis*) is a subspecies of black rail (*Laterallus jamaicensis*), a small, cryptic marsh bird that occurs in salt, brackish, and freshwater wetlands in the eastern United States (east of the Rocky Mountains), Mexico, Central America, and the Caribbean (USFWS 2019). The USFWS listed the eastern black rail as a threatened species on November 9, 2020 (85 *FR* 63764). The USFWS has not designated critical habitat for this species.

4.1.1 Distribution and Abundance

The eastern black rail occupies portions of the eastern United States (east of the Rocky Mountains), Mexico, Central America, and the Caribbean. The northeastern, southeastern, and interior United States differ in the quantity and quality of survey data available for the eastern black rail (USFWS 2019). The south Texas coast has had few reports of eastern black rails (Watts 2016). The current understanding of the species' distribution indicates a "possible" presence of the species in Cameron County (see Figure 2-6 in USFWS 2019). Historical breeding records for Cameron County indicate a "probable" breeding status, but recent records (2011–2016) indicate no eastern black rail breeding in Cameron County (see Figure 2-7 in USFWS 2019). Within the action area, the eastern black rail has been observed in 1995 and 2005 around the South Padre Island Nature and Birding Center (Lockwood et al. 2005). A single black rail was also reported on Kenedy Park Ranch in Kenedy County, about 50 miles north of the action area (Watts 2016). SpaceX's previous biological monitoring in the action area has not recorded an eastern black rail.

4.1.2 Habitat

The eastern black rail is a tropical migrant species that breeds and/or winters in Texas coastal marshes. Although primarily known from coastal areas, the eastern black rail has also been observed, periodically, in inland areas. Relatively little is known of the ecological requirements of the species, but it generally occurs in salt, brackish, and freshwater marshes with dense herbaceous vegetation (or cover). The USFWS has defined dense overhead cover as "the cover that exists in excess of the height of an eastern black rail, and is assessed from above in terms of herbaceous persistent emergent wetland plant cover (as defined by Cowardin et al. 1979, p. 20) versus non-vegetative cover of the ground, including bare ground itself." Eastern black rails typically occupy areas with overhead cover that permits little or no view of bare ground.

On the Gulf Coast, in Texas coastal salt marshes, eastern black rails occupy high elevation zones dominated by gulf cordgrass and salt meadow cordgrass which may be accompanied by shrub species such as eastern baccharis or Jesuit's bark (USFWS 2019). Eastern black rail suitable habitat (i.e., marsh with dense herbaceous vegetation) is not present at or near (within 0.6 miles) the launch site.

4.1.3 Life History

Because eastern black rails are typically hidden from view (inside dense marsh grasses), they are a difficult species to observe. From late winter through spring, males establish and defend territories up to 10 acres in extent (Cornell Lab of Ornithology 2021). Males are known to sign at all times of day or night, depending on their location. Most studies suggest that eastern black rails are monogamous, though little is known about their behavior during courtship. Both parents remain active near the nest, sharing incubation duties, and both typically shepherd the tiny chicks after hatching (Cornell Lab of Ornithology 2021).

Eastern black rails are small birds that make easy prey for marsh hunters like great blue herons, great egrets, northern harriers, and owls. Mammals like raccoons, foxes, and cats presumably also eat eastern black rails or their eggs, as do snakes. The rails are especially vulnerable to predators when flooded out of their preferred habitats (Cornell Lab of Ornithology 2021).

4.1.4 Population Dynamics

Regional populations still exist for this subspecies; however, the best available scientific data suggest that the remaining populations support a relatively small total population size across the contiguous United States. There were an estimated 1,299 individuals on the upper Texas coast within specific protected areas prior to Hurricane Harvey (USFWS 2019). In 2016, there was an estimated 100–500 breeding pairs in Texas; however, the uncertainty of this estimate was considered high (USFWS 2019)

Given that there is not consistent monitoring or survey results for the eastern black rail throughout the Caribbean, Central America, and Brazil, it is likely that the birds still occur throughout this region; however, there is no information to indicate that the bird is present in large numbers (USFWS 2019).

4.1.5 Reasons for Listing/Threats to Survival

The Service has concluded that the eastern black rail is at risk of extinction within the foreseeable future due to continued wetland habitat loss, sea level changes, increasing storm frequency and intensity and increased flood events (which are both associated with high tides and storms), wetland subsidence, and land management practices (e.g., incompatible prescribed fire, grazing, and mechanical treatment activities) (85 *FR* 63797).

4.1.6 Section 4(d) Rule

Under the ESA, the USFWS has broad authority to issue regulations for the conservation of threatened species. The ESA provides a specific list of prohibitions for endangered species under section 9 but does not automatically provide these same prohibitions to threatened species. Section 4(d) of the ESA allows the USFWS to establish prohibitions or exceptions to prohibitions for threatened species.

In its final rule (85 *FR* 63764), the USFWS established a 4(d) rule for the eastern black rail. The primary goals of this 4(d) rule are to minimize incidental take of eastern black rails and ensure that the dense overhead cover that the eastern black rail needs is maintained.

Prohibited Activities

- Purposeful "take" of eastern black rail, to include capture, handling, or other activities.
- Incidental take of an eastern black rail from the following activities: prescribed burns (unless utilizing best management practices); mowing, haying, and other mechanical treatment activities in the bird's habitat during the nesting or brooding periods; grazing activities on public lands that occur in the bird's habitat and do not support the maintenance of dense overhead cover in at least 50% of habitat in any given calendar year within a management boundary; and long-term or permanent damage, fragmentation, or conversion of eastern black rail habitat and the contiguous wetland-upland transition zone to other habitat types (such as open water) that do not support the bird.
- Possession and other acts with unlawfully taken eastern black rails.
- Import or export of eastern black rails.
- Possession of unlawfully taken specimens of eastern black rails or conducting any other acts with unlawfully taken specimens of eastern black rails.
- Engaging in interstate or foreign commerce of eastern black rails in the course of commercial activity.
- Selling eastern black rails or offering eastern black rails for sale.

Activities Excepted from Prohibitions

- Activities expressly permitted by 50 CFR §17.32 (permits issued for scientific purposes, enhancement of propagation or survival, economic hardship, zoological exhibition, educational purposes, incidental taking, or special purposes consistent with the purposes of the ESA).
- "Take" of an eastern black rail during the course of official duties by any employee or agent of the USFWS, National Marine Fisheries Service, or a State conservation agency, operating a conservation program for the bird.

- Incidental take resulting from haying, mowing or other mechanical treatment activities in persistent emergent wetlands during the nesting and brooding periods that is a maintenance requirement to ensure safety and operational needs. This includes maintaining existing infrastructure such as fire-breaks, roads, rights-of-way, levees, dikes, fence lines, airfields, and surface water irrigation infrastructure (e.g., head gates, ditches, canals, water control structures, and culverts).
- Incidental take resulting from haying, mowing or other mechanical treatment activities in persistent emergent wetlands during the nesting and brooding periods and occur from the control of woody encroachment and other invasive plant species in order to restore degraded eastern black rail habitat.
- Incidental take of an eastern black rail resulting from actions taken to control wildfires.
- Incidental take of an eastern black rail resulting from the establishment of new fire-breaks (for example, to protect wildlands or man-made infrastructure) and new fence lines.
- Incidental take of an eastern black rail resulting from prescribed burns, grazing, and mowing or other mechanical treatment activities in existing moist soil management units or prior converted croplands (e.g., impoundments for rice or other cereal grain production).

Of the several prohibited activities identified in the 4(d) rule, the one that is most applicable to the Proposed Action is long-term or permanent damage, fragmentation, or conversion of eastern black rail habitat and the contiguous wetland-upland transition zone to other habitat types (such as open water) that do not support the bird. However, eastern black rail suitable habitat is not located at or near the launch site.

Based on the 4(d) rule, the only aspect of the Proposed Action that would be exempt from the ESA's take prohibitions are actions taken to control a wildfire if SpaceX's launch operations created a wildfire.

4.2 Northern Aplomado Falcon

In 2014, the USFWS released a 5-year review for the northern aplomado falcon (USFWS 2014a). Current causes of decline include the increased presence of the great-horned owl (*Bubo virginianus*) which preys upon the falcons (Hunt et al. 2013), degraded grasslands, and drying climatic conditions on prey populations (Hector 1987; Gulf South Research Corporation and La Tierra Environmental Consulting 2013). Habitat loss and degradation on the breeding and wintering grounds of migratory birds negatively impact important avian prey species for aplomado falcons, such as mourning doves (*Zenaida macroura*) and meadowlarks (*Sturnella* spp.) (DeSante and George 1994; Gulf South Research Corporation and La Tierra Environmental Consulting 2013).

Northern aplomado falcon surveys were conducted on USFWS lands within the action area in the vicinity of the Port of Brownsville from 1993 to 2003. Aplomado falcons were observed foraging and nesting within this area. In 1999, 2001, and 2003, no aplomado falcon nests were observed during these surveys; however, several aplomado falcons were observed. However, in 1996, 1997, 1998, 2000, and 2002, an aplomado falcon nest was observed (Blanton & Associates 2001, 2002, 2003).

Currently, there are 23 artificial nest platforms that have been constructed within this survey area. The two closest platforms are approximately 2.7 miles to the southwest and 4.5 miles to the northwest of the LLCC (USFWS 2012b). No aplomado falcon nests or observations were observed on these nest platforms during the surveys.

In 2010 and 2011, the Peregrine Fund conducted surveys in the Laguna Atascosa NWR in Cameron County and Matagorda Island NWR in Calhoun County, over 99 miles north of the action area. In 2010, the surveyors observed 82 falcons in 32 of 40 known territories (Laguna Atascosa NWR – 18/24; Matagorda Island NWR – 14/16) (Peregrine Fund 2010). In 2011, the surveyors observed 79 falcons occupying 34 of 44 known territories (Laguna Atascosa NWR – 20/26; Matagorda Island NWR – 14/18) (Peregrine Fund 2011).

Hunt et al. (2013) conducted northern aplomado falcon surveys to assess success of Peregrine Fund-released falcons along the mid-coast of Texas. Researchers documented that the Brownsville subpopulation of falcons extends some 34 miles northward from the Mexican border through the Laguna Atascosa NWR and beyond (Jenny et al. 2004; Hunt et al. 2013). The researchers observed territories within a 3 to 7-mile-wide band of prairie and prairie-brushland within 12 miles of the Laguna Madre, with the densest aggregation found within and nearby the action area between Brownsville and Highway 100. From 2008 to 2013, Hunt et al. (2013) found the nesting territory occupancy of the Brownsville subpopulation to be between 14 and 17 adult nesting pairs.

Potential foraging habitat for the northern aplomado falcon exists within the action area. Some perching and nesting sites (trees and yuccas) occur within the vicinity of the LLCC and the VLA.

As part of implementing the terms and conditions of the 2013 BO, UTRGV most recently conducted bird surveys between October 10, 2018 and November 25, 2019 on accessible U.S. soil within 3 miles of the Boca Chica Launch Site. Since surveys began in 2015, no aplomado falcons have been recorded during these surveys (UTRGV 2019).

4.3 Piping Plover

In its most recent 5-year review, the USFWS (2020a) identifies destruction, modification, and loss of habitat as continuing threats to the piping plover coastal migration and wintering range. The migration and wintering ranges show continued loss and degradation of habitat due to shoreline and inlet stabilization efforts (Rice 2016, 2017). Human disturbance represents an increasing threat to plovers (USFWS 2020a). Gibson et al. (2018) found piping plovers using disturbed sites across North Carolina, South Carolina, and Georgia had lower true annual survival rates than those using undisturbed sites. Storm-formed coastal habitats can benefit or adversely affect piping plovers of all life stages (Saunders et al. 2014; Bourque et al. 2015). Saunders et al. (2014) found that adult piping plover survival was negatively correlated with hurricane frequency. Severe cold weather can also lead to reductions in survival, as seen by Gibson et al. (2017) in a group of piping plovers in Georgia that declined by 52 percent during a period of cold weather. Wind farms are becoming an increasing concern in Texas, where they may increase the threats of collision with turbine blades, habitat modification, and presence of avian predators (USFWS 2020a). Additionally, accelerating sea level rise coupled with development of beaches is predicted to increase piping plover's vulnerability to sea level rise and limit their ability to adapt (USFWS 2020a).

In 2009, Coastal Bird Conservation conducted migratory (September 4 through October 9) and wintering (November 17 through December 14) surveys for piping plovers within the Lower Laguna Madre region in South Texas. A portion of the lower Laguna Madre region is within the action area; the remaining area extends north. Surveys were conducted on federal, state, county and private lands and covered all areas designated as critical habitat for wintering piping plovers. The objective was to thoroughly survey all known and potential nonbreeding shorebird habitat within the study area. During the migratory surveys, 801 piping plovers were observed, while 881 were documented during the wintering surveys. This is an increase from 459 plovers observed during a 2006 International Piping Plover Census. During the migratory survey, the surveyors recorded two piping plovers on Boca Chica Beach and five piping plovers on Boca Chica flats. During the wintering surveys, the surveyors did not observe any piping plovers on Boca Chica Beach and observed 11 piping plovers on Boca Chica Flats (Zdravkovic and Durkin 2011).

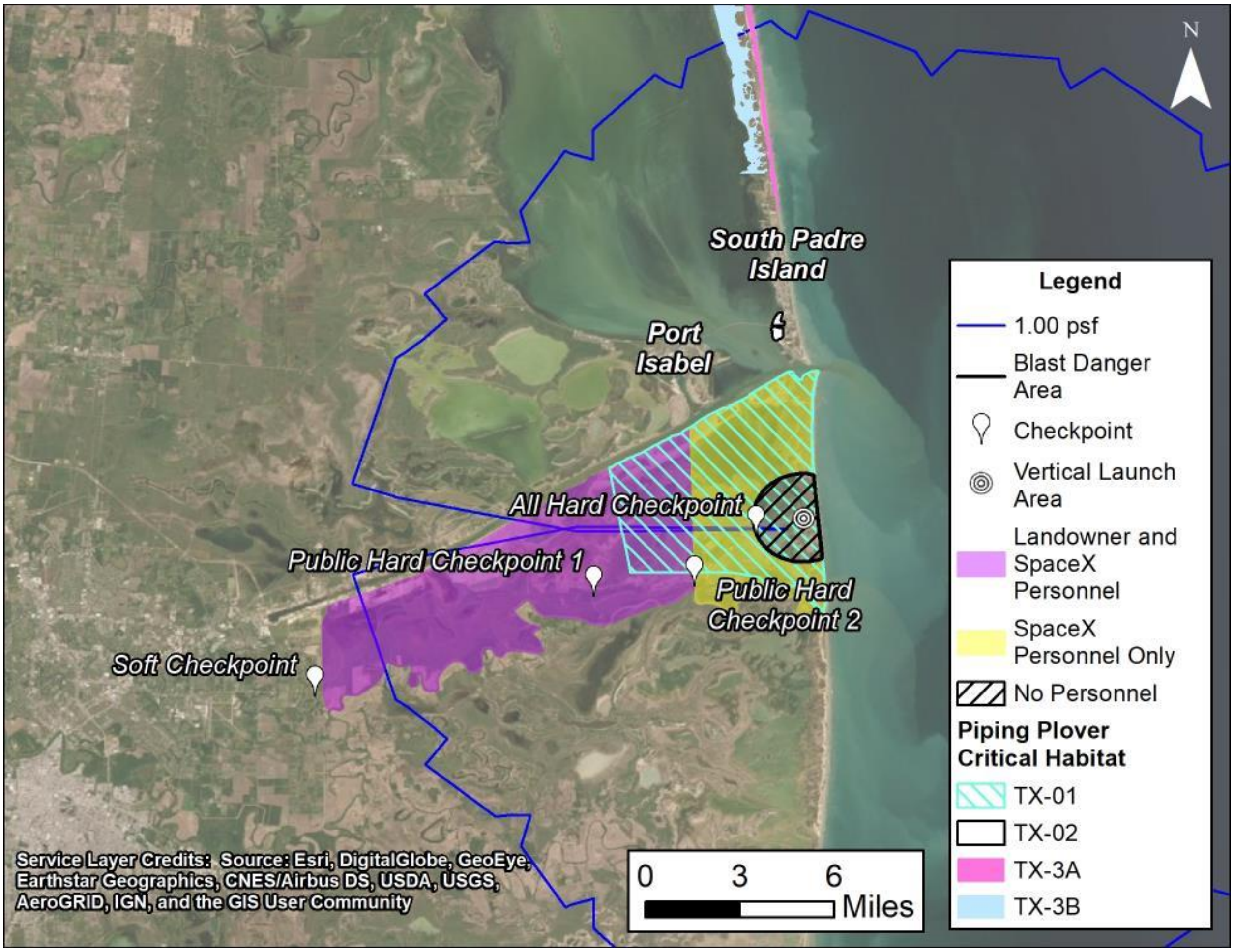
During both the migratory and wintering survey periods, the surveyors observed most of the piping plovers using barrier island/peninsular habitats (85% and 62%, respectively). Piping plovers demonstrated limited use of other coastal habitats; mainland coastal bays (migratory 6%, wintering 3%), mainland beach (migratory and wintering 1%), and river mouth (migratory 3%, wintering 0%). In addition, the 2009 surveys found that piping plovers in the Lower Laguna Madre region preferred habitats with mixed substrate habitat (combination of two or more substrates such as sand, algal, mud, shell, wrack, etc.) (Zdravkovic and Durkin 2011).

Approximately 45 miles north of the action area, Christmas Bird Counts in 2014 documented a newly identified group of 363 plovers in Land Cut in the Laguna Madre (USFWS 2020a).

As part of implementing the terms and conditions of the 2013 BO, UTRGV most recently conducted bird surveys between October 10, 2018 and November 25, 2019 on accessible U.S. soil within 3 miles of the Boca Chica Launch Site. A cursory analysis of uniquely marked piping plovers observed on multiple occasions between 2016 and 2019 showed a tight spatial clustering of foraging sites along the Gulf of Mexico shoreline, indicating considerable site fidelity and territoriality during the non-breeding season (UTRGV 2019).

On July 10, 2001, the USFWS designated 142 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for the wintering population of the piping plover (66 *Federal Register* [*FR*] 36038). In 2009, the USFWS published a final rule revising critical habitat for the wintering population of the piping plover, which divided Unit TX-3 into subunits 3A and 3B (74 *FR* 23476). The action area encompasses all of Critical Habitat Unit TX-1 (South Bay and Boca Chica), TX-2 (Queen Isabella Causeway), and the southern portions of TX-3A (South Padre Island- Gulf of Mexico Shoreline), and TX 3B (South Padre Island- Interior) (Figure 4-1). The SpaceX Boca Chica Launch Site is located within Unit TX-1. The TX-1 unit includes wind tidal flats that are infrequently affected by season winds, and a tidal flats area known as South Bay. It does not include densely vegetated habitat within those boundaries. Portions of Unit TX-1 are owned and managed by the Lower Rio Grande Valley NWR, South Bay Coastal Preserve, Boca Chica State Park, and private citizens (USFWS 2001).

Figure 4-1. Piping Plover Critical Habitat within the Action Area



The primary constituent elements (PCEs) essential for the conservation of wintering piping plovers are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. The PCE are found in geologically dynamic coastal areas that support or have the potential to support intertidal beaches and flats (between annual low tide and annual high tide) and associated dune systems and flats above annual high tide (65 *FR* 41782; 66 *FR* 36038).

Important components of intertidal flats include sand and/or mud flats with no or very sparse emergent vegetation. In some cases, these flats may be covered or partially covered by a mat of blue-green algae. Adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide are also important, especially for roosting piping plovers. Such sites may have debris, detritus (decaying organic matter), or microtopographic relief (less than 20 inches above substrate surface) offering refuge from high winds and cold weather (65 *FR* 41782; 66 *FR* 36038).

Unvegetated salt flats with little to no topographic relief—important PCE—are present within the areas of proposed VLA expansion and at the proposed parking lot across from the VLA. Other areas within the vicinity of the VLA consist of heavily vegetated areas with upland steep dunes to the east paralleling the coast. The areas of high marsh are also heavily vegetated and would not provide PCE for wintering piping plover critical habitat. None of the land near the LLCC contains PCE for wintering piping plover habitat.

4.4 Red Knot

Since completing the 2013 BA, the red knot was listed as threatened on December 11, 2014 (79 *FR* 73705). On July 15, 2021, the USFWS issued a proposed rule to designate critical habitat for this species (86 *FR* 37410). The USFWS is proposing to designate 649,066 acres in 120 units in Massachusetts, New York, New Jersey, Delaware, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas.

The red knot is listed as a threatened species due to loss of both breeding and nonbreeding habitat; likely effects related to disruption of natural predator cycles on the breeding grounds; reduced prey availability throughout the nonbreeding range; and increasing frequency and severity of asynchronies (mismatches) in the timing of the birds' annual migratory cycle relative to favorable food and weather conditions. The USFWS has concluded there is insufficient data to provide a precise range-wide population estimate. However, the western Gulf of Mexico/Central America population is estimated at approximately 6,000 birds, with about 2,000 to 4,000 in Texas and northern Mexico (USFWS 2021c).

Red knots have been recorded within the action area. The Laguna Madre supports wintering red knots (USFWS 2014d). Records indicate the red knot has been observed in the action area prior to 1996 on Boca Chica Beach (Skagen et al. 1999); in Laguna Atascosa NWR (Skagen et al. 1999; USFWS 2010d), portions of which are within the action area; and on nearby Padre Island (Audubon Society 2009; Niles et al. 2009 as cited in USFWS 2011).

Coastal Bird Conservation also conducted migratory and wintering surveys for red knot in 2009. Within the action area, at Boca Chica Beach and Laguna Atascosa NWR, the surveyors did not observe the red knot. The surveyors observed red knots within the action area on South Padre Island and approximately 15 miles north of the action area at Mansfield Channel spoil islands (Zdarvkovic and Durkin 2011).

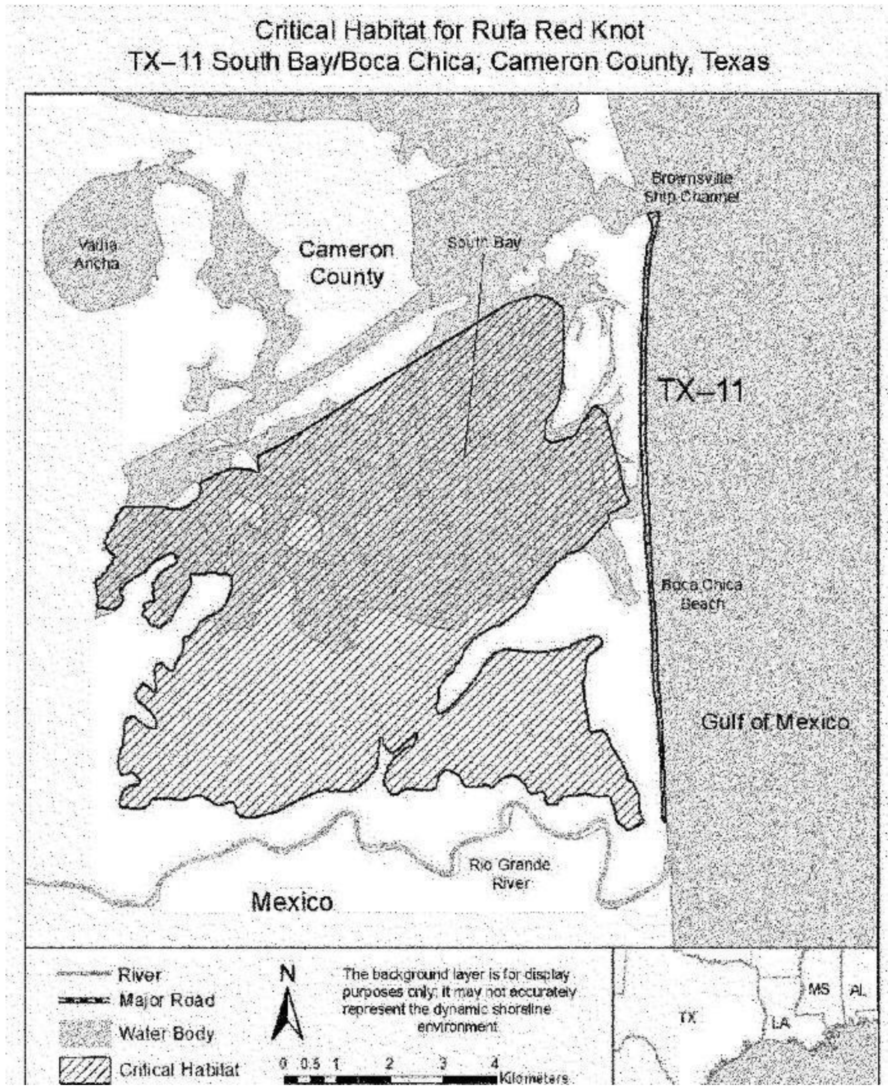
As part of implementing the terms and conditions of the 2013 BO, UTRGV most recently conducted bird surveys between October 10, 2018 and November 25, 2019 on accessible U.S. soil within 3 miles of the Boca Chica Launch Site construction area. The surveyors observed red knots in the survey area; however, their presence was erratic and unpredictable. The surveyors recorded an average group size of 4.66 individuals in each quadrat, with a maximum group size of 15 individuals; however, UTRGV noted that this estimate may underestimate actual numbers of individuals. On one occasion in early May 2019, the UTRGV surveyors observed a large group of red knots (>150 individuals) on the Boca Chica route, but the survey could not be completed due to flooding. UTRGV also found that the species exhibits widespread use of the survey area during the study period and exhibits narrow time windows of occupancy during the year (UTRGV 2019).

The Boca Chica Launch Site is located within proposed critical habitat Unit TX-11 (Figure 4-2). Unit TX-11 unit consists of approximately 15,243 acres in Cameron County, Texas. This entire unit overlaps with designated critical habitat for the piping plover. The Boca Chica gulf shoreline portion of this unit begins south of the Brownsville Ship Channel and extends approximately 6.5 miles to the south.

Within the South Bay, the northern boundary is south of Brownsville Ship Channel dredge spoil placement areas, and the southern boundary is north of the Rio Grande River. The eastern boundary is the bayside of the Boca Chica Beach (Gulf of Mexico) up to where dense vegetation begins, and the western boundary is west of the Loma islands up to where dense vegetation begins along the wind tidal flats.

The unit includes wind tidal flats and all seagrass beds that are infrequently inundated and/or exposed as low tides, and the tidal flats within the area known as South Bay. Specific habitat types within this unit include: estuarine (bayside) seagrass mud or sand flats that are subtidal and are nearly flat areas with rooted vascular plants (seagrass) growing below the water surface in subtidal mud or sand substrate; estuarine (bayside) algal mud or sand flats regularly inundated by tides and are nearly flat areas with a layer of algae growing on a moist mud or sand substrate and are otherwise devoid of vegetation; estuarine (bayside) algal mud or sand flats irregularly inundated by tides; estuarine (bayside) sandy shore (beach/sandbar) rarely exposed due to tidal fluctuation; estuarine (bayside) sandy shore (beach/sandbar) irregularly or regularly inundated by tides, depending upon the location; estuarine (bayside) sandy shore (beach/sandbar), spoils irregularly inundated by tides; and marine sandy coastline (beach) irregularly or regularly inundated by tides, depending upon the location.

Figure 4-2. Proposed Red Knot Critical Habitat Unit TX-11



4.5 GULF COAST JAGUARUNDI

In addition to the threats of habitat loss and predator control, the 2013 Jaguarundi Recovery Plan identified mortality from vehicle collisions, possible competition with bobcats (Sanchez-Cordero et al. 2008), and increases in temperature and decreases in precipitation resulting from climate change as threats to the Gulf Coast jaguarundi (USFWS 2014b). The last known record of a jaguarundi in the United States was a roadkill in 1986 along SH 4, just east of Brownsville. Unconfirmed jaguarundi sightings within the vicinity of the action area include those observed in Lower Rio Grande Valley NWR and Laguna Atascosa NWR (USFWS 2004, USFWS 2014b). The area surrounding the Boca Chica Launch Site has very little shrub cover and therefore does not contain quality habitat for the jaguarundi. However, the action area encompasses large regions of the South Texas Refuges Complex made up of Santa Ana NWR, Laguna Atascosa NWR, and Lower Rio Grande Valley NWR. These NWRs, as well as the habitat between them, represent a wide north-south coastal corridor on the eastern boundary of the Rio Grande delta that supports a matrix of native rangeland wetlands and upland communities that may be suitable for jaguarundi movement (USFWS 2004).

4.6 Ocelot

In addition to threats from habitat loss and vehicle strikes, the 2016 Ocelot Recovery Plan identifies small population sizes in Texas and isolation from conspecifics in Mexico threatens ocelots in Texas with inbreeding (USFWS 2016a; Janečka et al. 2011; Korn 2013). Additionally, issues associated with barriers such as the border fence and border wall on the U.S.-Mexico border and agent patrols of border areas further exacerbate the isolation of Texas and Arizona ocelots from those in Mexico (Lorey 1999; Grigione and Mrykalo 2004; Flesch et al. 2009).

The Laguna Atascosa NWR supports the largest known U.S. population of the ocelot. The Laguna Atascosa NWR is a complex of lands, and portions of the complex occur within the action area. Currently, the USFWS estimates approximately 10–25 ocelots occur on and adjacent to the Laguna Atascosa Unit of the Refuge (USFWS 2010a). There have also been reports of ocelot sightings from the Lower Rio Grande Valley NWR in the past 25 years (USFWS 1997, 2004). In 1998, one ocelot was observed and trapped traveling along SH 4 within the action area, approximately 3.5 miles west (by road) of the LLCC (Blanton & Associates 1998). Areas in the vicinity of the SpaceX Boca Chica Launch Site do not contain quality habitat for the ocelot. However, the action area is located within the center of the South Texas Refuges Complex made up of Santa Ana NWR, Laguna Atascosa NWR, and Lower Rio Grande Valley NWR. These NWRs, as well as the habitat between them, represent a wide north-south coastal corridor on the eastern boundary of the Rio Grande delta that supports a matrix of native rangeland wetlands and upland communities that may be suitable for ocelot movement (USFWS 2004).

4.7 West Indian Manatee

In April of 2017, the USFWS reclassified the West Indian manatee from endangered to threatened (85 *FR* 1668). Of the 69 records of manatees from Texas since 1912, only 11 have been within the action area; nine are from 1912–1919 near the mouth of the Rio Grande (Gunter 1941; Fertl et al. 2005), and a single manatee was seen in 1992 and 1994 in the Lower Laguna Madre near Port Isabel (

Table 4-2). Since that time, there have been no recorded sightings of manatees within the action area.

Table 4-2. West Indian Manatee Occurrences in and near the Action Area

Date	Number of Individuals	Location	Distance from Action Area	Source
1912–1919	~7	Mouth of Rio Grande	Within	Gunter 1941; Fertl et al. 2005
1913/1914	2	2 miles north of mouth of Rio Grande	Within	Fertl et al. 2005
1977	2	Padre Island	28 miles north	Fertl et al. 2005
1992	1	Padre Island	15 miles north	Fertl et al. 2005
1992	1	Port Isabel, Laguna Madre	Within	Fertl et al. 2005
1994	1	Port Isabel, Laguna Madre	Within	Fertl et al. 2005
1995	2	Port Mansfield Pass	24 miles north	Fertl et al. 2005
2004	1	Willacy County Navigation Ramp	22 miles north	Fertl et al. 2005
2005	1	Port Mansfield	28 miles north	Brezosky 2005

Date	Number of Individuals	Location	Distance from Action Area	Source
2006	1	Port Mansfield	28 miles north	USFWS 2012b

4.8 Green Sea Turtle

In Texas, green sea turtles are known to nest on the beaches of North Padre Island (approximately 24 miles north of the action area) and South Padre Island (approximately 11 miles of which are within the action area) (NPS 2012a). In 2019, one green sea turtle false crawl was documented within the action area on Boca Chica Beach; however, no green sea turtles were documented nesting on Boca Chica Beach (Sea Turtle, Inc. 2020). From 2008 to 2012, 25 green sea turtles were documented nesting on either Padre Island National Seashore or South Padre Island (8 in 2012, 6 in 2011, 5 in 2010, 1 in 2009, and 5 in 2008) (Shaver 2009, 2010, 2011, 2012; NPS 2012c, d). From 2013 to 2019, 65 nests were documented in Texas (11 in 2019, 5 in 2018, 29 in 2017, 0 in 2016, 5 in 2015, 0 in 2014, 15 in 2013) (Shaver 2020).

4.9 Hawksbill Sea Turtle

The only hawksbill nest documented on the Texas coast was in 1998 at Padre Island National Seashore, approximately 24 miles north of the action area (NPS 2012b). No hawksbill sea turtles have been recorded nesting in the action area (Sea Turtle, Inc. 2020).

4.10 Kemp's Ridley Sea Turtle

In addition to the threats discussed in the 2013 BA (FAA 2013), oil spills and global warming are expected to adversely impact Kemp's ridley habitat (NMFS and USFWS 2016). Harmful algal blooms known as 'red tide,' as well as strandings, also threaten the species (NMFS and USFWS 2016).

In the United States, Kemp's ridley nesting primarily occurs in Texas, especially at the Padre Island National Seashore, about 24 miles north of the action area (NMFS and USFWS 2015). Within the action area, at Boca Chica Beach, six Kemp's ridley nests were recorded in 2019, 7 in 2018, 23 in 2017, 9 in 2016, 0 in 2015, 2 in 2014, and 3 in 2013 (Shaver 2020). From 2008 to 2012, 38 Kemp's ridley nests were recorded on Boca Chica Beach (10 in 2012, 3 in 2011, 4 in 2010, 9 in 2009, and 12 in 2008) (Shaver 2009, 2010, 2011, 2012; NPS 2012c, d). From 2013 to 2019, 1,410 nests were documented on Texas coasts (Shaver 2020).

4.11 Leatherback Sea Turtle

In addition to the threats discussed in the 2013 BA, impacts from climate change, especially global warming, are likely to become apparent in future years and affect leatherback sea turtle prey distributions and habitat conditions in water and on beaches (NMFS and USFWS 2013). Leatherbacks are also threated by the inadequacy of existing regulatory mechanisms for their protection (NMFS and USFWS 2013).

No leatherback sea turtles have been recorded nesting within the action area. In 2008, the first leatherback nest confirmed on the Texas coast since the 1930s was found on Padre Island National Seashore, approximately 24 miles north of the action area (Shaver 2009).

4.12 LOGGERHEAD SEA TURTLE

One loggerhead sea turtle nest was documented on Boca Chica Beach in 2006 (Sea Turtle, Inc. 2020). From 2008 to 2012, 17 loggerhead sea turtles have nested on the Texas coast – all nesting areas except South Padre Island are more than 25 miles north of the action area (3 in 2008 on Padre Island National Seashore, Mustang Island, and Bolivar Peninsula; 9 in 2010 on Padre Island National Seashore; 0 in 2011; and 5 in 2012 at Quintana Beach, North Padre Island, Padre Island National Seashore, and South Padre Island) (Shaver 2009, 2010, 2011, 2012). From 2013 to 2020, 50 nests were documented in Texas, outside of Boca Chica Beach (8 in 2019, 6 in 2018, 8 in 2017, 6 in 2016, 7 in 2015, 2 in 2014, and 13 in 2013) (Shaver 2020).

5 Analysis of Potential Effects

5.1 Approach to Analysis

This section presents an analysis of potential effects to ESA-listed species and critical habitat from the Proposed Action. Activities that may affect ESA-listed species and critical habitat include launch site-related construction, daily operations, and launch operations (tank tests, wet dress rehearsals, static fire engine tests, suborbital launches, and orbital launches).

Effects of the action are all consequences to listed species or critical habitat that are caused by the Proposed Action, including consequences of other activities that are caused by the Proposed Action (50 CFR § 402.02). Direct effects are the direct or immediate effects of the project on the species or its habitat. Indirect effects are those that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur (e.g., attraction of predators due to development and human presence). All direct and indirect project effects on listed species in this BA have been further classified and evaluated based on their anticipated longevity (i.e., temporary or permanent effects). Effects can also include the consequences of other activities that are caused by the Proposed Action. A consequence is caused by the proposed action if it would not occur but for the Proposed Action and it is reasonably certain to occur (50 CFR 402.17). Under the Proposed Action, there are no other activities that would cause consequences to listed species or critical habitat.

As they relate to the ESA-listed species considered in this BA, direct and indirect effects from proposed activities within the action area have been evaluated herein based upon: (1) an understanding of the methods and equipment that would be used during construction and operations within the Boca Chica Launch Site, (2) knowledge of the potential for such methods and equipment to disturb the natural resources on which the subject species depend, and (3) awareness of the types of effects that have resulted from similar actions in the past.

The FAA identified threats associated with proposed construction and operations based on previous consultations as well as review of various species recovery plans. Eleven threats were identified (see Table 5-1). Section 5.2 provides an overview of each of these threats. Section 5.3 discusses the effects analysis and determinations for the ESA-listed species and critical habitat.

Table 5-1. Potential Effects to ESA-Listed Species and Critical Habitat Based on Stressors/Threats Associated with the Proposed Action

Number	Stressor or Threat	Potential Effect on Species	Species Potentially Effected
1	Visual Presence and Noise from Launches	Disturbance to species from noise depends on the type of noise generated, the proximity to the noise source, duration of the sound, frequency of events, the species, and the history of exposure to noise events by individuals of a species. For instance, vehicular traffic can mask bird calls (such as alarm calls) and inhibit breeding birds to find mates and to defend territories. Sudden noise events can cause birds to abandon nests or roosts which may increase the potential for predation. Noise events associated with construction and operations (including launches) are generally thought to result in short-term behavioral responses which may be considered harassment, but sustained noise events may render habitat unusable.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail • Jaguarundi • Ocelot • All sea turtles
2	Rocket Heat Plume	The heat plume generated from Starship/Super Heavy launches would travel away from the launch pad, with temperatures of 212 ^{0}F approximately 0.3 mile from the launch pad and temperatures reaching ambient temperature (90^{0}F) 0.6 mile from the launch pad. Individual animals caught in the heat plume would likely die or be injured.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail • Jaguarundi • Ocelot • All sea turtles
3	Launch-Related Closures	Launch-related closures during sea turtle nesting season could impact the ability of sea turtle patrol personnel to locate nests and collect eggs for off-site incubation. Launch-related closures could also impact researchers and Refuge staffs' ability to conduct bird and vegetation surveys.	• Piping plover • Red knot • All sea turtles
4	Night Lighting	Lighting on beaches or offshore may disrupt hatchling emergence from sea turtle nests. Hatchlings that crawl toward artificial light sources are following the same instinctive response that leads them seaward. This effect may result in harassment or harm to sea turtle species. Inappropriate lighting may also result in abandonment of nesting and roosting areas by terrestrial birds. Inappropriate lighting would not be expected to result in adverse effects to mammal species.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail • Jaguarundi • Ocelot • All sea turtles
5	Hazardous Materials	During operations, there is the potential for spills of hazardous materials. The likelihood that an ESA-listed species would come into contact of a hazardous material during a spill is low given SpaceX's immediate clean-up response.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail • Jaguarundi • Ocelot • All sea turtles
6	Ground Vibrations	Short-term ground vibrations could occur during construction and launches. There is a potential for ground vibrations to disturb nesting turtles and impact eggs.	• All sea turtles
7	Increased Traffic and Human Presence	An increase in vehicle traffic during daily operations from construction and SpaceX operations personnel could potentially increase the likelihood of wildlife being killed by a collision with a vehicle. In addition, increased traffic and human presence could cause wildlife to avoid the area.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail • Jaguarundi • Ocelot

Number	Stressor or Threat	Potential Effect on Species	Species Potentially Effected
8	Tall Structures	The construction of new structures could pose a potential collision impact to birds.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail
9	Habitat Loss (including Critical Habitat)	Direct loss of habitat reduces a species ability to reproduce, find food, find shelter, and survive.	• Piping plover • Red knot • Eastern black rail
10	Invasive Species Introductions	Construction activities could potentially increase the potential for the introduction of invasive species from equipment or fill material. These introductions can degrade habitats by altering native species composition and structure.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail • Jaguarundi • Ocelot • All sea turtles
11	Anomaly	A launch or test could fail. An anomaly of Starship/Super Heavy on the launch pad represents the most substantial potential for impact. Should this occur, several possible outcomes could result, the most likely being a fire on the launch pad. An explosion on the launch pad would likely spread debris. An anomaly could also cause the launch vehicle to impact the water, intact or via debris.	• Piping plover • Red knot • Aplomado falcon • Eastern black rail • Jaguarundi • Ocelot • All sea turtles
12	Increased Boat Traffic	A potential increase in boat traffic during launch days could increase the potential for seagrass beds to be disturbed from rotor wash and therefore result in a decrease in a food source for the manatee. In addition, the risk to manatees from boat strikes would increase.	• West Indian manatee

5.2 Stressors or Threats Associated with the Proposed Action

5.2.1 Visual Presence and Noise from Launches

The greatest effects to the ESA-listed species from launches would be from the visual effect of the launch vehicle and launch noise. The duration of a noise source can be continuous (constant), transient (short duration), or impulsive (typically less than 1 second). Launch noise is classified as a transient noise event and sonic booms (i.e., shock waves created from supersonic flight when a launch vehicle travels faster than the speed of sound) are classified as impulsive noise events. A transient noise event has a beginning and an end where the sound temporarily rises above the background and then fades back into it. Transient sounds are typically associated with a sound source that moves, such an aircraft overflight (USACHPPM 2005). Impulsive sound is of short duration and high intensity. It has an abrupt onset, rapid decay, and often a rapidly changing spectral composition, and is typically associated with sources such as explosions or the discharge of firearms (USACHPPM 2005).

The L_{Amax} represents the maximum A-weighted sound level measured during an event. A-weighting approximates the natural range and sensitivity of human hearing (USACHPPM 2005). The L_{Amax} is used for the analysis of noise impacts to humans and wildlife.

Studies have shown that wildlife react to visual stimuli (e.g., aircraft overflights) that are below 1,000 feet above ground level (Lamp 1989; Bowles 1995). Vehicle launches and the associated noise can affect wildlife directly. Wildlife responses may include increased movement after a launch, avoiding or leaving areas where a launch occurs, changes in foraging patterns, and arousal of species- specific defensive behaviors (e.g., flight, aggression). Noise from vehicle launches may also have indirect effects on wildlife such as masking. Masking occurs when noise interferes with the perception of a sound of interest. For example, masking may affect predator avoidance and the detection of social signals (Bowles 1995).

The effects of noise and sonic booms from vehicle launches are difficult to assess because several adaptive responses may be involved, making the overt behavioral or physiological changes in response to noise highly variable. These responses include the acoustic startle, the orienting response, other species-typical and individual strategies for coping with novelty, species-typical defensive behaviors, and responses conditioned by previous exposures to noise. The primary concern with rocket launches, and the associated noise, is the startle effect. For example, this occurs when birds are surprised by sudden, unexpected loud noises and leave the nest or perch suddenly. Possible negative impacts from this behavior include 1) the expulsion of eggs or nestlings from the nest as the parent leaves suddenly, 2) increased predation of eggs or young when parents are off the nest, 3) eggs or young may become chilled if the parent is off the nest for an extended period of time and/or 4) cause young, flightless birds to jump out of a nest. Launches could cause a noise-induced startle response at a critical time in the nesting cycle of any bird. Repeated nest failures could eventually trigger desertion of a nesting area. A literature review of studies of aircraft and noise impacts on birds, which included various species of songbirds, upland game birds, waterfowl, seabirds, and raptors, showed that reactions vary boom to boom but birds “occasionally run, fly, or crowd” in response to a sonic boom (Manci et al. 1988). The accompaniment of engine noise with the sonic boom and visual disturbance may temper any impact from the sonic boom because the species would likely already be alert.

The effects of sonic booms on wildlife have been investigated in scientific studies. The following is a summary of some of the more relevant studies addressing potential effects to wildlife from sonic booms. Teer and Truett (1973) tested the effects of sonic booms on quail eggs at 2, 4, and 5.5 psf and found no adverse effects. Heinemann and LeBrocq (1965) exposed chicken eggs to sonics booms at 3–18 psf and found no adverse effects. In a mathematical analysis of the response of avian eggs to sonic boom overpressures, Ting et al. (2002) determined that it would take a sonic boom of 250 psf to crack an egg. Bowles (1995) states that it is physically impossible for a sonic boom to crack an egg because one cannot generate sufficient sound pressure in air to crack eggs.

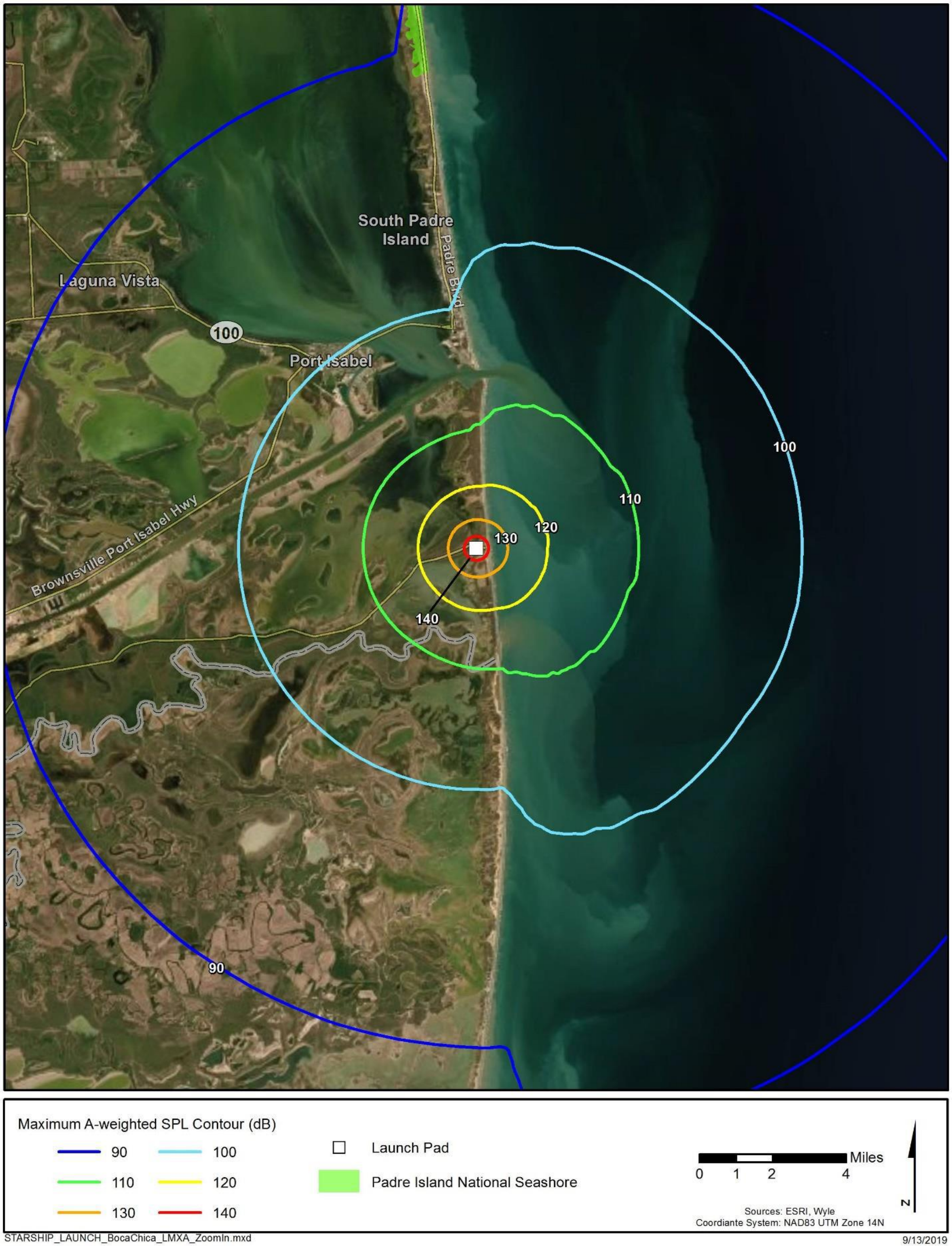
Teer and Truett (1973) examined reproductive success in mourning doves, mockingbirds, northern cardinals, and lark sparrows when exposed to sonic booms of 1 psf or greater and found no adverse effects. Awbrey and Bowles (1990) in a review of the literature on the effects of aircraft noise and sonic booms on raptors found that the available evidence shows very marginal effects on reproductive success. Ellis et al. (1991) examined the effects of sonic booms (actual and stimulated) on nesting raptor species. While some individuals did respond by leaving the nest, the response was temporary and there were no adverse effects on nesting overall. Lynch and Speake (1978) studies the effects of real and simulated sonic booms on the nesting and brooding of eastern wild turkey (*Meleagris gallopavo silvestris*) in Alabama. Hens at four nest sites were subjected to between 8 and 11 combined real and simulated sonic booms. All tests elicited similar responses, including quick head lifting and apparent alertness for between 10 and 20 seconds. No apparent nest failure occurred as a result of the sonic booms.

Cape Canaveral, Florida provides a long history of launches and limited impacts to wildlife. The ESA-listed Florida scrub-jay (*Aphelocoma coerulescens*) was monitored for behavior after Delta, Atlas, and Titan launches with no apparent impacts from noise; these data came from 42 launches at a rate of 16 launches per year (Schmalzer et al. 1998). Monitoring associated with the Space Shuttle program (135 launches over 30 years or 4.5 launches per year) found that there was an initial flight response from birds in the vicinity, but no long-term impacts were observed (NASA 2014). In addition, nesting wood storks (a federally listed wading bird species) were observed flying off active nests in response to launches but would typically return within 4 minutes during the Kennedy Space Center Space Shuttle program.

Most of the effects of noise on wildlife are mild enough that they may never be detectable as changes in population size or population growth against the background of normal variation (Bowles 1995). Many other environmental variables (e.g., predators, weather, changing prey base, ground based human disturbance) may influence reproductive success and confound the ability to tease out the ultimate factor in limiting productivity of a certain nest, area, or region (Smith et al. 1988). In contrast, the effects of other human intrusions near nests, foraging areas, dens, etc. (e.g., hiking, bird watching, boating) are readily detected and substantial (USFS 1992).

On behalf of SpaceX, KBR conducted engine noise modeling to predict the noise levels generated during Starship/Super Heavy launches (KBR 2020; see Attachment 1). The modeled noise levels are shown in Figure 5-1.

Figure 5-1. Starship/Super Heavy Launch from the Boca Chica Launch Site: Maximum A-Weighted Sound Levels



The L_{Amax} 90 dB through 140 dB contours shown in Figure 5-1 represent the maximum levels estimated for a Starship/Super Heavy launch at the Boca Chica Launch Site. The higher L_{Amax} contours (100–140 dB) are located within about 7 miles of the launch pad. The 100-dB contour extends into parts of South Padre Island and Port Isabel. The 90-dB contour extends into Laguna Vista and eastern parts of Brownsville.

In addition to engine noise, a sonic boom would be generated while Starship and Super Heavy are supersonic during their descents, above an altitude of approximately 15 miles and 5 miles, respectively. Suborbital launches of Starship would not result in sonic booms when landing at the VLA, as the vehicle would not reach Mach 1 during descent. Starship suborbital launches with landings downrange in the Gulf of Mexico may create a sonic boom; however, these sonic booms would not impact land. Also, sonic booms generated during ascent would not impact land.

Depending on the distance from the landing pad, the sonic boom may be heard before or within a few seconds following the landing of Starship or Super Heavy. SpaceX used PCBOOM to model the overpressures of Starship and Super Heavy landings. Starship landing is planned to occur at the landing pad at the VLA or downrange in the Gulf of Mexico. Super Heavy would land downrange on a floating platform in the Gulf of Mexico or on the landing pad at the VLA.

The sonic boom modeling predicts that overpressures up to 15 psf for Super Heavy and 2.2 psf for Starship would be generated during landings (see Figure 5-2 and Figure 5-3). Because of the trajectory, most of the sonic boom during a Starship landing would impact the ocean, with areas of South Padre Island experiencing 1 to 2 psf. For Starship landings, the location of maximum overpressure will vary with weather conditions, so it is unlikely that any given location would experience the maximum estimated level more than once over multiple events.

Overpressure levels for a Super Heavy landing at the VLA range from 1 psf to 15 psf (Figure 5-3). Brazos Island State Park, Boca Chica Bay, Boca Chica State Park, and portions of Lower Rio Grande Valley NWR would experience levels up to 15 psf. Boca Chica and the southern tip of South Padre Island are within the 6.0 psf contour. South Padre Island, Port Isabel, and the Port of Brownsville ship channel are included in the 4.0 psf contour. Sonic booms up to 1 psf would be expected to reach up to 15 miles from the VLA.

Figure 5-2. Sonic Boom Contours for Starship Landing at the VLA

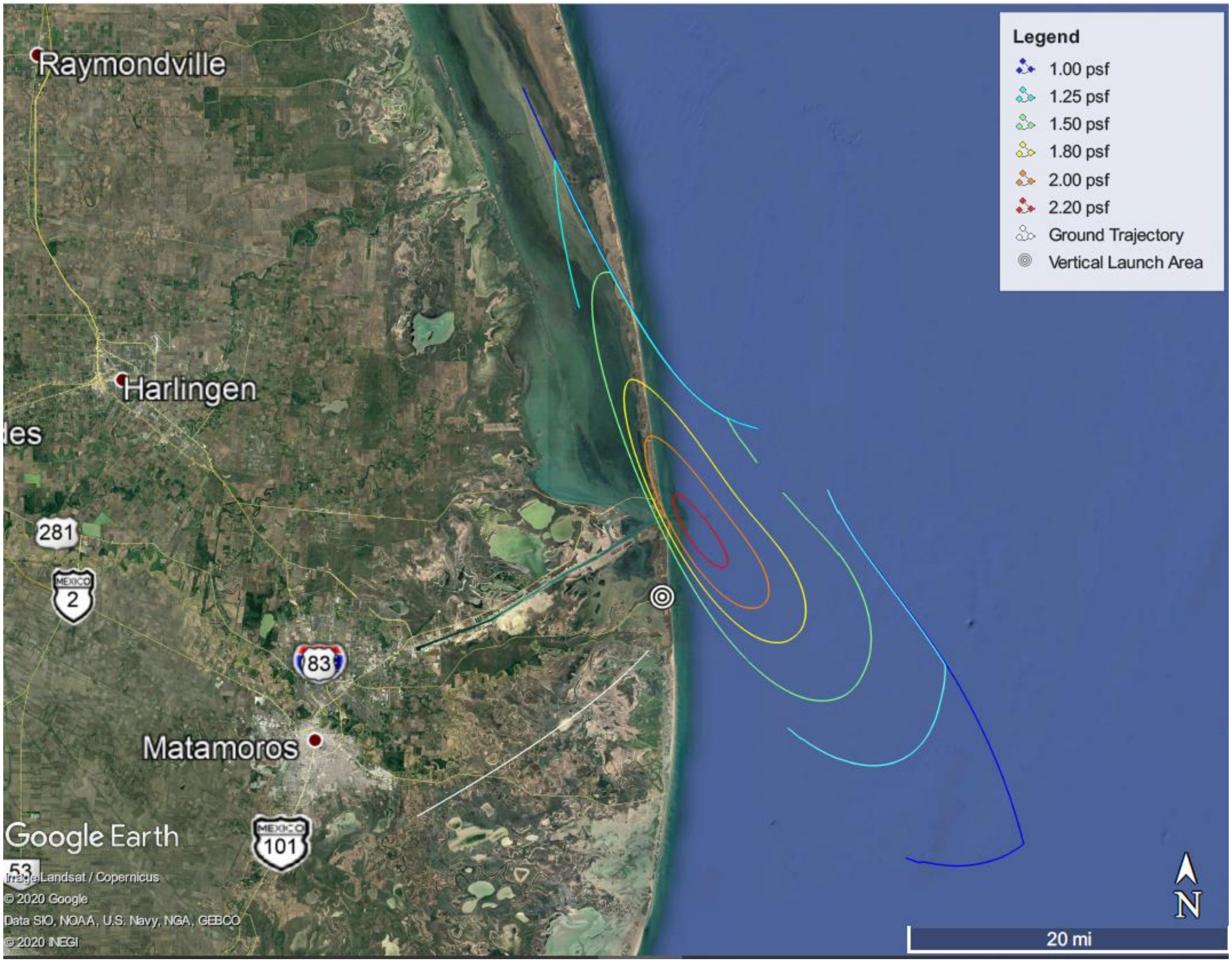
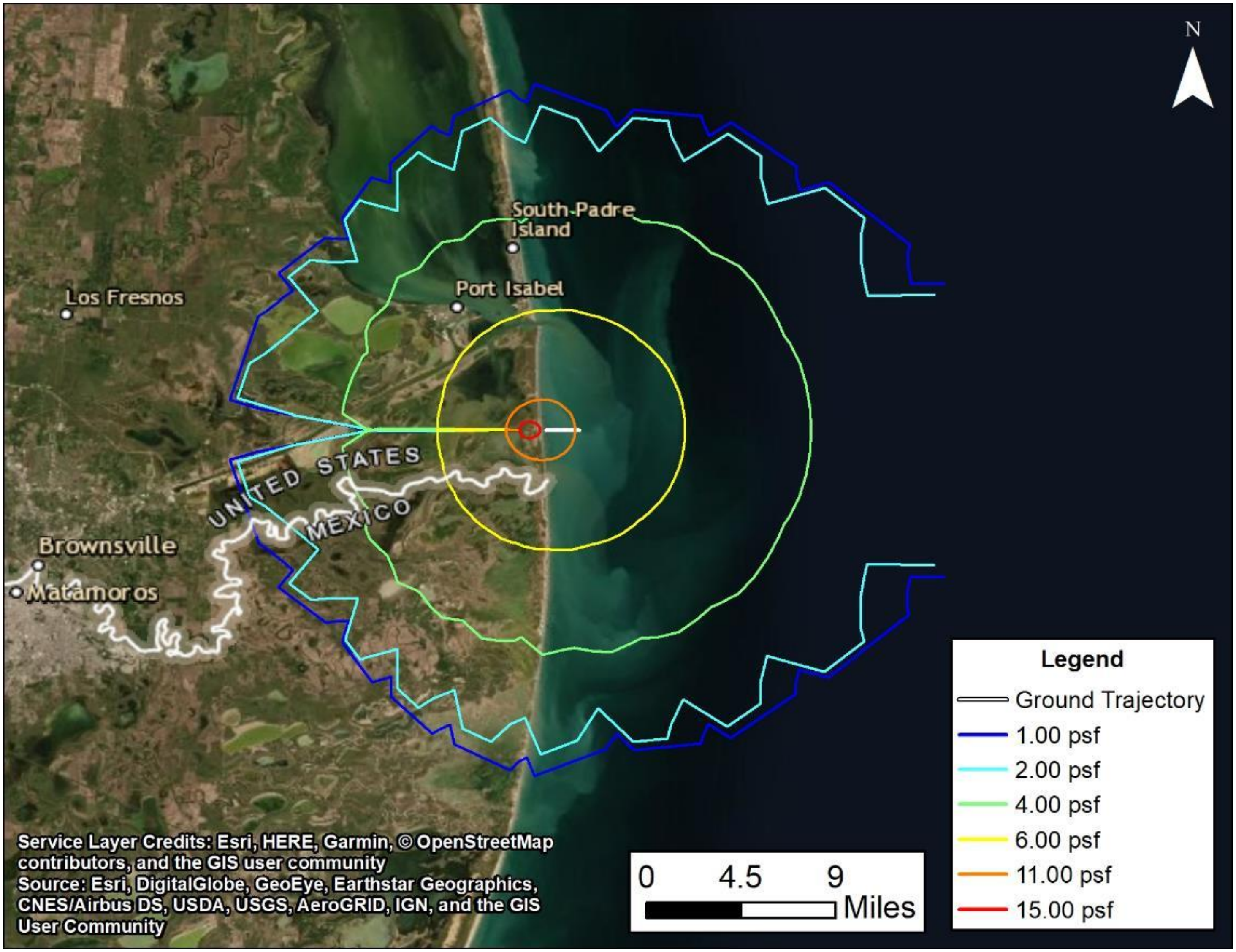


Figure 5-3. Sonic Boom Contour for Super Heavy Landing at the VLA



ESA-listed species in the action area would be exposed to sonic booms generated by Starship and Super Heavy up to ten times per year (sonic booms impacting land would only occur during Starship/Super Heavy orbital missions).

5.2.2 Rocket Heat Plume

Ignition of the Starship and Super Heavy Raptor engines during static fire engine tests and launches (including landings) would generate a heat plume. The plume would appear clear and consist of water vapor, carbon dioxide, carbon monoxide, hydrogen, methane, nitrogen oxides (NOx), and oxygen. While all operations involving engine ignition would cause a heat plume, orbital launches would create the largest and hottest plume from the ignition of all Super Heavy's 37 Raptor engines. Static fire engine tests, landings, and suborbital launches would all require fewer engines and would generate a smaller, cooler plume compared to an orbital launch. The heat plume generated from Starship/Super Heavy orbital launches would travel away from launch pad, with temperatures of about 300 °F at the edge of the VLA, 212 °F approximately 0.3 mile from the launch pad, and temperatures reaching ambient temperature (90 °F) approximately 0.6 miles from the launch pad. These temperatures would be intermittent and temporary in nature and would only occur during engine ignition and dissipate within minutes. The maximum heat plume from Starship/Super Heavy orbital launches would occur up to 5 times a year.

Noise associated with engine ignition would likely cause animals in the vicinity of the vehicle to disperse; however, less mobile animals or animals unable to disperse quickly enough could be exposed to the heat plume and be injured or killed. Additionally, just prior to launch, noises from fueling the vehicle would also deter any animals or birds in the vicinity.

The heat plume may cause some alterations to the plant community and could lead to vegetation changes. Changes include loss of sensitive species, loss of plant community structure, reduction in total cover and replacement of some native species with weed species. The heat plume would dissipate within minutes.

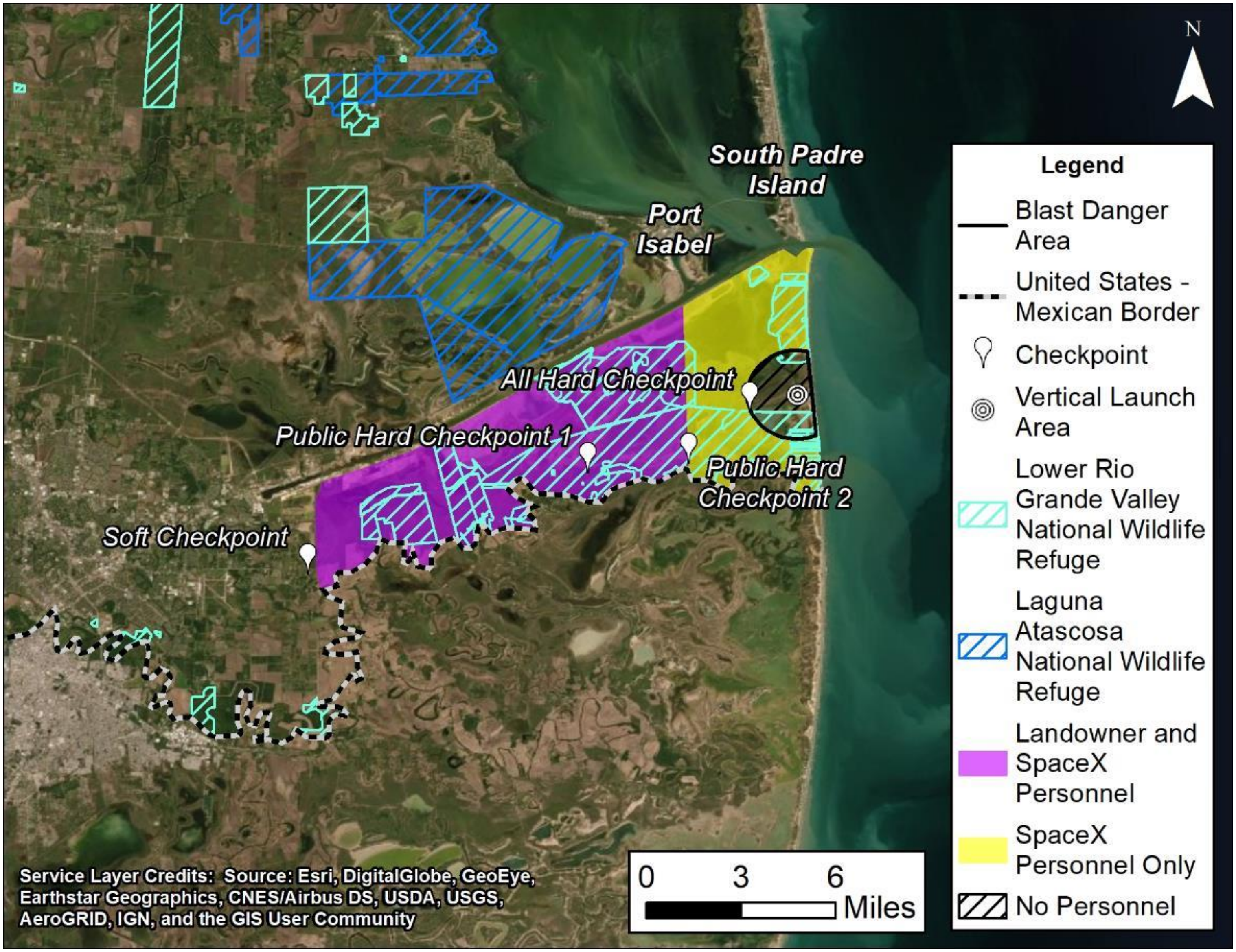
5.2.3 Launch-Related Closures

The Proposed Action would require temporary closure of areas in the vicinity of the Boca Chica Launch Site, which would preclude public access, including folks that conduct species surveys (e.g., sea turtle beach patrols) in the action area. The closure area was developed in consultation with the USFWS during preparation of the 2013 BA (FAA 2013) and 2014 EIS (FAA 2014). In addition to including the FAA-approved hazard area, the closure area includes the entire Lower Rio Grande Valley NWR because the USFWS expressed concern over potential public intrusion in these sensitive areas during launch operations. The closure area includes areas along SH 4, on Boca Chica Beach, and offshore areas (Figure 2-4). Figure 5-4 shows the closure area in relation to the NWRs in the area.

SpaceX estimates that its operations that require restricting public access to protect public safety (i.e., wet dress rehearsals, static fire engine tests, and launches) will require up to 500 hours of closure per year. This represents approximately 5.7 percent of the total number of hours in a year. During closures, only landowners and their guests would be allowed to access their property within the soft checkpoint area. SpaceX uses drones to monitor the closure area for unauthorized individuals and would not conduct ground sweeps. Therefore, closures would not cause direct physical effects to ESA-listed species or critical habitat in the action area.

While the closures would serve to prevent public intrusion and adverse effects to listed species and critical habitat during SpaceX operations, USFWS staff and staff from other wildlife organizations (e.g., Sea Turtle, Inc.) would be prevented from conducting daily duties in the area as part of their regulatory or mission responsibilities while the closure is in effect. This could cause delays to scheduled research or monitoring for any of the species in the area and may also result in missed sea turtle nests. This may also limit Lower Rio Grande Valley NWR staff from being able to conduct maintenance activities within the closure area. These operational related impacts would be temporary and only occur when a closure is established. SpaceX is proposing measures to minimize the potential impacts associated with a closure (see Section 2.2.2).

Figure 5-4. Road Closures and Checkpoints in Relation to National Wildlife Refuges



5.2.4 Night Lighting

Night lighting represents a potential stressor to nesting sea turtles on nearby Boca Chica Beach as well as migrating birds and nocturnal species. Kemp's ridley sea turtles nest during the day and is the most common species of sea turtle to nest in the action area. Lighting (e.g., sky glow) at night can disorient or interrupt the nesting process of the other species of sea turtles, which nest nocturnally. All sea turtle nests detected on Texas beaches are collected, and the eggs are incubated in facilities. Sky glow from nighttime lighting at the launch site could cause emerging hatchlings (from those eggs that are not collected) to crawl in the wrong direction (i.e., away from the ocean). Hatchlings whose sea-finding is disrupted by unnatural stimuli often die from exhaustion, dehydration, predation, or other causes (Witherington et al. 2014).

SpaceX would attempt to conduct most launches and tests between the hours of 7:00 a.m. and 7:00 p.m. However, there could be delays or missions that require launching at a specific time at night to achieve a particular orbital position. For conservative purposes, this BA assumes that 20 percent of annual operations would occur at night. During nighttime launch activity, SpaceX would require bright spotlighting for short durations when illuminating the launch vehicle. In addition to nighttime launch activity, SpaceX would need to perform ground support operations 24/7 at the VLA throughout the year using white lighting for the safety of SpaceX personnel.

5.2.5 Hazardous Materials

Hazardous materials have the potential to impact the ESA-listed species and the piping plover's critical habitat in the action area. The likelihood that an ESA-listed species would come into contact of a hazardous material during a spill during construction and operations is low given SpaceX's immediate clean-up response.

5.2.5.1 Construction

Construction activities would require the use of hazardous materials. Most of the hazardous materials expected to be used are common to construction activities and include diesel fuel, gasoline, and propane to fuel the construction equipment; hydraulic fluids, oils, and lubricants; welding gases; paints; solvents; adhesives; and batteries. An accidental release of hazardous materials during construction (e.g., equipment fuel spill) could affect individual ESA-listed species if they were exposed to the contaminant, which could cause injury, sickness, or death. Accidental spills could also affect vegetated habitat, including designated critical habitat, by damaging or killing plants, which could affect plant density and diversity. SpaceX personnel and associated contractors would be required to comply with appropriate hazardous materials handling and management procedures. The FAA expects that any release of hazardous materials during construction would be small and would affect a limited area, and that SpaceX's immediate clean-up response would avoid or minimize effects on species and habitat.

In accordance with the CWA, SpaceX would continue to operate under the construction storm water discharge permit and the SWPPP would be updated prior to the commencement of new construction activities. Every outdoor storage area where hazardous materials are proposed to be stored or staged during construction would be identified in the SWPPP and inspected on a recurring basis during the construction phase and until the permit is terminated.

Hazardous materials associated with construction activities would be delivered and stored in a manner that would prevent these materials from leaking or spilling, in accordance with applicable federal and state environmental and public and occupational health and safety regulations. Public transportation routes would be used for the conveyance of hazardous materials during construction. Transportation of all materials would be conducted in compliance with U.S. Department of Transportation (DOT) regulations.

Hazardous materials would be stored in their original containers with their original product labels and would not be stored directly on the ground. These materials would be stored on pallets under cover and with secondary containment. Incompatible materials would not be stored together, and sufficient space would be provided between stored containers to allow for spill cleanup and emergency response access. Storage units would meet building and fire code requirements and would be located away from vehicle traffic. Storage instructions would be posted, and construction employees would be trained in proper receiving, handling, and storage procedures. Material Safety Data Sheets for all hazardous materials stored at the launch site would be provided and available to all site personnel.

Hazardous waste would be generated during construction activities, including empty hazardous material containers, spent solvents, paints, sealants, adhesives, waste oil, spill cleanup materials (if used), batteries, and various universal wastes (e.g., fluorescent bulbs). Other hazardous materials, such as welding gases, are expected to be consumed in their entirety, and the empty gas cylinders would be returned to the suppliers. Construction contractors would be responsible for safely removing these construction-generated wastes from the site and for arranging for recycling or disposal in accordance with applicable regulations. Compliance with appropriate handling and management procedures during construction activities would avoid or minimize potential effects to ESA-listed species and critical habitat.

5.2.5.2 Operations

Potential impacts to ESA-listed species and critical habitat during operations would be similar to those described for construction. Starship/Super Heavy launch operations would require the use and storage of hazardous materials for launches as well as for routine maintenance and flight support activities. Most of these materials would be stored as near to their point of use as possible to minimize the potential for accidental spills. The hazardous materials storage tanks would be located within secondary containment designed to hold at least 110 percent of the tank's maximum volume. The main propellants used for launch operations, LOX and LCH_4, are both gaseous at room temperature and thus would not contaminate vegetation or habitats if released.

Because the Boca Chica Launch Site is located within the 100- and 500-year floodplains, SpaceX would ensure that the storage of hazardous materials would implement flood control measures such as locating water-sensitive equipment, supplies, chemicals, etc. above flood level. The implementation of these measures would reduce the likelihood that a flood event might result in a release of stored hazardous materials.

Operations would result in the use of products containing hazardous materials, including paints, solvents, oils, lubricants, acids, batteries, surface coating, and cleaning compounds. Hazardous materials such as propellants, chemicals, and other hazardous material payload components would be transported to the facilities in accordance with DOT regulations governing interstate and intrastate shipment of hazardous materials, as applicable (e.g., 49 CFR 100–199).

SpaceX's SPCC Plan would be revised in accordance with the CWA requirements included in 40 CFR Part 112 to outline proper management and spill response procedures for changes in the oils and fuels stored at the SpaceX Boca Chica Launch Site.

Small quantities of hazardous waste would be generated during routine operations. Most of the hazardous materials would be consumed, so substantial volumes of hazardous waste would not require disposal. Launch vehicle maintenance, 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, spill response materials, and used batteries. The estimated amount of hazardous waste anticipated to be generated at the launch site would qualify the site as a small quantity generator of hazardous waste or a conditionally exempt small quantity generator as defined by 30 Texas Administrative Code Part 1 § 335(c).

Hazardous wastes would be managed on site in accordance with applicable federal, state, and local regulations. Hazardous wastes would be prepared for transport in accordance with DOT regulations, and the wastes would be disposed of at approved Treatment, Storage, and Disposal facilities and would be transported using appropriately licensed contractors. Compliance with appropriate handling and management procedures during operations would avoid or minimize potential effects to ESA-listed species and critical habitat.

During a Starship/Super Heavy orbital launch, up to 350,000 gallons of deluge water could be used. Because SpaceX uses LOX and LCH_4 propellants, deluge water following the launch would convert to steam with insignificant amounts of hazardous materials that would degrade quickly. The steam is expected to generate negligible impacts on surface water quality or vegetation and habitats near the VLA, because of the small volume of water expected to condense from the exhaust cloud. Water that is not vaporized or expelled would be contained in retention basins adjacent to the launch pad. This water would then be sampled and analyzed to determine if the water contained controlled contaminants at levels that exceed the TCEQ water quality standards. Water containing contaminants that exceed the water quality criteria would be removed and hauled to an approved industrial wastewater treatment facility outside the VLA. All other water not containing prohibited chemicals would be pumped back to the water tanks.

5.2.6 Ground Vibrations

Short-term ground vibrations could occur during construction and launches. There is a potential for ground vibrations to disturb nesting turtles. Vibrations from rocket launches could frighten nesting turtles, causing them to abandon their nesting attempt. However, vibrations from launch operations would last a few minutes, reducing the likelihood that vibration would occur during the time a sea turtle is attempting to nest.

Vibrations could also harm incubating eggs. However, current standard procedure in Texas for protecting and conserving the species is for all eggs to be retrieved from each nest and transported to an incubation facility. Sea Turtle, Inc. administers nesting sea turtle patrols and relocation of eggs on Boca Chica Beach. Therefore, any vibrations from a rocket launch would most likely only have the potential to affect eggs that were laid the same day of the launch or were not previously found due to a beach closure.

5.2.7 Increased Traffic and Human Presence

An increase in vehicle traffic during daily operations from construction and SpaceX operations personnel would increase the potential for vehicle collisions with wildlife, including ESA-listed species. In addition, increased traffic and human presence could cause wildlife to avoid the area. Most of the traffic from construction and operations would occur during daylight hours. Peak ocelot activity is around sunset and sunrise, with activity continuing during the night; however, jaguarundis are known to be primarily diurnal. SpaceX anticipates that up to 55 construction vehicles a day would be associated with the construction period. In addition, up to 450 SpaceX staff vehicles would be expected per day in the area as well. The Proposed Action is anticipated to add up to 505 vehicles per day within the Lower Rio Grande Valley NWR corridor and within the corridor providing access to Boca Chica Beach and the VLA. The proposed environmental protection measures discussed in Section 2.2 would the minimize the chance of vehicle collisions with wildlife, including ESA-listed species. To date, there have been no recorded vehicle collisions with jaguarondi or ocelots by SpaceX or contractor personnel.

5.2.8 Tall Structures

The construction of new structures could pose a potential collision impact to birds. According to the USFWS, collision hazards for birds depend on several factors related to the bird, infrastructure, and location. Research indicates that collision mortality increases with structure height for most structures (e.g., communication towers and wind turbines) (USFWS 2020b). During the daytime, birds collide with windows because they see reflections of the landscape in the glass (e.g., clouds, sky, vegetation, or the ground); or they see through glass to perceived habitat (including potted plants or vegetation inside buildings) or to the sky on the other side (USFWS 2016b). At night, during spring and fall bird migrations when inclement weather occurs, birds can be attracted to lighted structures resulting in collisions, entrapment, excess energy expenditure, and exhaustion (Manville 2009). The Proposed Action involves the construction of several tall structures. These structures do not include glass windows and would be comprised of opaque surfaces, which are of less risk regarding bird collisions (LEED 2020). Potential effects from lighting would be reduced by complying with established lighting policy for minimizing disorienting effects on migratory birds.

5.2.9 Habitat Loss (including Critical Habitat)

The expansion of the vertical launch area would result in the direct removal of piping plover critical habitat and proposed red knot critical habitat. Direct loss of habitat reduces a species' ability to reproduce, find food, find shelter, and survive. Destruction, modification, and loss of habitat have been identified by the USFWS as continuing threats to the piping plover and red knot. Additionally, habitat loss and degradation on the breeding and wintering grounds of migratory birds negatively impact important avian prey species for aplomado falcons, such as mourning doves (*Zenaida macroura*) and meadowlarks (*Sturnella* spp.) (DeSante and George 1994; Gulf South Research Corporation and La Tierra Environmental Consulting 2013). The small amount of habitat that would be affected by the Proposed Action would not substantially affect the recovery of the piping plover, red knot, or the breeding and wintering grounds of migratory birds. The proposed addition of three pull-offs along SH-4 would be located alongside the highway on uplands. The pull-offs would be less and a quarter of an acre and would be adjacent to a paved two-lane highway. These areas would not significantly contribute to the runoff of the area and impact to habitat would be minimal.

5.2.10 Invasive Species Introductions

Proposed construction activities have the potential to increase the movement and spread of invasive plant species within the action area, which would degrade habitat and potentially directly or indirectly affect ESA-listed species. Habitat degradation or changes in vegetation and habitat structure from establishment and spread of invasive plants could result in conditions that would no longer support ESA-listed species. Invasive species might be accidentally introduced to the area through construction of the launch site infrastructure or shipment of supplies and equipment to the launch site. Species that might be introduced or spread include various plants, such as vitex, that can degrade habitat by displacing native species and ultimately reduce food or important nesting or roosting habitat. To prevent invasive species from spreading, SpaceX would continue to perform routine inspections of construction areas to identify and remove any invasive species (see Section 2.2.1). The successful implementation of specific invasive species control procedures would restrict the movement of invasive species within the action area.

5.2.11 Anomaly

A Starship/Super Heavy test operation or launch could fail (referred to as an anomaly or mishap). Immediately following an anomaly, it may be required to continue to restrict public access in the vicinity of the VLA to address any impacts and ensure public safety. In the event of an anomaly, a limited number of SpaceX staff would enter the debris field and conduct an initial evaluation. Following the initial evaluation of the area, SpaceX would coordinate with TPWD and USFWS prior to any attempt of cleanup, to minimize damage to the Refuge lands and sensitive historic, biological, and geological resources. The method of debris cleanup would be assessed on a case-by-case basis and would be approved by TPWD and USFWS. Conditions that would be assessed include location of the debris, weather, condition of the soil, number of support staff, etc.

Cleanup of debris on State Highway 4 would be the first priority, followed by Refuge or TPWD lands, and then SpaceX property. SpaceX would coordinate with USFWS and TPWD to minimize impacts to the Refuge during cleanup. Entry of SpaceX staff into the Refuge would be done on foot as much as possible, and the use of vehicles on refuge land would be coordinated with Refuge staff to minimize impacts.

In the event of an anomaly, an explosion could injure or kill wildlife species adjacent to the launch pad or within areas impacted by debris. In addition, fires could potentially start from an explosion that could result in a loss of habitat. The habitat would be lost until vegetation has been restored or grows back. Should an anomaly occur on the launch pad, several possible outcomes could result, the most likely being a fire on the launch pad. An explosion on the launch pad would likely spread debris within the FAA-approved hazard area and vegetation across the hazard area would likely be burned. Liquid methane could be released. Because some propellant would likely be burned prior to failure, it is unlikely that the maximum amount of liquid methane held in the tanks would be released. The liquid methane would quickly vaporize and burn.

Debris may temporarily impact habitat. Debris may cause ruts in the unvegetated salt flats or depressional wetlands upon impact or during recovery. SpaceX would coordinate with the Refuge and TPWD to determine the least invasive removal option. The temporary impacts would be restored following the debris removal.

SpaceX would follow the emergency response and cleanup procedures outlined in the Hazardous Materials Emergency Response Plan and Fire Mitigation and Response Plan (if a fire occurs). Procedures include containing a chemical spill using appropriate disposable containment materials such as absorbent berms, fences, trenches, sandbags, and cleaning the area with absorbents or other material to reduce the magnitude and duration of any effects. If the spill is greater than 25 gallons of petroleum or of any size that affects or threatens to affect surface waters (i.e., one that creates a sheen, emulsion, or sludge), SpaceX would report the spill within two hours to the National Response Center, the Texas State Emergency Response Commission, and the TCEQ. SpaceX would collect as much debris as possible from the near-shore marine environment and dispose of it in accordance with federal, state, and local regulations. Short-term effects on the near-shore marine environment may result, but long-term effects would be negligible due to the emergency response and cleanup procedures and the buffering capacity of the waters of the Gulf of Mexico.

5.3 Effects Analysis and Determination for ESA-Listed Species and Critical Habitat

The following effects analysis considers the threats and stressors discussed above and summarized in Table 5-1 and focuses on those effects that could lead to adverse effects (i.e., take of a listed species or critical habitat).

5.3.1 Eastern Black Rail

Potential suitable eastern black rail habitat exists within the action area, and individuals have been documented within Cameron County (Watts 2016; Lockwood et al. 2005). However, recent records (2011–2016) indicate no eastern black rail breeding in Cameron County (USFWS 2019). Suitable habitat is not present at or near the launch site.

Launch noise and the heat plume represent the greatest potential impact on the eastern black rail. Launch noise could extend into potentially suitable habitat and could temporarily displace any individuals present in the area. These potential effects would be short term as noise levels associated with a launch would last a few minutes and occur on an intermittent basis. Sonic booms generated during landing would also impact the action area. Up to ten sonic booms, each lasting less than a second, could occur under the Proposed Action. The sonic booms would be up to 15 psf in the vicinity of the VLA (see Figure 5-3), which would startle eastern black rails.

The heat plume generated during engine ignition events could impact eastern black rails that may be present in the vicinity (up to 0.6 miles) of the launch pad. Individual animals caught in the heat plume may be injured or killed. Noise and human presence associated with pre-launch operations and the engines may cause individuals to disperse from the area prior to being exposed to the heat plume. The heat plume is not expected to affect eastern black rails because suitable habitat is not present at or near (within 0.6 miles) the launch site and breeding individuals were not recorded in Cameron County in the years 2011–2016.

Based on the above analysis of potential direct and indirect effects on the eastern black rail from the proposed construction and operations, lack of suitable habitat at and near the launch site, and recent eastern black rail survey data indicating the eastern black rail is not present in Cameron County, the FAA has determined the Proposed Action **may affect and is not likely to adversely affect** the eastern black rail (i.e., potential effects are insignificant or discountable). A determination of **may affect** is warranted for the Proposed Action based on the following rationale:

- Potential suitable habitat occurs within the action area.
- Possible presence of eastern black rails in Cameron County.
- Noise and human presence from construction and operations may temporarily disturb or displace eastern black rails.
- The heat plume could injure or kill an eastern black rail if it was present within 0.6 mile of the vertical launch area during a Starship/Super Heavy launch.

A determination of **not likely to adversely affect** is warranted for the Proposed Action based on the following rationale:

- Lack of suitable habitat at and near (within 0.6 miles) the vertical launch area.
- No recent documented presence of eastern black rail in the action area.
- No recent indication of eastern black rail breeding in Cameron County (USFWS 2019).

If an eastern black rail was recorded within the action area, the FAA would immediately reinitiate ESA Section 7 consultation with the USFWS.

5.3.2 Northern Aplomado Falcon

Potential foraging habitat for the northern aplomado falcon exists within the action area. Limited perching and nest site areas (trees, yuccas, and power poles) occur within the vicinity of the LLCC and VLA, but outside the project footprint. Falcons have been observed within the action area west of Boca Chica Beach. Increased vehicular traffic, noise, and human presence from construction and operations may startle or displace aplomado falcons. However, human presence and vehicular traffic is already prevalent near the launch site since Boca Chica Beach is a popular recreational area.

Tall structures could attract falcons to the launch site for nesting and perching. The heat plume from engine ignition could harm or kill individual falcons; however, operational noise (e.g., gas venting from the launch vehicle tank) would likely cause falcons that are located near the launch vehicle during an operation to fly away prior to engine ignition.

Based on the above analysis of potential direct and indirect effects on the northern aplomado falcon from the proposed construction and operations, the FAA has determined the Proposed Action **may affect, and is likely to adversely affect** the northern aplomado falcon. A determination of **may affect** is warranted for the Proposed Action based on the following rationale:

- Potential presence of Northern aplomado falcons in the action area.
- Potential foraging habitat occurs in the action area.

A determination of **likely to adversely affect** is warranted for the Proposed Action based on the following rationale:

- Proposed infrastructure, including the proposed integration towers, could attract falcons to the launch site for nesting and perching thereby exposing them to human presence and disturbance, and potential injury or death from structure collisions.

- Noise and human presence from construction and operations may startle or displace northern aplomado falcons. Disturbance during nesting may cause the adult to leave the nest, exposing eggs or small young to inclement weather or predators. Disturbance may also reduce foraging efficiency and feeding time.

5.3.3 Piping Plover

The Boca Chica Launch Site is located within designated piping plover critical habitat Unit TX-1, and the action area also includes Unit TX-2, TX-3A, and TX-3B. Construction is only proposed within Unit TX-1; the critical habitat description within Unit TX-1 specifically states that it does not include densely vegetated habitat. Areas surrounding the Boca Chica Launch Site include a mix of densely vegetated and unvegetated flats and depressional wetlands which are considered critical habitat.

The 2013 BA determined that approximately 0.70 acre of unvegetated flats and depressional wetlands that occur within the footprints of the VLA would be filled. In addition, 0.31 acre of unvegetated wetland salt flats would be indirectly impacted and cut off by tidal influence. Under the Proposed Action, the expansion of the VLA would fill 11.03 acres of piping plover critical habitat (0.20 acres of depressional wetlands and 10.83 acres of unvegetated salt flats). The proposed location of the parking lot across from the VLA is mostly disturbed uplands, with the central portion of the site being a remnant paved/concrete pad. Construction of the parking lot would fill 0.14 acres of piping plover critical habitat (0.06 acres of unvegetated salt flats and 0.08 acres of depressional wetlands). A total of 11.17 acres of piping plover critical habitat would be filled under the Proposed Action. As part of CWA Section 404 permitting, SpaceX will be required to mitigate wetland impacts. Initial construction of the VLA filled 0.70 acres of piping plover critical habitat. In total, 11.87 acres of piping plover critical habitat would be filled by the completed and proposed construction of the VLA.

The proposed addition of three pull-offs along SH-4 would be located alongside the highway on uplands and would not affect piping plover critical habitat (Figure 4-1). SpaceX is also proposing to expand the total solar farm area by approximately 1.8 acres into land not previously assessed. Land cover in the solar farm expansion area consists primarily of mowed grass. The 2016 National Land Cover Database identifies this expansion area primarily as a mix of low intensity developed and medium intensity developed (EPA 2020). Therefore, the proposed solar farm expansion would not affect piping plover critical habitat.

The total area designated as piping plover critical habitat in Texas is 71,053 acres. The small amount of critical habitat that would be affected by the Proposed Action would not affect the recovery of the species. There is other habitat nearby that the piping plover could use. Based on recent migratory and wintering surveys for piping plovers conducted within the Lower Laguna Madre region in south Texas, the piping plover is not known to use areas within the action area in large numbers (Zdravkovic and Durkin 2011). Surveys conducted between 2018 and 2019 within 3 miles of the VLA estimated piping plover to be the most prevalent of the monitored bird species, with average group sizes of 4.09 individuals, and a maximum group size of 45 individuals (UTRGV 2019). The piping plover does not nest within the action area; therefore, the Proposed Action would not impact piping plover nesting. During engine ignition, the heat plume from the Raptor engines would cause high temperatures in the vicinity of the launch pad; however, these temperatures would be temporary and would not be expected to cause permanent damage to the unvegetated flats used by piping plover. If water is to be used on the plume, the water would be evaporated and would not impact the piping plover habitat. Individual animals caught in the heat plume could be injured or killed. Noise associated with the engines and pre-launch operations may cause individuals to disperse from the area prior to being affected by the heat plume.

Increased vehicular traffic and human presence from construction and operations may displace the piping plover. However, the annual avian modeling performed by UTRGV from 2016 through 2020 shows an abundance of piping plovers and there has not been a major influence on variation of local populations. The mean number of individual piping plovers compared year to year to test for a temporal trend showed a slight negative trend but likely not significant (UTRGV 2020). In addition, human presence and vehicular traffic is already prevalent within the project area since Boca Chica Beach is a popular recreational area. Direct mortality from construction equipment is unlikely since human presence and activity are likely to disperse wildlife prior to any equipment use.

Noise from launch operations would extend into piping plover habitat and most likely temporarily displace piping plovers. However, these impacts would be short term as noise levels associated with testing and launch operations would last a few minutes. Sonic booms generated during landing would impact the area. Up to ten sonic booms, each lasting less than a second, would occur under the Proposed Action. The sonic booms are modeled to be up to 15 psf in the vicinity of the VLA, and would likely startle individuals, causing them to disperse. Based on a previous ESA section 7 consultation between the USFWS and National Aeronautics and Space Administration for proposed launches at the Wallops Flight Facility, Virginia, and potential effects to piping plovers, the USFWS concluded that launches were not likely to jeopardize the continued existence of the piping plover (NASA 2005).

During an operation involving deluge water, water tanks may discharge up to 350,000 gallons of water onto the launch pad. During a launch, most of the water would evaporate. Remaining deluge water would be collected and tested. The water would be analyzed to determine if the water contained controlled contaminants at levels that exceed the TCEQ water quality standards. Water containing contaminants that exceed the water quality criteria would be removed and hauled to an approved industrial wastewater treatment facility outside the VLA. All other water not containing prohibited chemicals would be pumped back to the water tower.

Even though the launch pad is located next to an unvegetated flat that provides habitat for the piping plover, no deluge water would reach the critical habitat during a launch. While there is a small potential for water vapor to reach this unvegetated area, the amount of water vapor from a maximum of five orbital launches per year is not expected to alter the habitat and cause vegetation to grow on the unvegetated flat and adversely modifying piping plover critical habitat.

Based on the results of the biological monitoring that has occurred to date and the above analysis of potential direct and indirect effects on the piping plover and its designated critical habitat from the proposed construction and operations, the FAA has determined the Proposed Action **may affect, and is likely to adversely affect** the piping plover and its critical habitat. A determination of **may affect** is warranted for the Proposed Action based on the following rationale:

- The documented presence of piping plovers in the action area.
- The presence of critical habitat within the proposed construction area.

A determination of **likely to adversely affect** is warranted for the Proposed Action based on the following rationale:

- Loss and degradation of foraging and roosting habitat, which could result in decreased fitness and survivorship of wintering piping plovers.
- Rocket heat plume may injure or kill individual plovers.
- Proposed construction would result in permanent loss of 11.17 acres of piping plover critical habitat.

5.3.4 Red Knot

Proposed critical habitat and potential foraging habitat for the red knot exists within the action area. The red knot has been observed in action area; it is a transient winter visitor to Boca Chica Beach.

The Boca Chica Launch Site is located within proposed red knot critical habitat Unit TX-11. The Proposed Action would impact approximately 23.2 acres of proposed red knot critical habitat. SpaceX assumes all of the area within the proposed expansion of the VLA is considered red knot critical habitat. The total area proposed as red knot critical habitat in Texas is 186,240 acres; the total area proposed in TX-11 is 15,243 acres. The small amount of critical habitat that would be affected by the Proposed Action would not affect the recovery of the species.

Increased vehicular traffic and human presence from construction and operations may displace the red knot. However, the annual avian modeling performed by UTRGV from 2016 through 2020 shows that there has not been a major influence on variation of local red knot populations. The mean number of individual red knots compared year to year to test for a temporal trend showed a slight negative trend but likely not significant (UTRGV 2020). In addition, human presence and vehicular traffic is already prevalent within the project area since Boca Chica Beach is a popular recreational area. Direct mortality from construction equipment is unlikely since human presence and activity are likely to disperse wildlife prior to any equipment use.

Noise from launch operations would extend into red knot habitat and most likely temporarily displace red knots. However, these effects would be short term as noise levels associated with a launch would last a few minutes and occur on an intermittent basis. Sonic booms generated during landing would also impact the action area. Up to ten sonic booms, each lasting less than a second, could occur under the Proposed Action. The sonic booms would be up to 15 psf in the vicinity of the VLA, which would startle red knots.

In addition, individual red knots present in the vicinity of the launch pad may be impacted by the heat plume generated during engine ignition. Individual animals caught in the heat plume may be injured or killed. Noise associated with pre-launch operations (e.g., gas venting from the launch vehicle tank) and the engines may cause individuals to disperse from the area prior to being exposed to the heat plume.

Based on the results of the biological monitoring that has occurred to date and the above analysis of potential direct and indirect effects on the red knot from the proposed construction and operations, the FAA has determined the Proposed Action **may affect and is likely to adversely affect** the red knot. A determination of **may affect** is warranted for the Proposed Action based on the following rationale:

- Potential foraging habitat occurs within the action area.
- Documented presence of red knot in the action area.

A determination of **likely to adversely affect** is warranted for the Proposed Action based on the following rationale:

- Noise and human presence from construction and operations may temporarily disturb or displace wintering red knots.
- Rocket heat plume may injure or kill individuals.
- Proposed construction would result in permanent loss of 23.2 acres of proposed red knot critical habitat.

5.3.5 Gulf Coast Jaguarundi and Ocelot

The Laguna Atascosa NWR supports the largest known U.S. population of the ocelot, and portions of the NWR are within the action area. The launch site and adjacent areas do not include suitable habitat for the jaguarundi and ocelot. The area near the launch site could act as a travel corridor connecting suitable habitat. Travel through these areas of unsuitable habitat could expose jaguarundis and ocelots to increased risk of mortality from vehicle collision. While there currently is traffic along SH 4, the Proposed Action would increase vehicle traffic during construction and daily operations. This could increase the potential for ocelot and jaguarundi vehicle collisions. Most of the project-related traffic would occur during daylight hours. Peak ocelot activity is around sunset and sunrise, with activity continuing during the night. Jaguarundis are known to be primarily diurnal. SpaceX anticipates up to 55 construction vehicles per day would be associated with the construction period. In addition, SpaceX anticipates up to 450 SpaceX staff vehicles per day in the area as well during construction. The Proposed Action is anticipated to add up to 505 vehicles per day within the Lower Rio Grande Valley NWR corridor and within the corridor providing access to Boca Chica Beach. Implementation of the proposed conservation measures discussed in Section 2.2 would avoid or minimize effects to the ocelot and jaguarondi, including 1) the continued education of construction and SpaceX personnel on the potential for vehicle collisions with ocelots and jaguarundis, 2) reduction of vehicle speeds along SH 4 near the LLCC and VLA, and 3) the “Watch Out for Ocelots/Jaguarundis” or “Watch Out for Wildlife” signs along both sides of SH 4. To date, there have been no recorded vehicle collisions with jaguarondi or ocelots in the vicinity of the launch site since SpaceX began initial construction of the launch site.

Construction and operations would also increase noise and human activity, which could temporarily cause ocelots and jaguarundis to avoid the area. Launch noise levels would last a few minutes. Sonic booms generated during landing could also startle jaguarundis or ocelots in the action area. Up to ten sonic booms, each lasting less than a second, could occur under the Proposed Action. The sonic booms would be up to 15 psf in the vicinity of the VLA. Ocelot and jaguarundi response to noise could potentially cause the species to expend energy, increase their risk of vehicular collision, or cause individuals to abandon their movements through the area and decrease opportunities to improve genetic diversity within the Texas populations.

Ocelot and jaguarundi could be affect by the heat plume generated during engine ignition. While the area surrounding the VLA that would be exposed to high heat of the engine plume does not contain suitable habitat, individuals may be present in the area traveling to suitable habitat during operations. If individual cats were present and within the high temperature areas of the heat plume, they may be injured. Individuals may be discouraged from traveling through the area during operations due to the noise and human activity that would take place in support of the operations.

An anomaly could also affect an ocelot and jaguarundi, particularly if a wildfire is started and burns many acres of suitable cat habitat. The loss of habitat could affect species movement and potentially affect migration corridors. The habitat would be lost until vegetation has been restored or grows back. SpaceX would implement its Fire Mitigation and Response Plan to avoid or minimize these potential effects.

Based on the above analysis of potential direct and indirect effects on the Gulf Coast jaguarundi and ocelot from the proposed construction and operations, the FAA has determined the Proposed Action **may affect, and is likely to adversely affect** the jaguarundi and ocelot. A determination of **may affect** is warranted for the Proposed Action based on the following rationale:

- The documented presence of ocelot and jaguarundi in the action area.
- The action area could act as a travel corridor connecting suitable habitat.

A determination of **is likely to adversely affect** is warranted for the Proposed Action based on the following rationale:

- Construction and operations would increase traffic within the action area, thereby increasing the risk of vehicle collisions with jaguarundi and ocelot.
- Animals may avoid lit areas and seek other north-south travel corridors through the lomas, expending additional energy and increasing the potential for vehicular mortality.
- Rocket heat plume may injure or kill individual cats exposed to the plume.

5.3.6 West Indian Manatee

None of the proposed construction areas are located within manatee habitat. This species has not been observed within the action area since 1914. A launch event could increase boat traffic within the vicinity of the VLA during launch days. This would increase the potential for seagrass beds to be disturbed from rotor wash and therefore result in a decrease in a food source for the manatee. In addition, the risk to manatees from boat strikes would increase due to an increase in boat traffic. Potential effects to manatees present in the action during a launch event would be avoid or minimized by an educational outreach program to inform vessel operators about manatees in the area and why and how to avoid them. Given the lack of species presence in the action area and the education outreach program, the FAA has determined the Proposed Action **may affect and is not likely to adversely affect** the West Indian manatee.

5.3.7 Sea Turtles

The Kemp's ridley, loggerhead, green, hawksbill, and leatherback sea turtles have all been recorded nesting within the action area in the past. However, the Kemp's ridley sea turtle is the only species that has been recently recorded to nest on Boca Chica Beach with any regularity (Sea Turtle, Inc 2020). Kemp's ridley sea turtles primarily nest on windy days, when launch operations are unlikely to occur because of poor weather conditions (Sea Turtle, Inc. 2012).

Noise and vibrations from rocket launches could frighten nesting turtles, causing them to abandon their nesting attempt. However, noise and vibrations from launch operations would last a few minutes; reducing the likelihood for the noise and vibrations to occur during the time a sea turtle is attempting to nest. Vibrations could also harm incubating eggs. However, current standard procedure for all nests that are observed in Texas is for all eggs to be retrieved from each nest and transported to an incubation facility. Sea Turtle, Inc. administers nesting sea turtle patrols and relocation of eggs on Boca Chica Beach. Therefore, any vibrations from a rocket launch would most likely only impact eggs that were laid the same day of the launch or were not found due to an operational beach closure. There is also potential for a nest to be missed by patrol and therefore not relocated. These nests that are not found in time to be relocated could potentially be affected by nest predators, vehicles driving on the beach and dunes, or from human poachers. It is possible that activities associated with digging up sea turtle eggs and relocating them to an incubating facility would potentially subject sea turtle eggs to greater vibration and noise levels than those vibrations and noise levels received during engine ignition while buried on the beach. The FAA is not aware of any effects to sea turtle eggs during transport to an incubating facility due to vibration or noise.

The areas where construction and operations are proposed to occur are not located in sea turtle nesting habitat. The heat plume, however, would expose Boca Chica Beach to high temperatures during engine ignition. The heat plume is not expected to affect sea turtle nests because the eggs are buried in the sand and Sea Turtle, Inc. administers nesting sea turtle patrols and relocation of eggs on Boca Chica Beach. Nesting females and hatchlings could be affected by the heat plume if they were present on the beach at the time of engine ignition. Kemp's ridley sea turtles are the only sea turtle species that have been documented to nest on Boca Chica Beach with any regularity (Sea Turtle, Inc 2020). This species primarily nests on windy days (Sea Turtle, Inc. 2012). SpaceX is not likely to conduct launch operations during windy days. The remaining sea turtle species nest during the night, when 20 percent of operations, including 1 launch, could occur.

While lighting at the VLA could potentially be visible on the beach, it is not likely to affect (disorient) hatchlings because eggs are retrieved and transported to an incubation facility. However, there is potential for a nest to be missed by patrol and therefore not relocated. In addition, during launch days, patrol personnel would potentially not be able to access the beach. As a result, there is potential for some eggs to not be collected and thus hatchlings to emerge near the launch site. These emerging hatchlings could be disoriented by lighting at the VLA. The risk would be highest when a launch vehicle is present on a pad and pad lighting is used. SpaceX would avoid or minimize potential effects from lighting on sea turtles by complying with established lighting policy for minimizing disorienting effects on sea turtle hatchlings. SpaceX is currently updating its existing Facility Design and Lighting Management Plan and will send the updated plan to the USFWS for review.

Based on the above analysis of potential direct and indirect effects on sea turtles from the proposed construction and operations, the FAA has determined the Proposed Action **may affect, and is likely to adversely affect** the loggerhead, green, leatherback, hawksbill, and Kemp's ridley sea turtles. A determination of **may affect** is warranted for the Proposed Action based on the following rationale:

- Sea turtles have been recorded nesting in the action area, including along South Padre Island and Boca Chica Beach.

A determination of **is likely to adversely affect** is warranted for the project based on the following rationale:

- Noise and vibrations from rocket launches could frighten nesting turtles, causing them to abandon their nesting attempt.
- On launch days during sea turtle nesting season, sea turtle nest patrol personnel could

potentially be unable to access the beach, thereby missing a sea turtle nesting event and failure to collect and relocate eggs.

- Lighting could cause adult females to false crawl or hatchlings that were not relocated to become disoriented and reduce nesting success / hatchling survival.
- Sea turtles (adults and hatchlings) present near the VLA at the time of engine ignition could be injured or killed by the rocket heat plume.

6 CUMULATIVE EFFECTS ANALYSIS

"Cumulative effects" under the ESA are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation (50 CFR § 402.02). The FAA conducted a thorough review of the action area to identify state or private activities that, when combined with the Proposed Action, may result in cumulative effects to the ESA-listed species and critical habitat addressed in this BA. The FAA conducted a search within each of the municipalities and unincorporated areas within the action area to identify private projects planned to occur within the action area. The FAA identified projects at the Port of Brownsville, Port Isabel, and South Padre Island, as well as several Texas Department of Transportation projects within the action area. None of SpaceX's proposed future activities occur within designated critical habitat for the piping plover. These actions and the potential cumulative effects to ESA-listed species are described below.

6.1 PORT OF BROWNSVILLE

There are 2 major projects at the Port of Brownsville:

- **Construction of Liquid Cargo Dock 6 and Rehabilitation of Liquid Cargo Dock 3**. The Port of Brownsville is constructing a new liquid cargo dock, Liquid Cargo Dock 6, and rehabilitating Liquid Cargo Dock 3, to improve and expand marine delivery and shipment of refined petroleum products including asphalt, gasoline, and low-sulfur diesel fuel.
- **Administration Complex Rehabilitation and Building Additions**. The Port of Brownsville is rehabilitating existing buildings and constructing new buildings for the administration facilities at 100 Foust Road. Activities include construction of new buildings, rehabilitation of existing buildings, and construction of a new parking area (Port of Brownsville 2020).

6.2 PORT ISABEL

A grant request was submitted to the Texas Community Development Block Grant (TxCDBG) Program for $500,000 for the installation of ADA-compliant sidewalks, street lighting, drainage improvements and street improvements in the City of Port Isabel. The application is under review (Port Isabel 2020).

6.3 SOUTH PADRE ISLAND

6.3.1 Wind and Water Park

The City of South Padre Island has signed a lease agreement with a property owner and has been working towards developing a Wind and Water Sports Park. The project site is located on a 107-acre parcel of land, wind tidal flats, and salt marsh contiguous with the Laguna Madre, approximately 0.3 miles north of Beach Access Road 4 along Ocean Boulevard (Park Road 100), South Padre Island, Cameron County, Texas. The City proposes to place approximately 13,423 cubic yards of "Geoweb" stabilizing material and crushed stone into 2.332 acres of tidal flats (0.16 acre), estuarine marsh (1.98 acres) and palustrine wetlands (0.192 acre) to construct a permeable vehicular path from Park Road 100 to the Laguna Madre to improve recreational access for non-motorized wind and water-based activities (wind surfing, kayaking, fishing, etc.). Four permeable parking areas would be constructed, one of which would also include a permeable vehicle unloading zone and two equipment setup/rigging areas. The four parking areas would provide parking for up to 309 vehicles both within and outside of jurisdictional waters. A "Green Flush" restroom facility would be constructed in an upland area to avoid direct impacts (USACE 2020).

6.3.2 Laguna Boulevard Improvements

The City of South Padre Island is planning to improve Laguna Boulevard. Proposed improvements include 11 foot-travel lanes and an elevated 8-foot shared use path on the west side of the street. The project will improve the drainage and incorporate low impact development so the City can become more resilient (South Padre Island 2020).

6.4 Texas Department of Transportation Activities

The Texas Department of Transportation Project Tracker identifies multiple transportation improvement projects within the action area that may result in potential cumulative effects to ESA-listed species or critical habitat when combined with the Proposed Action. Most of the projects consist of pavement rehabilitation and preventative maintenance activities. These types of projects are typically implemented within each facility's existing right-of-way. Several road widening projects are also planned to occur within the next four years, as well as a small amount of road construction in new locations (Texas DOT 2020).

6.5 Magic valley Electric Cooperative

Magic Valley Electric Cooperative (MVEC) is planning to upgrade the existing power line from Brownsville to Boca Chica Village. The line upgrade will include construction along Hwy 4 of aboveground, overhead lines using utility poles. The line will go underground at the intersection of Richardson Ave and Hwy 4 and continue to Boca Chica Village.

6.6 Other SpaceX Activities

SpaceX is in the construction and continued planning and design phase for its production and manufacturing facility on privately owned property near the LLCC. SpaceX is developing the manufacturing area to include the following:

- Additional large production tents
- Support buildings
- Extension of existing buildings
- Additional parking lots

Further west of the production area is the SpaceX processing area. SpaceX is developing the processing area and is proposing to include the following:

- Office space
- Storage foundations for Starship and Super Heavy vehicles
- Water wells

SpaceX anticipates that the processing and manufacturing areas—which will operate 24 hours a day, 7 days a week—will be staffed by approximately 450 people at any given time.

SpaceX's manufacturing and processing activities and associated development will occur on private land, are privately funded, do not require any federal approval, and are planned to continue regardless of whether the FAA issues SpaceX licenses for Starship/Super Heavy operations. For example, the components manufactured and processed in Boca Chica could be shipped to support launch and test activities at any of SpaceX's facilities, including Vandenberg Air Force Base; McGregor, TX; or CCAFS. The air separation unit and natural gas production area will be used for production-related purposes, and the refined fuel will also support SpaceX operations at other sites. Accordingly, these anticipated activities have independent utility from the FAA's Proposed Action.

6.7 Cumulative Effects Analysis

As identified in Section 5.1.1, the FAA identified 11 threats associated with proposed construction and operational activities, including noise; ground vibrations; increased traffic and human presence; potential invasive species introductions; launch-related closures; potential gas, fuel, oil, or solvent spills; lighting; habitat loss; potential anomalies; rocket heat plume; and tall structures. The projects identified above create the same types of threats to the ESA-listed species addressed in this BA and could result in adverse cumulative effects to the species when combined with the Proposed Action. The Service is continually working with private and state entities to review proposed projects, offer technical assistance, and provide recommendations on avoidance and minimization measures and reintroduction and restoration measures to protect the listed species, including their habitats, addressed in this BA. By continued cooperative efforts to replace, secure, and improve such habitats and connect optimal habitat that exists on NWR and private lands, the FAA does not believe that the potential cumulative effects are likely to jeopardize the continued existence of the listed species addressed in this BA.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

1/31/22

Refer to NMFS No: OPR-2021-02908

Michelle Murray
Manager, Operations Support Branch (A), ASA-140
FAA Office of Commercial Space Transportation
800 Independence Ave SW, Suite 325
Washington, DC 20591

RE: 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

Dear Ms. Murray:

On August 25, 2021, the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NMFS) Endangered Species Act (ESA) Interagency Cooperation Division received a request for concurrence with the Federal Aviation Administration's (FAA) determination that launch and reentry vehicle operations in the marine environment may affect, but are not likely to adversely affect ESA-listed species or designated critical habitat under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.). On August 11, 2021, the FAA submitted a consultation request letter to the ESA Interagency Cooperation Division seeking concurrence on their determination that issuing experimental permits and/or a Vehicle Operator License that would allow SpaceX to launch the Starship/Super Heavy from the Boca Chica (Cameron County, TX) Launch Site may affect, but are not likely to adversely affect ESA-listed species or designated critical habitat. Because of the similarities in the two proposed actions, NMFS decided to batch the two consultations into a single programmatic letter of concurrence. This response to your consultation requests was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at (50 CFR §402), and agency guidance for preparation of letters of concurrence.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with agency guidelines issued under section 515 of the Treasury and General Government Appropriations Act of 2001 (Data Quality Act; 44 U.S.C. 3504(d)(1) and 3516). A complete record of this informal consultation is on file at NMFS Office of Protected Resources in Silver Spring, Maryland.

Consultation History

Because of the history of the FAA requesting individual consultations for different components of space launches and reentries, NMFS proposed a programmatic consultation focused on commercial space launches and reentries to the FAA in March 2018. The FAA agreed to a programmatic approach to combine space launches and reentries into a single consultation. The

National Aeronautics and Space Administration (NASA) and the U.S. Space Force (USSF) are included as federal action agencies in this programmatic consultation due to their involvement with commercial space launch operations that are part of the proposed action, such as leasing launch complexes and launch-related infrastructure to commercial launch operators.

The FAA submitted a consultation request letter to the ESA Interagency Cooperation Division on August 11, 2021, seeking concurrence on their effects determination for the proposed issuance of experimental permits and/or a Vehicle Operator License that would allow SpaceX to launch the Starship/Super Heavy from the Boca Chica (Cameron County, TX) Launch Site. NMFS ESA Interagency Cooperation Division decided to combine the two consultations into a single programmatic letter of concurrence. Programmatic ESA section 7 consultations allow the Services to consult on the effects of programmatic actions such as: (1) multiple similar, frequently occurring or routine actions expected to be implemented in particular geographic areas; and (2) a proposed program, plan, policy, or regulation providing a framework for future actions (50 C.F.R. §402.02).

The history of this consultation is as follows:

- During early coordination and technical assistance, the FAA submitted a draft Programmatic Biological Evaluation (BE) to NMFS on February 25, 2021, to solicit review and comments. The ESA Interagency Cooperation Division subsequently distributed the draft BE to NMFS regional offices for review. NMFS comments on the BE were combined and provided to the FAA on June 4, 2021.
- The FAA provided a revised BE to NMFS on August 25, 2021. The revised BE was reviewed by ESA Interagency Cooperation Division staff and sent to the NMFS regional offices. NMFS provided the FAA with questions following review of the revised BE on September 13, 2021. FAA provided responses on October 13, 2021. NMFS had additional questions regarding these responses, which were sent to the FAA on October 18, 2021, and the FAA responded on October 22, 2021.
- The SpaceX concurrence request letter was subsequently distributed to NMFS regional offices for review by the ESA Interagency Cooperation Division. NMFS comments on the letter were combined and provided to the FAA on September 15, 2021. The FAA provided responses on November 4, 2021, that included a revised letter and an expanded action area in the Gulf of Mexico for the consultation.
- On October 15, 2021, the ESA Interagency Cooperation Division staff requested a meeting with the FAA to discuss combing the Starship-Super Heavy proposed activities with the programmatic launch and reentry vehicle operations consultation. The meeting occurred on November 5, 2021, and, due to the significant overlap of proposed activities, action areas and effects analysis, NMFS and the FAA agreed to incorporate the Starship-Super Heavy consultation into the programmatic launch and reentry vehicle operations consultation.

The FAA, NASA, the USSF, and the U.S. Air Force (USAF) prior to the creation of USSF, have completed informal consultations with NMFS for the types of activities included in this programmatic consultation.

Previous consultations for the activities included in this programmatic consultation include:

- **SER-2016-17894:** On April 11, 2016, the FAA, USAF and NASA submitted a request for concurrence under ESA section 7 to NMFS's Southeast Regional Office (SERO) for SpaceX launch operations occurring from Cape Canaveral, Kennedy Space Center, and the SpaceX Texas Launch Site (now referred to as the SpaceX Boca Chica Launch Site), and launch recovery operations occurring in open waters in the Atlantic Ocean and Gulf of Mexico. On August 8, 2016, NMFS issued a Letter of Concurrence for those proposed activities.
- **FPR-2017-9231:** After concluding the 2016 consultation, SpaceX informed the FAA that parafoils and parachutes associated with the payload fairings that descend through the Earth's atmosphere and land in the Atlantic Ocean after a launch might not be fully recovered by SpaceX. The FAA also learned the parachutes associated with other spacecraft (e.g., Dragon) reentry were not always recovered. These aspects of the project were not considered in the 2016 consultation because it was assumed all parachutes and parafoils would be fully recovered. SpaceX also proposed to conduct Falcon 9 launch vehicle and Dragon spacecraft recovery operations in the Pacific Ocean, which were not addressed in the 2016 consultation. Actions in the Pacific Ocean include recovery of parafoils and parachutes associated with payload fairings and the Dragon spacecraft. On June 7, 2017, via conference call, staff from the FAA, USAF, NASA, and NMFS Protected Resources staff (from Headquarters and SERO) discussed ongoing operations and ESA coverage needs for future operations. The parties mutually agreed that NMFS ESA Interagency Cooperation Division would complete the ESA section 7 consultation for the expanded operations. On October 2, 2017, NMFS issued a Letter of Concurrence for SpaceX's proposed launch and recovery operations in the Atlantic Ocean, Gulf of Mexico, and Pacific Ocean.
- **SER-2018-19649 and FPR-2018-9287:** On October 15, 2018, the FAA reinitiated ESA consultation with NMFS (Headquarters and SERO) to consider the effects to the giant manta ray (*Manta birostris*) and the oceanic whitetip shark (*Carcharhinus lonigmanus*) because these species were federally listed subsequent to the 2016 and 2017 consultations. On November 21, 2018 and November 30, 2018, NMFS SERO and NMFS Headquarters, respectively, issued Letters of Concurrence.
- **OPR-2020-00268:** On October 7, 2019, the FAA reinitiated ESA consultation with NMFS (Headquarters) because SpaceX expanded their proposed launch trajectories to include a southern trajectory for payloads requiring polar orbits. The change expanded the action area for which Falcon first stage booster return and recovery operations in the Atlantic Ocean could occur. On February 26, 2020, NMFS Headquarters issued a Letter of Concurrence.

The purpose of this programmatic consultation is to streamline the FAA's, USSF's, and NASA's compliance with ESA section 7 for the actions as described in the *Proposed Action* section of this letter. This programmatic consultation includes all the project-specific activities evaluated in the above-mentioned consultations (including the environmental protection measures) and expands upon them to enable application to future launch projects or operations. Thus, this programmatic consultation supersedes the above-mentioned consultations.

Office of National Marine Sanctuaries

If a federal agency finds that a proposed action is likely to injure National Marine Sanctuary resources, the agency is required to consult with the NOAA Office of National Marine Sanctuaries (ONMS). The ESA Interagency Cooperation Division provided the Programmatic BE and the Starship Super Heavy concurrence request letter to ONMS on October 1, 2021, to determine if consultations would be needed for the proposed activities. The ONMS responded on October 12, 2021, stating that a permit might be needed if any material is expected to make its way into a sanctuary. The FAA determined none of the proposed activities are expected to occur within sanctuaries.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) requires that an incidental take authorization be obtained for the unintentional "take" of marine mammals (e.g., by harassment) incidental to otherwise lawful activities. The action agencies and/or their commercial space partners are required to apply for an MMPA authorization from the NMFS Office of Protected Resources, Permits and Conservation Division, if their activities could subject marine mammals to "take" as defined by the MMPA.

PROPOSED ACTION AND ACTION AREA

Agency Action Overview

The FAA, USSF, and NASA prepared the Programmatic BE to address the potential effects of the following federal actions on ESA-listed species and designated critical habitat:

1) FAA's action of issuing licenses or permits to commercial space applicants in general practice, and specifically for SpaceX Starship-Super Heavy operations launched from Boca Chica;
2) USSF's (Space Launch Delta [SLD] 30 and 45) action of conducting launch operations from Cape Canaveral Space Force Station (CCSFS) and Vandenberg Space Force Base (VSFB)[1], including the action of leasing launch complexes to commercial launch operators; and
3) NASA's action of conducting launch, landing, and recovery operations from Kennedy Space Center (KSC) and Wallops Flight Facility (WFF), including the action of leasing launch complexes and launch-related infrastructure to commercial launch operators.

The following subsections provide an overview of the FAA's, USSF's, and NASA's missions pertaining to this consultation.

Federal Aviation Administration

The FAA Office of Commercial Space Transportation oversees, licenses, and regulates U.S. commercial launch and reentry activity, as well as the operation of non-federal launch and reentry sites, as authorized by the Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. 50901–50923. An FAA license or permit is required for any commercial launch or reentry, or the operation of any commercial launch or reentry site, by U.S. citizens anywhere in the world, or by any individual or entity within the United States. An FAA license

[1] With the creation of the USSF, Cape Canaveral Air Force Station and Vandenberg Air Force Base were renamed Cape Canaveral Space Force Station and Vandenberg Space Force Base. The 30th and 45th Space Wings were renamed Space Launch Delta (SLD) 30 and 45.

or permit is not required for launch or reentry activities carried out by the federal government, such as NASA or Department of Defense (DoD) launches. The FAA licensing and permitting evaluation consists of five major components: 1) a policy review, 2) a payload review, 3) a safety review, 4) a determination of maximum probable loss for establishing financial responsibility requirements, and 5) an environmental review.

The FAA defines a ‘launch vehicle’ as a vehicle built to operate in, or place a payload in, outer space, or a suborbital rocket. The FAA defines a ‘reentry vehicle’ as a vehicle designed to return from Earth orbit or outer space to Earth substantially intact. The FAA issues licenses or permits to commercial launch vehicle operators (referred to as vehicle operators or launch operators) for operation of launch and reentry vehicles. The same vehicle operators may also conduct operations for NASA or DoD. Additionally, NASA and DoD may conduct launches and/or reentries of launch and reentry vehicles that were built by the federal government.

The FAA Office of Commercial Space Transportation issues the following types of licenses and permits, in accordance with Title 14, Code of Federal Regulations (CFR) parts 420, 437, and 450:

- **Launch Site Operator License** (14 CFR Part 420): A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator (i.e., a person or company conducting the launch of a launch vehicle and any payload) for each launch point, launch vehicle type, and weight class identified in the license application and upon which the licensing determination is based. Examples of launch site operators include airports and state or local governments. Examples of launch operators include companies such as SpaceX, Blue Origin, Firefly, Rocket Lab, Northrop Grumman, Virgin Orbit, and United Launch Alliance. Issuance of a launch site operator license does not relieve a licensee of its obligation to comply with any other laws or regulations, nor does it confer any proprietary, property, or exclusive rights in the use of airspace or outer space. A launch site operator license remains in effect for 5 years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee. Actual launches cannot occur from a launch site until a launch operator receives a vehicle operator license for the site.
- **Vehicle Operator License** (14 CFR Part 450):A vehicle operator license authorizes a licensee to conduct one or more launches or reentries using the same vehicle or family of vehicles. Launch includes the flight of a launch vehicle and pre- and post-flight ground operations. Reentry includes activities conducted in Earth orbit or outer space to determine reentry readiness and that are critical to ensuring public health and safety and the safety of property during reentry flight. Reentry also includes activities necessary to return the reentry vehicle, or vehicle component, to a safe condition on the ground after impact or landing.
- **Experimental Permits** (14 CFR Part 437): An experimental permit authorizes launch or reentry of a reusable suborbital rocket. The authorization includes pre- and post-flight ground operations. A suborbital rocket is a vehicle, rocket-propelled in whole or in part, intended for flight on a *suborbital* trajectory. A permit is an alternative to licensing and is valid for a one-year renewable term.
- **SpaceX Starship-Super Heavy, Boca Chica:** SpaceX must obtain an experimental permit or launch vehicle operator license from the FAA for Starship (spacecraft)-Super

Heavy (rocket booster) launch and reentry operations that originate from the Boca Chica Launch Site. SpaceX proposed launch operations include suborbital and orbital launches.

U.S. Space Force

The USSF is the lease or license holder for the real property and ranges where launches occur from CCSFS and VSFB. The USSF uses its own launch and reentry vehicles, as well as those of commercial launch operators, to launch USSF payloads into space.

- **Space Launch Delta 45:** SLD 45 is responsible for overseeing the preparation and launching of U.S. government, civil, and commercial satellites from CCSFS, Florida, and operates the Eastern Range for the USSF. SLD 45 also provides launch facilities and services to support NASA and commercial space operations. A directive of the USSF is to provide efficient means of executing national security and military policy goals. The Eastern Range operations provide the resources and activities for safe flight, range instrumentation, infrastructure, and schedule to support space and ballistic launches. The Eastern Range consists of tracking stations at CCSFS, mainland annexes, and downrange tracking stations on islands located in the Caribbean Sea and South Atlantic Ocean. SLD 45 is the primary missile and rocket launch organization for the USSF on the east coast of the United States.
- **Space Launch Delta 30:** SLD 30 at VSFB is the Air Force Space Command organization responsible for DoD space and missile launch activities on the west coast of the United States. The primary mission of VSFB is to launch and track satellites destined for polar or near-polar orbit, test and evaluate America's Intercontinental Ballistic Missile systems, and support aircraft operations. SLD 30 supports West Coast launch activities for the DoD (including USAF and Missile Defense Agency), NASA, foreign nations, and various private contractors.

National Aeronautics and Space Administration

The National Aeronautics and Space Act is the U.S. federal statute that created NASA. The Space Act gives NASA the responsibility for planning, directing, and conducting the nation's civilian space program, aeronautics and aerospace research activities. It also gives NASA the authorization to enter into cooperative agreements, leases, and contracts with public and private entities in the use of NASA's services, equipment, and facilities in support of scientific research and discovery.

- **Kennedy Space Center:** Established in 1962 as the NASA Launch Operations Center, KSC has carried out launch operations for the Apollo, Skylab, Space Shuttle, and cargo and crewed launches to the International Space Station. KSC is NASA's only launch site for human spaceflight. KSC's mission is to function as a multi-user spaceport for launch operations operated by NASA and a growing number of private partners. In addition to providing all aspects of launch, landing, and recover operations for both government and commercial launch providers, KSC also provides payload processing, testing, and integration for government and commercial partners at facilities across KSC. KSC is located adjacent to CCSFS and the two entities work closely together to execute their missions, sharing resources, facilities, and infrastructure.

  KSC's launch complexes consist of Launch Complex 39A and 39B, Launch Complex 48, and the Shuttle Landing Facility. KSC also has land identified for up to two additional launch complexes for potential future development. In anticipation of missions to the moon and Mars, KSC will facilitate further research, development, and diverse partnerships to develop, integrate, and sustain space systems. Launch Complex 39A is designated as a multi-use complex that will support the NASA Space Launch System launch vehicle and the Orion crew capsule for manned missions beyond low Earth orbit. Launch Complex 39A is operated by SpaceX and supports Falcon vehicle launch operations with potential plans to support future SpaceX launch vehicle operations. Launch Complex 48 is a small class vehicle pad that is being developed to support commercial launches.

- **Wallops Flight Facility:** NASA Goddard Space Flight Center manages WFF, the oldest active launch range in the continental United States and the only rocket testing and launch range owned and operated by NASA. For over 70 years, WFF has flown thousands of research vehicles in the quest for information on the flight characteristics of launch vehicles and spacecraft, and to increase the knowledge of the Earth's upper atmosphere and the near space environment. The primary purpose of the WFF launch range is to provide the infrastructure, data services, logistics, and safety services necessary for flight projects supporting NASA science, technology, and exploration programs; DoD research and other government agency needs; and academic and commercial industry needs. WFF regularly provides launch support, range safety, and downrange tracking for the emerging commercial launch industry, either directly or through the Mid-Atlantic Regional Spaceport, which is a commercial launch site on Wallops Island licensed by the FAA and operated by the Virginia Commercial Space Flight Authority (Virginia Space). The Spaceport provides facilities and services for NASA, DoD, and commercial launches of payloads into space.

Launch Sites

USSF launches occur at CCSFS and VSFB. NASA launches occur at KSC and WFF. Commercial space launches are currently authorized to occur at several launch sites, including sites at CCSFS, VSFB, KSC, and WFF.[2] Existing launch sites that involve operations in the marine environment are listed in Table 1. The FAA, USSF, and/or NASA might receive proposals in the future for launch operations involving operations in the marine environment at other existing launch sites or new launch sites. Upon receipt of a new proposal that involves operations in the marine environment, the lead action agency will review the proposal and coordinate with NMFS to determine if the proposed launch operations fall within the scope of this consultation (see *Project Specific Review* for details).

Table 1. Launch Sites with Operations in the Marine Environment

Launch Site	FAA-License	Location	Site Operator	Type of Launch (Vertical or Horizontal)[a]
Cecil Airport	Yes	Jacksonville, FL	Jacksonville Aviation Authority	Horizontal
CCSFS (multiple launch and landing complexes)	No	Cape Canaveral, FL	U.S. Space Force	Vertical

[2] See the FAA's website for a current list of active licenses: https://www.faa.gov/data_research/commercial_space_data/licenses/.

Launch Site	FAA-License	Location	Site Operator	Type of Launch (Vertical or Horizontal)[a]
CCSFS Skid Strip	No	Cape Canaveral, FL	U.S. Space Force	Horizontal
CCSFS LC-46	Yes	Cape Canaveral, FL	Space Florida	Vertical
Ellington Airport	Yes	Houston, TX	Houston Airport System	Horizontal
Mojave Air and Space Port	Yes	Mojave, CA	Mojave Air & Space Port	Horizontal
NASA KSC (except SLF)	No	Merritt Island, FL	NASA	Vertical
NASA KSC SLF	Yes	Merritt Island, FL	Space Florida	Horizontal
NASA WFF (except LC-0)	No	Wallops Island, VA	NASA	Both
NASA WFF LC-0 (referred to as MARS)	Yes	Wallops Island, VA	Virginia Commercial Space Flight Authority	Vertical
NASA WFF Main Base	Yes	Wallops Island, VA	NASA	Horizontal
Pacific Spaceport Complex Alaska	Yes	Kodiak Island, AK	Alaska Aerospace Development Corporation	Vertical
Space Coast Regional Airport	Yes	Titusville, FL	Titusville-Cocoa Airport Authority	Horizontal
SpaceX Boca Chica Launch Site	No[b]	Brownsville, TX	SpaceX	Vertical
VSFB (multiple launch and landing complexes)	No	Vandenberg, CA	U.S. Space Force	Vertical

[a] Vertical = the launch vehicle takes off vertically from a launch pad (i.e., a traditional rocket launch); Horizontal = the launch vehicle takes off horizontally from a runway like an aircraft.
[b] SpaceX is the exclusive user of the Boca Chica Launch Site and therefore only need a vehicle operator license to launch.
AK = Alaska; CA = California; CCSFS = Cape Canaveral Space Force Station; FL = Florida; KSC = Kennedy Space Center; LC = Launch Complex; MARS = Mid-Atlantic Regional Spaceport; NASA = National Aeronautics and Space Administration; SLF = Shuttle Landing Facility; TX = Texas; VA = Virginia; VSFB = Vandenberg Space Force Base; WFF = Wallops Flight Facility

Launch Vehicles

A launch vehicle is a vehicle built to operate in, or place a payload in, outer space, or it is a suborbital rocket. Launch vehicles are commonly termed rockets. Launch vehicles take off either vertically from a launch pad or horizontally from a runway.

Currently, all of the vertical launch vehicles included in this consultation are expendable (i.e., individual stages are either disposed of in the ocean or in outer space), except for the first stages of SpaceX's Falcon 9, Falcon Heavy, and Super Heavy rockets, which are reusable (i.e., SpaceX recovers the first stages by either landing them at a launch site or on a barge in the ocean). In the future, the FAA, USSF, and/or NASA expect to receive proposals from other operators (e.g., Blue Origin) for first stage booster landings at a launch site or on a barge in the ocean, similar to SpaceX.

In addition to vertically launched rockets, there are three main types (or concepts) of horizontal launch vehicles: Concepts X, Y, and Z (Table 2). Concepts X and Y vehicles are reusable (i.e., they are not expended during a launch mission). Concept Y vehicles are similar to Concept X vehicles, except they are powered solely by rocket engines. Propellants include liquid oxygen and either kerosene or alcohol. The Concept Y vehicle takes off from the runway under rocket power and flies a suborbital trajectory. Upon atmospheric reentry, the vehicle conducts an unpowered descent and landing at the spaceport. The Concept Z vehicle is a two-part launch system consisting of a carrier aircraft (reusable) and a rocket (expendable or reusable). The turbojet engines of the carrier aircraft use Jet-A fuel (kerosene) and the hybrid rocket engine uses nitrous oxide and hydroxyl-terminated polybutadiene. During a launch, the carrier aircraft takes off from the spaceport runway with the rocket attached and ascends to an altitude of approximately 50,000 feet (ft), where the rocket is released from the carrier aircraft. The rocket ignites its engines and flies a suborbital trajectory. Upon atmospheric reentry, a reusable rocket makes an unpowered descent and landing at the spaceport. Meanwhile, the carrier aircraft makes a normal powered landing after releasing the rocket. Use of an expendable rocket for the Concept Z launch vehicle involves expending a booster stage into the ocean.

Table 2. Types of Horizontal Launch Vehicles

Type	Takeoff Propulsion	Propulsion to Reach Orbit	Landing Propulsion	Reusable or Expendable
Concept X	Jet	Rocket	Jet	Reusable
Concept Y	Rocket	Rocket	Unpowered (glide)	Reusable
Concept Z[a]	Jet	Rocket	Jet (carrier aircraft); Unpowered (rocket)	Both

Notes:
[a] The Concept Z vehicle is a two-part launch system consisting of a carrier aircraft (reusable) and a rocket (expendable or reusable).

Examples of launch vehicles (vertical and horizontal) for which operations could affect ESA-listed species under NMFS jurisdiction are listed in Table 3.

Table 3. Examples of Launch Vehicles that could affect the Marine Environment

Launch Vehicle	Type	Operator(s)	Launch Site(s)
Alpha	Vertical	Firefly	VSFB
Antares Family	Vertical	Northrop Grumman	WFF
Astra Rocket 3	Vertical	Astra Space, Inc.	PSCA
Atlas V	Vertical	ULA, Lockheed Martin	CCSFS, VSFB
Delta IV	Vertical	ULA	CCSFS, VSFB
Electron	Vertical	Rocket Lab	WFF
Falcon 9	Vertical	SpaceX	CCSFS, KSC, VSFB

Launch Vehicle	Type	Operator(s)	Launch Site(s)
Falcon Heavy	Vertical	SpaceX	KSC
Minotaur Family	Vertical	Northrop Grumman	CCSFS, WFF, VSFB
New Glenn	Vertical	Blue Origin	CCSFS, VSFB
Pegasus	Horizontal – Concept Z (expendable)	Northrop Grumman	CCSFS, WFF, VSFB
LauncherOne	Horizontal – Concept Z (expendable)	Virgin Orbit	MASP
RS1	Vertical	ABL Space Systems	CCSFS, VSFB
Sounding Rockets	Vertical	NASA	WFF
Starship/Super Heavy	Vertical	SpaceX	KSC, SpaceX Boca Chica Launch Site
Terran 1	Vertical	Relativity Space, Inc.	CCSFS, VSFB
Vector-H, Vector-R	Vertical	Vector	CCSFS, WFF
Vulcan	Vertical	ULA	CCSFS, VSFB
X-60	Horizontal	Generation Orbit	Cecil Airport, WFF

AFB = Air Force Base; CCSFS = Cape Canaveral Space Force Station; KSC = Kennedy Space Center; MASP = Mojave Air & Space Port; PSCA = Pacific Spaceport Complex-Alaska; ULA = United Launch Alliance; VSFB = Vandenberg Space Force Base; WFF = Wallops Flight Facility

Starship-Super Heavy Launch Vehicle

The fully integrated launch vehicle is approximately 400 ft tall by 30 ft diameter and comprised of two stages: Super Heavy is the first stage (or booster) and Starship is the second stage. Both stages are designed to be reusable. Unlike the SpaceX Falcon launch vehicle, Starship-Super Heavy will not have separable fairings or parachutes. The Super Heavy is expected to be equipped with up to 37 Raptor engines, and the Starship will employ up to six Raptor engines. The Raptor engine is powered by liquid oxygen (LOX) and liquid methane (LCH_4). Super Heavy is expected to hold up to 3,700 metric tons (MT) of propellant and Starship will hold up to 1,500 MT of propellant.

Reentry Vehicles

Reentry means to return or attempt to return, purposefully, a vehicle and its payload or human being, if any, from Earth orbit or from outer space to Earth. A reentry vehicle is a vehicle designed to return from Earth orbit or outer space to Earth intact. Examples of reentry vehicles are SpaceX's Dragon and Starship spacecrafts, NASA's Orion spacecraft, Boeing's Starliner spacecraft, and Sierra Nevada's Dream Chaser spacecraft. SpaceX's Dragon spacecraft has reentered Earth and landed in the Pacific Ocean and the Gulf of Mexico. SpaceX is proposing to have Starship landings occur in the Gulf of Mexico and a location in the Pacific Ocean (offshore Kauai Island, Hawaii; see Figure 5 in the *Action Area*).

SpaceX is able to conduct landings of the first stage of the launch vehicle shortly after launch (takeoff). These first stage operations are suborbital and are not considered by the FAA to be a reentry vehicle because they have not completed one orbit around the Earth. These first stage landings are considered part of a launch and it is expected that additional launch operators will utilize this strategy in the future.

Vertical Launches

Vertical launches occur from launch pads located at a launch site. After liftoff, the rocket quickly gains altitude and flies over the ocean. At some point downrange, the rocket reaches supersonic speeds (which generates a sonic boom) and pitches over to attain its intended orbital trajectory. Depending on the rocket's orientation, it is possible for the sonic boom to intercept the Earth's surface. Given the altitude at which the rocket reaches supersonic speeds, most of the sonic boom footprint that reaches the Earth's surface is usually of small magnitude (1–2 pounds per square foot [psf]), but there could be areas that experience a sonic boom up to 8 psf. The area exposed to the higher overpressure (up to 8 psf) is much smaller than the areas that experience lower overpressures. Sonic boom intensity, in terms of psf, is greatest under the flight path and progressively weakens with greater horizontal distance away from the flight track.

Vertical rocket launches may involve expending one or more stages (or boosters) in the ocean. After stage separation during the rocket's flight, the booster(s) falls into the ocean and sinks to the ocean floor. This has been the normal practice for decades. The commercial aerospace company SpaceX has developed the ability to recover first stage boosters for subsequent reuse instead of expending boosters in the ocean. For missions involving booster recovery, the booster conducts fly back and landing on a platform barge in the ocean or on a pad at a launch site. The platform barge[3] has its own azimuth thrusters to maintain position needed for landings. After securing the vehicle, the barge is towed (by an approximately 80 ft long tugboat) with the booster to a port or wharf (e.g., Port of Cape Canaveral, a CCSFS-located wharf, Port of Long Beach, or Port of Los Angeles). During booster landing in the ocean, a sonic boom is produced, up to 8 psf directly underneath and directed towards the landing barge platform. Other launch companies will likely develop technology to recover boosters in the future.

In addition to expended boosters falling into the ocean, payload fairings also fall into the ocean and sink. The fairing consists of two halves that separate to facilitate the deployment of the payload. Like booster recovery, SpaceX has developed the ability to conduct fairing recovery. SpaceX's fairing recovery operations use a parachute system hundreds of miles offshore in deep water. The parachute system consists of one drogue parachute and one parafoil (see Appendix A for characteristics of parachutes and parafoils). Drogue parachutes are thinner and smaller (65-113 foot square[ft^2]) than the parafoils (1,782-3,000 ft^2), deployed to gain control of the fairing at speeds that would destroy the larger parafoil, and therefore deployed before the parafoil. Following re-entry of the fairing into Earth's atmosphere, the drogue parachute is deployed at a high altitude (approximately 50,000 ft) to begin the initial slow down and to extract the parafoil. The drogue parachute is then cut away following the successful deployment of the parafoil. A salvage ship (approximately 170 ft long, offshore supply vessel) that is stationed in a designated safety zone near the anticipated splashdown area facilitates the fairing and parafoil recovery

[3] A converted Marmac freight barge (~300 ft x 100 ft) that SpaceX refers to as an autonomous drone ship. https://www.americaspace.com/2015/01/04/spacex-autonomous-spaceport-drone-ship-sets-sail-for-tuesdays-crs-5-rocket-landing-attempt/

operation. Upon locating the fairing, rigid-hulled inflatable boats (RHIBs; approximately 12 ft long) recover the fairing. If sea or weather conditions are poor, recovery of the fairing and parafoil may be unsuccessful. The salvage ship transports the fairing to a port, wharf, (e.g., Port of Cape Canaveral, Port of Long Beach or Port of Los Angeles). The drogue parachute assembly is deployed at a high altitude, so it can be difficult to locate, but if the recovery team can get a visual fix, recovery of the drogue parachute is attempted. The drogue parachute becomes saturated with seawater quickly and begins to sink (see Appendix A for approximate sink rates), which also makes recovery of the drogue parachute difficult.

Boosters and fairings that are expended in the ocean are made of materials that sink, strong metal with heavy duty components designed to stand up to the stressful forces of launch, reentry, and extreme temperatures. A few internal parts that are lighter items (e.g., carbon composite-wrapped aluminum containers) could be released upon impact and may float, but are expected to become waterlogged and sink within a few days (10 days maximum).

SpaceX Starship-Super Heavy Launches

During the program's development, SpaceX is proposing to conduct up to 20 Starship suborbital launches annually (Table 4). As the program progresses, SpaceX is proposing to conduct up to five Starship suborbital launches annually (operational phase). During a Starship suborbital launch, the Starship would ascend to high altitudes and then its engines would throttle down or shut off to descend, landing back at the Boca Chica Launch Site or downrange (no closer than 19 miles from shore) either directly in the Gulf of Mexico or on a platform barge (as described above for the Falcon booster landings) in the Gulf of Mexico. A Super Heavy launch could be orbital or suborbital and could occur by itself or with Starship integrated as the second stage of the launch vehicle.

Table 4. Proposed SpaceX Starship-Super Heavy Annual Operations

Operation	Program Development Phase	Operational Phase
Starship Suborbital Launch	20	5
Super Heavy Launch	3	5

Each Starship-Super Heavy orbital launch would include an immediate boost-back and landing of the Super Heavy. During flight, the Super Heavy's engines would cut off at an altitude of approximately 40 miles and the booster would separate from Starship. Shortly thereafter, Starship's engines would start and burn to the desired orbit location. After separation, Super Heavy would rotate and ignite engines to place it in the correct angle to land. Once Super Heavy is in the correct position, the engines would be shut off. Super Heavy would then perform a controlled descent using atmospheric resistance to slow it down and guide it to the landing location (like current Falcon 9 booster landings at Cape Canaveral Space Force Station). Once near the landing location, Super Heavy would ignite its engines to conduct a controlled landing. Super Heavy could have approximately up to 5 metric tons of LCH_4 onboard following an orbital flight.

When Super Heavy landings occur on a platform barge downrange in the Gulf of Mexico, the Super Heavy would then be delivered on the towed barge to the Port of Brownsville and transported the remaining distance to the Boca Chica Launch Site over roadways. Super Heavy landings would generate a sonic boom(s). The maximum overpressure from a sonic boom generated by a Super Heavy landing is predicted to be 15 psf. A maximum of five Super Heavy landings in the Gulf of Mexico could occur each year during the operational phase (Table 4).

It is SpaceX's goal to recover and reuse the Starship and Super Heavy boosters. However, during launches that are still early in the program development, SpaceX may require expending Super Heavy or Starship in the ocean (Gulf of Mexico or Pacific Ocean). When this occurs, SpaceX would not recover the Super Heavy or the Starship and expects they would breakup on impact with the ocean surface. Impact debris is expected to be contained within approximately one kilometer of the landing point. SpaceX expects debris to sink because the launch vehicle is made of steel, and if some lighter internal parts (e.g., carbon composite-wrapped aluminum containers as stated for other vertical launches) are released, they are expected to become waterlogged and sink within 10 days.

Horizontal Launches

Horizontal launches, including takeoff and landing, occur from a runway at the launch site. Concept X, Concept Y, and reusable Concept Z launch vehicle operations do not involve expending launch vehicle components in the marine environment. Horizontal launch vehicle operations can produce a sonic boom during flight over the marine environment that may affect the ocean's surface. The expendable Concept Z launch vehicle operations (e.g., Pegasus launches) involve expending a stage(s) into the ocean. The stage(s) is not recovered and rapidly sinks to the ocean floor.

Launch Failure Anomaly

An unintended launch failure (referred to as a launch anomaly) is possible during launch operations. Accidental failure could result in an explosion and/or breakup of a rocket booster and/or spacecraft on or near the launch pad or landing area. Anomalies could also occur later, during flight. Since 1989, there have been 415 commercial launches and 27 have resulted in mishaps that involved debris in the water.

Spacecraft Reentry and Recovery Operations

Some launch companies launch spacecraft as their payload into space (e.g., SpaceX Dragon spacecraft and Boeing Starliner spacecraft). After completing its mission in space, the spacecraft returns to Earth. Spacecraft reentry, splashdown, and recovery are the three elements of a spacecraft landing operation. After completing its mission in space, the spacecraft travels back to Earth where it completes a deorbit burn and reenters the atmosphere. During reentry, the spacecraft creates a sonic boom that may impact the ocean's surface. Spacecraft reentry would not be conducted in any type of stormy weather (i.e., weather that would compromise the success of the mission; e.g., a severe thunderstorm or hurricane) unless deemed necessary in an emergency (e.g., a medical emergency with an astronaut).

Spacecraft typically deploy two drogue parachutes and three to four main parachutes to assist in landing. The smaller drogue parachutes (19 ft^2 each) are deployed first to gain control of the spacecraft and then are released (and expected to land in the ocean within 0.5–1 mile from the spacecraft) before the larger main parachutes (116 ft^2 each) are deployed. The main parachutes slow the spacecraft enough to allow for a soft splashdown in the water (or on land). Drogue and main parachutes are typically made of Kevlar and nylon (see Appendix A).

During reentry, the spacecraft reenters Earth's atmosphere on a pre-planned trajectory and is tracked to a splashdown area in the ocean. Following splashdown, an electronic locator beacon on the spacecraft assists in locating and recovering the spacecraft by a pre-positioned 160 ft long recovery vessel equipped with up to six RHIBs.

Hypergolic fuels (e.g., nitrogen tetroxide [NTO] and monomethylhydrazine [MMH]) may be on the spacecraft during splashdown. A spacecraft's propellant storage is designed to retain residual propellant, so any propellant remaining in the spacecraft is not expected to be released into the ocean. In an unlikely event the propellant tank ruptures on impact, the propellant would evaporate or be quickly diluted and buffered by seawater.

The vehicle operator's personnel attempt to recover all parachutes deployed and load the spacecraft onto the recovery vessel. It is possible some or all the parachutes may not be recovered due to sea or weather conditions, and the drogue parachute may land well beyond sight of the spacecraft recovery area. For missions involving space crew (humans), the crew and any time-critical cargo may be transported via helicopter to the nearest airport. The recovery vessel transports the spacecraft to whatever port the launch operator uses (e.g., Port of Cape Canaveral, a CCSFS-located wharf, commercially available port or wharf on the Gulf Coast, Port of Long Beach, or Port of Los Angeles).

SpaceX Starship-Super Heavy Reentry and Recovery Operations

Each Starship-Super Heavy orbital launch would include a Starship reentry and landing after Starship completes its orbital mission. Starship landing could occur at the vertical launch area, downrange in the Gulf of Mexico (either on a floating platform or expended in the Gulf of Mexico), or expended in the Pacific Ocean approximately 62 nautical miles (NM) north of Kauai, Hawaiian Islands (Figure 5). Starship may have between 1 to 10 metric tons of LCH_4 onboard following an orbital flight. As Starship slows down during its landing approach, a sonic boom(s) with a maximum predicted overpressure of 2.2 psf will be generated. If a Starship landing occurs downrange in the Gulf of Mexico on a floating platform barge, it will be delivered on the barge to the Port of Brownsville, and transported the remaining distance to the Boca Chica Launch Site over roadways.

For missions involving the Starship landing in the Pacific Ocean, SpaceX will arrange an overflight to confirm that debris from the impact has sunk and attempt to locate the launch vehicle mission recording device (aka the 'black box') which has a global positioning system (GPS) tracking signal. If the tracking signal from the recording device is found, locally contracted scuba divers may be deployed to facilitate device retrieval. If there is floating debris found, a local contractor may be utilized to recover any floating debris that could drift into the Papahanaumokuakea Marine National Monument.

Launch Abort Tests

As part of research and development, launch operators may conduct launch abort tests that include waterborne landings. Abort tests may include pad abort tests and launch ascent abort tests. For both types of tests, operations may involve launching spacecraft on a low-altitude, non-orbit trajectory resulting in a waterborne landing in the Atlantic Ocean (see Atlantic Ocean in *Action Area*). Abort test operations typically involve a non-propulsive spacecraft landing using drogue and main parachutes. Recovery of the spacecraft will be similar to recovering a reentry vehicle (i.e., use of a recovery vessel and RHIBs). During an abort test, the launch vehicle could break apart (explode) and land in the ocean. In such a case, the launch operator will be responsible for retrieving as many pieces of debris as feasible. SpaceX's January 19, 2020 in-flight abort test is an example of a launch abort test. During that test, the Falcon 9 launch vehicle exploded and landed in the Atlantic Ocean. SpaceX personnel retrieved as many pieces of debris as they could locate.

Weather Balloon Deployment

Launch operators and federal government personnel (e.g., the Weather Squadron at VSFB) release weather balloons, typically 5 but up to 15 if there are any launch delays, to measure wind speed prior to launches. The data are used to create wind profiles that help determine if it is safe to launch and land the vehicle. A radiosonde, typically the size of a half-gallon milk carton, is attached to the weather balloon to measure and transmit atmospheric data to the launch operator. The latex balloon rises to approximately 20-30 kilometers (km) above Earth's surface and bursts. The radiosonde and shredded balloon pieces fall back to Earth and are not recovered. The radiosonde does not have a parachute and is expected to sink to the ocean floor.

Spotter Aircraft and Surveillance Vessels

A number of spotter aircraft and surveillance vessels (watercraft) are used during launch activities to ensure that designated hazard areas are clear of non-participating crafts. Combinations of radar and visual spotter aircraft, and surface surveillance and law enforcement vessels (watercraft), may be deployed prior to launch. Most fixed wing aircraft operate at altitudes of 15,000 ft but may drop to 1,500 ft to visually obtain a call sign from a non-participating vessel.

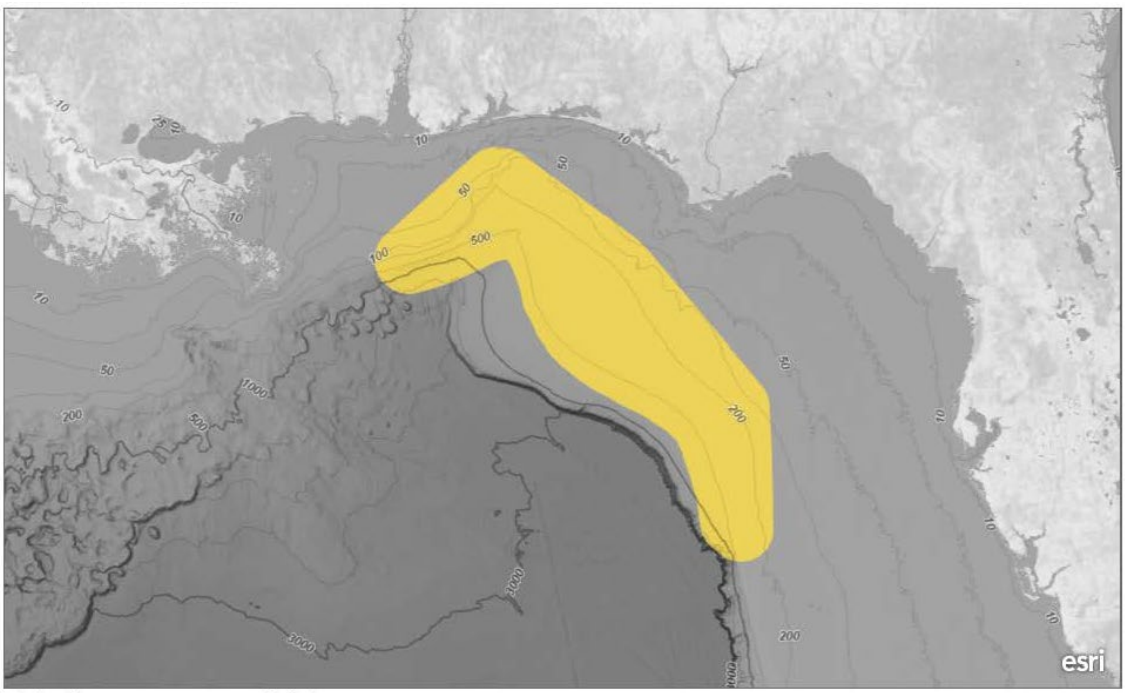
Project Design Criteria

Project design criteria (PDCs) are identified as part of a programmatic consultation and are applicable to future projects implemented under the program. In the case of this consultation, PDCs include environmental protection measures developed by the FAA to limit the effects of launch operations. These environmental protection measures will lead to avoidance and minimization of effects to ESA-listed species and designated critical habitat in the action area to assist in the conservation of these resources.

General PDCs applicable to this consultation:

- Launch and reentry operations will be conducted by the USSF, NASA, or an FAA-licensed (or permitted) commercial operator from a launch site identified in Table 1. Launch preparations will occur in compliance with standard operating procedures and best management practices currently implemented at these existing launch vehicle facilities.
- Launch operations will utilize launch vehicles identified in Table 3.
- Launch activities, including suborbital landings and splashdowns, and orbital reentry activities will occur in the proposed action area at least 5 NM offshore the coast of the United States or islands. The only operations component that will occur near shore will be watercraft transiting to and from a port when recovering spacecraft or launch vehicle components, or possibly for surveillance.
    - No launch operator will site a landing area in coral reef areas.

  - No activities will occur in or affect a National Marine Sanctuary unless the appropriate authorization has been obtained from the Sanctuary.
- Landing operations will not occur in the aquatic zone extending 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out of the Western Distinct Population Segment (DPS) Steller sea lion located west of 144° W.
- Launch abort testing will only occur in the Atlantic Ocean from CCAFS or KSC as previously analyzed (SER-2016-17894, FPR-2017-9231). In addition:
  - It will not occur in designated critical habitat for the North Atlantic right whale.
  - It will not occur during the North Atlantic right whale winter calving season from November to mid-March.
- Utilize all feasible alternatives and avoid landing in Rice's whale core habitat distribution area as much as possible. No more than one splashdown, reentry and recovery of the Dragon capsule, will occur in Rice's whale core habitat distribution area per year. No other operations, spacecraft, launch or reentry vehicle landings, or expended components will occur in Rice's whale core habitat distribution area. The Rice's whale core habitat distribution area map (Figure 1) and GIS boundary can be accessed here: [https://www.fisheries.noaa.gov/resource/map/rices-whale-core-distribution-area-map-gis-data.](https://www.fisheries.noaa.gov/resource/map/rices-whale-core-distribution-area-map-gis-data)



Rice's whale core area transparent with bathmetry

General Bathymetric Chart of the Oceans (GEBCO); NOAA National Centers for Environmental Information (NCEI)

Figure 1. Rice's Whale Core Distribution Area in the Gulf of Mexico.

Education and Observation

- Each launch operator will instruct all personnel associated with launch operations about marine species and any critical habitat protected under the ESA, and species protected under the MMPA that could be present in the operations area.[4] The launch operator will advise personnel of the civil and criminal penalties for harming, harassing, or killing ESA-listed and MMPA-protected species.

- Each launch operator will provide a dedicated observer(s) (e.g., biologist or person other than the watercraft operator that can recognize ESA-listed and MMPA-protected species) that is responsible for monitoring for ESA-listed and MMPA-protected species with the aid of binoculars during all in-water activities, including transiting marine waters for surveillance or to retrieve boosters, spacecraft, other launch-related equipment or debris.
    - When an ESA-listed or MMPA-protected species is sighted, the observer will alert vessel operators to apply the Vessel Operations protective measures.
    - Dedicated observers will record the date, time, location, species, number of animals, distance and bearing from the vessel, direction of travel, and other relevant information, for all sightings of ESA-listed or MMPA-protected species.
    - Dedicated observers will survey the launch recovery area for any injured or killed ESA-listed or MMPA-protected species and any discoveries will be reported as noted below.

Reporting Stranded, Injured, or Dead Animals

- Each launch operator will immediately report any collision(s), injuries or mortalities to, and any strandings of ESA-listed or MMPA-protected species to the appropriate NMFS contact listed below, and to Cathy Tortorici, Chief, ESA Interagency Cooperation Division by e-mail at cathy.tortorici@noaa.gov.
    - For operations in the Gulf of Mexico and Atlantic Ocean: 727-824-5312 or via email to takereport.nmfsser@noaa.gov, and a hotline 1-877-WHALE HELP (942-5343).
    - For operations on the west coast/Pacific Ocean: 562-506-4315 or via email to Justin.Viezbicke@noaa.gov, and a hotline for whales in distress 877-767-9245.
    - For operations near Alaska, statewide hotline: 877-925-7773.
    - Additional regionally organized contact information is here: https://www.fisheries.noaa.gov/report.
- In the Gulf of Mexico and Atlantic Ocean waters near Florida, each launch operator will report any smalltooth sawfish sightings to 941-255-7403 or via email Sawfish@MyFWC.com.
- Each launch operator will report any giant manta ray sightings via email to manta.ray@noaa.gov.
- In the Atlantic Ocean, each launch operator will report any injured, dead, or entangled North Atlantic right whales to the U.S. Coast Guard via VHF Channel 16.

Vessel Operations

All watercraft operators will be on the lookout for and attempt to avoid collision with ESA-listed and MMPA-protected species. A collision with an ESA-listed species will require reinitiation of consultation. Watercraft operators will ensure the vessel strike avoidance measures and reporting are implemented and will maintain a safe distance by following these protective measures:

- Maintain a minimum distance of 150 ft from sea turtles.

[4] The FAA is responsible for ensuring ESA compliance. The launch operator is responsible for MMPA compliance. Measures to protect all marine mammals are included here for animal conservation purposes.

- In the Atlantic Ocean, slow to 10 knots or less and maintain a minimum distance of 1,500 ft (500 yards) from North Atlantic right whales.
- In the Gulf of Mexico, slow to 10 knots or less and maintain a minimum distance of 1,500 ft (500 yards) from Rice's whale [formerly Gulf of Mexico Bryde's whale]. If a whale is observed but cannot be confirmed as a species other than a Rice's whale, the vessel operator must assume that it is a Rice's whale.
- Maintain a minimum distance of 300 ft (100 yards) from all other ESA-listed and MMPA-protected species. If the distance ever becomes less than 300 ft, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.
- Watercraft operators will reduce speed to 10 knots or less when mother/calf pairs or groups of marine mammals are observed.
- Watercraft 65 ft long or longer will comply with the Right Whale Ship Strike Reduction Rule (50 CFR §224.105)[5] including reducing speeds to 10 knots or less in Seasonal Management Areas or in Right Whale Slow Zones, which are dynamic management areas established where right whales have been recently seen or heard.
    - The Whale Alert app automatically notifies when entering one of these areas.
- Check various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sightings in the area. These include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners.
    - There is also an online right whale sightings map available at https://apps-nefsc.fisheries.noaa.gov/psb/surveys/MapperiframeWithText.html.
- Attempt to remain parallel to an ESA-listed or MMPA-protected species' course when sighted while the watercraft is underway (e.g., bow-riding) and avoid excessive speed or abrupt changes in direction until the animal(s) has left the area.
- Avoid vessel transit in the Rice's whale core distribution area. If vessel transit in the area is unavoidable, stay out of the depth range of 100 m to 425 m (where the Rice's whale has been observed; Rosel et al. 2021) as much as possible and go as slow as practical, limiting vessel speed to 10 knots or less.
- No operations or transit will occur at night in Rice's whale core distribution area.

Aircraft Procedures

Spotter aircraft will maintain a minimum of 1,000 ft over ESA-listed or MMPA-protected species and 1,500 ft over North Atlantic right whales. Additionally, aircraft will avoid flying in circles if marine mammals or sea turtles are spotted to avoid any type of harassing behavior.

Hazardous Materials Emergency Response

In the event of a failed launch operation, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan). Procedures may include containing the spill using disposable containment materials and cleaning the area with absorbents or other materials to reduce the magnitude and duration of any impacts. In most launch failure scenarios, at least a portion (if not most) of the

[5] See: http://www.fisheries.noaa.gov/pr/shipstrike/.

propellant will be consumed by the launch/failure, and any remaining propellant will evaporate or be diluted by seawater and biodegrade over time (timeframes are variable based on the type of propellant and environmental conditions, but generally hours to a few days).

Project-Specific Review

Project-specific reviews for this programmatic consultation for launch and reentry vehicle operations in the marine environment are not required as long as the activities are within the scope of the *Proposed Action*, within the action area, and comply with the PDCs. If operations are proposed that are not a part of the *Proposed Action* and/or are not in the *Action Area*, an individual consultation will be needed. If operations in the future include the use of a new launch site, a new launch vehicle, or other substantial changes in technology and operations, an individual consultation or reinitiation of this programmatic consultation may be required.
A project specific review is required when proposed operations do not fully comply with the applicable PDCs identified in this consultation. For example, if a reentry landing and recovery operation could possibly happen at night in the Rice's whale core habitat distribution area, a project specific review would be needed.

When projects do not fully meet the requirements, the action agency should submit a request for project-specific review to the NMFS Office of Protected Resources ESA Interagency Cooperation Division. The request should be sent by email to cathy.tortorici@noaa.gov with the subject line "Project Specific Review Request, OPR-2021-02908, Programmatic Concurrence for Launch Vehicle and Reentry Operations" and include the following information: a project description that details the operations, where and when they will occur, any criteria or measures that may not be fully implemented, and determination of effects to ESA-listed species and critical habitat that could result from the project.

NMFS will review the request to determine if the scope of the project is within this programmatic concurrence, if a supplemental effects analysis is needed, or if an individual consultation is required. Requests for project-specific review should be submitted at least six months in advance of the proposed activity to allow time for completion of a formal ESA section 7 consultation if one is required.

Annual Reporting to NMFS

The FAA, USSF, and NASA, in collaboration with launch operators, propose to prepare and submit reports to NMFS by December 31 beginning the calendar year this consultation is completed and continuing each year activities covered under this consultation occur. The reports will document the outcome of each launch mission that may affect the marine environment. The FAA will report on FAA-licensed launches (i.e., commercial launches) and USSF and NASA will report on their respective launches (i.e., government launches), including those involving commercial space vehicle operations.

Annual reports will include the following for all activities covered under this programmatic:

1) The dates and locations of all missions, including launch site, launch and reentry vehicles and any relevant license or permit that authorized the activities;
2) Contact information for the agencies and commercial entities involved in the events;
3) Details of launch and reentry operations that may affect the marine environment, such as booster stage landings at sea, and particularly those that involve entry of materials into

the marine environment, such as payload fairing recovery missions, spacecraft reentries, and abort tests;

4) Dates of reentry and recovery operations if different from launch date;
5) Approximate locations with GPS coordinates when available of all landing and splashdown areas, including fairing recoveries (and drogue parachute recoveries, if applicable) and spacecraft recoveries (including abort tests). Information should also be provided regarding support vessels used during operations and transit routes, as well as aircraft activity associated with an event;
6) Any available information on the location and fate of unrecovered parachutes, parafoils, expended components and debris;
7) Information regarding the implementation of the *Environmental Protection Measures* described above, including any issues identified by an observer or other crew member, divers or other personnel engaged in in-water activities;
8) Any information regarding effects to ESA-listed species due to the activities; and
9) Sighting logs with observations of ESA-listed species with date, time, location, species (if possible to identify), number of animals, distance and bearing from the vessel, direction of travel, and other relevant information.

Annual reports should be submitted electronically to cathy.tortorici@noaa.gov with the subject line "Annual Review, OPR-2021-02908, Programmatic Concurrence for Launch Vehicle and Reentry Operations Starship/Super Heavy Launch Vehicle Operations at SpaceX's Boca Chica Launch Site."

Basic information regarding events conducted in a given year can be provided in tabular form accompanied by a narrative summary organized by geography: Pacific, Atlantic, and Gulf of Mexico. Copies of the annual reports should also be submitted electronically to the appropriate NMFS regional offices for their review and comment dependent on where launch and reentry activities occur in a given year: SERO (nmfs.ser.esa.consultations@noaa.gov), PIRO (EFHESAconsult@noaa.gov), and WCR (see https://www.fisheries.noaa.gov/west-coast/consultations/esa-section-7-consultations-west-coast for information on contacts based on geographic area).

The summary of annual aggregate activities and associated effects will allow NMFS to evaluate, among other things, whether the scope of the activities are consistent with the description of the proposed action and action area, and whether the nature and scale of the effects predicted continue to be valid. Annual reviews help monitor development of the industry and the potential for increased frequency of activities that may indicate the effects to ESA resources could change, requiring new analysis and/or adjustments to implementing requirements under the programmatic.

Landing Failure Anomaly

It is possible that a stage booster landing could have a failure. The FAA indicated that, for the past several years, SpaceX has been successfully landing boosters on land and offshore on a barge. A failure on the barge would be very rare. SpaceX has adjusted mission operations to avoid explosions on the barge. During reentry/descent, if the launch vehicle indicates any failures, SpaceX would expend it into the open ocean, rather than attempt a barge landing to avoid an explosion on the barge. Therefore, this consultation does not include stage booster landing failure. If a failure were to occur in the marine environment, reinitiation of this consultation may be required.

Action Area

The action area is defined in 50 CFR §402.02 as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." In general, the action area includes portions of the Atlantic Ocean, Gulf of Mexico, and the Pacific Ocean where launch and reentry activities are anticipated (see Figures 2, 3 and 4). SpaceX is proposing to land the Starship after an orbital mission in the Pacific Ocean, approximately 62 NM north of Kauai, Hawaii, as shown in Figure 5.

The launch and reentry activities occurring in the marine environment would occur in deep waters at least 5 NM offshore the coast of the United States or islands, with most activities occurring hundreds of miles offshore. The only component of the launch and reentry operations that occurs near (less than 5 NM offshore) the coast of the United States are the vessels (watercraft) transiting to and from a port during pre-launch surveillance or when recovering and transporting spacecraft or launch vehicle components in the ocean. These nearshore vessel transit areas in the action area include marine waters that lead to the Port of Brownsville, Texas; Port Canaveral, Florida; Port of Los Angeles, California; Port of Longview, California; Port of Kodiak, Alaska; and a port facility at Vandenberg Space Force Base, California.

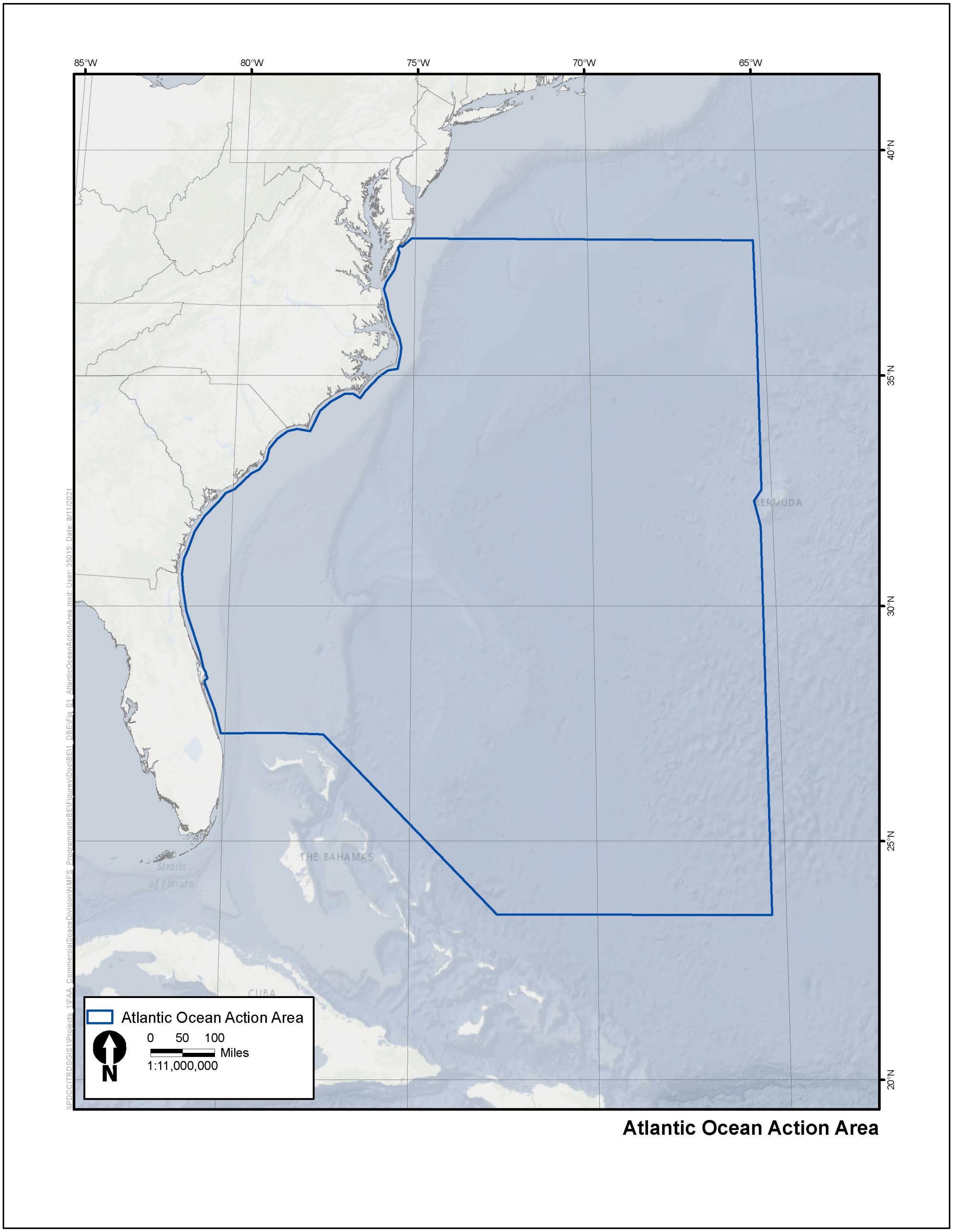


Figure 2. Atlantic Ocean Action Area

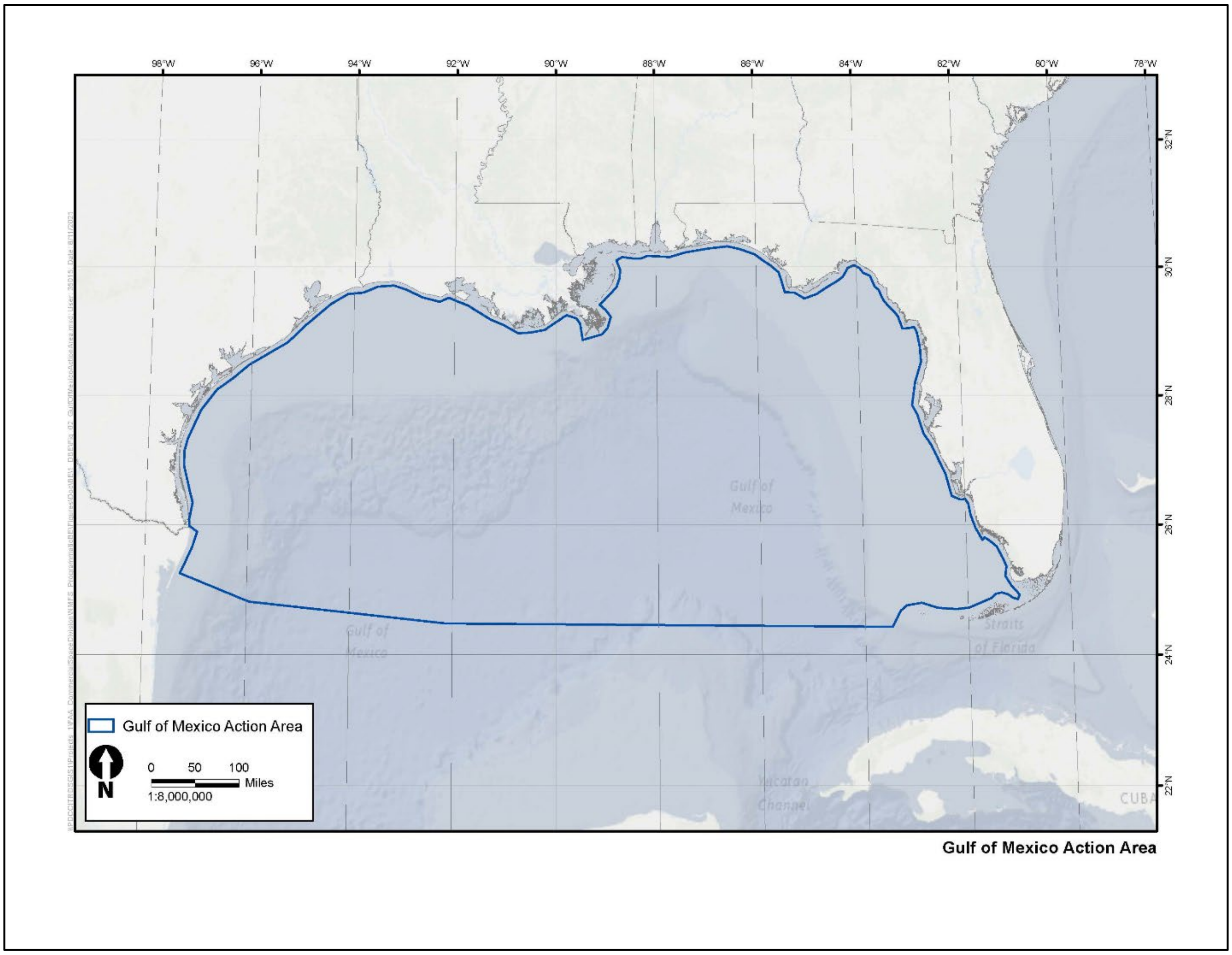


Figure 3. Gulf of Mexico Action Area

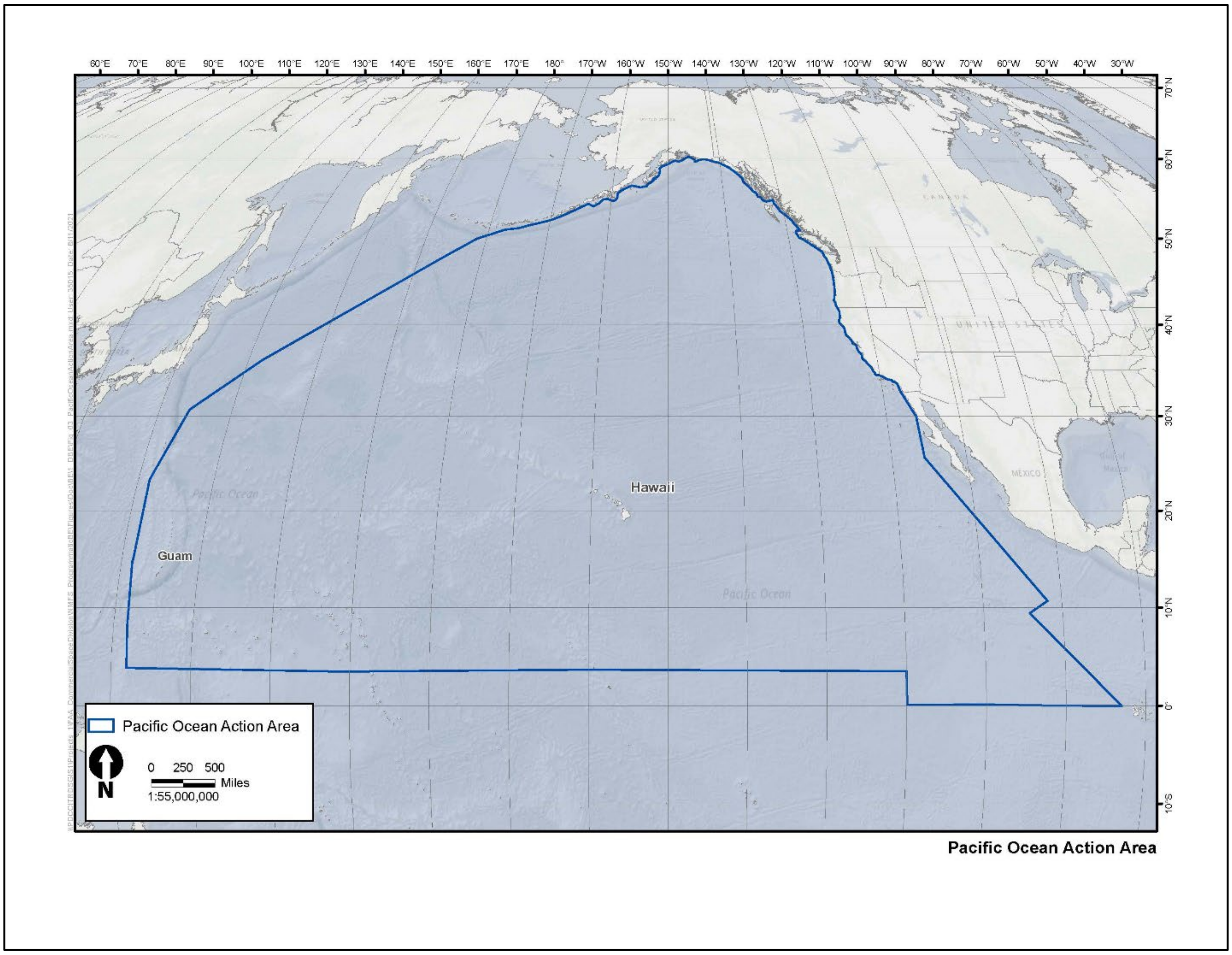


Figure 4. Pacific Ocean Action Area

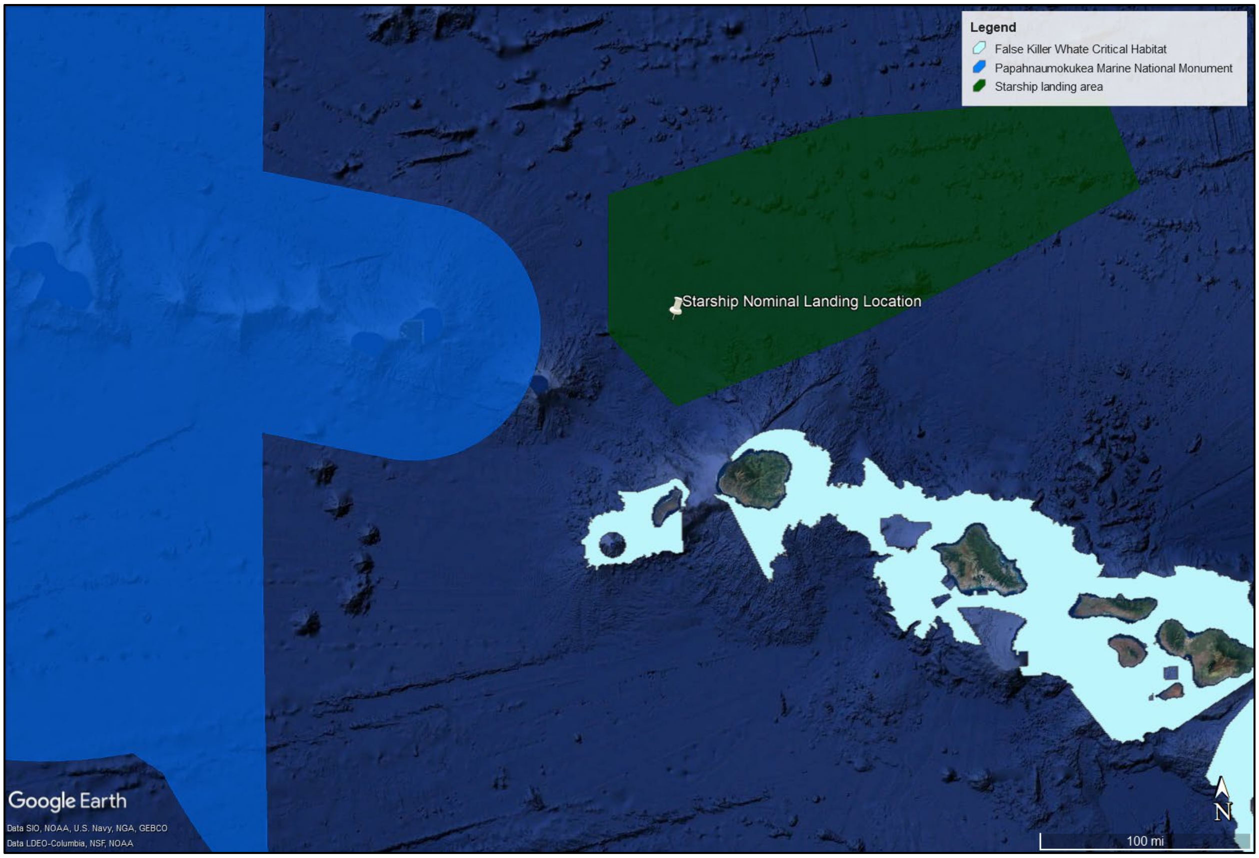


Figure 5. Proposed Landing Area in the Pacific Ocean for SpaceX Starship Orbital Missions.

Annual Operations per Ocean Area

Dependent on mission needs, the amount of annual launch and recovery operations can be variable. The table below outlines the maximum annual operations expected by the action agencies in the marine environment over the next five years (2022 through 2026) for the activities included in this consultation.

Table 5. Maximum Annual Operations

Type of Operation	Maximum # of Annual Operations
Atlantic Ocean Action Area	
Launches involving stages and fairings that are expended in the ocean (not recovered)	30
Launches involving attempted recovery of stages and fairings in the ocean	70
Spacecraft reentry and landing in the ocean	10
Launch abort test	1
Pacific Ocean Action Area	
Launches involving stages and fairings that are expended in the ocean (not recovered)	30
Launches involving attempted recovery of stages and fairings in the ocean	20
Spacecraft reentry and landing in the ocean	3
Gulf of Mexico Action Area	
Launches involving stages that are expended in the ocean (not recovered)	5

Type of Operation	Maximum # of Annual Operations
Launches involving attempted recovery of stages in the ocean	5
Spacecraft reentry and landing in the ocean	10

ESA-Listed Species and Critical Habitat in The Action Area

Several ESA-listed marine mammals (cetaceans and pinnipeds), sea turtles, fishes and designated critical habitats are known to occur or have the potential to occur in the action area (Table 6). The FAA, USSF, and NASA have determined that launch and reentry vehicle operations in the marine environment may affect, but are not likely to adversely affect any ESA-listed species or designated critical habitat.

The action area does not include nearshore areas where most ESA-listed coral species occur. There is proposed critical habitat for three coral species in the Gulf of Mexico farther offshore (i.e., > 5 NM). However, no launch operator would site a landing area in coral reef areas, and the location of the proposed critical habitat in the Gulf of Mexico is too far north of the launch trajectories from the Boca Chica Launch Site to be affected. Therefore, the FAA determined launch and reentry operations will have no effect on ESA-listed coral species or their proposed critical habitat in the action area.

Table 6. ESA-listed Species and Designated Critical Habitat Potentially Present in the Action Area

Species	ESA Status	Critical Habitat	Recovery Plan
Marine Mammals - Cetaceans			
Blue Whale (*Balaenoptera musculus*)	E – 35 FR 18319	-- --	07/1998 11/2020
False Killer Whale (*Pseudorca crassidens*) – Main Hawaiian Islands Insular DPS	E – 77 FR 70915	83 FR 35062	Draft – 85 FR 65791 9/2020
Fin Whale (*Balaenoptera physalus*)	E – 35 FR 18319	-- --	75 FR 47538 07/2010
Gray Whale (*Eschrichtius robustus*) – Western North Pacific Population	E – 35 FR 18319	-- --	-- --
Humpback Whale (*Megaptera novaeangliae*) – Central America DPS	E – 81 FR 62259	86 FR 21082	11/1991
Humpback Whale (*Megaptera novaeangliae*) – Mexico DPS	T – 81 FR 62259	86 FR 21082	11/1991

Humpback Whale (*Megaptera novaeangliae*) – Western North Pacific DPS	E – 81 FR 62259	86 FR 21082	11/1991
Killer Whale (*Orcinus orca*) – Southern Resident DPS	E – 70 FR 69903 Amendment 80 FR 7380	71 FR 69054 86 FR 41668	73 FR 4176 01/2008
North Atlantic Right Whale (*Eubalaena glacialis*)	E – 73 FR 12024	81 FR 4837	70 FR 32293 08/2004
North Pacific Right Whale (*Eubalaena japonica*)	E – 73 FR 12024	73 FR 19000	78 FR 34347 06/2013
Rice's Whale (*Balaenoptera ricei*)	E – 84 FR 15446 E – 86 FR 47022	-- --	-- --
Sei Whale (*Balaenoptera borealis*)	E – 35 FR 18319	-- --	12/2011
Sperm Whale (*Physeter macrocephalus*)	E – 35 FR 18319	-- --	75 FR 81584 12/2010
Marine Mammals - Pinnipeds			
Guadalupe Fur Seal (*Arctocephalus townsendi*)	T – 50 FR 51252	-- --	-- --
Hawaiian Monk Seal (*Neomonachaus schauinslandi*)	E – 41 FR 51611	80 FR 50925	72 FR 46966 2007
Steller Sea Lion (*Eumetopias jubatus*) – Western DPS	E – 55 FR 49204	58 FR 45269	73 FR 11872 2008
Marine Reptiles			
Green Turtle (*Chelonia mydas*) – North Atlantic DPS	T – 81 FR 20057	63 FR 46693	10/1991
Green Turtle (*Chelonia mydas*) – Central North Pacific DPS	T – 81 FR 20057	-- --	63 FR 28359 01/1998
Green Turtle (*Chelonia mydas*) – Central West Pacific DPS	E – 81 FR 20057	-- --	63 FR 28359 01/1998
Green Turtle (*Chelonia mydas*) – Central South Pacific DPS	E – 81 FR 20057	-- --	63 FR 28359 01/1998

Green Turtle (*Chelonia mydas*) – East Pacific DPS	T – 81 FR 20057	-- --	63 FR 28359 01/1998
Hawksbill Turtle (*Eretmochelys imbricata*)	E – 35 FR 8491	63 FR 46693	57 FR 38818 08/1992 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --	09/2011
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710 and 77 FR 4170	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean DPS	T – 76 FR 58868	79 FR 39855	74 FR 2995 10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 05/1998 – U.S. Pacific 01/2009 – Northwest Atlantic
Loggerhead Turtle (*Caretta caretta*) – North Pacific Ocean DPS	E – 76 FR 58868	-- --	63 FR 28359
Olive Ridley Turtle (*Lepidochelys olivacea*) – All Other Areas/Not Mexico's Pacific Coast Breeding Colonies	T – 43 FR 32800	-- --	-- --
Olive Ridley Turtle (*Lepidochelys olivacea*) – Mexico's Pacific Coast Breeding Colonies	E – 43 FR 32800	-- --	63 FR 28359
Fishes			
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Carolina DPS	E – 77 FR 5913	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – Chesapeake DPS	E – 77 FR 5879	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus*	T – 77 FR 5879	82 FR 39160	-- --

oxyrinchus) – Gulf of Maine DPS			
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – New York Bight DPS	E – 77 FR 5879	82 FR 39160	-- --
Atlantic Sturgeon (*Acipensar oxyrinchus oxyrinchus*) – South Atlantic DPS	E – 77 FR 5913	82 FR 39160	-- --
Chinook Salmon (*Oncorhynchus tshawytscha) –* California Coastal ESU	T – 70 FR 37160	70 FR 52488	81 FR 70666
Chinook Salmon (*Oncorhynchus tshawytscha)* – Central Valley Spring-Run ESU	T – 70 FR 37160	70 FR 52488	79 FR 42504
Chinook Salmon (*Oncorhynchus tshawytscha)* – Lower Columbia River ESU	T – 70 FR 37160	70 FR 52629	78 FR 41911
Chinook Salmon (*Oncorhynchus tshawytscha)* – Puget Sound ESU	T – 70 FR 37160	70 FR 52629	72 FR 2493
Chinook Salmon (*Oncorhynchus tshawytscha) –* Sacramento River Winter-Run ESU	E – 70 FR 37160	58 FR 33212	79 FR 42504
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Fall-Run ESU	T – 70 FR 37160	58 FR 68543	80 FR 67386 (Draft)
Chinook Salmon (*Oncorhynchus tshawytscha)* – Snake River Spring/Summer Run ESU	T – 70 FR 37160	64 FR 57399	81 FR 74770 (Draft) 11-2017-Final
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Columbia River Spring-Run ESU	E – 70 FR 37160	70 FR 52629	72 FR 57303
Chinook Salmon (*Oncorhynchus tshawytscha)* – Upper Willamette River ESU	T – 70 FR 37160	70 FR 52629	76 FR 52317

Chum Salmon (*Oncorhynchus keta*) – Columbia River ESU	T – 70 FR 37160	70 FR 52629	78 FR 41911
Chum Salmon (*Oncorhynchus keta*) – Hood Canal Summer-Run ESU	T – 70 FR 37160	70 FR 52629	72 FR 29121
Coho Salmon (*Oncorhynchus kisutch*) – Central California Coast ESU	E – 70 FR 37160	64 FR 24049	77 FR 54565
Coho Salmon (*Oncorhynchus kisutch*) – Lower Columbia River ESU	T – 70 FR 37160	81 FR 9251	78 FR 41911
Coho Salmon (*Oncorhynchus kisutch*) – Oregon Coast ESU	T – 73 FR 7816	73 FR 7816	81 FR 90780
Coho Salmon (*Oncorhynchus kisutch*) – Southern Oregon and Northern California Coasts ESU	T – 70 FR 37160	64 FR 24049	79 FR 58750
Eulachon (*Thaleichthys pacificus*) –Southern DPS	T – 75 FR 13012	76 FR 65323	9/2017
Giant Manta Ray (*Manta birostris*)	T – 83 FR 2916	-- --	-- --
Green Sturgeon (*Acipenser medirostris*) – Southern DPS	T – 71 FR 17757	74 FR 52300	2010 (Outline) 8/2018- Final
Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)	T – 56 FR 49653	68 FR 13370	09/1995
Nassau Grouper (*Epinephelus striatus*)	T – 81 FR 42268	-- --	8/2018- Outline
Oceanic Whitetip Shark (*Carcharhinus longimanus*)	T – 83 FR 4153	-- --	9/2018- Outline
Smalltooth Sawfish (*Pristis pectinata*) – U.S. portion of range DPS	E – 68 FR 15674	74 FR 45353	74 FR 3566 01/2009
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Central and Southwest Atlantic DPS	T – 79 FR 38213	-- --	-- --

Scalloped Hammerhead Shark (*Sphyrna lewini*) – Eastern Pacific DPS	E – 79 FR 38213	-- --	-- --
Scalloped Hammerhead Shark (*Sphyrna lewini*) – Indo-West Pacific DPS	T – 79 FR 38213	-- --	-- --
Shortnose Sturgeon (*Acipenser brevirostrum*)	E – 32 FR 4001	-- --	63 FR 69613 12/1998
Sockeye Salmon (*Oncorhynchus nerka*) – Ozette Lake ESU	T – 70 FR 37160	70 FR 52630	74 FR 25706
Sockeye Salmon (*Oncorhynchus nerka*) – Snake River ESU	E – 70 FR 37160	58 FR 68543	80 FR 32365
Steelhead Trout (*Oncorhynchus mykiss*) – California Central Valley DPS	T – 71 FR 834	70 FR 52487	79 FR 42504
Steelhead Trout (*Oncorhynchus mykiss*) – Central California Coast DPS	T – 71 FR 834	70 FR 52487	81 FR 70666
Steelhead Trout (*Oncorhynchus mykiss*) – Lower Columbia River DPS	T – 71 FR 834	70 FR 52629	78 FR 41911
Steelhead Trout (*Oncorhynchus mykiss*) – Middle Columbia River DPS	T – 71 FR 834	70 FR 52629	74 FR 50165
Steelhead Trout (*Oncorhynchus mykiss*) – Northern California DPS	T – 71 FR 834	70 FR 52487	81 FR 70666
Steelhead Trout (*Oncorhynchus mykiss*) – Puget Sound DPS	T – 72 FR 26722	81 FR 9251	84 FR 71379
Steelhead Trout (*Oncorhynchus mykiss*) – Snake River Basin DPS	T – 71 FR 834	70 FR 52629	81 FR 74770 (Draft) 11-2017-Final
Steelhead Trout (*Oncorhynchus mykiss*) – South-Central California Coast DPS	T – 71 FR 834	70 FR 52487	78 FR 77430

Steelhead Trout (*Oncorhynchus mykiss*) – Southern California Coast DPS	E – 71 FR 834	70 FR 52487	77 FR 1669
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Columbia River DPS	T – 71 FR 834	70 FR 52629	72 FR 57303
Steelhead Trout (*Oncorhynchus mykiss*) – Upper Willamette River DPS	T – 71 FR 834	70 FR 52629	76 FR 52317

DPS=distinct population segment; ESU=evolutionarily significant unit; E=endangered; T=threatened; FR=*Federal Register*

ESA-Listed Marine Mammals in the Action Area

Blue whales, fin whales, and sei whales are widely distributed across the globe in all major oceans. All of these species typically winter at low latitudes, where they mate, calve and nurse, and summer at high latitudes, where they feed. They are most common in offshore continental shelf and slope waters that support productive zooplankton blooms.

Humpback whales are also widely distributed and winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed. The Western North Pacific DPS of humpback whales breeds/winters in the area of Okinawa and the Philippines, which are not in the action area, and migrates to feeding grounds in the northern Pacific Ocean, primarily off the Russian coast outside of the action area, but also feeds near the Aleutian Islands and the Gulf of Alaska (81 FR 62259). The Mexico DPS of humpback whales breeds along the Pacific coast of mainland Mexico and the Revillagigedos Islands, and feeds in the action area across a broad geographic range from California to the Aleutian Islands (81 FR 62259). The Central America DPS of humpback whales breeds along the Pacific coast of Central America and feeds in the action area almost exclusively offshore of California and Oregon (81 FR 62259).

The Southern Resident DPS killer whale is found along the Pacific Coast of the United States and Canada. Southern Resident killer whales occur in the inland waterways (not in the action area) of Puget Sound, the Strait of Juan de Fuca, and the Southern Georgia Strait during the spring, summer and fall. During the winter, they move out into coastal waters primarily off Oregon, Washington, California, and British Columbia.

The Western North Pacific gray whales tend to feed near the bottom in productive waters closer to shore. Some Western North Pacific of gray whales winter in the action area on the west coast of North America, while most others migrate south to winter in waters off Japan and China and summer in the Okhotsk Sea off northeast Sakhalin Island, Russia, and off southeastern Kamchatka in the Bering Sea (Burdin et al. 2013).

The North Atlantic right whale is primarily found in the western North Atlantic Ocean from shallow coastal water breeding grounds in temperate latitudes off the coast of the southeastern

U.S. during the winter, and feeding in summer outside the action area on large concentrations of zooplankton in the sub-polar latitudes (Colligan et al. 2012) off the coast of Nova Scotia (Waring et al. 2016).

North Pacific right whales mostly inhabit coastal and continental shelf waters in the North Pacific Ocean. They have been observed in temperate latitudes during winter off Japan (outside the action area), California, and Mexico where they likely calve and nurse. In the summer, they feed on large concentrations of zooplankton in sub-polar waters around Alaska.

The range of Rice’s whale is primarily in a relatively small biologically important area in the northeastern Gulf of Mexico near De Soto Canyon, in waters 100 to 400 meters (m) deep along the continental shelf break. It inhabits the Gulf of Mexico year round, but its distribution outside of this biologically important area is unknown. It should be noted that population estimates for Rice’s whale are very low, in 2009 estimated at 33 individuals (Rosel et al. 2016). An estimate by Roberts et al. (2016) utilizing habitat-based density models that incorporate visual survey data from 1992 to 2009 is 44 individuals.

The sperm whale is widely distributed globally, found in all major oceans. Sperm whales mostly inhabit areas with a water depth of 600 m (1,968 ft) or more, and are uncommon in waters less than 300 m (984 ft) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid and demersal fish.

False killer whales prefer waters more than 1,000 m (3,280.8 ft) deep, feeding on fishes and cephalopods. The Main Hawaiian Islands Insular DPS of false killer whale is considered resident within 40 km (21.6 NM) of the Main Hawaiian Islands.

Guadalupe fur seals breed mainly on Guadalupe Island with another smaller breeding colony in the San Benito Archipelago, Baja California, Mexico (Belcher and T.E. Lee 2002). Guadalupe fur seals feed mainly on squid species (Esperon-Rodriguez and Gallo-Reynoso 2013) with foraging trips that can last between four to 24 days (average of 14 days) and cover great distances, with sightings occurring thousands of kilometers away from the main breeding colonies (Aurioles-Gamboa et al. 1999). Guadalupe fur seals are infrequently observed in U.S. waters but they can be found on California’s Channel Islands.

The entire range of the Hawaiian monk seal is located within U.S. waters. The main breeding subpopulations are in the Northwestern Hawaiian Islands, but there is also a small growing population found on the Main Hawaiian Islands. Hawaiian monk seals are considered foraging generalist that feed primarily on benthic and demersal prey such as fish, cephalopods, and crustaceans in subphotic zones (Parrish et al. 2000).

The Western DPS Steller sea lions reside in the central and western Gulf of Alaska, the Aleutian Islands, as well as coastal portions of Japan and Russia that are not in the action area. Western DPS Steller sea lions typically forage in coastal waters on the continental shelf, but they sometimes forage in deeper continental slope and pelagic waters, especially in the non-breeding season.

ESA-Listed Sea Turtles in the Action Area

The green turtle has a circumglobal distribution, occurring throughout nearshore tropical, subtropical and, to a lesser extent, temperate waters. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage believed to last several years. Adult green turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Green turtles from the North Atlantic DPS range from south of the action area from the boundary of South and Central America throughout the Caribbean Sea (outside action area), into the Gulf of Mexico and the U.S. Atlantic coast (in the action area), and range north of the action area toward Canada (outside the action area). The range of the North Atlantic DPS of green turtle also extends east beyond the action area to the western coasts of Europe and Africa. The North Atlantic DPS of green turtle nesting occurs primarily outside the action area in Costa Rica, Mexico, and Cuba, but also in Florida. The Central North Pacific DPS of green turtle is found in the Pacific Ocean near the Hawaiian Archipelago and Johnston Atoll. The major nesting site for the Central North Pacific DPS of green turtle is at East Island, French Frigate Shoals, in the Northwestern Hawaiian Islands; lesser nesting sites are found throughout the Northwestern Hawaiian Islands and the Main Hawaiian Islands. Green turtles in the Central West Pacific DPS are found throughout the western Pacific Ocean, in Indonesia, the Philippines, the Marshall Islands, and Papua New Guinea. In the action area, Central West Pacific DPS green turtle nesting assemblages occur in the Federated States of Micronesia, and the Marshall Islands. Green turtles in the East Pacific DPS are found in the action area from the California/Oregon border to south of the action area, to central Chile. Nesting occurs outside the action area at major sites in Michoacán, Mexico, and the Galapagos Islands, Ecuador. Smaller nesting sites are found in the Revillagigedos Archipelago, Mexico, and along the Pacific Coast of Costa Rica, Columbia, Ecuador, Guatemala and Peru (Seminoff et al. 2015). The Central South Pacific DPS green turtle is found in the South Pacific Ocean extending north from northern New Zealand to Tuvalu and extending east over to Easter Island, Chile. The Central South Pacific DPS encompasses several island groups including American Samoa, French Polynesia, Cook Islands, Fiji, Kiribati, Tokelau, Tonga, and Tuvalu. Those island groups are south of the action area, except Kiribati breaches into the action area, the most northern island group. Central South Pacific DPS nesting occurs sporadically throughout the geographic distribution of the population, with isolated locations having relatively low to moderate nesting activity.

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters of the Atlantic, Indian, and Pacific Oceans. In their oceanic phase, juvenile hawksbill turtles can be found in *Sargassum* mats; post-oceanic hawksbills may occupy a range of habitats that include coral reefs or other hard-bottom habitats, seagrass, algal beds, mangrove bays and creeks (Bjorndal and Bolten 2010; Musick and Limpus 1997).

The Kemp's ridley turtle occurs from the Gulf of Mexico and up along the Atlantic coast of the U.S. (TEWG 2000). The majority of Kemp's ridley turtles nest at coastal Mexican beaches in the Gulf of Mexico. During spring and summer, juvenile Kemp’s ridleys occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp’s ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many Kemp's ridley turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2010).

Globally, olive ridley sea turtles can be found in tropical and subtropical waters in the Atlantic, Indian, and Pacific Oceans. Major nesting beaches are found outside the action area in Nicaragua, Costa Rica, Panama, India and Suriname. Olive ridleys may forage across ocean basins, primarily in pelagic habitats, on crustaceans, fish, mollusks, and tunicates. The range of the endangered Pacific coast breeding population extends as far south as Peru and up to California. Olive ridley turtles of the Pacific coast breeding colonies nest outside the action area on arribada beaches at Mismaloya, Ixtapilla and La Escobilla, Mexico. Solitary nesting takes place all along the Pacific coast of Mexico.

Loggerhead turtles are circumglobal, and are found in the temperate and tropical regions of the Atlantic, Indian, and Pacific Oceans. The post-hatchling stage is in pelagic waters and juveniles are first in the oceanic zone and later in the neritic zone (i.e., coastal waters). While in their oceanic phase, loggerhead turtles undertake long migrations using ocean currents. Adults and sub-adults occupy nearshore habitat important for foraging and inter-nesting migration. The Northwest Atlantic Ocean DPS of loggerhead turtle hatchlings disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. Genetic evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71 to 88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic (Masuda 2010). North Pacific Ocean DPS of loggerhead turtles are found throughout the Pacific Ocean, north of the equator. Their range extends from the West Coast of North America to eastern Asia. Two major juvenile foraging areas have been identified in the North Pacific Basin: Central North Pacific and off Mexico's Baja California Peninsula. Hatchlings from Japanese nesting beaches outside the action area use the North Pacific Subtropical Gyre and the Kurishio Extension to migrate to those foraging grounds (Abecassis et al. 2013; Seminoff et al. 2014). The leatherback sea turtle is unique among sea turtles for its large size and ability to maintain internal warmth (due to thermoregulatory systems), which allows it to range worldwide from tropical into subpolar latitudes. Leatherbacks occur throughout marine waters, from nearshore habitats to oceanic environments (Shoop and Kenney 1992). Leatherback sea turtles migrate long, transoceanic distances between their tropical nesting beaches and the highly productive temperate waters where they forage, primarily on jellyfish and tunicates. Detailed population structure is unknown, but the leatherback distribution is assumed dependent upon nesting beach locations in the Pacific, Atlantic, and Indian Oceans. Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current boundaries, and coastal retention areas (Benson et al. 2011).

ESA-Listed Fishes in the Action Area

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment. Atlantic sturgeon occupy ocean waters and associated bays, estuaries, and coastal river systems from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (ASMFC 2006; Stein et al. 2004). Five DPS's of Atlantic sturgeon are listed under the ESA: Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic. Juveniles typically spend two to five years in freshwater before eventually becoming coastal residents as sub-adults (Boreman 1997; Schueller and Peterson 2010; Smith 1985). Atlantic sturgeon exhibit high fidelity to their natal rivers but can undergo extensive mixing in coastal waters (Grunwald et al. 2008; King et al. 2001; Waldman et al. 2002).

The Pacific salmon (chinook, coho, chum and sockeye) and steelhead trout are anadromous fishes and the ESA-listed DPSs and ESUs spawn in their natal rivers in Washington, Oregon and California. Juvenile Chinook may reside in freshwater for 12 to 16 months, but some migrate to the ocean as young-of-the-year within eight months of hatching. Chinook salmon spend a few years feeding in the ocean, and sexually mature between the ages of two and seven but are typically three or four years old when they return to spawn, generally in summer or early fall. Coho salmon spend a year in freshwater and then migrate out to the ocean to spend about 1.5 years feeding before returning to spawn, generally in fall or early winter. Sockeye salmon rear in freshwater for one to three years, after which they reach the smolt stage and migrate to the ocean to feed and grow. They typically mature and return to freshwater to spawn in the summer or fall after two to three years at sea, but some return earlier or stay at sea longer, between four and five years. Steelhead trout typically migrate to open marine waters after spending two years in freshwater. They reside in marine waters for typically two or three years prior to returning to their natal stream as four- or five-year-olds to spawn shortly after river entry from December through April. Young chum salmon (fry) typically migrate directly to estuarine and marine waters soon after they are born and do not reside in freshwater for an extended period. As chum salmon grow larger, they migrate offshore and as they approach maturity, typically between the ages of three and six, they migrate back to spawn in late summer through March.
The eulachon is an anadromous fish, smaller than salmonids (8.5 inches, 21.5 centimeters), that can be found in the continental shelf waters of the eastern Pacific Ocean. Adult and juvenile Southern DPS eulachon typically occupy waters 50 to 200 m deep (Gustafson 2016), and up to depths of about 300 m, from California to the Bering Sea. Southern DPS eulachon are those that return to spawn in rivers south of the Nass River in British Columbia to the Mad River in California.

The giant manta ray occupies tropical, subtropical, and temperate oceanic waters and productive coastlines where they feed on zooplankton. Giant manta rays are commonly offshore in oceanic waters, but are sometimes found feeding in shallow waters (less than 10 m [32.8 ft]) during the day. Giant manta rays can dive to depths of over 1,000 m (3,280.8 ft), and also conduct night descents to between 200 and 450 m (656.2 to 1,476.4 ft) deep.

The green sturgeon is an anadromous fish that occurs in the nearshore coastal waters to a depth of 110 m from Baja California, Mexico to the Bering Sea, Alaska (Hightower 2007). Adult Southern DPS green sturgeon enter San Francisco Bay and migrate up the Sacramento River to spawn (Heublin et al. 2009).

The current range of the Gulf sturgeon extends from Lake Pontchartrain in Louisiana east to the Suwannee river system in Florida. Young-of-the-year slowly work their way downstream from where they hatched and arrive in estuaries and river mouths where they will spend their next six years developing (Sulak and Clugston 1999). After six years, Gulf sturgeon enter the marine environment to forage on benthic (bottom dwelling) invertebrates along the shallow nearshore (2-4 m depth), barrier island passes, and in unknown offshore locations in the Gulf of Mexico (Huff 1975, Carr et al. 1996, Fox et al. 2002, Ross et al. 2009).

The Nassau grouper is distributed from south Florida throughout the Caribbean, and Bermuda. Juveniles inhabit macroalgae, coral clumps, and seagrass beds, and are relatively solitary. As they grow, they occupy progressively deeper areas and offshore reefs, and can be in schools of up to forty individuals. When not spawning, adults are most common in waters less than 100 m deep.

The oceanic whitetip shark is a large pelagic shark distributed globally throughout open ocean waters, outer continental shelves, and around oceanic islands, primarily from 10 degrees North to 10 degrees South, but up to 30 degrees North and 35 degrees South (Young 2016). They occur from the surface to at least 152 m (498.7 ft) deep, and display a preference for water temperatures above 20 degrees Celsius (°C).

Shortnose sturgeon occur in estuaries, rivers, and the sea along the east coast of North America (Vladykov and Greeley 1963). Their northerly distribution extends north of the action area to the Saint John River, New Brunswick, Canada, and their southerly distribution historically extended to the Indian River, Florida (Evermann and Bean 1898, Scott and Scott 1988). Some populations rarely leave freshwater while others are known to migrate along the coast between river systems (Quattro et al. 2002, Wirgin et al. 2005, Dionne et al. 2013, Altenritter et al. 2015).

The scalloped hammerhead shark is found throughout the world and the Central and Southwest Atlantic DPS, Eastern Pacific DPS, and Indo-West Pacific DPSs live in coastal warm temperate and tropical seas. The species occurs over continental shelves and the shelves surrounding islands, as well as adjacent deep waters, but is seldom found in waters cooler than 22 (°C) (Compagno 1984; Schulze-Haugen and Kohler 2003). It ranges from the intertidal and surface to depths of up to 450 to 512 m (1,476.4 to 1,679.8 ft), with occasional dives to even deeper waters. It has also been documented entering enclosed bays and estuaries. The Central and Southwest Atlantic DPS of scalloped hammerhead shark's range extends from the southeast coast of Florida to outside the action area, down to Brazil, including the Caribbean Sea, but not the Gulf of Mexico. The Eastern Pacific DPS of scalloped hammerhead shark's range extends from the coast of southern California, down south past the action area, to Ecuador and possibly Peru, and waters off Tahiti. The Indo-West Pacific DPS of scalloped hammerhead shark ranges from Japan down to Australia, including tropical Pacific islands in the action area. The central Pacific Ocean waters near Hawaii are not included within the range of listed DPSs.

Historically within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, with the largest number of recorded captures in Florida (NMFS 2010). Recent capture and encounter data suggest that the current distribution is primarily south and southwest Florida from Charlotte Harbor through the Dry Tortugas (Seitz and Poulakis 2002, Poulakis and Seitz 2004). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the distribution of smalltooth sawfish (Bigalow and Schroeder 1953). Juvenile sawfish spend the first 2-3 years of their lives in the shallow waters provided in the lower reaches of rivers, estuaries, and coastal bays (Simpfendorfer et al. 2008 and 2011). As smalltooth sawfish approach 250 centimeters (cm), they become less sensitive to salinity changes and begin to move out of the protected shallow water embayments and into the shorelines of barrier islands (Poulakis et al. 2011). Adult sawfish typically occur in more open water, marine habitats (Poulakis and Seitz 2004).

Critical Habitat in the Action Area

This section discusses designated critical habitat that is either completely encompassed by the action area or is partially within the action area.

Green Sturgeon

The action area includes critical habitat for Southern DPS green sturgeon (Figure 6). In marine waters, the designated critical habitat is up to the 110 m depth isobath from Monterey Bay to the U.S.-Canada border.

The physical and biological features (PBFs) essential for the conservation of the Southern DPS green sturgeon are:

1. **Migratory corridor:** A migratory pathway necessary for the safe and timely passage within marine and between estuarine and marine habitats.
2. **Water quality:** Nearshore marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants (e.g., pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal behavior, growth, and viability of subadults and adults.
3. **Food resources:** Abundant prey items for subadults and adults, which may include benthic invertebrates and fishes.

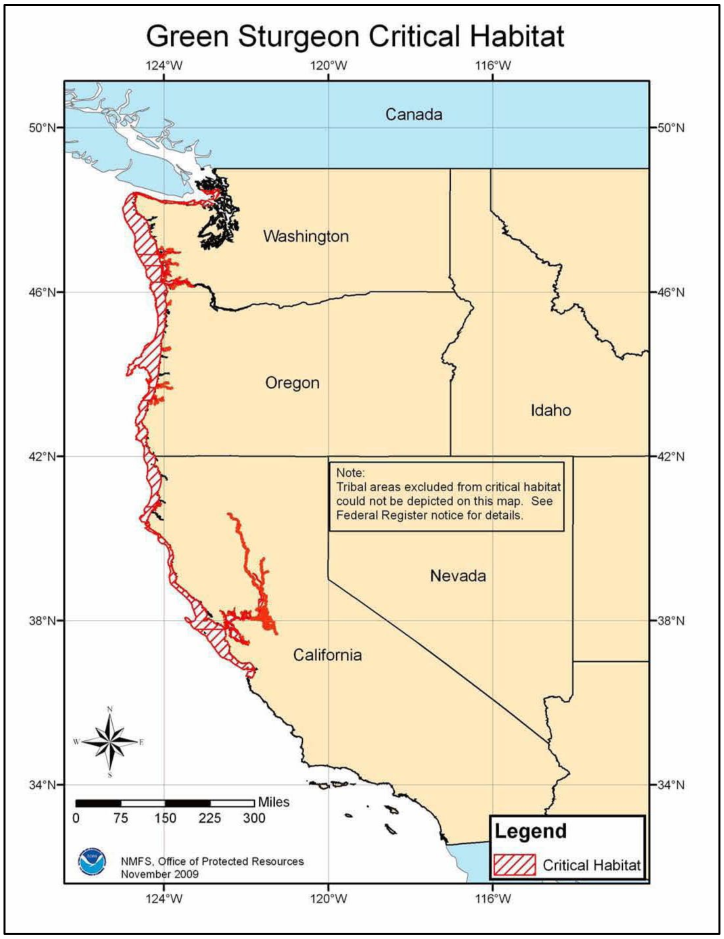


Figure 6. Green Sturgeon Critical Habitat

Gulf Sturgeon

Most of the Gulf sturgeon critical habitat is outside the action area, except for a boundary portion near Cedar Key, Florida, in the Gulf of Mexico (Figure 7). Most subadult and adult Gulf sturgeon spend cool months (October or November through March or April) in estuarine areas, bays, or in the Gulf of Mexico.

The PBFs relevant to the conservation of gulf sturgeon in estuarine and marine areas are:

1. Abundant prey items within estuarine and marine habitats and substrates for juvenile, subadult, and adult life stages;
2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;
3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and
4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., a river unobstructed by any permanent structure, or a dammed river that still allows for passage).

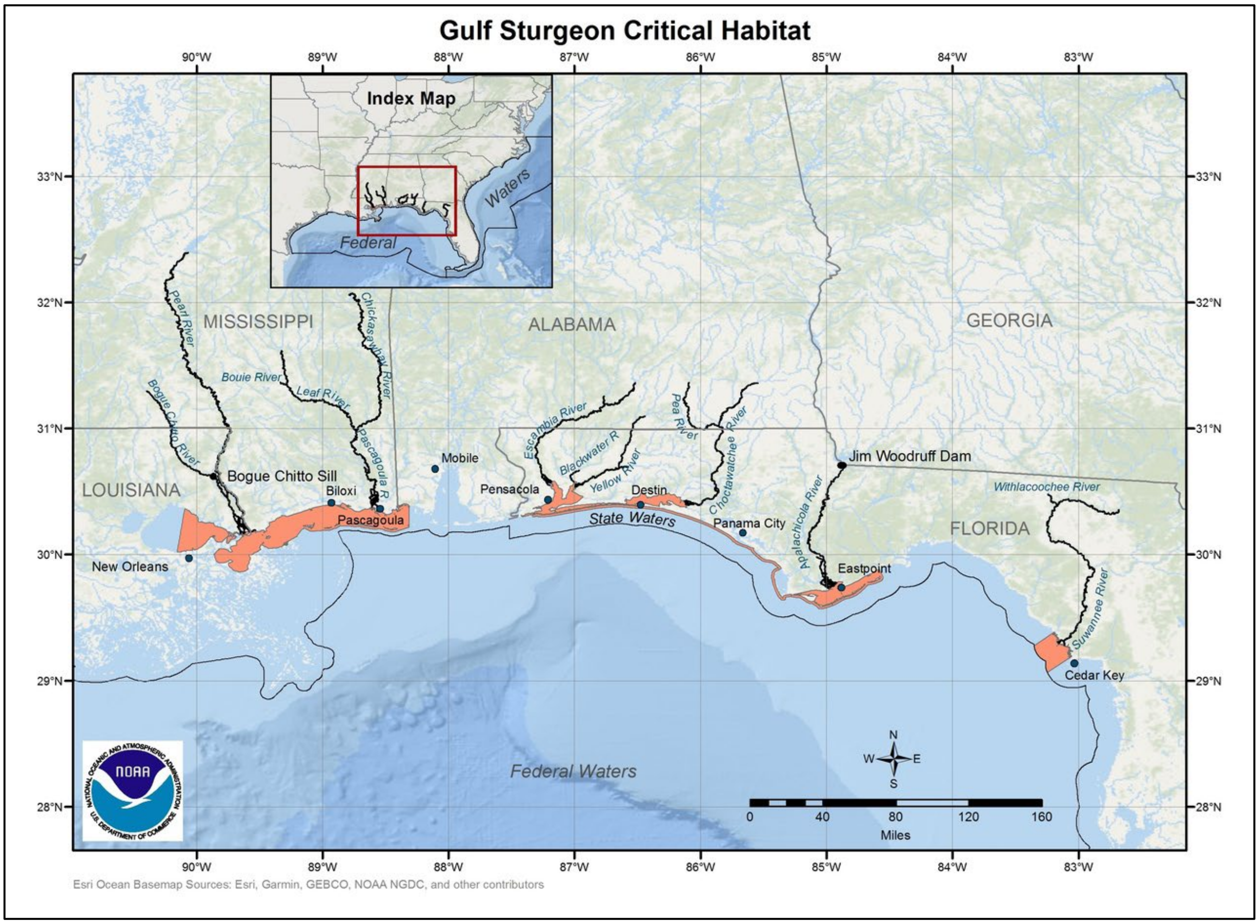


Figure 7. Gulf Sturgeon Critical Habitat

Pacific Leatherback Sea Turtle

The action area includes leatherback sea turtle critical habitat along the U.S. West Coast (Figure 8). This designation includes approximately 43,798 square kilometers stretching along the California coast from Point Arena to Point Arguello east of the 3000 m depth contour; and 64,760 square kilometers stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 m depth contour. The designation includes waters from the ocean surface down to a maximum depth of 80 m. These waters were designated specifically because of the occurrence of prey species, primarily Scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

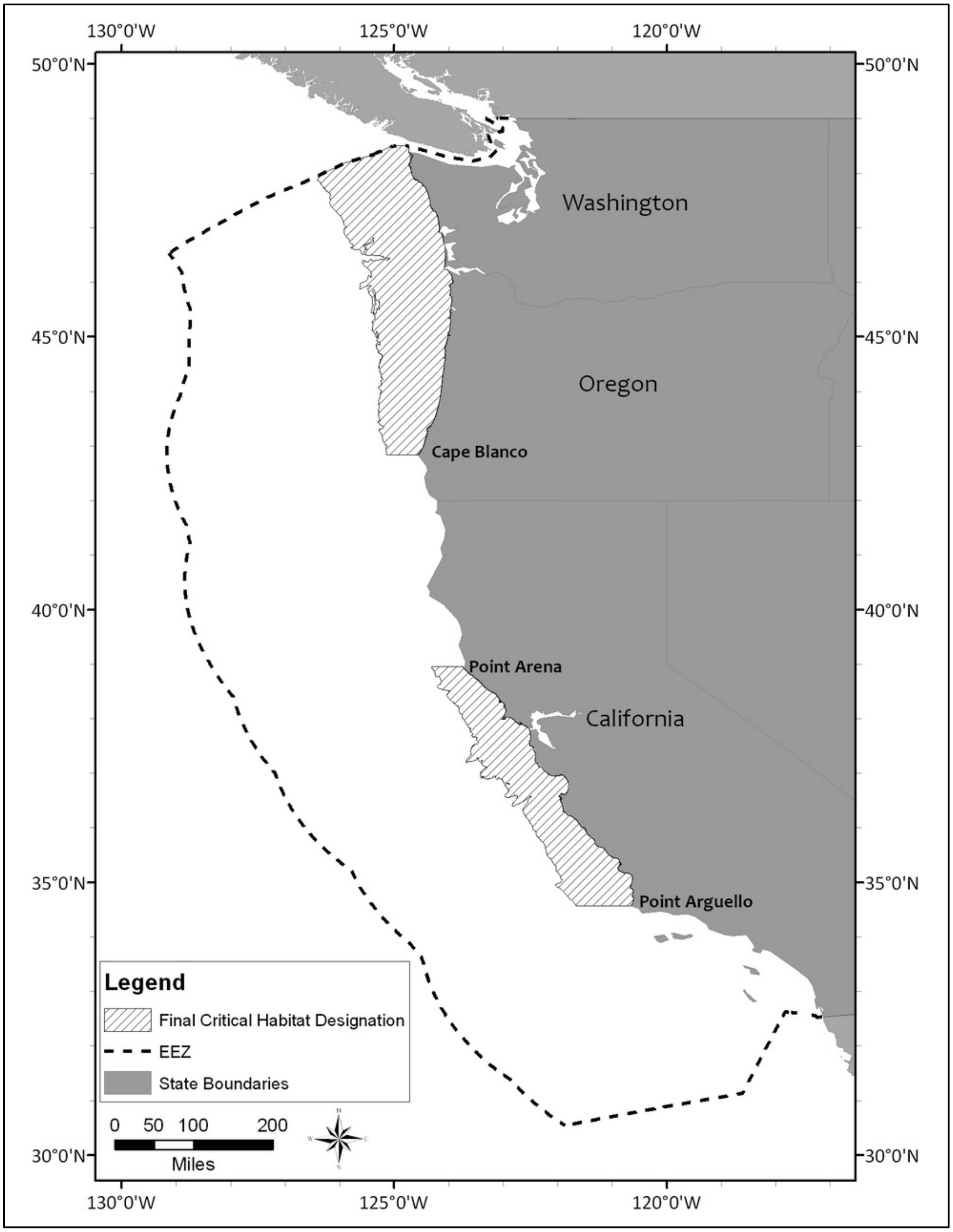


Figure 8. Pacific Leatherback Sea Turtle Critical Habitat

Loggerhead Sea Turtle

The action area includes Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat in the Gulf of Mexico and Atlantic Ocean (Figure 9). The designated critical habitat includes overlapping areas of nearshore reproductive habitat, constricted migratory habitat, breeding habitat, and *Sargassum* habitat (descriptions below). The FAA determined that approximately 13 miles of nearshore reproductive habitat is within the action area around Cape Canaveral and Port

Canaveral, but the remaining nearshore reproductive habitat areas are outside the action area because the landing/splashdown area begins 5 NM offshore.

- **Nearshore reproductive habitat:** The PBFs of nearshore reproductive habitat as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. The following primary constituent elements support this habitat: (i) nearshore waters directly off the highest density nesting beaches and their adjacent beaches, as identified in 50 CFR § 17.95(c), to 1.6 kilometers offshore; (ii) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and (iii) waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.
- **Constricted migratory habitat:** The PBFs of constricted migratory habitat as high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. Primary constituent elements that support this habitat are the following: (i) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and (ii) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.
- **Breeding habitat:** The PBFs of concentrated breeding habitat as those sites with high densities of both male and female adult individuals during the breeding season. Primary constituent elements that support this habitat are the following: (i) high densities of reproductive male and female loggerheads; (ii) proximity to primary Florida migratory corridor; and (iii) proximity to Florida nesting grounds.
- ***Sargassum* habitat:** The PBFs of loggerhead *Sargassum* habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially *Sargassum*. Primary constituent elements that support this habitat are the following: (i) convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the *Sargassum* community in water temperatures suitable for the optimal growth of *Sargassum* and inhabitance of loggerheads; (ii) *Sargassum* in concentrations that support adequate prey abundance and cover; (iii) available prey and other material associated with *Sargassum* habitat including, but not limited to, plants and cyanobacteria and animals native to the *Sargassum* community such as hydroids and copepods; and (iv) sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by *Sargassum* for post-hatchling loggerheads, i.e., >10 m in depth.

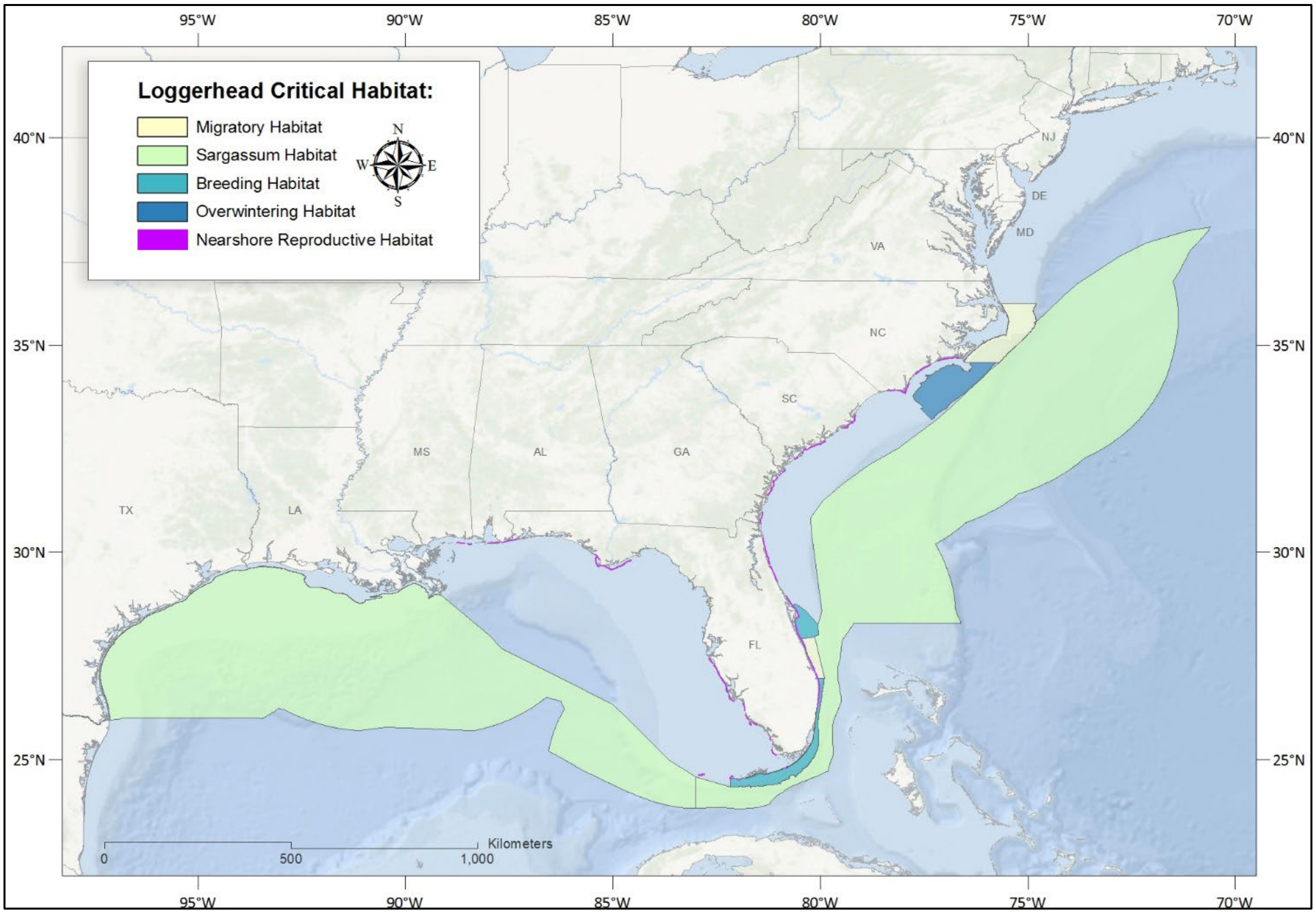


Figure 9. Loggerhead Sea Turtle Critical Habitat

North Atlantic Right Whale

NMFS designated two units of critical habitat for the North Atlantic right whale. Unit 1 is for foraging habitat in the Gulf of Maine and Georges Bank region, and is not in the action area. Unit 2 is for calving and is in the action area, consisting of all marine waters from Cape Fear, North Carolina, southward to approximately 27 NM below Cape Canaveral, Florida (Figure 10). Unit 2 occurs off the coast of CCSFS and extends seaward approximately 5 NM off the coast north of CCSFS. The following PBFs are present in Unit 2:

- Sea surface conditions associated with Force 4 or less on the Beaufort Scale.
- Sea surface temperatures of 7°C to 17°C.
- Water depths of 6-28 m, where these features simultaneously co-occur over contiguous areas of at least 231 square NM of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.

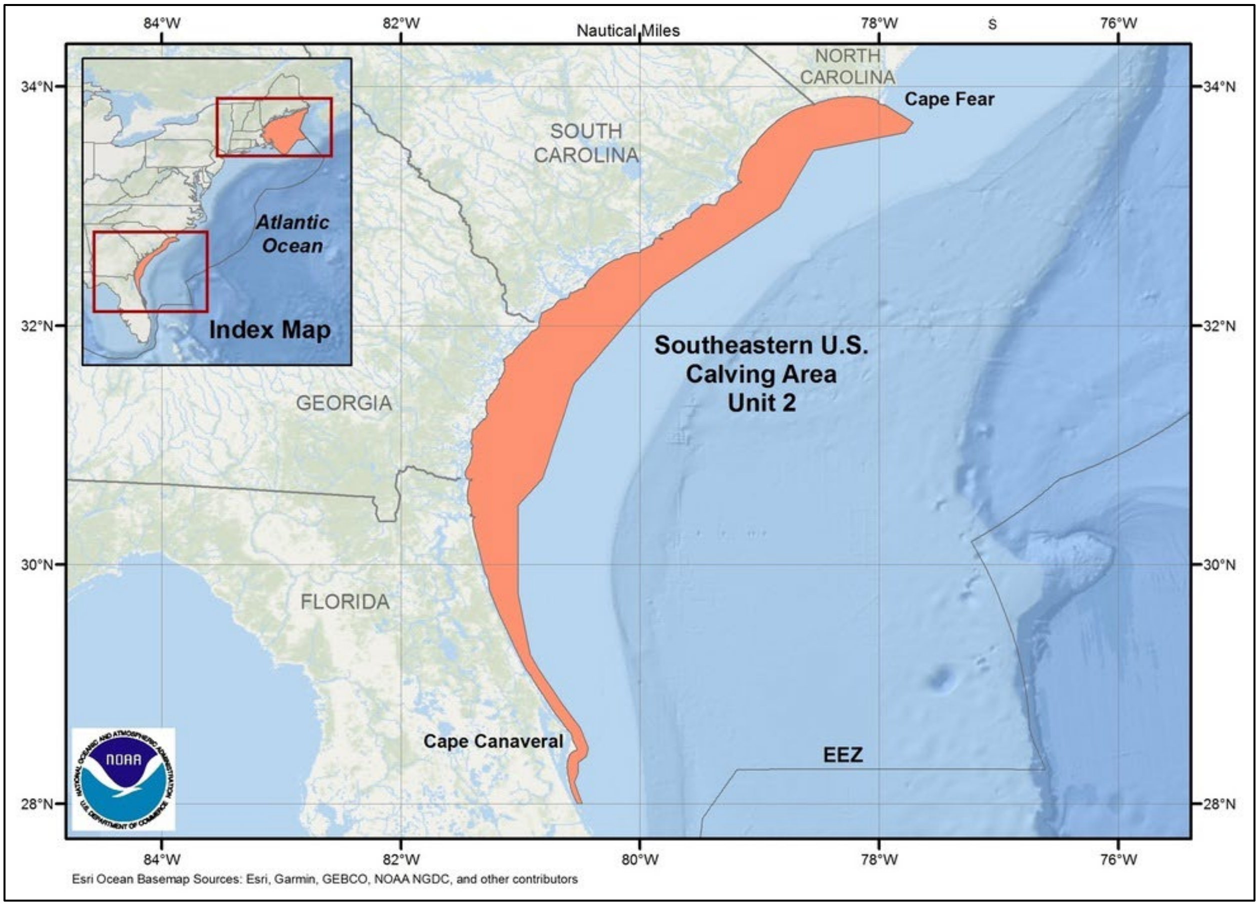


Figure 10. North Atlantic Right Whale Critical Habitat Unit 2

North Pacific Right Whale

Designated critical habitat for the North Pacific right whale includes an area in the Southeast Bering Sea, which is not in the action area, and an area south of Kodiak Island in the Gulf of Alaska (Figure 11), which is in the northern boundary of the action area in the Pacific. Both critical habitat areas support feeding by North Pacific right whales because they contain the designated PBFs, which include: nutrients, physical oceanographic processes, certain species of zooplankton (e.g. copepods *Calanus marshallae*, *Neocalanus cristatus*, and *N. plumchris*, and the euphausiid *Thysanoëssa raschii*), and a long photoperiod due to the high latitude (73 FR 19000).

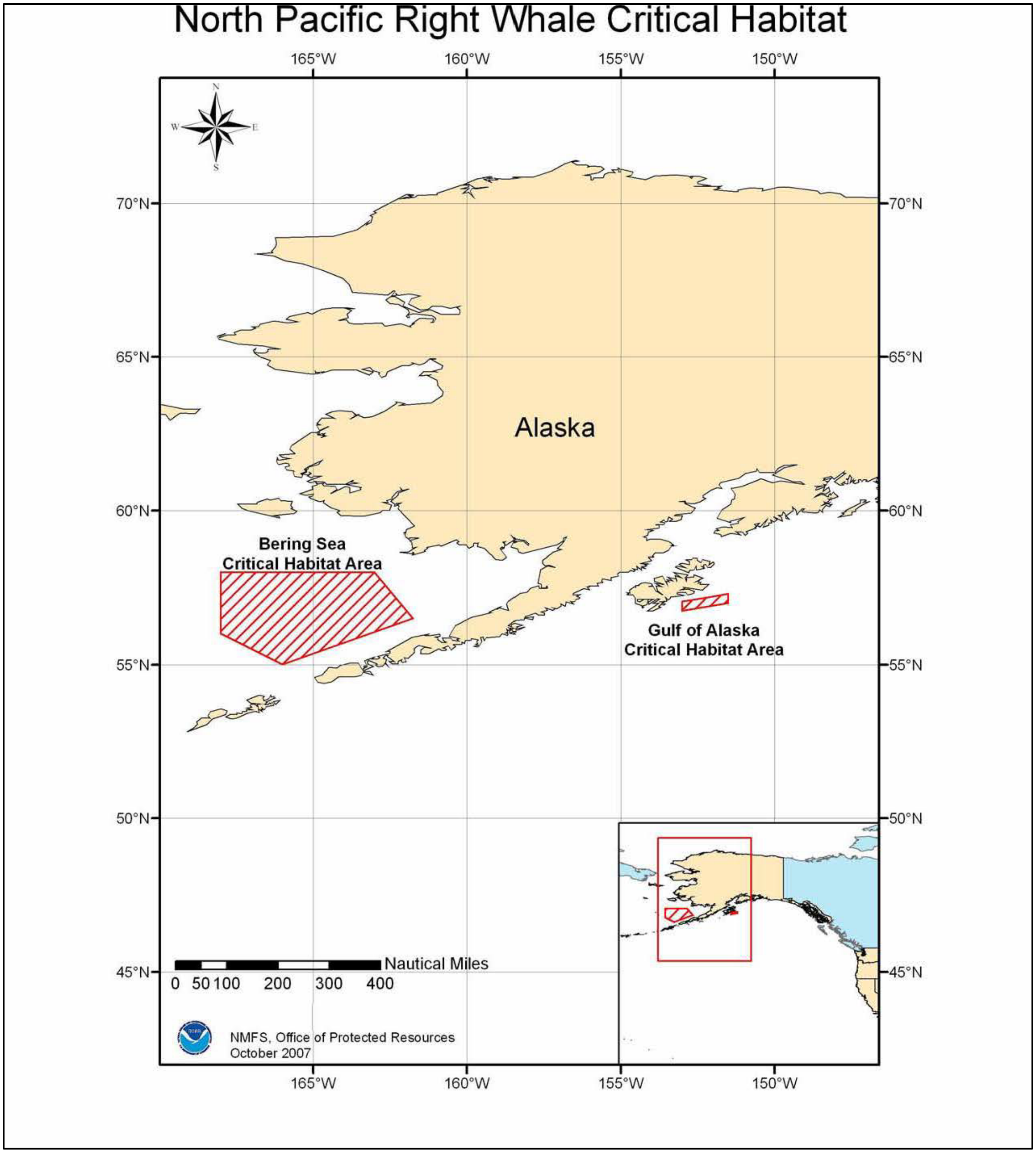


Figure 11. North Pacific Right Whale Critical Habitat

Humpback Whale

NOAA Fisheries designated critical habitat for the endangered Western North Pacific DPS, the endangered Central America DPS, and the threatened Mexico DPS of humpback whales on May 21, 2021 (86 FR 21082; Figures 12-14). The area designated as critical habitat for the Central America DPS contain approximately 48,521 square NM of marine habitat in the Pacific Ocean within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California (Figure 12). Areas designated as critical habitat for the Mexico DPS contain approximately 116,098 square NM of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem (Figure 13). Areas designated as critical habitat for Western North Pacific DPS contain approximately 59, 411 square NM of marine habitat in the North Pacific Ocean, including areas within the eastern Bering Sea and Gulf of Alaska (Figure 14).

The following PBFs were identified as essential to the conservation of the DPSs as follows:

1. **Central American DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, and Pacific herring, of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.
2. **Mexico DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, Pacific herring, capelin, juvenile walleye pollock, and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.
3. **Western North Pacific DPS:** prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific herring, capelin, juvenile walleye pollock, and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

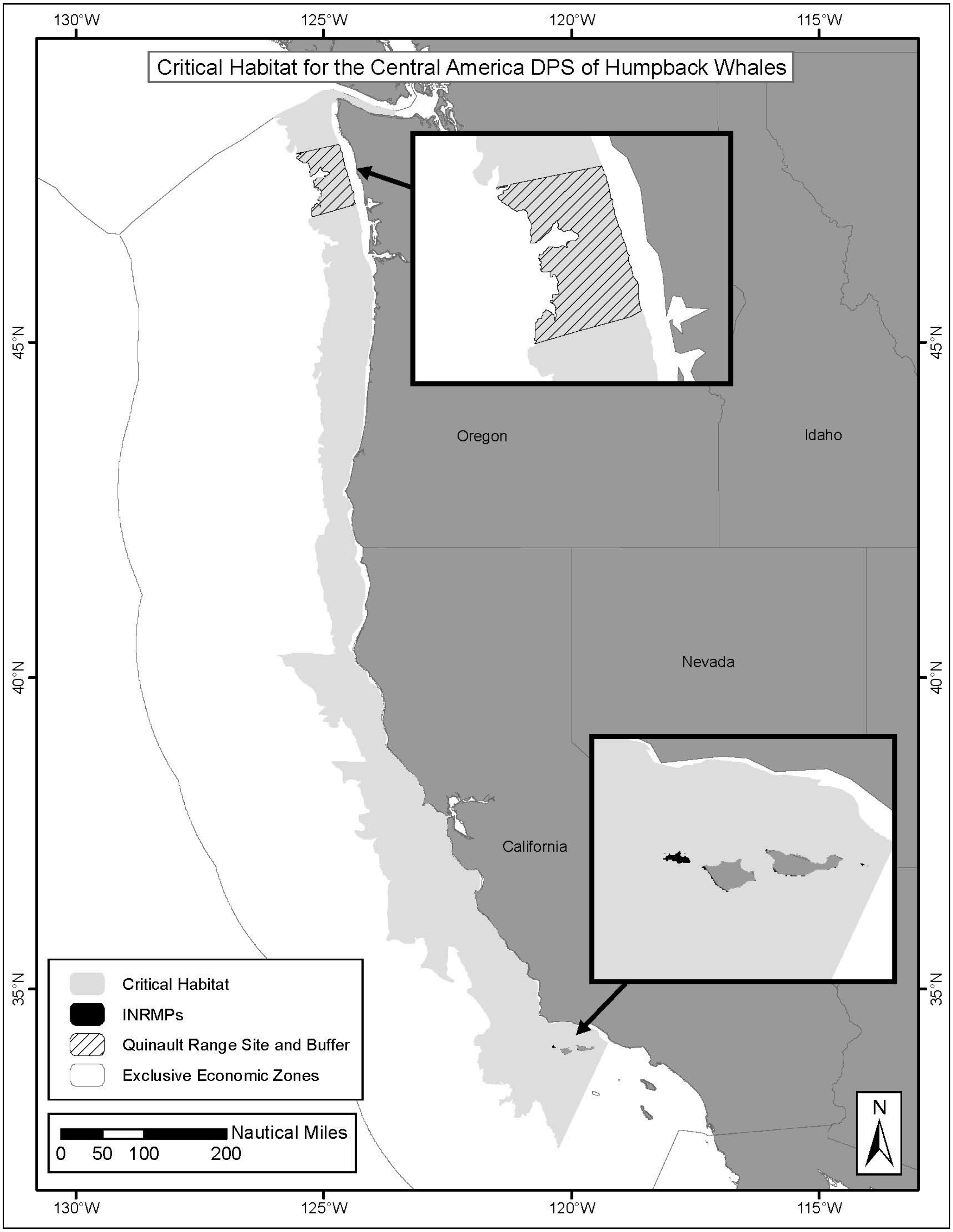


Figure 12. Critical Habitat for Central America DPS humpback whales

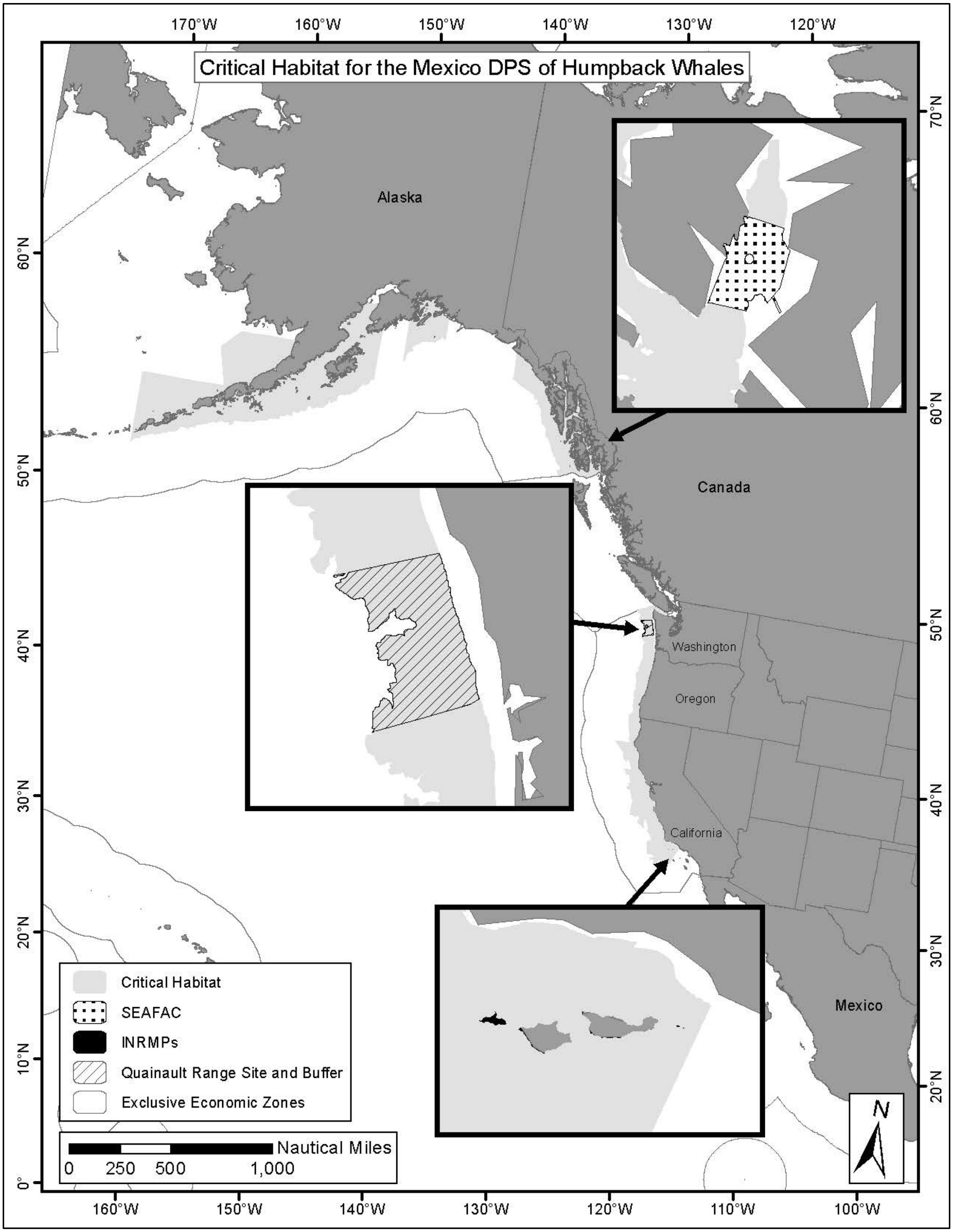


Figure 13. Critical Habitat for Mexico DPS humpback whales

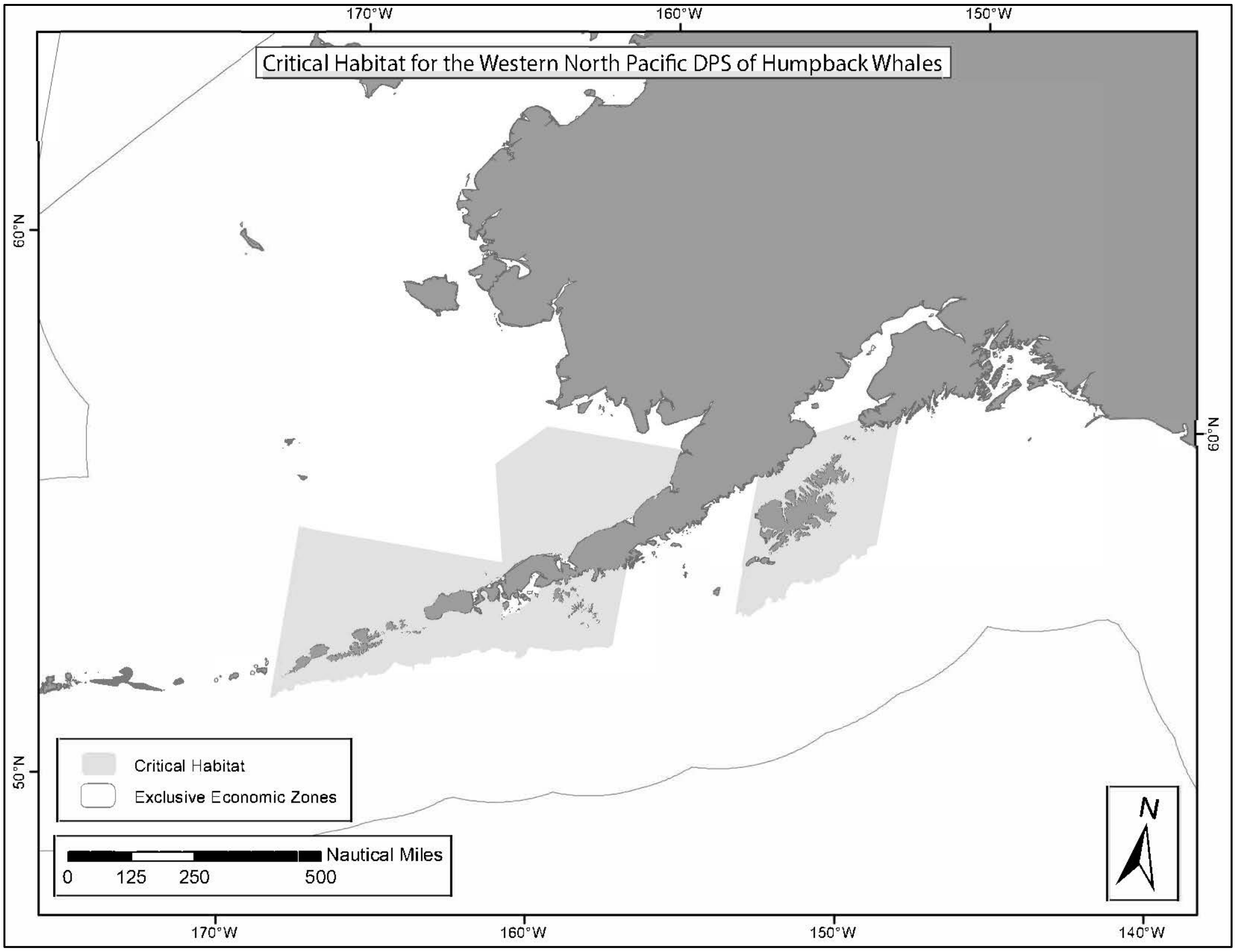


Figure 14. Critical Habitat for Western North Pacific DPS humpback whales

Killer Whale

In 2006, NMFS issued a final rule designating approximately 2,560 square miles of inland waters of Washington State as critical habitat for the Southern Resident DPS killer whale. In August of 2021, NMFS issued a revised rule to the critical habitat designation by expanding it to include six new areas along the U.S. West Coast, while maintaining the whales' currently designated critical habitat in inland waters of Washington (Figure 15). The expanded critical habitat includes marine waters between the 6.1 m depth contour and the 200 m depth contour from the U.S. international border with Canada south to Point Sur, California. Critical habitat within the action area contains PBFs associated with water quality to support growth and development, prey availability for growth, reproduction and development, and overall population growth; and passage conditions to allow for migration, resting, and foraging.

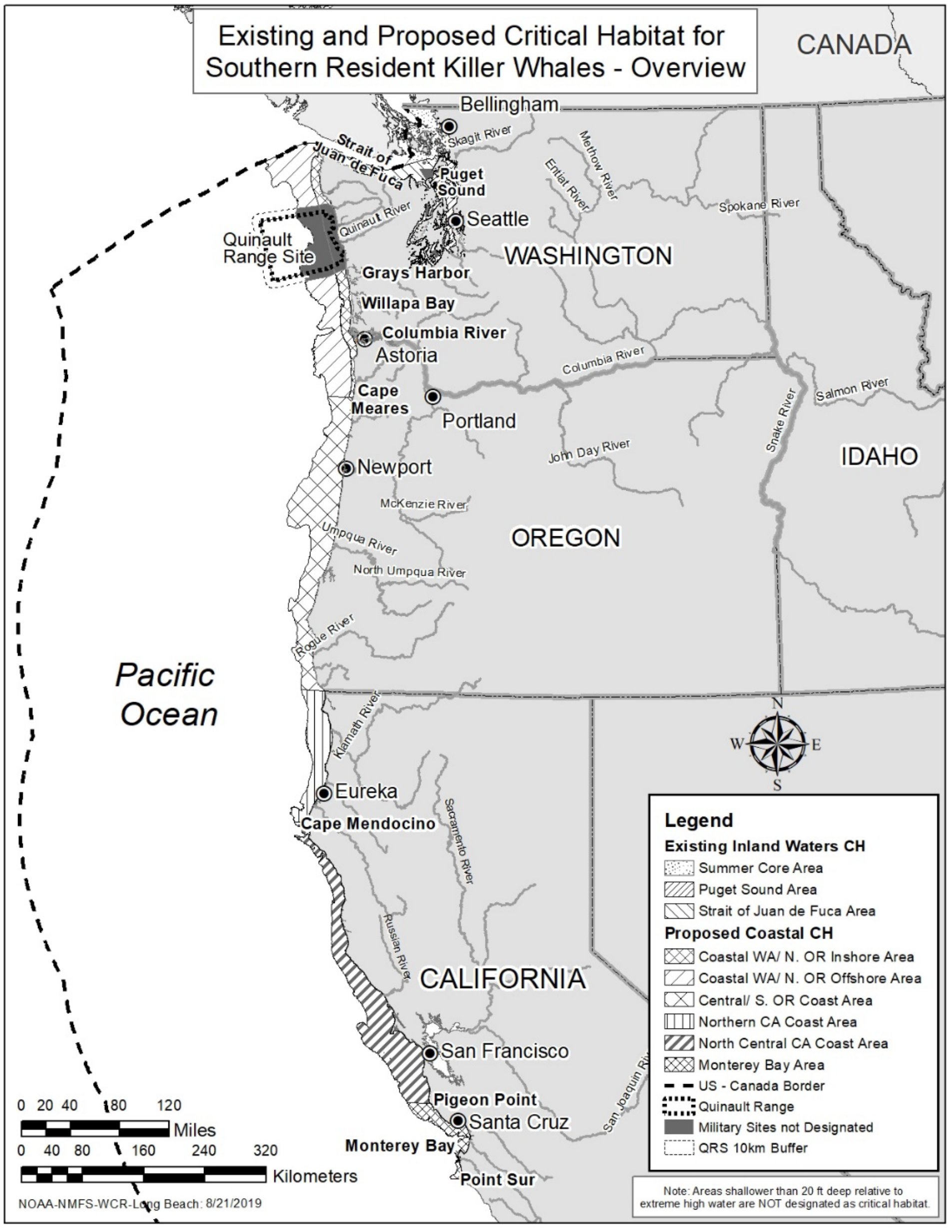


Figure 15. Southern Resident Killer Whale Critical Habitat

False Killer Whale

On July 24 2018, NOAA Fisheries designated critical habitat for the main Hawaiian Islands insular false killer whale DPS by designating waters from the 45-m depth contour to the 3,200-m depth contour around the main Hawaiian Islands from Ni'ihau east to Hawai'i (Figure 16). Island-associated marine habitat is an essential feature for the conservation of the main Hawaiian Islands insular false killer whale. Main Hawaiian Islands insular false killer whales are island-associated whales that rely entirely on the productive submerged habitat of the main Hawaiian Islands to support all of their life-history stages. The following characteristics of this habitat support insular false killer whales' ability to travel, forage, communicate, and move freely around and among the waters surrounding the main Hawaiian Islands:

1. Adequate space for movement and use within shelf and slope habitat;
2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth;
3. Waters free of pollutants of a type and amount harmful to main Hawaiian Islands insular false killer whales; and
4. Sound levels that would not significantly impair false killer whales' use or occupancy.

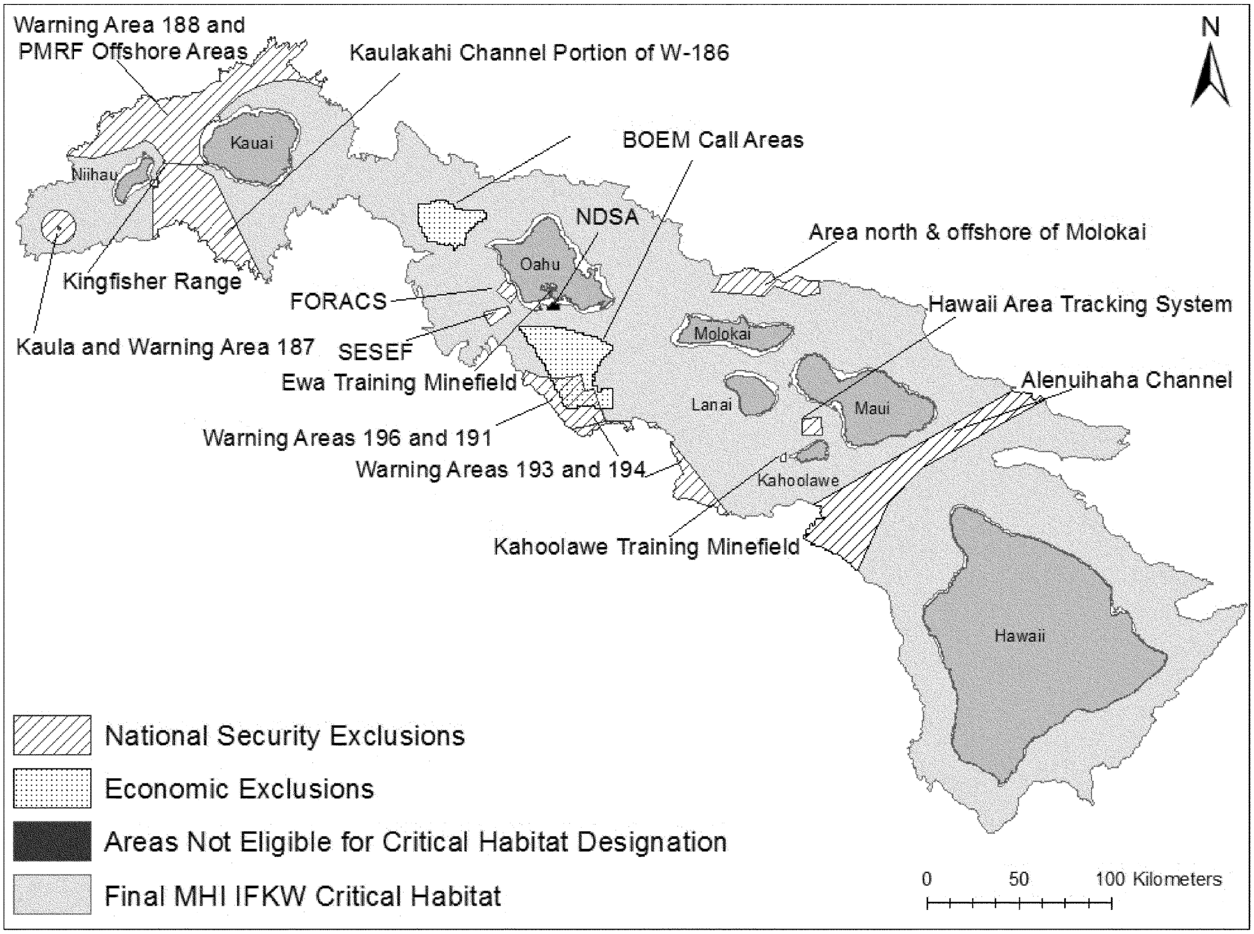


Figure 16. Main Hawaiian Islands insular DPS false killer whale critical habitat.

Hawaiian Monk Seal

NOAA Fisheries designated Critical Habitat for the Hawaiian monk seal in sixteen occupied areas within the range of the species (See series of Critical Habitat maps at: https://www.fisheries.noaa.gov/resource/map/hawaiian-monk-seal-critical-habitat-map). These areas contain one or more PBFs essential to Hawaiian monk seal conservation, including: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas out to 200 m in depth.

Northwestern Hawaiian Islands (Hawaiian names in parenthesis)

There are ten designated Hawaiian monk seal critical habitat areas in the Northwestern Hawaiian Islands that include all beach areas, sand spits, and islets, including all beach crest vegetation to its deepest extent inland, as well as the seafloor and marine habitat 10 m in height above the seafloor from the shoreline out to the 200 m depth contour around:

- Kure Atoll (Hōlanikū)
- Midway Atoll (Kuaihelani)
- Pearl and Hermes Reef (Manawai)
- Lisianski Island (Kapou)
- Laysan Island (Kamole)
- Maro Reef (Kamokuokamohoaliʻi)
- Gardner Pinnacles (ʻŌnūnui)
- French Frigate Shoals (Lalo)
- Necker Island (Mokumanamana)
- Nihoa Island

Main Hawaiian Islands

There are six designated Hawaiian monk seal critical habitat areas in the main Hawaiian Islands that include the seafloor and marine habitat to 10 m above the seafloor from the 200-m depth contour through the shoreline and extending into terrestrial habitat 5 m inland from the shoreline between identified boundary points around the following islands:

- Kaula Island (includes marine habitat only)
- Niʻihau (includes marine habitat from 10 to 200 m in depth)
- Kauaʻi
- Oʻahu
- Maui Nui (including Kahoʻolawe, Lānaʻi, Maui, and Molokaʻi)
- Hawaiʻi Island

Steller Sea Lion

Critical habitat for designated for the Steller sea lion includes specific rookeries, haul-outs, and associated areas, as well as three foraging areas that are considered to be essential for the health, continued survival, and recovery of the species. Critical habitat includes terrestrial, air and aquatic areas that support reproduction, foraging, resting, and refuge.
Critical habitat in Alaska includes a terrestrial zone extending 3,000 ft (0.9 km) landward from each major rookery and haul-out; it also includes air zones extending 3,000 ft (0.9 km) above these terrestrial zones and aquatic zones. Aquatic zones extend 3,000 ft (0.9 km) seaward from the major rookeries and haul-outs east of 144°W (Figure 17). West of 144° W, where the Western DPS is located, the aquatic zone extends 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out (Figure 18). In addition, NMFS designated special aquatic foraging areas as critical habitat for the Steller sea lion. These areas include the Shelikof Strait (in the Gulf of Alaska), Bogoslof Island, and Seguam Pass (the latter two are in the Aleutians). These sites are located near Steller sea lion abundance centers and include important foraging areas with large concentrations of prey.

Although within the range of the now delisted Eastern DPS, the designated critical habitat in California and Oregon remains in effect (Figure 19). In California and Oregon, major Steller sea lion rookeries and associated air and aquatic zones are designated as critical habitat. Critical habitat includes an air zone extending 3,000 ft (0.9 km) above rookery areas historically occupied by sea lions. Critical habitat also includes an aquatic zone extending 3,000 ft (0.9 km) seaward.

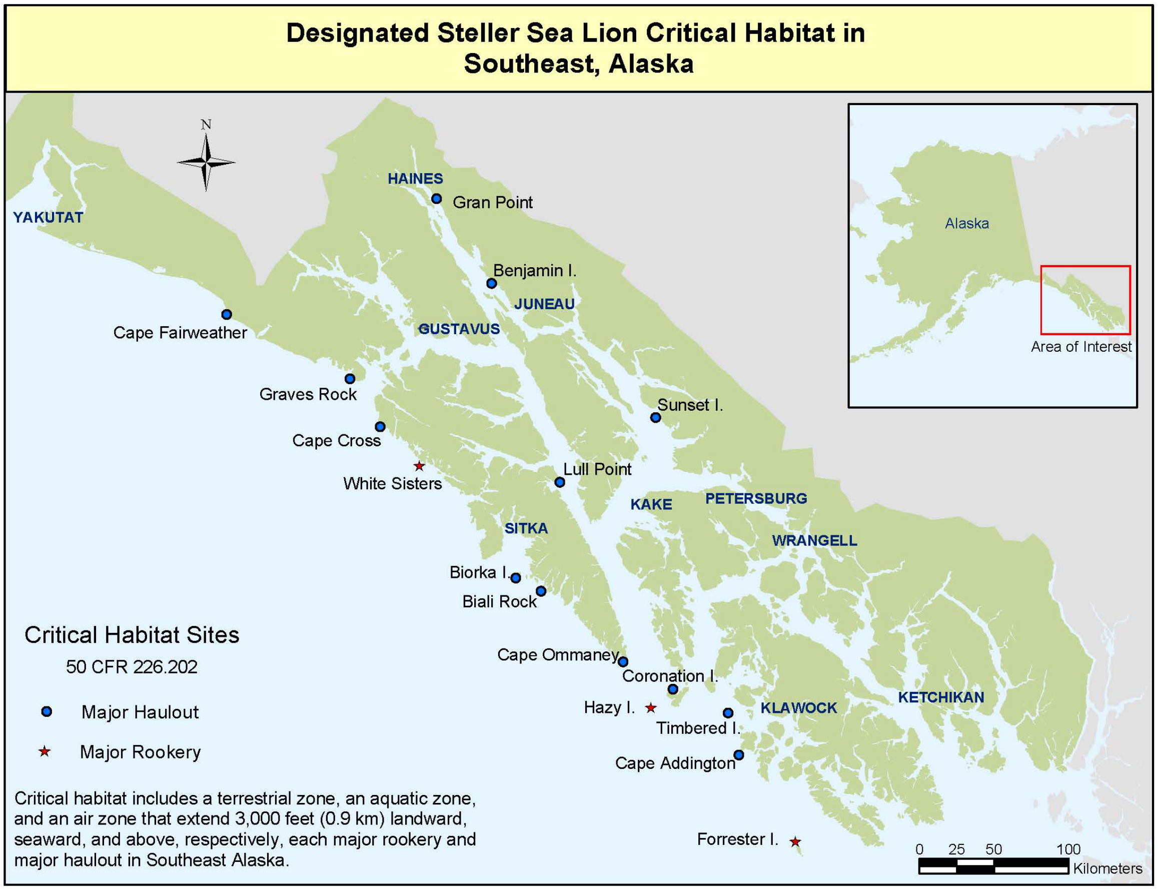


Figure 17. Steller Sea Lion Critical Habitat – Southeast Alaska

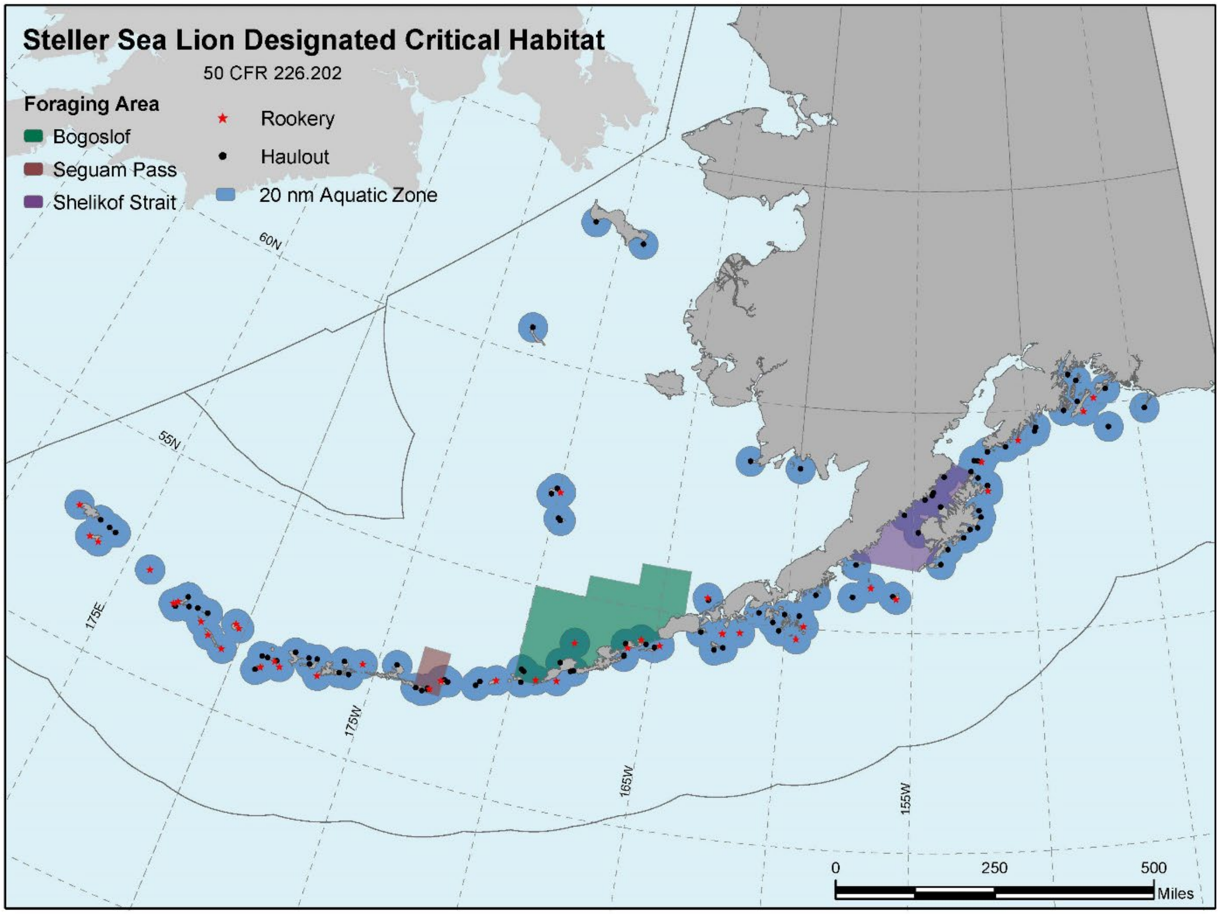


Figure 18. Steller Sea Lion Critical Habitat – Western Alaska

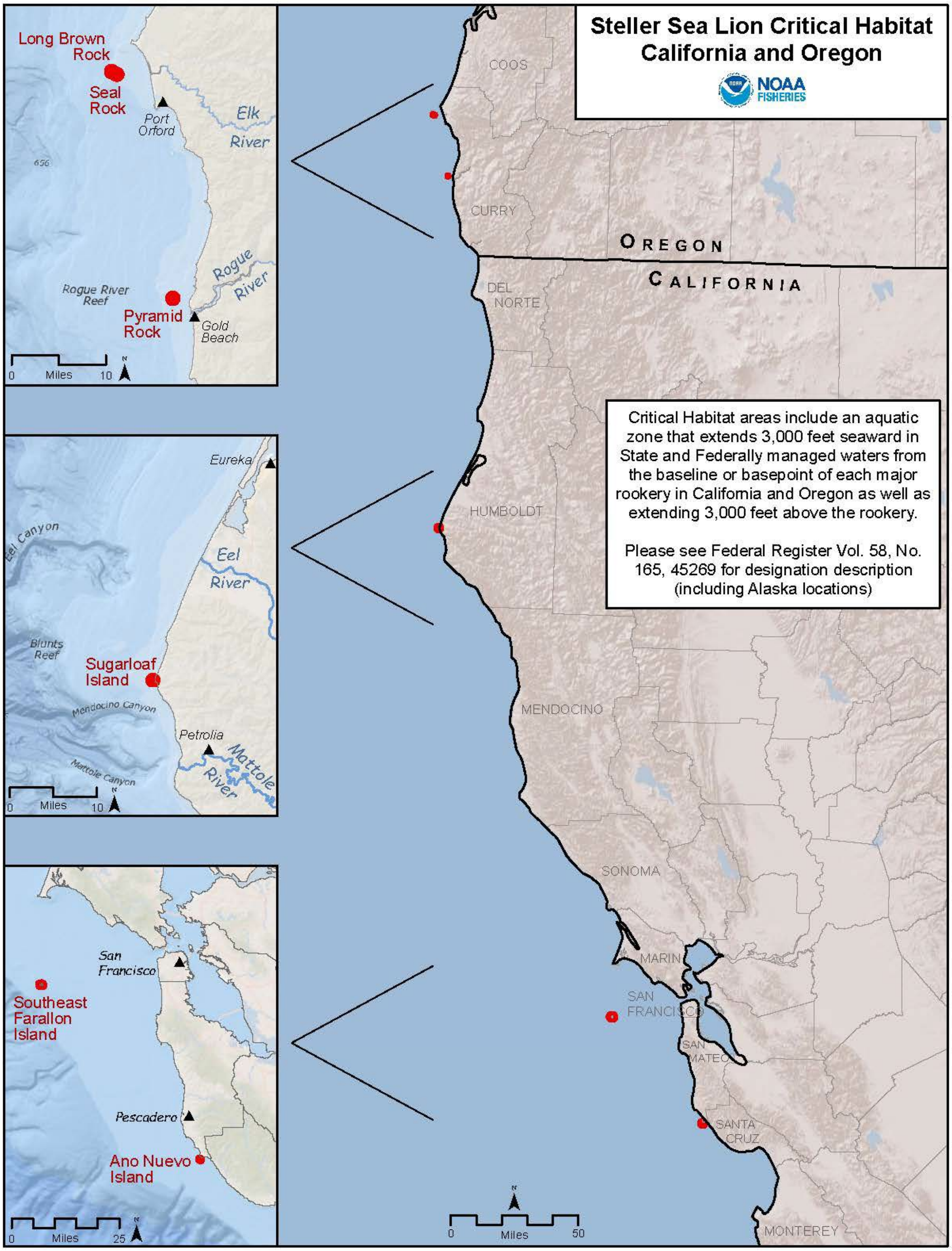


Figure 19. Steller Sea Lion Critical Habitat – Oregon and California

EFFECTS ANALYSIS

"Effects of the action" means all consequences to ESA-listed species or designated critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 C.F.R. §402.2).

The applicable standard to find that a proposed action is not likely to adversely affect ESA-listed species or designated critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or wholly beneficial. Beneficial effects have an immediate positive effect without any adverse effects to the species or habitat. Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action that would be an adverse effect if it did affect an ESA-listed species), but it is very unlikely to occur.
The following subsections identify the potential stressors and analyze the potential effects of the proposed launch and reentry vehicle operations on the ESA-listed species and critical habitat in the action area.

Potential Stressors to ESA-Listed Species

Stressors are any physical, chemical, or biological agent, environmental condition, external stimulus, or event that may induce an adverse response in either an ESA-listed species or its designated critical habitat. Potential stressors to ESA-listed species from the proposed activities include the following:

- Impact by fallen objects: spacecraft, rocket parts, radiosonde;
- Entanglement in unrecovered parachutes and parafoils;
- Ingestion of material from unrecovered parachutes, parafoils, and weather balloon fragments;
- Exposure to hazardous materials;
- Exposure to sonic booms (overpressure) and impulse noise generated during spacecraft reentry or stage landings in the ocean;
- Ship strike; and
- Harassment by aircraft overflight.

Fallen objects, unrecovered parachutes/parafoils, and hazardous materials could also impact designated critical habitat. Potential effects to the ESA-listed species from these stressors are discussed in the following sections, followed by potential effects to the PBFs of designated critical habitat.

Impact by Fallen Objects

Boosters, fairings, spacecraft, and radiosondes from weather balloons falling through the atmosphere to Earth's surface have the potential to affect ESA-listed species marine species. Debris from a launch abort test or any launch failure anomalies could also have an effect. The primary concern is a direct impact from an object landing on an ESA-listed marine mammal, sea turtle or fish.

The action area where objects could splashdown encompasses vast expanses of ocean. ESA-listed species are sparsely distributed across these ocean expanses, resulting in very low densities of species overall. The probability of a direct impact to an ESA-listed species is thus extremely unlikely.

The same conclusion was reached when analyzing the Joint Flight Campaign missile testing from some of the same launch sites and overlapping areas of the Atlantic and Pacific Oceans (OPR-2021-02470). The BE for the Joint Flight Campaign utilized the best available density data for ESA-listed marine mammals and sea turtles, which is from the U.S. Navy's Marine Species Density Databases for training and testing areas in the Pacific and Atlantic (U.S. Navy 2017a and b, U.S. Navy 2018). Species densities were averaged across study areas within a proposed drop zone and the highest estimated densities across seasons were used to represent animal densities in the entire drop zone. For a flight test from VSFB, the maximum number of estimated animal exposures for any ESA-listed species in the broad ocean area is for fin whales at 0.00002 individuals, corresponding to a one in 50,000 chance of contacting a fin whale during a single test from VSFB. For a flight test from WFF, the maximum number of estimated animal exposures for any ESA-listed species in the broad ocean area is 0.000008 individuals for marine mammals (fin whales) and 0.00005 for sea turtles (loggerheads). This corresponds to a one in 121,000 chance of contacting a fin whale and a one in 22,000 chance of contacting a loggerhead turtle during a single test from WFF.

The very low probabilities of direct contact further illustrate the likelihood of ESA-listed mammals or sea turtles being in the same spot where these materials happen to land in vast open ocean areas is very low. Similar density data for ESA-listed fish species is not available, but most of the fish species that may be present in the action area do not spend much time near the surface where direct strikes could occur and often prefer deeper waters (e.g., eulachon, grouper, sawfish, sturgeons, salmonids). Additionally, a physical strike affecting a fish depends on the relative size of the object potentially striking the fish and the location of the fish in the water column. Because fish are likely able to detect an object descending in the water column (e.g., sensing the pressure wave or displacement of water) and are highly mobile, fish would likely swim away from an oncoming object. The oceanic whitetip shark, scalloped hammerheads and giant manta ray are known to spend time near the surface, likely to utilize sunlight-warmed waters, but are also known to dive to greater depths. However, the chance of any ESA-listed fish species being in the same spot where launch materials happen to land is highly unlikely, and therefore, the risk of being directly hit by any falling objects from launch operations is extremely low.

It is worth noting that materials have been expended from rocket launches for decades with no known interactions with any of the ESA-listed species considered in this programmatic. In summary, because it would be extremely unlikely for an ESA-listed species to be directly struck by launch vehicle components, spacecraft, radiosondes, and any launching or landing-related debris, the potential for effects to ESA-listed species from a direct impact by those fallen objects are discountable. Therefore, we conclude that direct impacts from fallen objects to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Entanglement

Spacecraft reentry and recovery operations and fairing recovery involve the use of parachutes and/or parafoils, which introduces the possibility of marine species becoming entangled in the parachute/parafoil material and attached lines, particularly if the material is not recovered by the launch operator. Entanglement can impact a marine animal by limiting its ability to move through the water for feeding, reproductive, or migratory purposes (Laist 1997). Materials entangled tightly around a body part may cut into tissues, enable infection, and severely compromise an individual's health, and may lead to death. A compromised individual is also less likely to be able to escape predation.

Drogue parachutes are the smallest and are cut away at altitude, which separates it from the spacecraft or fairing before the point of splashdown and so are more likely not to be recovered than the other parachutes and parafoils. The drogue parachute's primary material (nylon) is in the family of high molecular weight polymers, which are not easily degraded by abiotic (physical or chemical) or biotic processes (Haines and Alexander 1974). Photooxidative degradation, the process of decomposition of the material by light (most effectively by near-ultraviolet [UV] and UV wavelengths) would be the most effective source of damage exerted on the nylon parachute. However, the drogue parachute assembly becomes saturated within approximately one minute of splashing down and begins to sink. The drogue parachutes are expected to sink at a rate of approximately 1,000 ft in 46 minutes (or approximately 22 ft per minute; see Appendix A), rapidly sinking below the depths to which UV radiation penetrates in the oceans, eventually resting on the ocean floor where exposure to UV light would not occur, making photo-oxidation improbable. Once on the ocean floor, the relatively constant temperatures and lower oxygen concentration (as compared to the atmosphere) would slow the degradation process (Andrady 1990).

If the larger main parachutes or parafoils are not recovered, they will take longer than the drogue parachutes to become saturated and will sink more slowly, but even the largest parafoil is expected to sink at a rate of approximately 1,000 ft in 145.5 minutes (or approximately 7 ft per minute; see Appendix A). This still is a relatively short amount of time to pass through the water column, likely reaching the ocean floor within a matter of hours.

All parachutes and parafoils are meant to be recovered and they have been recovered during the majority of operations. Even if the parachutes or a parafoil are not recovered, they sink rather quickly and spend a short time passing through the water column. Fairing recovery typically takes place between 300-500 NM offshore and if any drogue parachutes or parafoils are not recovered, they are expected to settle (> 3,000 m [9,800 ft]). None of the ESA-listed species considered in this programmatic forage that deep, and therefore are not expected to encounter the settled parachutes or parafoils. SpaceX's Dragon spacecraft parachutes (drogue and main) are the only spacecraft parachutes that have been deployed to date for spacecraft re-entries. Missions use the Dragon spacecraft during contract support for NASA, delivering cargo to the International Space Station. Recovery of Dragon spacecraft reentering from resupply missions occurs offshore over deep waters (> 3,000 m [9,800 ft]), similar to the fairings. SpaceX has typically recovered the Dragon spacecraft within one hour of splashdown and subsequently recover parachutes.

However, there have two instances where sea and weather conditions during Dragon cargo spacecraft recovery created complications and SpaceX did not recover the parachutes. In 2020, a crewed test flight of Dragon-2 was conducted and the recovery operation was not as far offshore (approximately 27 NM), for human crew safety logistics, and therefore occurred over shallower water. The crewed Dragon test flight recovered both drogue parachutes and 3 of the 4 main parachutes. As the crewed Dragon flights become operational, procedures should become more efficient, including parachute retrieval. Crewed Dragon spacecraft missions will be less frequent than cargo missions and only expected to happen once or twice a year.

Considering the low occurrence of parachutes or parafoils not being recovered, the limited time they would spend in the water column and settling typically in the deep ocean, exposure of ESA-listed mammals, sea turtles, or fishes to the parachutes or parafoils is extremely unlikely and therefore the risk of entanglement is discountable.

Ingestion

Foraging individuals of ESA-listed species could be exposed and therefore risk ingesting, pieces of weather balloons, parachutes or parafoils.

Latex weather balloons typically have a diameter at launch of approximately 4 ft, but then rise to approximately 20–30 km where the volume increases to the point where the elastic limit is reached and the balloon bursts. The temperature at this altitude range can reach negative 40 degrees Fahrenheit (°F) and even colder. Under these conditions of extreme elongation and low temperature, the balloon undergoes "brittle fracture" where the rubber actually shatters along grain boundaries of crystallized segments. The resultant pieces of rubber are small strands comparable to the size of a quarter (Burchette 1989). This was confirmed by researchers at the University of Colorado and NOAA (University of Colorado and NOAA 2017). The small shreds then make their way back to the surface of the Earth and are expected to land in the ocean. Along the way, the pieces can be subject to movements in atmospheric pressure and wind as they sink through the air. This can cause the fragments to become scattered and disperse before landing on the surface of the ocean where they are subject to movement of surface currents, which can cause additional dispersion.

The balloon fragments would be positively buoyant, float on the surface, and begin to photo-oxidize due to UV light exposure. Studies have shown latex in water will degrade, losing tensile strength and integrity, though this process can require multiple months of exposure time (Pegram and Andrady 1989; Andrady 1990; Irwin 2012). Field tests conducted by Burchette (1989) showed latex rubber balloons are very degradable in the environment under a broad range of exposure conditions, including exposure to sunlight and weathering and exposure to water. The balloon samples showed significant degradation after six weeks of exposure (Burchette 1989).

The floating latex balloon fragments would provide substrate for algae and eventually be weighed down with growth of heavier epifauna, such as tunicates (Foley 1990). The degree to which such colonization may occur will correspond to the amount of time the balloon remains at or near the ocean's surface. Additionally, an area's geographic latitude (and corresponding climatic conditions) has a marked effect on the degree of biofouling on marine debris. Fouling of the latex shreds could be confused with organic matter while ESA-listed species are foraging. Green sea turtles are herbivorous and a large study of green sea turtles that stranded in Texas between 1987 and 2019, discovered 48% had ingested plastic, although there was no evidence of mortality related to the ingestion of the plastics (Choi et al. 2021). A study of latex balloon fragment ingestion by freshwater turtles and catfish found no significant impact on survival or blood measured indicators of stress response (Irwin 2012).

In addition to further degradation of the latex material, the embedded fouling organisms would cause the material to become negatively buoyant, making it slowly sink to the ocean floor. Studies in temperate waters have shown that fouling can result in positively buoyant materials (e.g., plastics) becoming neutrally buoyant, sinking below the surface into the water column after only several weeks of exposure (Ye and Andrady 1991; Lobelle and Cunliffe 2011), or descending farther to rest on the seafloor (Thompson et al. 2004).

Given the small balloon shreds are likely to be scattered and not concentrated, and they should only be available in the upper portions of the water column on the order of weeks, the potential for exposure of ESA-listed marine species to these shreds is extremely low and therefore discountable.

As stated previously, operators expect to recover parachutes/parafoils soon after splashdown and in the rare occasion they are not recovered (a few each year, see Appendix A), the parachutes/parafoils will sink to the seafloor within a matter of hours. As discussed previously, the degradation of parachute and parafoil materials will be a slow process that takes place after the materials have settled on the sea floor. It is possible that small fragments could temporarily resuspend in the water column, but the potential for this depends on local ocean floor conditions and the fragments are not expected to resuspend high in the water column where they would likely be encountered by ESA-listed species. As previously discussed recovery operations typically take place far offshore (e.g. 300-500 NM) and any drogue parachutes or parafoils not recovered are expected to settle (> 3,000 m [9,800 ft]). None of the ESA-listed species considered in this programmatic forage that deep, therefore, the likelihood of them encountering ingestible material once it has settled over the long-term is expected to be extremely unlikely to occur and thus discountable.

We conclude that the risk of ingesting pieces of weather balloons, parachutes or parafoils to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Exposure to Hazardous Materials

Hypergolic fuels (e.g., NTO and MMH) may be on the spacecraft during a splashdown. A spacecraft's propellant storage is designed to retain residual propellant, so any propellant remaining in the spacecraft is not expected to be released into the ocean. In an event the propellant tank actually ruptures on impact, the propellant would evaporate or be quickly diluted.

In the event of a failed launch operation, launch operators will follow the emergency response and cleanup procedures outlined in their Hazardous Material Emergency Response Plan (or similar plan). Procedures may include containing the spill using disposable containment materials and cleaning the area with absorbents or other materials to reduce the magnitude and duration of any impacts. In most launch failure scenarios, at least a portion of the propellant will be consumed by the launch/failure, and any remaining propellant will evaporate within hours or be diluted by seawater and degrade over time (timeframes are variable based on environmental conditions, but generally hours to days).

Launch vehicles and spacecraft are designed to retain propellants and even if there is a rare launch failure (> 93% success rate over 30 years), propellants will evaporate and be diluted within hours. The chance for ESA-listed marine species to be exposed to the residual propellants from a splashdown or launch failure is extremely low and therefore discountable. Therefore, we conclude that hazardous material exposure to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Exposure to Sonic Booms and Impulse Noise

A sonic boom will be generated during spacecraft reentry and stage landings in the ocean. Due to the shape and size of existing spacecraft and spacecraft in development, as well as the altitude at which reentering spacecraft generate a sonic boom, the FAA, USSF, and NASA do not expect the overpressure from reentering spacecraft to exceed 1 psf. An overpressure of 1 psf is similar to a thunderclap. For boosters that can currently land on a barge in the ocean (e.g., SpaceX Falcon series), overpressures at the ocean's surface could be up to 8 psf. For the Super Heavy, which is currently in developmental stages and expected to be operational soon, overpressures at the ocean's surface could be up to 15 psf from ocean barge landings. Boom intensity, in terms of psf, is greatest under the flight path and progressively weakens with horizontal distance away from the flight track. Based on modeling for landings at the Boca Chica Launch Site, the area beneath the stage receiving the maximum overpressure (up to 15 psf) as it is landing could be up to 1.28 km in diameter.

Overpressure from sonic booms are not expected to affect marine species underwater. Acoustic energy in the air does not effectively cross the air/water interface and most of the noise is reflected off the water surface (Richardson et al. 1995). The landing platform barge will also act as a barrier to the most intense portion of overpressure from landings. In addition, underwater sound pressure levels from in-air noise are not expected to reach or exceed threshold levels for injury or harassment to ESA-listed species.

Previous research conducted by the USAF supports this conclusion with respect to sonic booms, indicating the lack of harassment risk for protected marine species in water (U.S. Air Force Research Laboratory 2000). The researchers were using a threshold for harassment of marine mammals and sea turtles by impulsive noise of 12 pound per square inch (psi) peak pressure and/or 182 decibels (dB) referenced (re) to the standard unit of acoustic pressure underwater, 1 micro Pascal (µPa), which is an older threshold used by NMFS and DoD at the time. The researchers pointed out that, to produce the 12 psi in the water, there needs to be nearly 900 psf at the water surface, assuming excellent coupling conditions. They also noted that it is very difficult to create sonic booms that even approach 50 psf. Current thresholds utilized by NMFS for behavioral disturbance from impulsive acoustic sources are lower (in water, re 1 µPa: 175 dB sea turtles, 160 dB marine mammals, 150 dB fishes) but these are root mean square (rms) values and not peak pressure values.. The rms is a square root of the average of sound signal pressures that have been squared over a given duration. Due to the squaring and averaging of sound pressure values (which tends to level out large values), the rms, results in a more conservative value than just a peak value. Still, what the USAF research report illustrates is that it would take a tremendously greater sonic boom than what is generated by the booster stage landings to create an acoustic impact underwater that could approach disturbing ESA-listed marine mammals, sea turtles or fish. Therefore, any effect from the sonic booms on ESA-listed species while under water would be insignificant.

ESA-listed marine mammals and sea turtles could be exposed to the overpressures from sonic booms in the air when they are surfacing for air; however, the chances of both events happening at same time (i.e., species surfacing and a sonic boom occurring) is extremely unlikely, especially considering the length of a sonic boom is less than one second. The Guadalupe fur seal, Hawaiian monk seal, and Steller sea lion can spend time hauled out of the water and therefore may be affected by an in-air sonic boom. The potential for effect would only be present during spacecraft reentry missions occurring in the Pacific Ocean and rocket booster landing are not planned near areas where these species haul out. Spacecraft reentry in the Pacific Ocean would generate sonic booms at high altitudes (approximately 50,000 ft). The magnitude of the high altitude sonic boom overpressure that has the potential to impact land areas where Guadalupe fur seals, Hawaiian monk seals, and Steller sea lions may be present is low (1 psf or lower). Therefore, the effect of these sonic booms is unlikely to create any meaningful disturbance for these ESA-listed pinnipeds when they are out of the water.

The 2019 MMPA Letter of Authority for VSFB launch operations arrived at a similar conclusion (84 FR 14314). Over 20 years of monitoring data for species including harbor seals (*Phoca vitulina*), elephant seals (*Mirounga angustirostris*), and California sea lions (*Zalophus californianus*) at VSFB and the North Channel Islands (CA), show reactions to sonic booms tend to be insignificant when not above 1.0 psf. Observational data do not include the ESA-listed pinnipeds considered in this programmatic, but the long time series data for other species serve as a proxy indicating this category of sonic booms for marine mammals that haul out of water do not result in disturbance at low overpressures.

In summary, it is extremely unlikely that an ESA-listed sea turtle or marine mammal would surface close to a landing booster at the exact moment to be exposed to a sonic boom (greater than 1 psf) in the air, therefore the effects are discountable. Any ESA-listed sea turtles, marine mammals or fishes underwater are not expected to be exposed to measurable acoustic effects from a sonic boom therefore, the effects are insignificant. The low level sonic boom (not above 1 psf) resulting from spacecraft reentry at high altitude in the Pacific, is not expected to create any significant disturbance to hauled out ESA-listed pinnipeds and the effects are therefore insignificant.

Ship Strike

Ships and other watercraft vessels are used to recover launch vehicle stages that land on a platform in the ocean, as well as to recover spacecraft and payload fairings. Vessels may also be used for surveillance to ensure that designated hazard areas are clear of non-participating crafts. These watercraft operations have potential to result in a ship strike of ESA-listed species that spend time at or near the surface of the water (e.g., marine mammals, sea turtles, giant manta ray, oceanic whitetip shark, and scalloped hammerhead). ESA-listed marine mammals and sea turtles can spend time at the surface, but most of their time is spent submerged. Giant manta ray, oceanic whitetip and scalloped hammerhead sharks can also spend time at or near the ocean surface and be subject to potential ship strikes, but they also dive to great depths. All vessels would be required to comply with the *Environmental Protection Measures* for vessel operations. All watercraft would have a dedicated observer on board, adhere to maintaining minimum safety distances between ESA-listed species and vessels, and reduce speed as required.

During the portion of time that ESA-listed marine mammals, sea turtles, and some elasmobranch fish species may spend near the ocean surface, ship strikes are considered extremely unlikely to occur and therefore discountable, due to the use of dedicated observation personnel and safety procedures for avoidance. Based on previous operation reports provided as part of ESA section 7 consultations for similar operations, there have not been reported vessel collisions with ESA-listed marine species.

Rice's whale requires additional consideration due to its very low population size (likely < 50) and its ecology. The Rice's whale dives deep during the day to forage but at night tends to stay just below the surface, increasing the chance of the animal being struck at night. The *Vessel Operations* measures in the PDCs for this programmatic consultation include the condition that recovery and vessel transit will not occur at night in the Rice's whale core distribution area. The PDCs for this programmatic consultation stipulate only one splashdown, a reentry and recovery of the Dragon capsule, may occur in Rice's whale core habitat distribution area per year. These restrictions will ensure the effects of vessel strike due to recovery vessel operations are discountable.

We conclude that the risk of ship strike to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Aircraft Overflight

Noise from aircraft overflight may enter the water, but, as stated in relation to sonic booms, very little of that sound is transmitted into water. Sound intensity produced at high altitudes is reduced when it reaches the water's surface. At lower altitudes, the perceived noise will be louder, but it will decrease rapidly as the aircraft moves away. Individual ESA-listed species that occur at or very near the surface (e.g., marine mammals, sea turtles, giant manta ray and sharks) at the time of an overflight could be exposed to some level of elevated sound. There could also be a visual stimulus from overflight that could potentially lead to a change in behavior. Both noise and visual stimulus impacts would be temporary and only occur if an individual is surfacing or very close to the surface and an aircraft happens to be flying over at the same time.

Studies in the Gulf of Mexico found that most sperm whales dive when overflown by fixed wing aircraft (Wursig et al. 1998). Richter et al. (2006) documented only minor behavioral effects (i.e., both longer surface time and time to first vocalization) of whale-watching aircraft on New Zealand sperm whales. However, details on flight altitude were not provided. Smultea et al. (2008) studied sperm whales in Hawai'i, documenting that diving responses to fixed winged overflights occurred at approximately 820 ft above ground level (AGL).

Patenaude et al. (2002) observed bowhead whales, which are not a species considered in this consultation but serve as an example for mysticetes, during spring migration in Alaska and recorded short-term responses to fixed-wing aircraft activity. Few (approximately 2%) of the observed bowheads reacted to overflights (between 200 and 1,500 AGL), with the most common behavioral responses being abrupt dives, short surfacing episodes, breaching, and tail slaps (Patenaude et al. 2002). Most of these responses occurred when the aircraft was below altitudes of 600 ft (Patenaude et al. 2002), which is below the altitude expected to be flown by fixed wing aircraft during project-related surveillance for the activities considered in this consultation.

Species-specific studies on the reaction of sea turtles to fixed wing aircraft overflight are lacking. Based on sea turtle sensory biology (Bartol and Musick 2003), sound from low-flying aircraft could likely be heard by a sea turtle at or near the ocean surface. Sea turtles might be able to detect low-flying aircraft via visual cues such as the aircraft's shadow, similar to the findings of Hazel et al. (2007) regarding watercraft, potentially eliciting a brief reaction such as a dive or lateral movement. However, considering that sea turtles spend a significant portion of their time below the sea surface (Lutcavage and Lutz 1997) and the low frequency and short duration of surveillance flights, the probability of exposing an individual to an acoustically or visually-induced stressor from aircraft momentarily flying overhead would be very low. The same is relevant for giant manta rays and the ESA-listed shark species in the action area, considering their limited time near the surface and brief aircraft overflight.

As stated in the *Environmental Protection Measures*, spotter aircraft will maintain a minimum of 1,000 ft over ESA-listed or MMPA-protected species and 1,500 ft over North Atlantic right whales. Additionally, aircraft will avoid flying in circles if marine mammals or sea turtles are spotted to avoid any type of harassing behavior. The chances of an individual ESA-listed species being exposed to the proposed aircraft overflights are extremely low. Given the limited and temporary behavioral responses documented in available research, it is expected that potential effects on ESA-listed species, should they even occur, would be insignificant. We conclude that effects from aircraft overflight to ESA-listed marine mammals, sea turtles, and fish in the action area because of activities covered under this programmatic may affect, but are not likely to adversely affect these animals.

Critical Habitat

A common element across several of the designated critical habitats in the action area that may be affected by the proposed action is water quality: green sturgeon, Gulf sturgeon, Southern Resident DPS killer whale, and Main Hawaiian Islands Insular DPS false killer whale critical habitat include PBFs for water quality. Water quality may be temporarily degraded as a result of a launch failure. Potential effects to water quality could result from debris and propellants. Recovery activities and any emergency response and cleanup procedures would reduce the magnitude and duration of any impacts. As previously discussed, propellants are expected to evaporate and quickly become diluted, limiting any impacts to a temporary duration. Given the unlikely scenario of a launch failure and the brief exposure of residual propellants from splashdowns, it is highly unlikely that water quality features would become degraded to the extent the conservation value of the critical habitats are impacted.

Most of the proposed operations would occur well offshore in deep waters. Landing and recovery operations would not occur within 5 NM of the coast where most of the critical habitat for green sturgeon is located. The same is true for Gulf sturgeon, except for Cedar Key, Florida, but it is far away from flight trajectories from the Boca Chica Launch Site. It is very unlikely that any launch or reentry operations would occur within that portion of Gulf sturgeon critical habitat. Unit 2 of the North Atlantic right whale critical habitat occurs off the coast of CCSFS and extends seaward approximately 5 NM off the coast. Keeping operations out of the first 5 NM from shore helps avoid this critical calving area. Operations are not expected to have any impact on the oceanic features near the Unit 2 calving area such as sea temperature, sea state or depth. PBFs for Hawaiian monk seal conservation include significant haul-outs and preferred pupping/nursing areas. Operations will not occur in or near those areas. Critical habitat for Steller sea lions includes major rookeries, haul-outs, and associated zones extending 3,000 ft (0.9 km) landward, in the air above, or into the water from those major rookeries and haul-outs, that support reproduction, foraging, resting, and refuge. Operations will not occur in those zones. West of 144° W, where the Western DPS Steller sea lion is located, the critical habitat aquatic zone extends 20 NM (37 km) seaward from the baseline or basepoint of each major rookery and major haul-out. If operations cannot comply with the PDC that landings will not occur in those 20 NM aquatic zones, they will require a project-specific review.

Migratory passage and adequate space for movement are features common to Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, and Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitats. As stated previously, no operations will occur in the immediate nearshore environment (< 5 NM), resulting in a considerable amount of those critical habitats not being affected by the proposed action. Landing and reentry operations will typically be much farther out but, even if they were to occur close to the 5 NM limit, they are temporary with no long-term occupation or structures creating obstructions to movement, thus any potential effects are likely to be insignificant.

Prey and foraging areas are other common elements across several of the designated critical habitats in this consultation: leatherback, Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, North Pacific right whale; Western North Pacific, Central America, and Mexico DPSs of humpback whales; and Hawaiian monk seal and Steller sea lion foraging areas. As previously stated, sound from sonic booms is not expected to enter the water with enough intensity to create any significant disturbances to ESA-listed species and the effects of this sound is also expected to be insignificant for zooplankton or small pelagic schooling fishes that are the important prey species for these critical habitats. Pieces of weather balloons or parachutes/parafoils are not expected to be available to prey species in sufficient concentrations to measurably affect prey populations. Considering the rare occurrence of not recovering parachutes/parafoils, as the parachutes/parafoils begin to become saturated with seawater and begin to sink, prey fish species should be able to detect the object and move out of the way (as previously discussed for fishes) and the chance of entanglement is extremely unlikely to occur and thus discountable. Prey zooplankton species may have less of an ability to move out of the way and therefore some could get entrapped in the parachute/parafoil. The removal of a small amount of zooplankton is not expected to reduce the conservation value of that PBF in any designated critical habitats and therefore the effect will be insignificant.

A unique PBF for Main Hawaiian Islands Insular DPS false killer whale critical habitat is sound levels that would not significantly impair false killer whales' use or occupancy. As previously stated, sound of any intensity that would create meaningful disturbance underwater is not an expected effect from proposed operations.

Oceanographic conditions supporting *Sargassum* habitat having adequate abundance and cover for post hatchlings and prey is a PBF for Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat. The scale of operations are not large enough to affect boundary currents or areas of convergence that promote the aggregation of *Sargassum*. Any potential impacts to these features are expected to be very small and temporary, and therefore insignificant.

In summary, the effects associated with stressors from launch and reentry operations that are part of the proposed action may affect, but are not expected to adversely affect any of the designated critical habitats in the action area.

Additive Effects

We have concluded the proposed launch and reentry vehicle operations in the marine environment, when in compliance with the requirements of this programmatic, are not likely to adversely affect ESA-listed marine mammals, sea turtles, and fishes or designated critical habitat for green sturgeon, Gulf sturgeon, leatherback sea turtle, Northwest Atlantic Ocean DPS loggerhead sea turtle, North Atlantic right whale, North Pacific right whale; Western North Pacific DPS, Central America DPS, and Mexico DPS of humpback whales; Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, Hawaiian monk seal, and the Western DPS Steller sea lion. Programmatic consultations often involve actions that may occur with some frequency over many years and possibly continue for an indefinite time. As a result, we evaluate the potential for the effects of the stressors to ESA-listed species and designated critical habitat over the lifetime of the proposed action to result in additive effects due to chronic stress or cumulative effects. Therefore, we determine if, when considered additively, the effects of stressors associated with the launch and reentry vehicle operations in the marine environment that are part of the proposed action are likely to adversely affect the aforementioned ESA-listed species and designated critical habitat.

The USSF (and previously USAF), NASA, and commercial space operations with authorization from the FAA have been conducting launch and reentry vehicle operations for decades with little documented impact to the marine environment as a whole, including a lack of reported incidences affecting ESA-listed species and designated critical habitats in the action area. The activities considered in this programmatic consultation will occur across large expanses of open water in the Atlantic and Pacific Oceans, and the Gulf of Mexico. Each of the stressor categories (see *Effects of the Action*) were determined to have effects that are extremely unlikely to occur and therefore discountable, or to result in effects that are so small as to be insignificant. The possibility of the discountable effects overlapping in time and space and having a cumulative effect to ESA-listed species and designated critical habitat in the action area does not seem plausible considering the limited time operations occur in a small portion of the vast action areas. Within the same reasoning, chronic stress from activities whose effects are considered insignificant also does not seem plausible. Therefore, additive effects from the activities considered in this consultation are extremely unlikely and thus discountable.

CONCLUSION

Based on this analysis, NMFS ESA Interagency Cooperation Division concurs with the FAA, NASA and the USSF, that the proposed action may affect, but is not likely to adversely affect ESA-listed species and designated critical habitat.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

As previously stated, the Rice's whale population is likely less than 50 individuals and therefore at high risk from threats that could reduce their numbers. Vessel strike is one of those threats. As discussed in the *Effects Analysis*, spacecraft recovery vessel activities are not likely to adversely affect ESA-listed marine mammals such as the Rice's whale. Even though one Dragon capsule splashdown and recovery per year in the Rice's whale core distribution area is not considered a significant threat, we are using this opportunity within this programmatic consultation to emphasize the conservation priority of avoiding the area, especially depths greater than 100 m deep. We also want to take this opportunity to address debris that originates from space launch and reentry operations, even though it is mostly expected to sink and settle in deep water, any reduction of debris in the marine environment could benefit all marine wildlife, including ESA-listed species.

The following conservation recommendations are discretionary measures that NMFS believes are consistent with the Federal action agencies' obligation under section 7(a)(1) and therefore should be carried out where applicable:

- Every effort should be made to move spacecraft capsule splashdowns closer to shallow edges of the Rice's whale core distribution area boundaries. Moving out of the area altogether is preferred.
- No vessel transit should take place in the Rice's whale core distribution area unless to specifically to pick up the capsule and then immediately exit at the nearest boundary edge while staying out of the core habitat area with depths of 100 m to 425 m, where the Rice's whale has been observed (Rosel et al. 2021).
- The action agencies should coordinate with NMFS ESA Interagency Cooperation Division to foster collaboration with the NOAA Marine Debris Program (MDP), in order to evaluate how activities of the MDP may apply to debris that originates from space launch and reentry operations (e.g., expended vehicle components).

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, the FAA, NASA, and/or USSF (as applicable) should notify the ESA Interagency Cooperation Division and SERO of any conservation recommendations implemented as part of activities included in this programmatic consultation. This information can be included in annual reports.

REINITIATION OF CONSULTATION

Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal involvement or control over the action has been retained or is authorized by law and:

1. New information reveals effects of the action that may affect an ESA-listed species or designated critical habitat in a manner or to an extent not previously considered;
2. The identified action is subsequently modified in a manner that causes an effect to the ESA-listed species or designated critical habitat that was not considered in this concurrence letter;
3. Take of an ESA-listed species occurs; or
4. A new species is listed or critical habitat designated that may be affected by the identified action (50 C.F.R. §402.16).

Please direct questions regarding this letter to Dr. Soren Dahl, Consulting Biologist, at (301) 427-8495 or soren.dahl@noaa.gov, or me at (301) 427-8495, or by email at cathy.tortorici@noaa.gov.

Sincerely,

Cathryn E. Tortorici
Chief, ESA Interagency Cooperation Division
Office of Protected Resources

Cc: USSF, NASA

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Appendix A – Parachute Information Provided to NMFS by the FAA

A.1 Spacecraft Parachutes

Two sets of parachutes are typically used during spacecraft re-entry: drogue and main parachutes. The drogue parachutes are thin parachutes deployed during reentry to gain control of the spacecraft at speeds that would destroy larger parachutes and therefore are deployed before the larger and thicker main parachutes (see Figure A-1). Spacecraft can be rigged with two drogue parachutes. Each drogue parachute has a diameter of approximately 19 feet with 72 feet of risers/suspension and are made of variable porosity conical ribbon. The drogues typically land within 0.5–1 mile from the spacecraft.

Shortly after the drogue parachutes are deployed, they are released, and the main parachutes are deployed (see Figure A-1). The main parachutes slow the spacecraft to a speed of approximately 13 miles per hour allowing for a "soft" splashdown in the water. The main parachutes are made of Kevlar and nylon and have a diameter of approximately 116 feet with 147 feet of risers/suspension. Spacecraft may be rigged with up four main parachutes.

Figure A-1. Main Parachutes with Released Drogue Parachutes in the Background (SpaceX Dragon)

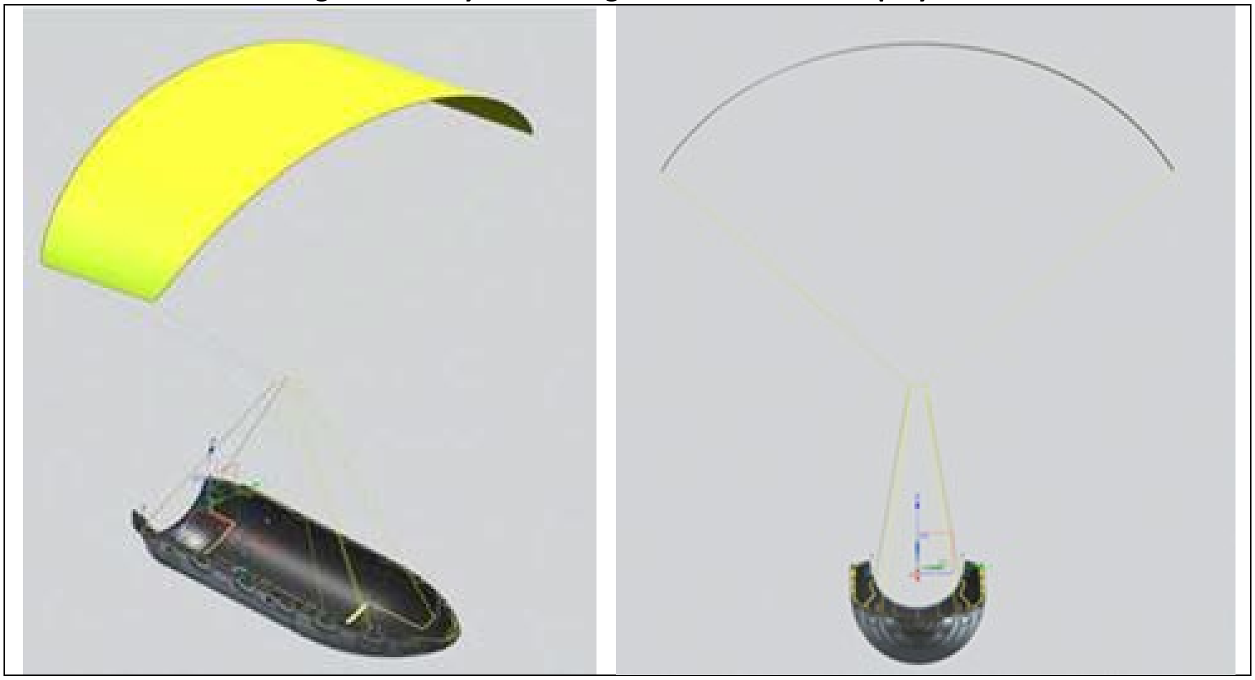
SpaceX's Dragon parachutes (drogue and main) are the only spacecraft parachutes that have been deployed to date for spacecraft re-entries. The parachutes remain floating on the surface enabling the recovery operations. However, due to sea and weather conditions, there have been two instances where SpaceX did not recover Dragon's main parachutes. Similarly, there have been four instances where SpaceX did not recover Dragon's drogue parachutes. Refer to the FAA's 2018–2020 annual reports sent to NMFS regarding SpaceX launch recovery efforts.

A.2 Payload Fairing Parachutes

SpaceX has designed a parachute system to enable recovering of payload fairings. Other launch operators may do the same in the future. SpaceX's parachute system consists of one drogue parachute and one parafoil (see Figures A-2 and A-3).

Figure A-2. Fairing Parafoil

Figure A-3. Payload Fairing Half with Parafoil Deployed



The parachute system slows the decent of the fairing to enable a soft splashdown such that the fairing remains intact. Following re-entry of the fairing into Earth's atmosphere, the drogue parachute is deployed at a high altitude (approximately 50,000 feet) to begin the initial slow down and to extract the parafoil. The drogue parachute is then cut away following the successful deployment of the parafoil. Refer to the FAA's 2018–2020 annual reports sent to NMFS regarding SpaceX launch recovery efforts.

Two parachute systems for the fairing may be used (Type 1 and Type 2). The specifications of each system are noted below (Tables A-1 and A-2). The Type 2 system has a similar drogue parachute as the Type 1 system but a larger and lighter parafoil than Type 1. Type 1 drogue parachute risers are made of Kevlar with nylon overwrap. Type 1 parafoil risers, for which there are four, are made of nylon with Kevlar overwrap. Type 2 drogue parachute risers are made of Kevlar. Type 2 parafoil risers, for which there are four, are made of nylon.

Table A-1. Specifications of Type 1 and Type 2 Fairing Drogue Parachutes

Drogue Type	Canopy Material	Area (ft^2)	Suspension Line Material	Deployment Bag (ft^2)[a]
Type 1	Nylon	63.59	Kevlar	28[b]
Type 2	Nylon	113	Kevlar	28[c]

[a] The deployment bag is part of the drogue parachute assembly; the two components are connected.

[b] Spectra cloth with Kevlar webbing.

[c] Nylon cloth.

ft^2 = square feet

Table A-2. Specifications of Type 1 and Type 2 Fairing Parafoils

Parafoil Type	Canopy Material	Area (ft^2)	Suspension Line Length (ft)
Type 1	Nylon	1,782	42.6
Type 2	Nylon	3,000	50

ft = feet; ft^2 = square feet

The projected sink rates for both types of drogue parachutes and parafoils are shown below (Tables A-3 to A-6 and Figures A-4 to A-7). As indicated in the figures, both types of drogue parachutes are expected to sink at a rate of approximately 1,000 feet in 46 minutes (or approximately 22 feet per minute). The Type 1 parafoil is expected to sink at a rate of approximately 1,000 feet in 63 minutes (or approximately 16 feet per minute). The Type 2 parafoil is expected to sink at a rate of approximately 1,000 feet in 145.5 minutes (or approximately 7 feet per minute). These estimated sink rates were calculated using a NASA method/spreadsheet for estimating sink rates of parachutes and balloons. The spreadsheet provides steady-state sink rates in water for parameters inputted by the user. There are conservative assumptions built in the spreadsheet, such as assuming the parachute remains open during the entire in-water descent, slowing the descent velocity, when, in actuality, the parachute could either collapse or become entangled in the other flight train components. The calculations present the most conservative (slowest) sink rates.

Table A-3. Projected Sink Rate for Type 1 Drogue Parachute

Properties	
Sum of masses:	18.2 pounds
Sum of buoyancy forces:	8.73 pounds
Sum of drag areas:	73 square feet
Sink Rate	
Terminal velocity of system in water:	0.36 feet/second
Sink time per 1,000 ft of depth:	46.2 minutes
Sink time per 100 m of depth:	15.17 minutes

Figure A-4. Sink Rate Chart for Type 1 Drogue Parachute

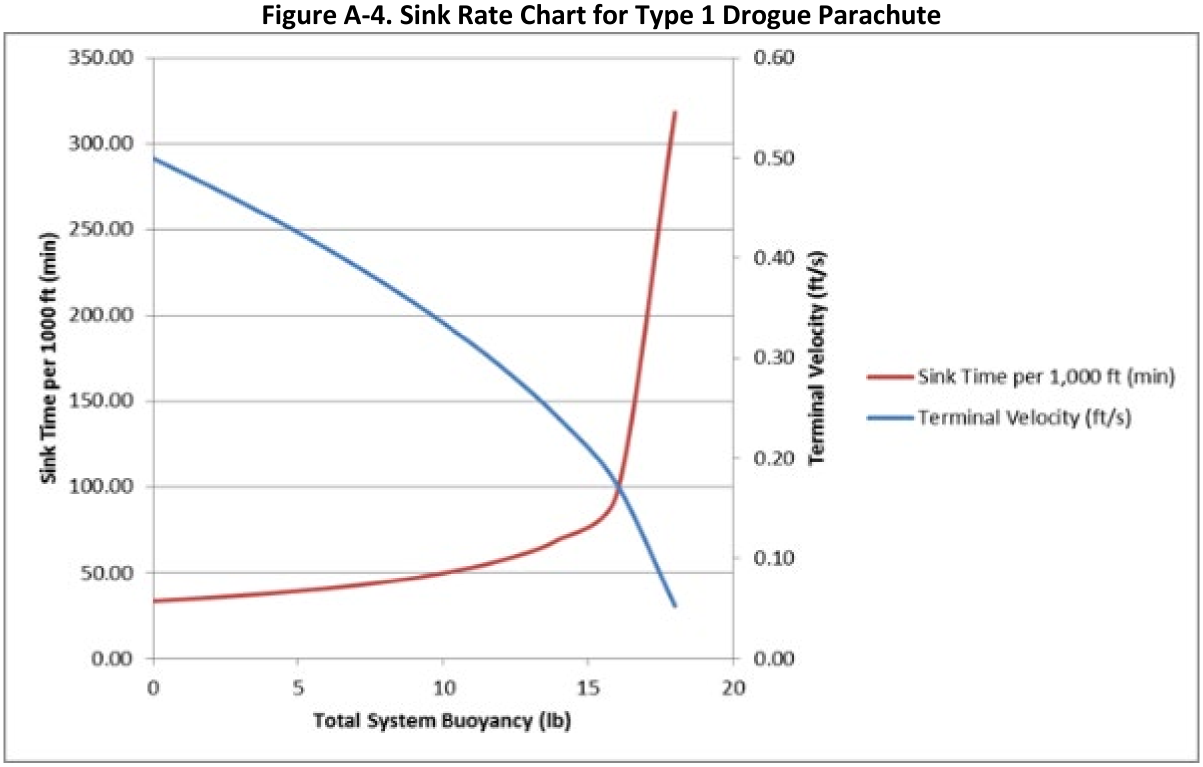


Table A-4. Projected Sink Rate for Type 1 Parafoil

Properties	
Sum of masses:	181 pounds
Sum of buoyancy forces:	84 pounds
Sum of drag areas:	1,426 square feet
Sink Rate	
Terminal velocity of system in water:	0.26 feet/second
Sink time per 1,000 ft of depth:	63.7 minutes
Sink time per 100 m of depth:	20.91 minutes

Figure A-5. Sink Rate Chart for Type 1 Parafoil

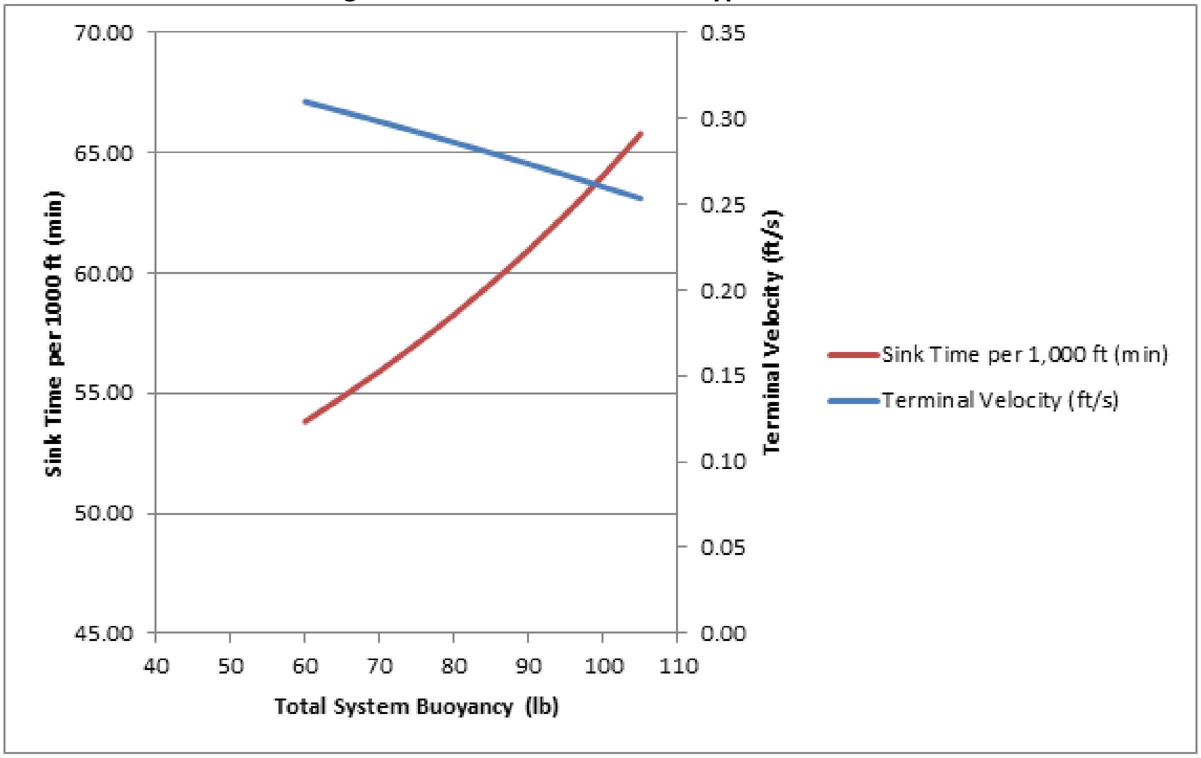


Table A-5. Projected Sink Rate for Type 2 Drogue Parachute

Properties	
Sum of masses:	18.2 pounds
Sum of buoyancy forces:	6.36 pounds
Sum of drag areas:	90 square feet
Sink Rate	
Terminal velocity of system in water:	0.36 feet/second
Sink time per 1,000 ft of depth:	45.9 minutes
Sink time per 100 m of depth:	15.07 minutes

Figure A-6. Sink Rate Chart for Type 2 Drogue Parachute

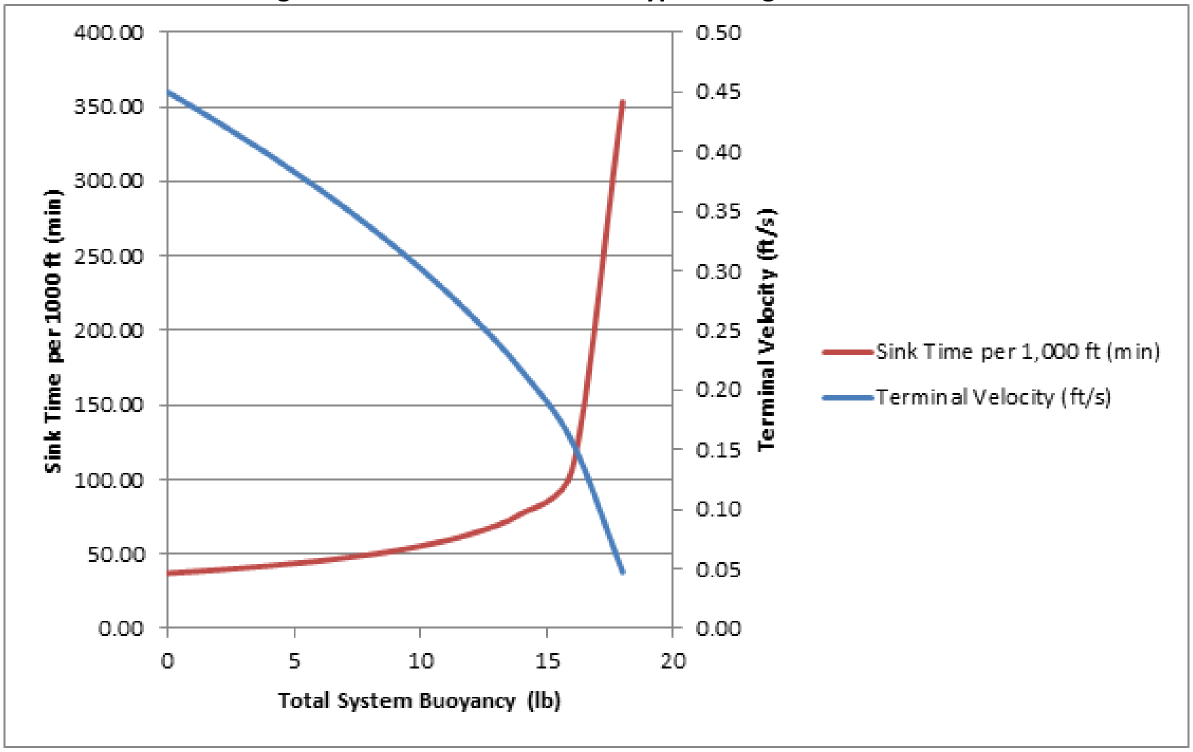
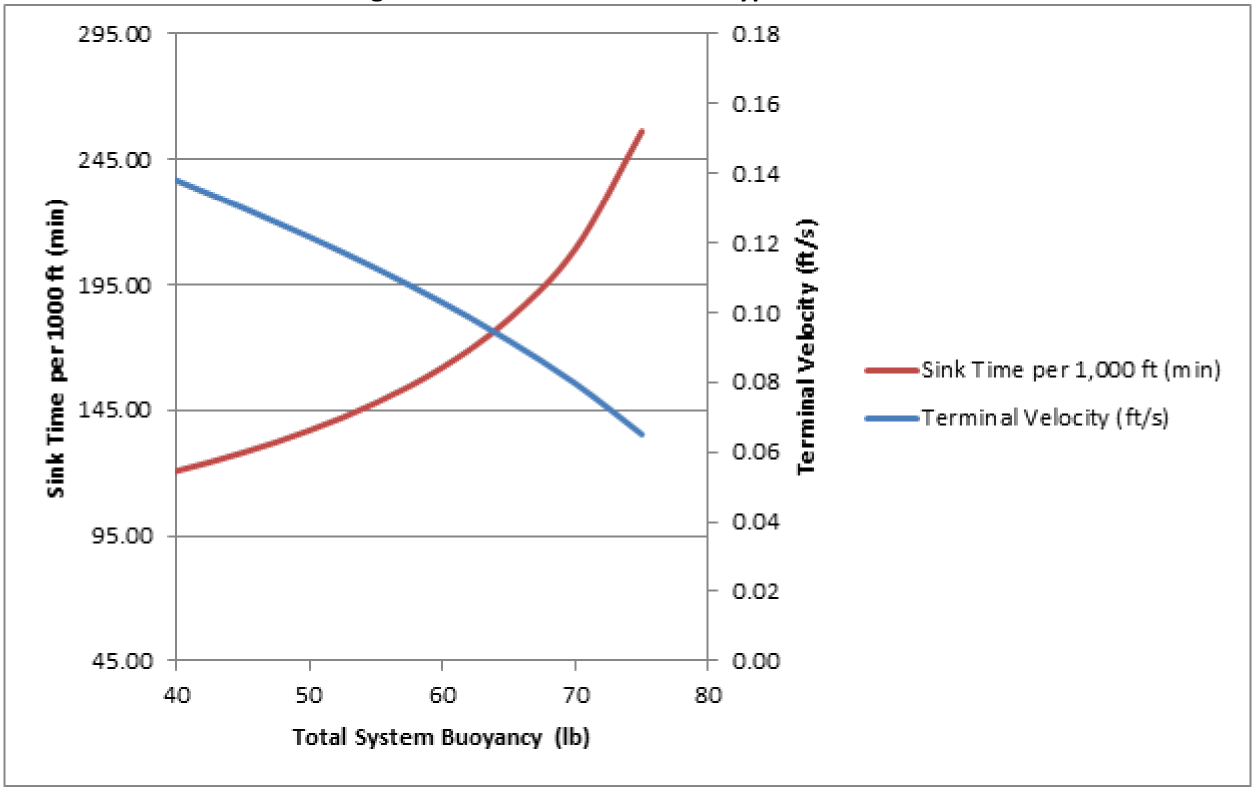


Table A-6. Projected Sink Rate for Type 2 Parafoil

Properties	
Sum of masses:	70 pounds
Sum of buoyancy forces:	39.01 pounds
Sum of drag areas:	2,376 square feet
Sink Rate	
Terminal velocity of system in water:	0.11 feet/second
Sink time per 1,000 ft of depth:	145.5 minutes
Sink time per 100 m of depth:	47.75 minutes

Figure A-7. Sink Rate Chart for Type 2 Parafoil



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Texas Coastal Ecological Services Field Office
4444 Corona Drive, Suite 215
Corpus Christi, Texas 78411
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In Reply refer to:
02ETCC00-2012-F-0186-R001

May 12, 2022

Stacey Zee
Office of Commercial Space Transportation
Federal Aviation Administration
800 Independence Ave, SW
Washington, DC 20591

Subject: SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site, Cameron County, Texas

Dear Ms. Zee:

This document transmits the U.S. Fish and Wildlife Service's (Service) final biological and conference opinion (BCO) based on our review of the effects of the Federal Aviation Administration (FAA)'s proposed issuance of an experimental permit and/or vehicle operator license to SpaceX for the Starship/Super Heavy Launch Vehicle Program at the Boca Chica Launch Site in Cameron County, Texas. The conference opinion refers to proposed red knot critical habitat. SpaceX's program requires an experimental permit and/or a vehicle operator license from the FAA. The BCO analyzes the potential effects of the issuance of those permits and/or licenses on the endangered northern aplomado falcon (*Falco femoralis septentrionalis*), Gulf Coast jaguarundi (*Herpailurus yagouaroundi cacomitli*), ocelot (*Leopardus pardalis*), Kemp's ridley sea turtle (*Lepidochelys kempii*), hawksbill sea turtle (*Eretmochelys imbricata*), leatherback sea turtle (*Dermochelys coriacea*) and threatened loggerhead sea turtle (*Caretta caretta*), green sea turtle (*Chelonia mydas*), piping plover (*Charadrius melodus*) and piping plover critical habitat, red knot (*Calidris canutus rufa*) and proposed red knot critical habitat, pursuant to section 7(a)(2) of the Endangered Species Act of 1973 (Act), as amended (16 U.S.C. 1531 *et seq.*). Your request for formal consultation was received on June 21, 2021. We initiated consultation on October 6, 2021.

The FAA determined the Proposed Action *may affect but was not likely to adversely affect* the threatened West Indian manatee (*Trichechus manatus*), eastern black rail (*Laterallus jamaicensis ssp. jamaicensis)* and those concurrences are given in Appendix A. The FAA further determined the Proposed Action would have *no effect* on the endangered South Texas ambrosia (*Ambrosia cheiranthifolia*) and Texas ayenia (*Ayenia limitaris*). The Service does not provide concurrences on *no effect* determinations and these species will not be further addressed in this BCO.

The monarch butterfly (*Danaus plexippus*) is a candidate species under consideration for official listing. On December 15, 2020, the Service issued a 12-month finding on a petition to list the monarch butterfly under the Act. Based on a thorough review of the monarch's status, the Service determined that listing is warranted but precluded by higher priority listing actions. The decision is the result of an extensive status review of the monarch that compiled and assessed the monarch's current and future status. The monarch is now a candidate under the Act and its status will be reviewed annually until a listing decision is made. There are generally no section 7 requirements for candidate species, but we encourage all agencies to take advantage of any opportunity they may have to conserve the species. Possible actions that may assist in the conservation of the monarch are listed in the Conservation Recommendations.

This BCO is based on information provided in the *Biological Assessment* (BA) *SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site, Cameron County, Texas, October 2021*, the *Draft Programmatic Environmental Assessment* (PEA) *for the SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site in Cameron County, Texas, September 2021* (PEA), the March 2022 Administrative Final PEA, telephone conversations and correspondence with SpaceX and FAA and, field investigations, meetings, workshops and other sources of information. Literature cited in this BCO is not a complete bibliography of all literature available on the species of concern, and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at the Texas Coastal Ecological Field Office located in Corpus Christi, Texas.

The SpaceX Boca Chica Launch Site is located in Cameron County, Texas, near the cities of Brownsville and South Padre Island (Figure 1 and Figure 2). The Boca Chica Launch Site consists of:

- the Vertical Launch Area (VLA), a 47.4-acre parcel of land owned by SpaceX located along the south side of SH 4 just inland from Boca Chica Beach;
- a Launch and Landing Control Center (LLCC), which is a two-story building (referred to as Stargate) located on the north side of State Highway (SH) 4 approximately 2 miles west of the VLA;
- a solar farm located on the north side of SH 4 approximately 1.5 miles west of the VLA; and
- a parking lot on SpaceX-owned land on the north side of SH 4 across from the VLA.

SH 4 provides the only land access to the Boca Chica Launch Site, as well as Boca Chica Beach, Texas Parks and Wildlife Department's (TPWD) Boca Chica State Park, and other land.

Activities subject to the FAA's issuance of an experimental permit and/or a vehicle operator license to SpaceX for the Starship/Super Heavy Launch Vehicle Program at the Boca Chica Launch Site include, as described in more detail below:

- New construction at the VLA that expands the previously developed area by approximately 23 acres and improves the surface of an existing parking lot on the north side of SH 4;
- New construction to expand the existing solar farm by 1.7 acres, building a payload production facility on previously developed land near the existing production and manufacturing area; and use of a SODAR system;
- New construction within the SH 4 existing right-of-way between the VLA and LLCC to add pull-offs and to install additional trenched utilities; and
- Annual launch-related operations that include tests, launches, and landings of the Starship and/or Super Heavy launch vehicles (Table 3).

The activities summarized above have consequences that contribute to effects of the action considered in this BCO. In addition, effects of the action may also arise from responses to anomalies that may occur with launch-related operations, such as debris removal, and from increased personnel and activity related to the day-to-day use, maintenance, monitoring, and security of the facilities at the Boca Chica Launch Site.

SpaceX previously constructed and continues to use facilities at the VLA, parking lot on the north side of SH 4, solar farm, and production and manufacturing area (which is located on the north side of SH 4 approximately 2 miles west of the VLA, and near the LLCC) for purposes that are not related to the Proposed Action. Some of these facilities and uses were related to the SpaceX Falcon/Falcon Heavy launch program addressed in the original BCO from 2013 (Consultation No. 02ETCC00-2012-F-0186). These previously constructed facilities and related uses would occur even in the absence of the Proposed Action. The previously constructed SpaceX facilities and related uses are part of the environmental baseline of the Action Area considered in this BCO.

The Boca Chica Launch Site is located in a sparsely populated coastal area adjacent to the Gulf of Mexico, characterized by sand dunes, beach, wind tidal flats, and lomas, or ancient clay dunes. The VLA is approximately 2.2 miles north of the U.S./Mexico border and the LLCC is approximately 1.3 miles north of the U.S./Mexico border. The VLA lies south of Boca Chica State Park, Brazos Island State Park, and parts of the Lower Rio Grande Valley National Wildlife Refuge (LRGVNWR), and east of the Palmito Ranch Battlefield National Historic Landmark (NHL) (Figure 3).

CONSULTATION HISTORY

Please see Appendix B for a more detailed consultation history.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

As the lead federal agency, the FAA is responsible for analyzing the potential environmental impacts of the Proposed Action. The Commercial Space Launch Act of 1984, as amended and codified at 51 U.S.C. §§ 50901–50923, authorizes the Secretary of Transportation to oversee, license, and regulate commercial launch and reentry activities, and the operation of launch and reentry sites within the United States or as carried out by U.S. citizens.

Regulations implementing the Act (50 CFR 402.02) define "action" as "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies of the United States or upon the high seas." The FAA's Proposed Action is to issue one or more experimental permits and/or a vehicle operator license to SpaceX that would allow SpaceX to launch and return Starship/Super Heavy and operate additional facilities at the Boca Chica Launch Site. FAA's environmental review includes the construction of launch related infrastructure. SpaceX's goal is to use Starship/Super Heavy for low Earth orbit (relatively close to Earth's surface), sun-synchronous orbit (traveling over the Polar Regions), geostationary transfer orbit (an elliptical orbit), and interplanetary missions (crewed or un- crewed missions to the moon or Mars) and provide greater mission capability to National Aeronautics and Space Administration, Department of Defense, and commercial customers.

Activities subject to the FAA's issuance of an experimental permit and/or a vehicle operator license to SpaceX for the Starship/Super Heavy Launch Vehicle Program at the Boca Chica Launch Site include, as described in more detail below:

- New construction at the VLA that expands the previously developed area by approximately 23 acres and improves the surface of an existing parking lot on the north side of SH 4;
- New construction to expand the existing solar farm by 1.7 acres, build a payload production facility on previously developed land near the existing production and manufacturing area; and use of a SODAR system;
- New construction within the SH 4 existing right-of-way between the VLA and LLCC to add pull-offs and to install additional trenched utilities; and
- Annual launch-related operations that include tests, launches, and landings of the Starship and/or Super Heavy launch vehicles (Table 3).

In addition, effects of the action may also arise from responses to anomalies that may occur with launch-related operations, such as debris removal, and from increased personnel and activity related to the day-to-day use, maintenance, monitoring, and security of the facilities at the Boca Chica Launch Site.

Table 1 outlines the elements of the Proposed Action being analyzed in this BCO.

Table 1. Elements of the Proposed Action

FAA Proposed Action	Elements of SpaceX's Proposal	Brief Description
Issuance of Experimental Permit or Vehicle Operator License	Test and Launch Operations	• Starship Static Fire Engine Tests • Super Heavy Static Fire Engine Tests • Starship Suborbital Launch • Super Heavy Launch • Starship landing at the VLA, on a floating platform in the Gulf of Mexico or the Pacific Ocean, or expended in the Gulf of Mexico or Pacific Ocean • Super Heavy landing at the VLA, on a floating platform in the Gulf of Mexico, or expended in the Gulf of Mexico
	Tank Tests	Test the structural capability of the launch vehicle stages
	Nominal Operational Access Restrictions	SpaceX anticipates the proposed operations would require 500 hours of annual access restriction of SH 4 and Boca Chica Beach
	Anomaly Response Access Restrictions	If an anomaly occurred, SpaceX anticipates debris cleanup would require up to 300 hours of annual access restriction of SH 4 and Boca Chica Beach. The 300 hours are in addition to the 500 hours of Nominal Operational Access Restrictions.
	Related Infrastructure	• Redundant Launch

	Construction	Pad (Launch Pad B) and Commodities (approximately 15 vertical tanks) • Redundant Landing Pad • Integration Tower B • Tank Structural Test Stands • Support Buildings and Parking Lots • Trenching • Payload Processing Facility • Expanded Solar Farm • State Highway 4 Pull-offs

The Proposed Action does not include the construction or operation of infrastructure related to non-licensed SpaceX activities in areas such as SpaceX's private production and manufacturing area. The FAA considers the constructed and operational elements at the production and manufacturing area to have independent utility because the components being manufactured there can be shipped and utilized at other SpaceX launch sites.

One of the proposed 480-foot integration towers and orbital pad (see "A" on Figure 8) has already been constructed without federal involvement or section 7 consultation and only the operation of this tower will be evaluated in this BCO. The parking lot on the north side of SH 4 near the VLA was previously cleared and is currently being used for parking, which did not require federal involvement and did not undergo section 7 consultation. Only improvement of the parking lot surface is evaluated in the effects of the action.

The Service understands from ongoing coordination with FAA and SpaceX that SpaceX is no longer proposing to construct the desalination plant, power plant, liquefier, and natural gas pre-treatment system that were described in the October 2021 BA and the September 2021 draft PEA. These former elements of the Proposed Action are not evaluated in this BCO.

The following sections describe the elements of the Proposed Action and related activities that are effects of the Proposed Action. Additional details about these elements and activities occurs in the October 2021 BA and the March 2022 Administrative Final PEA.

Launch Vehicle

While the manufacture and production of the Starship and Super Heavy launch vehicles are not part of the Proposed Action, understanding the characteristics of these vehicles is important context for understanding the effects of the action.

A fully integrated Starship/Super Heavy launch vehicle is comprised of two stages: Super Heavy is the first stage (or booster) and Starship is the second stage (Figure 4). The fully integrated Starship/Super Heavy launch vehicle is expected to be approximately 400 feet tall and 30 feet in diameter compared to the 224-foot Falcon 9 and Falcon Heavy proposed in the 2014 EIS. As designed, both stages are reusable, with any potential refurbishment actions taking place at existing and proposed SpaceX facilities. Both stages are expected to have minimal post-flight refurbishment requirements; however, they might require periodic maintenance and upgrades.

Super Heavy is expected to be equipped with up to 37 Raptor engines, and Starship would have up to six Raptor engines. The Raptor engine is powered by liquid oxygen (LOX) and liquid methane (LCH4) in a 3.6:1 mass ratio, respectively. Super Heavy is expected to hold up to 3,700 metric tons (MT) of propellant and Starship would hold up to 1,500 MT of propellant. Super Heavy, with all 37 engines, would have a maximum lift-off thrust of 74 Meganewtons, allowing for a maximum lift-off mass of approximately 5,000 MT. One Meganewton is exactly $1X10^6$ Newtons. One Newton is a force capable of giving a mass of one kilogram (kg) an acceleration of one meter per second. Launch propellant and commodities are currently stored at the VLA in aboveground tanks and this would continue under the Proposed Action. Commodities include liquid nitrogen (LN2), water, gaseous oxygen, gaseous methane, gaseous nitrogen, helium, hydraulic fluid, LOX, and LCH4.

Launch-related Annual Operations

SpaceX would launch both orbital and suborbital missions. An orbital launch would consist of a fully integrated vehicle with the second stage (Starship) stacked on top of the booster (Super Heavy). A suborbital launch would include just the Starship. Super Heavy launch could be orbital or suborbital and could occur by itself or with Starship. Further environmental review of landing at sites not described in this document would be necessary if proposed in the future.

The Proposed Action would authorize SpaceX to conduct static fire engine tests, suborbital and orbital launches of Starship and Super Heavy, and landings of Starship and Super Heavy within specified operational limits (Table 2). Static fire engine tests of Starship or Super Heavy would only occur during the day (i.e., between the hours of 7:00 a.m. and 7:00 p.m.). SpaceX is planning to conduct most launches of Starship and/or Super Heavy during the day. However, there could be launch delays due to unforeseen issues with the launch vehicle, weather conditions, or certain mission that require launching at a specific time at night to achieve a particular orbital position. SpaceX conservatively estimates that no more than 20 percent of annual launches of Starship and/or Super Heavy (i.e., up to 2 launches per year) would occur at night.

Static fire engine tests would be very brief and the cumulative duration of such tests would not exceed 150 seconds per year for Starship or 135 seconds per year for Super Heavy (Table 2). SpaceX would perform up to 5 suborbital launches of Starship (i.e., launches not combined with Super Heavy) and up to 5 launches of Super Heavy. Super Heavy would be launched with Starship affixed to the top (Table 2). Since Starship could be launched, either alone (up to 5 times) or affixed to Super Heavy (up to 5 times), up to 10 landings of Starship could occur per year. Super Heavy landings could occur up to 5 times per year (Table 2).

Table 2. Proposed Annual Operations

Operation	Time	Operational Limit
Starship Static Fire Engine Test	Day	150 seconds
Super Heavy Static Fire Engine Test	Day	135 seconds
Starship Suborbital Launch	Day or Night	5 launches
Super Heavy Launch	Day or Night	5 launches
Starship Landing	Day or Night	10
Super Heavy Landing	Day or Night	5

The difference in operations during nighttime launch activity versus a daytime launch activity would be SpaceX requiring bright spotlighting for periods of time (sometimes days) when illuminating the launch vehicle on the launch pad. These spotlights are typically metal halide.

Static fire engine tests, suborbital launches, and orbital launches, and related landings, are scheduled and require intermittent, temporary access restrictions. Related ground support operations could occur 24 hours a day, 7 days a week, throughout the year continually illuminating the VLA and LLCC with white lighting at night to ensure the protection and safety of SpaceX personnel. Bright spotlighting, usually metal halide, also illuminates the launch vehicle on the launch pad and would be required in future activities. Per the terms and conditions of this BCO, SpaceX is required to update its Lighting Management Plan as facility design and plans progress and share the plan with the Service.

Sound Detection and Ranging (SODAR)

SpaceX plans to use a SODAR device to collect weather data needed for launch and landing. The SODAR sends out a short sonic pulse every 15 minutes that can reach 92 decibels (dB) at the source and dissipates to 60 dB within 100 feet. The SODAR equipment would be located on a SpaceX private parcel in the production and manufacturing area. The exact location of the SODAR has not been identified.

SpaceX would also deploy weather balloons from a private parcel just prior to a launch to measure weather data that includes wind speeds, to create wind profiles to determine if it is safe to launch and land the vehicle. The balloons are made of latex and a radiosonde is attached to the balloon. The balloons would transmit data to SpaceX. After rising approximately 12-18 miles into the air, it would burst, shredding the balloon into pieces and falling to earth along with the radiosonde and landing in open marine waters where it would be expected to sink to the ocean floor.

Tank Tests

Prior to conducting a static fire engine tests or suborbital launch of a Super Heavy or Starship prototype, SpaceX would conduct tank tests to ensure the tank's reliability. This involves performing proof pressure tests to confirm the structural integrity of the launch vehicle. Proof pressure tests are broken into two main categories: pneumatic and 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 tests consist of loading the tank with a single propellant (typically LN2, LOX, or LCH4). The tanks are then pressurized past their rated limit to confirm their structural capability with appropriate safety factors. These proof pressure tests are designed to not release any propellant to the environment. All propellant is recycled back into the above ground system tanks after the test is completed.

In addition to the proof pressure tests, SpaceX may perform development tests on test tank articles to validate design improvements or characterize vehicle behavior. These development tests include hydrostatic and cryogenic break tests, in which the tanks are filled with water, LN2, or LOX, and pressurized to a specific limit or to deliberate failure to characterize the structural capability of the production vehicles. Break testing includes the deliberate release of the test media (water, LN2, or LOX) into the environment upon failure of the primary structure.

Tank tests could occur during the day or night. SpaceX is planning to conduct the tank tests described above for each Super Heavy and Starship prototype that is built until the test is successful. If a test is unsuccessful and results in damage to the test vehicle, a new test vehicle would be constructed and tested.

SpaceX is still determining the number of prototypes that it will build and test. For the purposes of the environmental impact analysis, SpaceX estimates a 10 percent rate of tank test anomalies; this is a conservative, upper bound estimate intended to capture the maximum potential impact. A tank test anomaly would result in an explosion. FAA's regulatory definition of an anomaly means any condition during licensed or permitted activity that deviates from what is standard, normal, or expected, during the verification or operation of a system, process, facility, or support equipment (14 CFR 401.7). Based on analysis conducted by SpaceX, the probability of debris spreading outside of the launch pad boundary from an explosive tank test anomaly during a tank test is low and not anticipated. An anomaly during a tank test operation could result in an explosion of debris, but it is unlikely. For example, a failure could result in buckling of the tank only. If the test did result in an explosion of debris, the probability of debris spreading outside the launch pad boundary is low because this type of test does not involve mixing of explosive commodities. Given the rates above, SpaceX estimates that one tank test each month may result in a tank test anomaly and potentially an explosion.

Pre-flight Operations

Pre-flight operations include mission rehearsals and static fire engine tests. The goal of mission rehearsals is to verify that all vehicle and ground systems are functioning properly, as well as to verify that all procedures are properly written. After final systems checkout, SpaceX would conduct a mission rehearsal without propellants on the launch vehicle (referred to as a *dry dress rehearsal*), followed by a mission rehearsal with propellants on the launch vehicle (referred to as a *wet dress rehearsal*) to verify full launch readiness. After completing rehearsals, SpaceX would conduct static fire engine tests. The goal of a static fire engine test is to verify engine control and performance. A static fire engine test is identical to a wet dress rehearsal, except engine ignition occurs. During a static fire engine test, the launch vehicle engines are ignited for approximately 5–15 seconds and then shut down.

Prior to a fully integrated Starship/Super Heavy launch, SpaceX may perform a Starship static fire engine test before being integrated with Super Heavy. SpaceX may also perform a Super Heavy static fire engine test, either by itself or with Starship integrated. SpaceX is proposing to conduct up to 135 seconds per year of static fire duration for Super Heavy and up to 150 seconds per year of static fire duration for Starship (Table 2). Static fires would only occur during the day. There may be occasions when a static fire engine test is attempted and is unsuccessful (e.g., the test results in a mishap or anomaly). If an engine test is unsuccessful, another attempt would be made.

During pre-flight operations, the launch vehicle would be connected to ground systems. After an operation involving propellant (i.e., wet dress rehearsal and static fire engine test), the propellant would be transferred back to the commodity tanks at the VLA. During an off-nominal operation (i.e., if the vehicle lost pneumatics and could not reconnect to the ground systems), SpaceX may release the LCH4 to the atmosphere. The amount of methane in the largest tank (Super Heavy) that could be released is approximately 814 tons. This represents the worst-case scenario and would be a rare, unplanned event.

Suborbital Launches

SpaceX is proposing to conduct Starship suborbital launches. During a suborbital launch, Starship would launch from the VLA and ascend to high altitudes and then throttle down or shut off engines to descend, landing back at the VLA or at least 19 miles offshore and downrange either directly in the Gulf of Mexico or on a floating platform in the Gulf of Mexico. A sonic boom might be produced during descent as Starship lands downrange in the Gulf of Mexico, no closer than 19 miles from shore, but, the sonic boom would not impact land.

Following a suborbital launch, Starship would have LOX and LCH4 (approximately 10 metric tons) remaining in the tank. Remaining LOX would be vented to the atmosphere and remaining LCH4 would likely be released to the atmosphere. Due to risks to personnel, SpaceX is unable to reconnect the launch vehicle to ground systems when LCH4 remains on the vehicle. In the future, SpaceX may recycle LCH4 back into tanks at the VLA as technology and design develop.

SpaceX is proposing to conduct up to 5 Starship suborbital launches annually. Each launch would include a landing (Table 2). SpaceX will not exceed the 5 suborbital launches annually.

Orbital Launches

SpaceX is proposing to conduct up to 5 Starship/Super Heavy orbital launches annually. Launches may occur during the day or night. Starship/Super Heavy missions would include cargo and human missions to various orbits, to the moon and Mars, and satellite payload missions to various orbits. Orbital launches would primarily be to low inclinations with flight north or south of Cuba that minimizes land overflight. Future launches may be higher, 70-degree inclination with limited overflight of remotely populated portions of Mexico. There could be multiple launches in close succession required to support a single mission (e.g., lunar resupply missions). SpaceX's launch manifest (i.e., scheduled launches) is still being developed at this time but is expected to evolve as the Starship/Super Heavy program develops. SpaceX will not exceed five Starship/Super Heavy orbital launches annually.

Starship/Super Heavy would launch from the VLA. During a launch, the exhaust plume would surround the launch pad and surrounding areas. A heat plume would be generated from the launches and would travel away from the launch pad, with temperatures of about 300 degrees F reaching the edge of the VLA, 212 degrees F approximately 0.3 mile from the launch pad and temperatures reaching ambient (90 degrees F) 0.6 mile from the launch pad. The plume would appear clear and consist of heat (and steam if deluge water is used). If SpaceX uses a diverter, a metal structure under the launch mount to divert the rocket plume laterally away from the ground, the high temperatures would be focused in a single direction instead of extending radially from the center of the launch pad.

If deluge water is discharged on the plume during a launch or test, a cloud would form. The cloud generated would be temporary and minimal volume of water condensing from the exhaust cloud and would vaporize. If treatment or retention of stormwater or wastewater is required, water would be contained in retention ponds adjacent to the launch mount. The exact number, location, and size of the retention ponds within the VLA would be determined based on quantities of deluge water and final site plans

Orbital Landings

Each Starship/Super Heavy orbital launch would include an immediate boost-back and landing of Super Heavy. Landing could occur down range in the Gulf of Mexico either on a floating platform or expended, no closer than approximately 19 miles off the coast, or at the VLA. During flight, Super Heavy's engines would cut off at an altitude of approximately 40 miles and the Super Heavy booster would separate from Starship. Shortly thereafter, Starship's engines would start and burn to the desired orbit location. After separation, Super Heavy would rotate and ignite to conduct the retrograde burn, which would place it in the correct angle to land. Once Super Heavy is in the correct position, the engines would be cut off. Super Heavy would then perform a controlled descent using atmospheric resistance to slow it down and guide it to the landing location. This is similar to current Falcon 9 booster landings at Cape Canaveral Space Force Station. Once near the landing location, Super Heavy would ignite its engines to conduct a controlled vertical landing and go into an automated safing sequence.

If a Super Heavy landing occurred downrange in the Gulf of Mexico on a floating platform, Super Heavy would be delivered by barge to the Port of Brownsville and transported the remaining distance to the Boca Chica Launch Site over the roadways. A floating platform would be a mobile vessel that would not attach to the seafloor.

For Super Heavy landings at the VLA and offshore, a sonic boom(s) would be generated. For landings at the VLA, the sonic boom would impact parts of Texas. Based on the modeling for Starship landings at the VLA, the sonic boom produced when landing downrange would not impact land (see Attachment 1 for the sonic boom report).

A maximum of 5 Super Heavy landings could occur each year (Table 2). Landings may occur during the day or night.

Similarly, each Starship/Super Heavy orbital launch would include a Starship landing after Starship completes its orbital mission. Starship landing could occur at the VLA or downrange in the Gulf of Mexico (on a floating platform or expended in the Gulf of Mexico), or Pacific Ocean (on a floating platform or expended in the Pacific Ocean) (Table 2). Starship would land vertically on the pad or platform in the Gulf of Mexico or Pacific Ocean and go into an automated safing sequence (i.e., put the vehicle in a safe state).

As Starship slows down during its landing approach, a sonic boom(s) would be generated and impact parts of Texas when landing at the VLA. Based on the modeling for Starship landings at the VLA, the sonic boom produced when landing downrange would not impact land (see Attachment 1 for the sonic boom report).

After Starship is in a safe state, a mobile hydraulic lift would raise Starship onto a transporter. If a Starship landing occurred downrange on a floating platform, it would be delivered by barge to the Port of Brownsville and transported the remaining distance to the Boca Chica Launch Site over roadways. If a Starship lands at the VLA the vehicle would be transported from the landing pad to the adjacent launch mount or to one of SpaceX's production locations for refurbishment.

Following an orbital launch, Starship and Super Heavy would have remaining LOX and LCH4 in the vehicle. Remaining LOX would be vented to the atmosphere and remaining LCH4 would likely be released to the atmosphere. Due to risks to personnel, SpaceX is unable to reconnect the vehicle to ground systems when LCH4 remains on the vehicle. Super Heavy would have approximately 5 metric tons of LCH4 onboard following an orbital flight. In the future, SpaceX may recycle LCH4 back into tanks at the VLA as technology and design develops. The FAA assumes all residual LCH4 is released to the atmosphere. The LCH4 vented to the atmosphere would evaporate within hours.

During early-unmanned orbital launches, SpaceX may require expending Super Heavy or Starship downrange in the Pacific Ocean or Gulf of Mexico no closer than 19 miles offshore. If this occurs, SpaceX would not recover Super Heavy or Starship. SpaceX expects each stage would sink in the ocean. SpaceX expects most of the launch vehicle would sink because it is made of steel. Lighter items (e.g., items not made of steel, such as composite overwrapped pressure vessels) may float but are expected to eventually become waterlogged and sink. If there are reports of large debris, SpaceX would coordinate with a party specialized in marine debris to survey the situation and sink or recover any large floating debris. Personnel would follow notification processes and procedures to manage floating debris.

Nominal Operational Access Restrictions

Ground Access Restrictions

Tanks tests, wet dress rehearsals, static fire engine tests, and launches (suborbital and orbital) would require temporarily restricting public access near the VLA and securing land and water areas as part of public safety requirements. SpaceX refers to the areas on land that would be restricted to public access is referred to as the *access restriction area* (Figure 5). The access restriction area includes an area of Boca Chica Beach, ranging from the Brownsville Shipping Channel south to the U.S./Mexico border. The Brownsville Shipping Channel would be temporarily restricted during orbital launches and some suborbital launches, but not restricted during tank tests, wet dress rehearsals, or static fire engine tests. SpaceX would coordinate with the Port of Brownsville to establish the times that activity in the shipping channel would be restricted. In the event of an anomaly, SpaceX would also inform the Port of any continued hazards and effects to channel restrictions.

The FAA defines an access restriction as follows:

> An access restriction begins when local law enforcement, under the direction of an order from the Cameron County Commissioners Court, shuts down SH 4 and Boca Chica Beach to support the FAA-permitted or FAA-licensed activity, which may include a tank test, wet dress rehearsal, static fire engine test, or launch. An access restriction ends when the operation is completed and local law enforcement opens SH 4 and Boca Chica Beach.

The FAA does not have a direct role in approving road and beach access restrictions. Therefore, access restrictions that are planned but not implemented (e.g., Cameron County revokes the access restriction) do not meet the FAA's definition of an access restriction. For an operation requiring an access restriction, SpaceX would coordinate with Cameron County under the authority granted in the 2013 Memorandum of Agreement between the Texas General Land Office (TGLO) and Cameron County (TGLO 2013).

SpaceX will perform the following notifications prior to a planned access restriction and in accordance with SpaceX's Access Restriction Notification Plan:

- Provide a forecast of planned access restrictions one to two weeks in advance of the access restriction on the County's website and/or send via email to the agency distribution list. Information about the proposed access restriction will be available on Cameron County's website https://www.cameroncounty.us/space-x/. The Cameron County judge issues a public notice of a Cameron County order to temporarily close Boca Chica Beach and SH 4 anywhere from a few hours to a few days after receiving SpaceX's request to close (Figure 6).

- Send access restriction notifications to the regulatory and public land-managing agencies as plans finalize (typically 24–48 hours prior to the access restriction). The agencies will continue to receive updates immediately when the access restrictions go into place and when the access restrictions end, as well as cancellations of requested access restriction. SpaceX personnel at the LLCC will send these notifications to ensure the most up-to-date information is distributed.

- Send real time status and updates on access restriction through a text message alert service. Subscribers can text "BEACH" TO 1-866-513-3475 to receive updates.

If an agency or researcher associated with the agency needs to access an area within a planned access restriction window, the agency researcher associated with the agency is encouraged to contact SpaceX directly to find the best opportunity to access the area and avoid any conflict in operations.

There may be certain operations, anomalies, or emergencies that require notification of access restrictions to occur less than a week from the activity. In those instances, SpaceX will notify Cameron County Commissioner's Court immediately with an access restriction request. SpaceX will post written notices of the date, time, and the proposed access restriction online at the Cameron County website. SpaceX will also coordinate with U.S. Customs and Border Protection, Cameron County and State of Texas law enforcement agencies, the U.S. Coast Guard, and Houston Air Route Traffic Control Center to ensure public safety and allow for the issuance of Notice to Mariners (NOTMAR) and Notice to Airmen (NOTAM). In addition, SpaceX will coordinate with the Secretariat of Communications and Transportation–Mexico if any land or water access restrictions in Mexico were required.

Prior to an operation requiring an access restriction, the public would be notified through local media and by NOTMARs and NOTAMs. SpaceX will also inform the cities of Brownsville and South Padre Island; NPS, including Palo Alto Battlefield National Historical Park; Service, including LRGVNWR; TPWD; TGLO; and Texas Department of Transportation (TxDOT) of the operation and associated access restriction schedules. Given the proximity of the LRGVNWR to the launch site, SpaceX has committed to work with the Service to fund additional resources or personnel necessary to enforce the access restrictions required for launch operations.

SpaceX proposes to limit public access at four pre-defined checkpoints on SH 4 to ensure that persons not authorized to enter remain out of the flight hazard area (Figure 5). The flight hazard area means any region of land, sea, or air that must be surveyed, controlled, or evacuated to ensure compliance with safety criteria in 40 CFR § 450.101. These checkpoints are similar to the checkpoints established during the 2014 EIS in coordination with the NPS and Service. The 2014 EIS included two checkpoints: a soft checkpoint (located east of the U.S. Customs and Border Patrol checkpoint) and a hard checkpoint (located near the LLCC). SpaceX is proposing a third checkpoint at Massey's Way and a fourth checkpoint at Richardson Avenue between those two checkpoints.

A soft checkpoint would be located at the intersection of Oklahoma Avenue and SH 4, just east of Brownsville. Government personnel, SpaceX personnel, and anyone with property beyond this soft checkpoint would be allowed to pass, but the public would be denied access. The second checkpoint (referred to as "public hard checkpoint 1") would be located at the intersection of Massey Way and SH 4. Only SpaceX personnel, government personnel, emergency personnel involved in SpaceX operations and anyone with property beyond this checkpoint would be able to pass this checkpoint. The third checkpoint (referred to as "public hard checkpoint 2") would be located at the intersection of SH 4 and Richardson Avenue. Only SpaceX personnel and FAA launch support personnel would be able to pass this checkpoint. The final checkpoint (referred to as "all hard checkpoint") would be located just west of the LLCC. No one would be able to pass this checkpoint (Figure 5).

The 2013 MOA between TGLO and Cameron County provides Cameron County with the authority to protect public safety and ensure that landowners and residents are absent from their property in the Safety Zone determined by the FAA flight safety analysis. Access restrictions for pre-launch operations, including tank tests, wet dress rehearsal, or static fire engine tests would be shorter than an access restriction for a launch (suborbital or orbital). The total number of access restrictions and access restriction hours for tank tests, wet dress rehearsals, static fire engine tests, and launches will not exceed 500 hours of closure per year for nominal operations. As of May 24, 2013, House Bill 2623 was signed by Texas Governor Rick Perry to amend the Texas Natural Resources Code Chapter 61 (Sec. 61.132) to allow for the TGLO and/or the Cameron County Commissioners Court to temporarily restrict access to public beaches for space flight activities, including launches. SpaceX would use reasonable efforts to avoid performing launch operations on weekends to the extent orbital mechanics and/or other operational issues do not conflict with or otherwise prevent such efforts. In addition, SpaceX will avoid performing launch operations on the following holidays: Memorial Day, Labor Day, July 4th, Martin Luther King Jr Day, Presidents' Day, Texas Independence Day, Cesar Chavez Day, Emancipation Day in Texas (also referred to as Juneteenth), Veteran's Day, Good Friday, Easter, Father's Day, Mother's Day, Thanksgiving Day, Christmas Eve, Christmas Day, New Year's Eve and New Year's Day.

Waterway Hazard Warnings
All launch and reentry operations will comply with necessary notification requirements, including issuance of NOTMARs, as defined in agreements required for a launch license issued by the FAA. A NOTMAR provides a notification regarding a temporary hazard within a defined area (a Ship Hazard Area) to ensure public safety during proposed operations. A NOTMAR itself does not alter or close shipping lanes; rather, the NOTMAR provides a notification regarding a temporary hazard within a defined area to ensure public safety during the proposed operations. The Proposed Action would not require shipping lanes to be altered or closed. Launches and reentries would be infrequent, of short duration, and scheduled in advance to minimize interruption to ship traffic.

Airspace Closures
All launch and reentry operations will comply with the necessary notification requirements, including issuance of NOTAMs, as defined in agreements required for a launch license issued by the FAA. The FAA issues a NOTAM at least 72 hours prior to a launch or reentry activity in the airspace to notify pilots and other interested parties of temporary conditions. Launches and reentries would be infrequent, of short duration, and scheduled in advance to minimize interruption to air traffic. The FAA conducts an analysis of the effects on airspace efficiency and capacity for each licensed launch operation. 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.

Personnel Levels
Launch operations related to the Starship/Super Heavy launch program would result in an increase of permanent and temporary personnel active at the Boca Chica Launch Site. SpaceX expects a maximum of 450 full-time employees or contractors on site at any given

time, 24 hours a day, 7 days a week, to support the Starship/Super Heavy launch program. To minimize potential impacts to wildlife from vehicles and reduce the number of vehicles traveling along SH 4, SpaceX provides a shuttle from Brownsville to the launch site for employees. Approximately four shuttle runs are conducted in the morning between 5 a.m. and 10 a.m. and five shuttle runs are conducted in the evening between 5 p.m. and 11 p.m.

Anomalies

A Starship/Super Heavy test operation or launch could fail (referred to as an anomaly). If an anomaly occurs on the launch pad, the result could be fire or the spread of debris. SpaceX expects the debris would be contained within a 700-acre area developed to assess potential effects of debris and debris retrieval within the FAA-approved hazard area, which would be contained within the "all hard checkpoint" area shown in Figure 5 (black dashed area represented as "no personnel"). SpaceX's SN11 anomaly created the largest debris filed of all launch anomalies to-date and although debris spread outside the launch pad, it was contained to the 700-acre area. Reports of debris further from the VLA are unconfirmed as pieces of SpaceX launch vehicles from SN11. If the debris is from a SpaceX launch vehicle, it is also possible that the debris was carried away in the water and ended up at a further location from the 700-acre debris study area.

In the event of an anomaly, SpaceX will evaluate the level of response based on the situation and notify the appropriate emergency personnel and land-managing agencies. SpaceX will contact the LRGVNWR, Cameron County Emergency Management and Brownsville Fire Department. The U.S. Coast Guard will be contacted to report any impact to safety of waterways. SpaceX will also coordinate with the Cameron County Judge, the Cameron County Commissioner, and the Cameron County Fire Marshal to provide information on the anomaly. SpaceX will adhere to its Fire Mitigation and Response Plan, which includes the anomaly and fire measures outlined in the Terms and Conditions to prevent and respond to any fires.

SpaceX has entered into a MOA with TPWD to mitigate and restore any impacts from anomalies at Boca Chica State Park, Brazos Island State Park, and other TPWD land (Appendix C). The MOA provides a protocol for responding to events, recovering debris, and implementing, monitoring, and adapting restoration efforts to restore impacts. In the event of an anomaly, a limited number of SpaceX staff would enter the debris field on foot and conduct an initial evaluation. Following the initial evaluation of the area, SpaceX would coordinate with TPWD, TGLO, and the Service, as applicable, prior to cleanup, in order to minimize damage to sensitive resources. The method of debris removal would be assessed on a case-by-case basis and would be coordinated with applicable landowners or public land-managing agencies. SpaceX would consult TPWD and/or the Service prior to any activity that may impact sensitive wildlife habitat. SpaceX would enter properties on foot as much as possible and coordinate the use of vehicles with TPWD, TGLO, and the Service, as applicable, to minimize impacts. SpaceX would perform an initial assessment of the debris to geotag and pick up debris by hand.

Immediately following an anomaly, public access restriction near the VLA may be required to address any impacts and ensure public safety. SpaceX will request an extension of the access restriction from Cameron County. The anomaly access restriction would be released when the area is deemed safe for the public by SpaceX and Cameron County. This determination by SpaceX and Cameron County would be made with input provided by public land-managing agencies (i.e., TPWD, TGLO, and/or the Service).

SpaceX estimates up to 300 anomaly access restriction hours could be needed to ensure public safety and debris removal. These hours would not count towards the nominal 500 operational access restriction hours and would be used, as needed, to address debris removal on public land. The hour count for nominal operations would stop when the launch operation is complete and the area is deemed safe for SpaceX or emergency personnel to enter. The anomaly-response hour count would start at that point to address debris removal and last until the area is deemed safe for the public and the access restrictions are released.

The access restriction area for an anomaly would be smaller than the access restriction area established for the launch (Figure 5). After securing the area, SpaceX would inform local law enforcement that they can open SH 4 up to the "all hard checkpoint." The area within the "all hard checkpoint" (Figure 5) would remain closed until SpaceX determines the area is safe to open.

If SpaceX suspects debris fell on a foreign country's land (i.e. Mexico), SpaceX would contact the U.S. Department of State. The State Department would lead any international coordination, and SpaceX would provide assistance as requested.

During a suborbital or orbital launch, the launch vehicle would be equipped with either a thrust termination or a destructive flight termination system, or both. In the event the vehicle varied from the planned trajectory, the vehicle would break up.

Construction

SpaceX is proposing additional construction, including expanding the solar farm near the manufacturing and production site, parking lots, a payload processing facility, trenching, and pull-offs along SH 4. Construction activities are anticipated to occur intermittently over a period of 2 years. At the VLA, SpaceX is proposing to construct a redundant launch pad and commodities, a redundant landing pad, two integration towers, tank structural test stands and additional support buildings. Under the Proposed Action, development of the VLA would be expanded from 17 acres to a total of approximately 40 acres, with the remainder of the VLA parcel (i.e., the portion proximate to Boca Chica Beach) remaining undeveloped.

The VLA was re-surveyed and the boundary was adjusted. Figure 7 shows the survey-verified VLA parcel. Figure 8 shows the existing developed area (green) and the overall proposed VLA (blue). Figure 9 is a site overview of the proposed SpaceX facilities, including the VLA, the LLCC, and other infrastructure within the scope of the FAA-licensed activities, as well as infrastructure related to non-licensed SpaceX activities in the private production and manufacturing area. The proposed infrastructure and facilities at the launch site are discussed in the following sections.

Redundant Launch Pad and Commodities

At the VLA, SpaceX is proposing to construct a redundant launch pad (denoted as "Orbital Launch Mount ('Pad B')" in Figure 8) adjacent to the existing launch pad (denoted as the existing “Orbital Launch Mount (‘Pad A’)” in Figure 8); Pad A is already constructed and is part of the environmental baseline for the BCO). Pad B would be approximately 65 feet high with a similar footprint and layout, as Pad A. SpaceX is proposing install approximately 15 additional commodity tanks, each approximately 100 feet tall at the VLA. The tanks will hold LOX, LN2, water, helium, gaseous nitrogen, gaseous methane, and LCH4. The existing commodity tanks near Pad A were previously constructed under FAA’s 2014 ROD.

Redundant Landing Pad
SpaceX is proposing to add a second landing pad in the southwest corner of the VLA. The pad would have similar dimensions as the existing landing pad (approximately 226 feet long by 226 feet wide). The redundant landing pad would be used when another launch vehicle is occupying the other landing pad or if the other landing pad is damaged by an anomaly.

Integration Towers
SpaceX is proposing to construct an integration tower located at Pad B. A similar integration tower has already been constructed at the existing Pad A, without federal involvement and performed on private land and did not undergo section 7 consultation and constructed prior to the completion of this BCO. It is currently part of the environmental baseline for this BCO. The integration towers and launch mounts are each approximately 480 feet tall with a 10-foot lightning rod on top and includes black cladding (Figure 10).

Tank Structural Test Stands
SpaceX currently performs structural tank tests, which includes pneumatic, hydrostatic, and cryogenic testing at the VLA on a concrete pad with temporary infrastructure. SpaceX is proposing to add infrastructure to the existing tank structural test stand and construct another structural test stand. The footprints for the tank structural test stands would be approximately 60 feet long by 60 feet wide and would be 10 to 20 feet tall.

Support Buildings and Parking Lots
SpaceX is proposing to construct additional support buildings at the VLA. The buildings would be below 30 feet in height. SpaceX is also proposing to construct parking lots for personnel working at the launch site. The parking lots would be built in combination with existing parking areas to accommodate the staff supporting tests and launches. One of the proposed parking lots would be located across from the VLA along SH 4 on SpaceX-owned land that has been cleared but no permanent infrastructure has been built or developed. It is being used currently for employee parking. The ongoing use of this cleared, unpaved area for parking purposes is part of the environmental baseline for this BCO. The Proposed Action includes the improvement of this parking lot with the addition of asphalt, road base, concrete, or other permeable material surface.

Trenching
Utility lines were installed along SH 4 as previously described in the 2013 BA (FAA 2013). The proposed Action will require additional utility lines that will be co-located with the existing utilities. The installation of these new utility lines will use trenching methods and involve previously disturbed lands within and along the SH 4 ROW. SpaceX will coordinate any modifications to SH 4 ROW with TxDOT and the Service, as the Refuge owns in fee the land beneath SH 4 for approximately 8.2 miles. The Refuge’s ownership begins at Palmetto Hill

Road, east to San Martin Blvd adjacent to the western edge of the SpaceX solar farms, with the exception of approximately 244 yards near Palmetto Hill Road, which is privately owned. For any modifications such as utility placements within that section and apart from TxDOT; SpaceX and any contractors will coordinate with the Service in a timely manner to determine permitting requirements for uses of the Refuge to include ROW permits and/or Special Use Permits.

Payload Processing Facility

SpaceX is proposing to construct a payload processing facility at SpaceX's manufacturing and production area (Figure 9). In 2013, SpaceX proposed constructing two payload-processing facilities, each up to 14,670 square feet in size and 65 to 85 feet tall. SpaceX is now proposing to construct one payload processing facility up to 22,000 square feet in size and up to 240 feet tall. The facility would be located on previously cleared, paved ground adjacent to the manufacturing and production area.

Expanded Solar Farm

Currently, electricity at the VLA is provided by solar power from the SpaceX solar panels near the LLCC. The solar energy farm currently covers 5.4 acres and supplies approximately 1 MW of power, and there is a 3.87 MW-hour battery for energy storage. Power is distributed from solar farm underground along the SH 4 ROW to a transformer on the launch pad. The solar array currently provides all of the power demands to run the day-to-day operations at the VLA.

Figure 11 shows the proposed solar farm layout, which includes the previously approved area and the proposed expansion area. The 5.4-acre area (green) was assessed in the 2013 BO. Approximately 2.0 acres (white) of that has been developed with solar panels. SpaceX is proposing to increase the solar farm by 1.7 acres (blue) making the solar array a total of 7.1 acres. The proposed site nearest to San Martin Blvd. has begun clearing and leveling for construction. The solar farm consists of Trina solar panels and Tesla Power Pack batteries containing Lithium Ion rechargeable batteries for power storage. In conformity with the existing solar arrays, the new solar arrays would be about 6.5 feet tall and composed of non-highly reflective materials. Any new batteries would be housed in small structures, approximately 13 feet tall and 970 square feet in size.

The expansion of the solar farm would add an additional 750 kilowatts of power, for a total of 1.6 MWs of energy and an additional battery system at the solar farm with up to 8 MW-hours of storage. Though not expected and would be a rare occurrence, a potential hazardous material release associated with the solar array infrastructure could occur. Small amounts of lithium cobalite and lithium hexaflorophosphate could be released if the battery pack charges too fast or physical mechanical damage causes a battery fire. The solar panels consist of Silicon/Gallium photocells. The cells themselves are 99 percent glass and the chemicals in the panels consist of various salts of silicon, gallium, lead, and cadmium encased in glass. In the event the cell is crushed and not cleaned up, it is possible that those salts could leach into the ground through rainwater. Damaged panels would be handled at a Recyclable Hazardous Waste site and retired solar panels would be sent to a contracted battery recycler. In the event there is a rare and unexpected release of hazardous material, the solar array would be subject to the management procedures in SpaceX's Anomaly Response Plan.

Pull-offs along State Highway 4

SpaceX would transport Starship or Super Heavy from the SpaceX production area to the VLA along SH 4. Due to the large size of the vehicles and transporter, SpaceX, in coordination with local law enforcement, must stop traffic to allow for the passage of the transporter. SpaceX proposes to add three pull-offs along SH 4 to allow traffic to pull onto a widened shoulder so the transporter can pass. The proposed locations of the three pull-offs are shown in Figure 9. The pull-offs would be approximately 75-feet long by 30-feet wide and would be within the SH 4 right-of-way. The transporter moves at 2 miles per hour. The proposed locations of the three pull-offs would create a maximum wait time of about 20 minutes for drivers instead of necessitating an access restriction of SH 4 in both directions. SpaceX will coordinate construction of the pull-offs with TxDOT and Cameron County.

Proposed Conservation Measures

The following sections describe conservation measures that the FAA would ensure SpaceX will implement to avoid or minimize the effects of the action on listed species and designated piping plover and proposed red knot critical habitat, if FAA issues the requested license and SpaceX proceeds with the project. These measures are part of the Proposed Action and will be captured in the FAA's Mitigated Finding of No Significant Impact or Record of Decision, which will be referenced as a term and condition of future licenses.

Construction Measures

1. In conjunction with final design and CWA permitting, SpaceX will update its Stormwater Pollution Prevention Plans (SWPPP) to address the additional facilities proposed for the site and ensure compliance with its TCEQ stormwater permit. The updates will be completed before construction begins under the Proposed Action. The SWPPP identifies BMPs for erosion and sedimentation controls, including techniques to diffuse and slow the velocity of stormwater to reduce potential impacts (e.g., soil loss and sedimentation) to water quality during construction. All permitted construction activities with the potential to impact water quality from potential runoff from the site will be conducted in accordance with the stormwater permit, including measures identified in the SWPPP. SpaceX will provide a copy of the SWPPP for permitted construction activity under the Proposed Action to FAA and Service before such construction begins and will provide the Service and FAA with written notice of updates to the SWPPP on a quarterly basis. This conservation measure minimizes modification of habitat for the piping plover and red knot adjacent to the VLA.

2. Prior to entry into or exit from unpaved areas of the VLA, SpaceX will ensure that heavy equipment (i.e., vehicles and machinery that are larger than a typical passenger truck) and vehicles to the maximum extent possible to traverses over a construction shaker or rumble plates or rock bed located at the VLA to remove any sediment and dirt for purposes of preventing the introduction and spread of non-native plant species. SpaceX will document the location(s) of the construction shakers or rumble plates installed at the VLA in its annual report to the Service. This conservation measure minimizes modification of habitat for the piping plover and red knot adjacent to the VLA.

3. SpaceX will implement a Spill Prevention, Control, and Countermeasure Plan (SPCCP). SpaceX will provide a copy of the SPCCP for permitted construction activity under the Proposed Action to FAA and the Service before such construction begins and will provide

the Service and FAA with written notice of updates to the SPCCP on a quarterly basis. This conservation measure minimizes modification of habitat for the piping plover and red knot adjacent to the VLA.

4. SpaceX will not place excavated or fill material in delineated CWA Section 404 waters of the United States except as authorized by a permit from the USACE. SpaceX, will ensure that discharged water associated with concrete mixing and placement activities does not reach surrounding water bodies or pools unless specifically authorized in a Department of Army permit. SpaceX will provide to USACE written notice documenting completion of the activity authorized under Section 404 of the CWA; compliance with all associated terms and conditions; and implementation of any required compensatory mitigation for impacts to waters of the United States. SpaceX will provide the notice to USACE within 30 days of completion of the activities authorized by the USACE and will include a copy of this notification in its annual report to the Service. This conservation measure minimizes the extent of habitat modification for the piping plover and red knot adjacent to the VLA.

5. SpaceX will continue contracting a qualified biologist to conduct pre-, during, post-construction biological monitoring (vegetation and birds). This monitoring is ongoing and will continue to be conducted within 3 miles of construction areas. Monitoring reports will continue to be sent to the Service annually. This measure benefits the northern aplomado falcon, piping plover, and red knot by providing information helpful to monitoring the status of these species and habitats.

6. SpaceX will limit vehicle operation to existing paved and unpaved roads, parking areas, and authorized construction sites. Vehicle operators within the VLA will not exceed 25 miles per hour.

Operational Measures

1. SpaceX will operate an employee shuttle between Brownsville and the project site and between parking areas at LLCC and the VLA to reduce the number of project-related vehicles traveling to and from the project site. SpaceX will encourage employees to use the shuttle by providing information on shuttle operation in new hire onboarding materials, routine staff communications (such as staff meetings), and in contractor environmental trainings. Mandate use of shuttle will be as practicable. This measure will reduce opportunities for vehicle collisions with ocelots or jaguarundis on SH 4.

2. SpaceX will update its Lighting Management Plan to account for Starship/Super Heavy launches and related infrastructure that is the subject of the Proposed Action. These updates will be completed at least 30 days before the beginning of sea turtle nesting season.

   Consistent with safety and security needs, SpaceX will initiate coordination with the Service and TPWD with the intent of incorporating the agencies' recommendations for minimizing lighting effects on ESA-listed species. This measure will minimize the modification of sea turtle habitat and minimize the likelihood of false crawls and disoriented hatchlings. Upon agreement with the Service and TPWD, SpaceX will implement the updated Lighting Management Plan. At a minimum, the plan will include:

   a. Directing, shielding, or positioning facility lighting to avoid or minimize visibility from the beach, minimize lateral light spread, and minimize uplighting without compromising safety and security of personnel.

b. Turning off lights when not needed to maintain a safe and secure facility.
c. Using low pressure sodium lights, to the extent practicable, during sea turtle nesting season. Limitations to the use of low-pressure sodium include the use of white lighting required for protection and safety of SpaceX personnel for ground support operations performed 24/7 throughout the year and the use of bright spotlighting during nighttime launch activities.
d. Installing new lighting with multiple levels of control (i.e., some, all, or none of the lights can be turned on) so that lighting levels can be matched with specific activities.
e. Where lighting is not essential to safety or security of personnel, installing timers to switch lights off in the evening. Where applicable and not a threat to security, installing motion-detector switches.

3. SpaceX will continue contracting a qualified biologist to conduct pre- and post-launch biological monitoring (vegetation and birds). Monitoring will be conducted within 1 mile of the VLA up to a week before a Starship or Super Heavy launch and the day after the launch. Monitoring reports will be sent to the Service within two weeks following compilation and analysis of the data. This measure benefits the northern aplomado falcon, piping plover and red knot by providing information helpful to monitor the status of these species and their habitats.

4. SpaceX will continue to collaborate with Sea Turtle, Inc. by supplying and storing field equipment and to provide sea turtle survey data within the Action Area to the Service annually. This measure supports activities that reduce the likelihood of death or injury to individual sea turtles.

5. Upon Service and SpaceX agreement of locations alongside SH 4 or other identified roads where the footprint is disturbed, SpaceX will fund the purchase of vehicle barrier materials to prevent trucks or ATVs from entering the refuge. The amount needed in any given year will be determined by the Refuge and is not to exceed $10,000 annually. SpaceX will install the barriers and Refuge staff will perform general maintenance and repairs of the barriers. Funds will be issued within 3 months from the issuance of the BCO, and by March 1 of each year afterwards for the duration of the BCO. SpaceX will be responsible for replacing or restoring damaged barriers caused by SpaceX personnel or an anomaly. This measure will reduce the likelihood of habitat modification for ocelots, jaguarundis, piping plovers, and red knots.

6. In coordination with NWR staff, SpaceX will develop a protocol (e.g., Access Restriction Notification Plan) providing as much advance notice as practicable to minimize disruption to refuge and land management activities. This measure would minimize traffic within the restricted zone during launch activities and minimize modification of habitat for sea turtles, ocelots, jaguarundis, piping plovers, and red knots.

Anomaly Measures

1. If an anomaly occurs, prior to taking action to recover debris on land outside the VLA, SpaceX will notify the appropriate emergency personnel, land-managing agencies, and water regulatory authorities, as required. In addition, SpaceX will comply with the terms of the

Memorandum of Agreement (MOA) between TPWD and SpaceX, including coordinating with TPWD and the Service prior to debris removal and clean-up and consulting with TPWD and/or the Service prior to any anomaly-response activity that may impact sensitive wildlife habitat. This measure minimizes modification of habitat for ocelots, jaguarundis, northern aplomado falcons, piping plovers, red knots, and sea turtles.

2. If an anomaly occurs, SpaceX will comply with its Anomaly Response Plan, Security Plan, and Fire Mitigation and Response Plan, as applicable. This measure minimizes modification of habitat for ocelots, jaguarundis, northern aplomado falcons, piping plovers, red knots, and sea turtles.

Environmental Worker Educational Briefings

1. SpaceX will develop educational training materials and submit to the Service for approval. Once approved SpaceX will provide all on-site personnel, including staff and contractors, with an environmental worker education briefing(s) prior to the start of construction activities that will include the following topics: species identification, instruction on implementing the conservation measures described herein, wildfire prevention measures, information regarding noxious or invasive weeds, requirements for safe handling and disposal of hazardous waste, proper disposal of litter and garbage, and the shuttle. SpaceX will also provide this environmental worker education briefing on an ongoing basis to all new hires of on-site staff and contractors before starting on-site work and will offer refresher briefings to all on-site staff and contractors on an annual basis. SpaceX will document completion of these educational briefings in its annual report to the Service. This measure will promote the implementation of conservation measures and minimize habitat modification for ocelots, jaguarundis, northern aplomado falcons, piping plovers, red knots, and sea turtles.

Other Conservation Measures and Offsets

SpaceX will implement as part of the proposed action the following conservation measures that may offset impacts to listed species, or address species that are not the subject of this consultation. The benefits of these conservation measures to listed species, may not be reasonably certain at this time. These conservation measures are considered in the Service's analysis of effects or jeopardy.

1. SpaceX will initiate coordination with the Service within 60 days of the start of construction under the Proposed Action to identify practicable opportunities to protect, restore, and/or enhance habitat for the ocelot, jaguarundi, piping plover, and/or red knot. SpaceX intends to continue coordination with the Service to complete one or more habitat protection, restoration, or enhancement projects to benefit the cats and the birds and contribute to the conservation of these species.

2. Within 6 months of the issuance the BCO, SpaceX will coordinate with the Service, the USACE, and the TxDOT to determine the feasibility of constructing wildlife crossings along SH 4 west of the first public hard checkpoint to benefit the ocelot and jaguarundi. If a wildlife crossing is deemed feasible by each of the coordinating parties, pending regulatory or other approvals from applicable agencies. SpaceX will fund the construction on one wildlife crossing west of the first public hard checkpoint within 1 year of the mutual determination of feasibility.

3. SpaceX will make an annual contribution of $5,000 to the Friends of LANWR Adopt-an-Ocelot Program within 3 months of the issuance of the BCO and by March 1 of each year thereafter for the duration of the BCO. Funds donated to the program are intended to pay for:
    i. Wildlife guzzlers
    ii. Camera trapping sets
    iii. Special events to raise awareness about the ocelot
    iv. Important supplies that allow biologist to monitor ocelot dispersal, behavior and habitat needs.

4. SpaceX will make an annual contribution of $5,000 to the Peregrine Fund within 3 months of the issuance of the BCO and by March 1 of each year thereafter for the duration of the BCO. These funds will provide assistance with increased releases, repairing or replacing existing hack sites and/or nest boxes, or constructing new hack sites and/or nest boxes if falcons are observed in a new location.

5. If proposed construction activities under the Proposed Action occur during the avian breeding season (February 15 through August 31), a biologist will search the proposed areas of construction activities, including laydown areas, for nests (in shrubs and on the ground) one time no more than 2 days before the start of construction within the surveyed area. If the biologist finds an active nest, construction workers and activity, including the operation of vehicles, equipment, or tools, within 50 meters (164 feet) (NPS 2022) of the nest will be avoided until the biologist determines the nest is no longer in use. SpaceX will mark the avoidance zone with flagging, fencing, or similar signage within 24 hours of detecting the nest and will inspect the marking daily, repairing or replacing as needed, to ensure that it remains intact and visible through the duration of the nesting activity. SpaceX will document inspections and provide a summary of inspections and avoidance actions to the FAA and the Service with the annual report.

Action Area

The Action Area is defined in 50 CFR § 402.02 as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action." For the Proposed Action, the Action Area is defined by those areas being directly impacted by construction and expansion activities at the VLA and LLCC, access restrictions for launches or testing activities, daily activities, traffic and noise (engine noise, sonic booms, overpressure, anomalies) during Starship/Super Heavy launches (which includes landings) and the access restriction for launches, testing, or anomaly response (closure area) (Figure 12). The Service analyzes effects for species within the U.S.; therefore, effects will not be evaluated beyond the Rio Grande into Mexico. Although the Action Area includes noise and sonic boom effects radially for 13 miles, analyses of effects will remain near shore for nesting sea turtles on the beach.

In accordance with the 2021 BA (FAA 2021), the engine noise component of the Action Area is defined by the 105 decibel (dB) maximum A-weighted sound level (LAmax) and is based on noise modeling conducted for the project. The 105 dB LAmax is estimated to extend approximately 5 miles from the launch pad over land (Figure 13).

A sonic boom is the sound associated with the shock waves created by a vehicle traveling through the air faster than the speed of sound. A sonic boom trace is an impulsive event that last for less than 300 milliseconds. SpaceX used PCBOOM to estimate single event sonic boom levels during Starship and Super Heavy descent. SpaceX's sonic boom assessment is located in Appendix D of this BCO. For suborbital launches, Starship would not reach supersonic speed during descent towards the VLA and therefore would not generate a sonic boom. Predicted overpressure levels remaining after the sonic boom for a Starship suborbital landing range from 1.2 to 2.2 pounds per square foot (psf). The 2.2 psf contour is estimated to be offshore and not impact land. Overpressures between 2.0 and 1.0 psf are predicted to impact areas of South Padre Island. Populated areas in Mexico are not predicted to be impacted by Starship sonic booms (Figure 14).

Predicted overpressure levels for a Super Heavy landing at the VLA range from 2.5 psf to 15 psf. A very small area of Boca Chica State Park to the south of the VLA would experience up to 15 psf. A small portion of Brazos Island State Park and portions of Boca Chica State Park and Boca Chica Beach would experience levels up to 11-15 psf. Boca Chica Village would experience a maximum of 9 psf. The southern portion of South Padre Island is expected to experience 6 psf and Port Isabel and Laguna Heights are expected to experience 4-6 psf. The remainder South Padre Island is expected to experience between 2-4 psf, and Laguna Vista and Tamaulipas, Mexico is expected to experience a maximum of 2 psf (Figure 15).

For a Super Heavy booster landing in the Gulf of Mexico, predicted overpressure levels range from 0.2 psf to approximately 12 psf. The modeled sonic boom footprint for this scenario is entirely over water. People, located offshore within about 20 miles of the Gulf of Mexico landing site, such as oil rig workers, may hear the sonic boom.

Figure 12 shows the Action Area. In summary, the Action Area is delineated by the access restrictions (access restriction) area and areas that would be exposed to sonic booms with modeled overpressures of at least 1 psf (which includes the area exposed to engine noise levels of 105 dB L_{Amax}).

The Action Area encompasses piping plover critical habitat Unit TX-1: South Bay and Boca Chica, Unit TX-2: Queen Isabella Causeway, Subunit TX-3A: South Padre Island and Gulf of Mexico Shoreline and Subunit TX-3B: South Padre Island Interior. It also encompasses all of proposed red knot critical habitat Unit TX-11: South Bay/Boca Chica. Proposed red knot critical habitat Unit TX-11 overlaps piping plover critical habitat Unit TX-1.

The only listed species that occurs offshore, which the Service has jurisdiction for is the West Indian manatee. The Service has concurred with FAA's determination of "may affect, but is not likely to adversely affect" for the manatee. The Service only has jurisdiction for nesting sea turtles on land. Therefore, the Action Area terminates at the water's edge.

The FAA has considered the potential for transboundary impacts and is consulting with the Mexican government through the State Department. National Marine Fisheries Service (NMFS) has responsibility for sea turtles that occur offshore. On January 31, 2022, NMFS issued a Programmatic Concurrence Letter for the launch and reentry vehicle operations in the marine environment and Starship/Super Heavy launch vehicles operations at SpaceX's Boca Chica

Launch Site, Cameron County, TX.

STATUS OF THE SPECIES AND CRITICAL HABITAT

The ocelot was designated as an endangered species under the Act in 1982, a status that extended protections to the species throughout its range in 22 countries, including the U.S. (Texas and Arizona), Mexico, and Central and South America. Critical habitat has not been designated for the ocelot. Two subspecies occur in the U.S.: the Texas ocelot (*Leopardus pardalis. albescens*) and the Sonoran ocelot (*L.p. sonoriensis*). The Texas ocelot is isolated from the Sonoran ocelot by the Sierra Madre highlands in Mexico (Tewes and Schmidly 1987, Service 1990). The Service completed a revised Ocelot Recovery Plan in 2016 (Service 2016a).

Selected Life History

The ocelot is a medium-sized cat, measuring up to three feet in body length and weighing twice as much as a large domestic cat. The ocelot is slender and its coat is covered with attractive, irregular-shaped rosettes and spots that run the length of their body. The ocelot's background coloration can range from light yellow, to reddish gray, to gold, to a grayish gold color. They have a white underside. The head has spots, two black stripes on the cheeks, four to five longitudinal black stripes on the neck and their back. Their ears have large white spots on the back. The tail has dark bars or incomplete rings. Although it resembles the margay *(Leopardus wiedii),* the ocelot is approximately twice the size of a margay with a slightly shorter tail (Murray and Gardner 1997, de Oliveira 1998).

The ocelot is primarily nocturnal, although some diurnal activity has been recorded (Navarro-Lopez 1985, Tewes 1986, Tewes and Schmidly 1987, Laack 1991, Caso 1994). Navarro-Lopez (1985) found ocelots in Texas to have two peaks of activity, one at about midnight and the other at daybreak. Ocelots are solitary hunters and eat a wide variety of prey, but mammals, especially rodents, make up the bulk of their diet (Bisbal 1986, Emmons 1987, Service 1990). Other items of prey include birds, armadillos, marsupials, monkeys, rabbits, bats, feral hogs, reptiles, fish, and crabs (Emmons 1987, Ludlow and Sunquist 1987, Service 1990, Booth-Bicznik et al. 2013).

The reproductive season is year-round, with spring or autumn breeding peaks noted in Texas and Mexico. The mating season varies from region to region. In the Yucatan, mating occurs in October and October-January peaks are reported from Paraguay and northeastern Argentina. Laack (1991) observed first reproduction in wild females between 30 and 45 months-of-age, but Eaton (1977) and Tewes and Schmidly (1987) estimated they may produce young at 18-30 months of age. Ocelots can produce young year round and have a gestation period of 70-80 days (Eaton 1977, Laack 1991). Litters contain one, two, and very rarely three kittens (Eaton 1977, Laack 1991). Laack et al. (2005) reported an average of 1.2 kittens per litter for 16 litters born to 12 female ocelots in Texas. Den sites are usually well hidden and include dense, thorny scrub, caves, hollows in trees or logs, and grass tussocks (Laack 1991, Tewes and Schmidly 1987). The mother provides extended parental care to the young because of the time it takes for them to become proficient at capturing prey. Males are believed to contribute little to direct parental care (Tewes 1986, Laack 1991).

Adults of both sexes tend to have home ranges exclusive of other adult individuals of the same sex, but there is considerable home range overlap between the sexes (Emmons 1988, Laack

1991). Adult males have larger home ranges than adult females. The home ranges of sub adult males and females tend to be similar in size to the home ranges of adult females until dispersal (Laack 1991). A number of studies have looked at the home range size of ocelots in Texas and Mexico, as determined from monitoring radio-collared individuals. Home range size generally varies from 0.77 to 6.9 square miles (Caso 1994, Ludlow and Sunquist 1987, Konecny 1989, and Dillon 2005). The established adult home ranges of ocelots in Laack's (1991) study of dispersing ocelots did not include semi-isolated patches, and transient home ranges were at times farther from the natal range than the animal's eventual home range.

In the lowland rainforest of Manu National Park in Peru, Emmons (1988) reported ocelot home ranges of approximately 2.3 and 3.1 square miles for males and approximately 0.6 and 1 square mile for females. In Cockscomb Basin Wildlife Sanctuary in Belize, home range was reported as 12 square miles for a male ocelot and 5.5 square miles for a female (Konecny 1989). In seasonally flooded savanna woodland, Ludlow and Sunquist (1987) reported a home range of 3.6 and 4.3 square miles for 2 males and mean home range of 1.3 square miles for six adult females in the Venezuelan llanos. In the Brazilian Pantanal, the home range for two adult females over six months was reported to be 0.3 and 0.6 square mile (Crawshaw and Quigley 1989).

Ocelots live solitary lives except when a female is with kittens or when pairs come together briefly to breed. They disperse from the natal range at approximately two years of age. Young males always disperse from their natal areas, while young females may or may not leave their natal area. Laack (1991) reported on the dispersal of five male and four female subadult ocelots at Laguna Atascosa National Wildlife Refuge (LANWR). One ocelot dispersed at 14 months-of-age, another at 20 months-of-age, and five at 30-35 months-of-age, but only four lived to establish home ranges. Seven to 9.5 months elapsed between the leaving the natal range and establishing an independent home range. One female moved 1.6 miles (distance between home range centers) and the males moved 4.3 to 5.6 miles. During dispersal, the ocelots used narrow corridors of brush, between 16.4 and 328-feet wide, along resacas, drainage ditches, and small scrub patches within agricultural or pastureland. The ocelots tended to avoid areas occupied by other adults. According to Laack (1991), none of the dispersing ocelots successfully joined a population outside of LANWR.

Several studies have resulted in the estimation of various survival rates. Tewes (1986) reported a survival rate of 71 percent, based on four mortalities while monitoring 12 radio-tagged ocelots. Haines et al. (2005a) estimated an annual survival rate at 87 percent for resident adults and 57 percent for transient ocelots. For newborn ocelots, Laack et al. (2005) estimated a 68 percent annual survival rate.

Population Dynamics

Tewes and Miller (1987) suggested that several factors may indicate the possibility of inbreeding, including: habitat islands saturated with resident ocelots, frustrated dispersal, and offspring that fail to leave parental home ranges. Habitat fragmentation reduces the ability of ocelots to interact freely, which may reduce the genetic viability of the species over time, and because ocelots have to cross-areas of little or no habitat to interact, it may also increase the risk of harm to individual ocelots. Genetic studies to determine genetic differentiation have been done on three ocelot populations: LANWR; Willacy County; and Tamaulipas and Vera

Cruz, in northern Mexico. Low variability was expected within the Texas populations because of range reduction and fragmentation. Inbreeding was detected in the three populations (Korn and Tewes 2013). The study showed the Willacy and Mexico populations were more closely related genetically than the LANWR population was to either. Walker (1997) suggested that the LANWR and Willacy populations have lost genetic variation when they became isolated from each other and from ocelots in Mexico. While some habitat in south Texas is managed for the ocelot, the quality and quantity of optimal habitat in Texas is on a downward trend and most likely supports a smaller ocelot population than that of the 1980's. The continued existence of the ocelot in its northern habitat is critical in stabilizing and reversing ocelot decline in Texas.

However, much of the area that could be restored to suitable habitat occurs on private lands. The Lower Rio Grande Valley is rapidly growing and agricultural lands are rapidly being developed (Wilkens et al. 2000). Opportunities for landowners to participate in economic incentive programs and Safe Harbor Agreements may enable the proactive conservation of the ocelot.

<u>Habitat</u>

Tamaulipan brushland is a unique ecosystem, found only in South Texas and northeastern Mexico. Characteristic vegetation of Tamaulipan brushland is dense and thorny; therefore, it is often referred to as thornscrub. It is estimated approximately 95 percent has been cleared for agriculture, urban development, road developments and expansions, and recreation (Service 1990, Jahrsdoerfer and Leslie 1988). Tewes and Everett (1986) found less than one percent of South Texas supported the extremely dense thornscrub used by ocelots. Tewes and Everett (1986) classified ocelot habitat in Texas according to the amount of foliar canopy. Class A, or optimal habitat, has 95 percent canopy cover, Class B, or suboptimal habitat, has between 75 to 95 percent canopy cover; and, Class C, considered inadequate habitat, and has less than 75 percent canopy cover. The most crucial habitat component is probably dense cover near the ground, less than three feet in height. Tewes and Everett (1986) found that core areas of ocelot home ranges on LANWR contained more thornscrub than peripheral areas of their home ranges. Jackson et al. (2005) suggest that the ocelot in Texas prefers closed canopy over other land cover types, but that areas used by this species tend to consist of more patches with greater edge. The ocelot is reported to occur along watercourses and will readily enter the water (Goodwyn 1970, as cited by Service 1990), but it is unclear if this proximity to water is a habitat requisite or simply an indication of where dense cover is most likely to occur.

Species composition of shrubs used by ocelots was quantified in three plant communities, two in Texas and one in Mexico (Shindle and Tewes 1998, Caso 1994). At the Texas sites, 45 woody species were found at the LANWR in Cameron County and 28 woody species on a private ranch in Willacy County (Shindle and Tewes 1998). The dominant species were granjeno *(Celtis pallida),* crucita *(Eupatorium odoratum),* Berlandier fiddlewood *(Citharexylum berlandieri),* honey mesquite *(Prosopis glandulosa),* and desert olive *(Forestiera angustifolia)* at LANWR, and honey mesquite and snake-eyes *(Phaulothanmus spinescens)* in Willacy County.

In Mexico, ocelot habitat use was 97.6 percent mature forest (heavy rain forest to sparse tropical deciduous forest) and 2.4 percent pasture-grassland (Caso 1994). In Veracruz, Hall and Dalquest

(1963) stated ocelots utilized the forests and jungles. Ocelots are known from the tropical forest of Belize, the lowland rain forest of Peru, and semideciduous forests and seasonally flooded marshes of Brazil (Ludlow and Sunquist 1987).

Status and Distribution

Reason for Listing

Habitat loss and fragmentation in addition to loss of connectivity are the primary reasons for ocelot decline in Texas. Ocelots rely upon thick vegetation along the Lower Rio Grande and the south Texas Tamaulipan brush community for foraging, resting, and establishing dens. They require corridors, such as riparian habitat along rivers, shorelines, and natural drainages to travel between optimal habitat areas. Destruction and fragmentation of habitat and travel corridors increases threats to the ocelot, as does incidental trapping, competition from feral dogs and cats, and primarily, mortality from vehicles. In Mexico, particularly in the northeast, ocelots suffer from habitat loss due to charcoal production, agriculture and livestock ranching. Human population increases and associated urban expansion and industrialization in the Lower Rio Grande Valley has resulted in brush clearing and increased pollution and water quality degradation (Service 1986). Thornscrub habitats have also been converted to rangeland using herbicides (Bontrager et al. 1979), root plowing, and fire (Hanselka 1980).

Pesticides can be incorporated into the food chain and are potentially harmful or fatal to terrestrial and aquatic organisms. Agriculture pesticides are used year-round in the Lower Rio Grande Valley and drift or overspray from aerial applications occurs periodically. In the Lower Rio Grande Valley, runoff from cultivated fields may concentrate pesticides and herbicides in permanent bodies of water. The types of pesticide chemical compounds and application rates have been extensive and heavy throughout the LRGV. As a result, pesticide accumulation) in the biota remains a major concern in management of thornscrub. Dichlorodiphenyldichloroethylene (DDE), polychlorinated biphenyls (PCBs), and mercury have been detected in ocelot blood and hair samples at low concentrations but are not believed to be a significant problem (Mora et al. 2000).

Although habitat loss in South Texas is mainly attributable to agricultural and urban expansion, other contributing factors include: human modifications of the Rio Grande with dams and reservoirs for flood control and hydroelectric power; floodway systems that remove water from the stream channel during peak flows; water diversions for irrigation, municipal, and industrial usage; and channel restriction and canalization (Coastal Impact Monitoring Program 1995).

As a result of increasing economic integration between the U.S. and Mexico, there is increasing pressure for new or improved highways and bridge infrastructure, as well as recently increasing national security concerns and the installation of border fences and lighting in the Texas/Mexico border region. There are 11 existing and one proposed international bridge along the Rio Grande between Falcon International Reservoir and the Gulf of Mexico. Local population growth and rapid industrialization on the Mexican side of the border have raised concerns regarding the placement of road and bridge infrastructure in the LRGV. Increased construction of these facilities may impact the Rio Grande floodplain and its riparian wildlife habitat, disrupting the continuity of the "wildlife corridor."

Importing and exporting skins of many spotted cats became illegal in the U.S. between 1967 and 1973 and the ocelot was added to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 1989. Recommendations have been made by Tewes and Everett (1986) for selective methods of predator control and hunter education to avoid the accidental shooting of ocelots. In 1997, the Service entered into a Section 7 consultation with the U.S. Department of Agriculture's Animal Damage Control for the use of leg-hold traps, snares, and M-44s explosive predator baits in south Texas and provided for the protection of ocelots during their control practices.

Data is limited regarding disease in the ocelot, but several diseases and parasites have been documented. They include: Notoedric mange *(Notoedres cati)* (Pence et al. 1995); Hepatozoon in the blood; Cytauxzoon in their red blood cells; fleas *(Pulex sp.);* dog ticks *(Dermacentor variabis);* and Amblyomma ticks (Mercer et al. 1988). The tapeworm *(Taenia taeniaeformis)* (Service 1990) and helminthes (Pence et al. 1995) have been reported in ocelots.

Ocelot mortality has also been attributed to aggression and predation by other animals. Ocelots can be prey of domestic dogs, coyotes, snakes, alligators and bobcats (Service 1990). In the last 30 years, vehicular collisions are the greatest known cause of ocelot mortality in South Texas, accounting for 45 percent of deaths of 80 radio-tagged ocelots monitored by Haines et al. (2005a) between 1983 and 2002. Calculation of known ocelot mortality in the LANWR population since the mid-1990s indicates road mortality may be increasing. Of the 33 known ocelot deaths since 1994, 14 (42 percent) were the result of road mortality. Road mortality numbers may be even higher because ocelot carcasses may be depredated or removed from roadways by members of the public before officials can arrive to examine the remains (Pers. Comm., M. Sternberg, Zone Biologist for Region 2, 2013). In addition, if an ocelot's carcass is found after decomposition has started, it is often difficult to determine the animal's cause of death. Since 2007, six of the 10 known ocelot deaths (60 percent) have been the result of road mortality (Pers. Comm., H. Swarts, Wildlife Biologist, 2021).

The TxDOT has installed several wildlife underpasses and culverts for ocelot use as travel corridors in critical areas. The construction or improvements to several roads have undergone section 7 consultation, resulting in the placement of additional wildlife crossings. These wildlife crossings may allow ocelots to disperse between patches of suitable habitat and reduce genetic isolation of the populations.

The construction of approximately 70 miles of border fence in the LRGV, covering three counties (Cameron, Hidalgo, and Starr) has increased habitat fragmentation and reduced or eliminated habitat connectivity. In Hidalgo County, 22 miles of flood control wall/fence acts as a barrier to terrestrial wildlife, as does the 6.9 miles of concrete barrier installed as a safety measure on SH 100 in Cameron County. The fence proposal (14 miles) in Starr County would be constructed within the floodplain close to the Rio Grande River, the major water source for wildlife, and isolate wildlife from the river. The "wildlife corridor" for the ocelot and along the river riparian area that the Service has been developing since 1979, is severely impacted by the border fence.

Range-wide Trend
The current population estimate for the ocelot is fewer than 80 individuals in south Texas. The population has been in decline in recent years. Tewes and Everett (1986) estimated the ocelot population in south Texas to be around 120 individuals, with the majority distributed in Cameron and Willacy counties. The Cameron County population located in and around LANWR was estimated to be about 30 individuals in 1991 (Laack 1991, Sternberg and Mays 2011). Habitat loss, fragmentation and road mortality continue to be the major causes of the ocelot population decline in Texas.

Critical Habitat
Critical habitat has not been designated for this species.

Climate Change
Variations in rainfall can also influence the ocelot prey base, and sea level rise can destroy loss of habitats and corridors used by ocelots (Service 2016a). Because of changes in the climate and changes in temperature and rainfall, predator-on-predator interactions may be rare, but may increase with time as they compete for water resources as witnessed in a video of a jaguar capturing an ocelot showed in *https://scitechdaily.com/climate-change-induced-conflict-rare-footage-captured-of-jaguar-killing-ocelot-at-waterhole*.

Gulf Coast jaguarundi
The Service listed the Gulf Coast jaguarundi (jaguarundi) as an endangered species without critical habitat under the Act on June 14, 1976 (41 FR 24064). The jaguarundi is also listed in the CITES Appendix I, which bans international commerce. CITES offers some protection over much of its range. Hunting is prohibited in Argentina, Belize, Bolivia, Columbia, Costa Rica, French Guiana, Guatemala, Honduras, Mexico, Panama, Paraguay, Surinam, Uruguay, the United States and Venezuela. Hunting is regulated in Peru, while no legal protection is offered in Brazil, Nicaragua, Ecuador, El Salvador, and Guyana. In 2013, the Service finalized the Gulf Coast Jaguarundi Recovery Plan (Service 2013).

Selected Life History
The jaguarundi is a small cat, it has a slender build, long neck, short legs, small and flattened head, long tail, and resembles a weasel. It is roughly twice the size of a domestic cat, weighting approximately 7 to 22 pounds, standing 10 to 14 inches at the shoulder, and can be up to 4 feet long from nose to tail tip, with the tail a third the length. The ears are short and rounded, and their eyes are small and set closely together. They have three distinct color phases, black, reddish-brown, and brownish-gray, although the latter phase has also been called blue. The phases are so distinct that at one time they were thought to be separate species. The black color phase does not occur in Texas (Goodwyn 1970).

Jaguarundis are primarily active during the day and hunt in the morning and evenings. Although some nocturnal activity has been recorded (Konecny 1989, Caso 1994), it does appear to be less nocturnal than the ocelot. They prey mainly on birds, small mammals, reptiles and fish (Goodwyn 1970; Tewes and Schmidly 1987; Davis and Schmidly 1994). Caso (1994) captured and radio collared jaguarundi in Tamaulipas, Mexico from 1991 to 2005. He found home range sizes averaged 3.8 and 3.2 square miles for males and females, respectively. Historical accounts from Mexico suggest that jaguarundis are good swimmers and enter the water freely.

Little is known of jaguarundi reproduction in the wild. Den sites include dense thickets, hollow trees, spaces under fallen logs overgrown with vegetation, and ditches overgrown with shrubs (Tewes and Schmidly 1987, Davis and Schmidly 1994). Jaguarundis are usually observed to be solitary, except during mating season (November and December or when a female is raising kittens. The reported litter size is one to four young, born in March and August, with possibly two litters per year. Research in northern Mexico suggests that jaguarundis den between March and August and produce two to four young (Service 2013). Kittens are spotted at birth and lose their markings as they mature. Gestation (based on captive jaguarundi) varies from 63 to 75 days (Goodwyn 1970, Tewes and Schmidly 1987, Davis and Schmidly 1994). Jaguarundis communicate by calls of which 13 have been identified in captive animals and largest repertoire occurring during the mating season (Hulley 1976).

Habitat

Habitat requirements in Texas are thought to be similar to those for the ocelot: thick, dense thorny brushlands or chaparral. Approximately 1.6 percent of the land area in south Texas is this type of habitat (Tewes and Everett 1986). The thickets do not have to be continuous but may be interspersed with cleared areas. Jaguarundis possibly show a preference for habitat near streams (Goodwyn 1970, Davis and Schmidly 1994) and may be more tolerant of open areas than the ocelot. The jaguarundi uses mature forest (i.e., brush) and pasture-grassland (Caso 1994); habitat use was 53 percent mature forest and 47 percent pasture-grassland. Jaguarundi use open areas for hunting and sometimes resting, but if threatened with a potential danger they will seek cover in brush areas.

The most common plants occurring in habitats in the Lower Rio Grande Valley of south Texas where the jaguarundi has been known to occur are: huisache *(Acacia farnesiana),* blackbrush acacia *(Acacia rigidula),* prairie baccharis *(Baccharis texana),* chilipiquin *(Capsicum annuwn),* lotebush (*Ziziphus obtusifolia*), allthorn goatbush *(Castela erecta),* Texas persimmon *(Diospyros texana),* coyotillo *(Karwinskia humboldtiana),* common lantana *(Lantana horrida),* berlandier wolfberry *(Lycium berlandier),* javelina bush *(Microrhammus ericoides),* Texas prickly pear (*Opuntia lindheimeri),* retama *(Parkinsonia aculeata),* honey mesquite, cedar elm *(Ulmus crassifolia),* and lime prickly ash *(Zanthoxylum fagara)* (Goodwyn 1970).

In south Texas, jaguarundis may use dense thorny shrublands, additionally they will use bunchgrass pastures if dense brush or woody cover is nearby. Optimal habitat has 95 percent canopy cover; habitat with 75 to 95 percent cover is considered suboptimal and habitat with less than 75 percent canopy cover is considered inadequate habitat (summarized in Service 2013).

Jaguarundis use suitable habitat in Texas for foraging and other elements of their life history; using dense thornscrub thickets; strips of marginal habitat along resacas, irrigation canals, drainage ditches, fence lines, and road edges; dense riparian cover along the Rio Grande; and other dense habitats. The dense thornscrub thickets do not have to be continuous and may be interspersed with cleared areas. They possibly show a preference for habitat near streams (Goodwyn 1970; Davis and Schmidly 1994) and may be more tolerant of open areas than the ocelot. Jaguarundis use open areas for hunting and resting, but if threatened with a potential danger they will seek cover in brush areas.

Population Dynamics

There are no known jaguarundi populations in the U.S. The last confirmed sighting of a jaguarundi in the U.S. was in April 1986, when a roadkill specimen was collected two miles east of Brownsville, Texas, and positively identified. Numerous unconfirmed sightings have been reported since then, including some sightings with unidentifiable photographs, but no U.S. reports since April 1986 have been confirmed as jaguarundi. The closest known jaguarundis to the U.S. border occur approximately 95 miles southwest in Nuevo Leon, Mexico (above summarized from Service 2013). However, on November 22, 2004, a Service biologist reported sighting two jaguarundis approximately 0.75 mile north of Farm to Market (FM) 106 and Buena Vista Road, which is the entrance road to LANWR (Reyes 2008). There have been no additional sightings in this area.

Habitat loss and alteration and fragmentation due to brush-clearing activities, human encroachment and disturbance, border security activities, mortality from collisions with vehicles and any loss of riparian or other corridor habitat that compromises the movement of jaguarundis is also a threat (Service 1995). Tracts of at least 75 to 100 acres of isolated dense brush, brush interconnected with other habitat tracts by brush corridors, or smaller tracts adjacent to larger areas of habitat may be used by jaguarundi. Roads, narrow water bodies, and rights-of-way are not considered barriers to movements. Brush strips connecting areas of habitat, such as brushy fence lines and watercourses, are very important in providing escape and protective cover.

The recovery strategy for jaguarundis and ocelots involves assessing, protecting, reconnecting, and restoring sufficient habitat to support viable populations. South Texas counties are important to the travel and dispersal of the cats. The Service and partners are working on two strategic plans to identify priority areas to create wildlife corridors for the jaguarundi and ocelot. One is the Bahia Grande Coastal Corridor Project (BGCCP) (Figure 16); a bi-national, federal, state and private land acquisition is an effort to link the Laguna Madre region of South Texas with the Northern Mexico Gulf Coast. The other is a Thornscrub Protection, Enhancement and Restoration Cooperative Agreement to create a wildlife corridor connecting LANWR and LRGVNWR with ranchlands to the north (Figure 17). The Thornscrub Protection, Enhancement and Restoration Cooperative Agreement Conceptual Ocelot and Jaguarundi Corridor Map, shows six conceptual wildlife corridor areas for conservation efforts.

Thornscrub protection, enhancement and restoration will allow jaguarundis, as well as ocelots, to move around the landscape safely, while limiting risk of vehicle collisions and potentially creating the right conditions for reproduction. Additional, actions are needed to identify lands to support viable and self-sustaining habitat and coordinate land acquisition activities to establish a wildlife corridor to strengthen connectivity between populations.

Status and distribution

Reason for Listing

Loss of habitat is one of the main threats to the jaguarundi. Historically, dense mixed brush occurred along dry washes, arroyos, resacas, and the flood plains of the Rio Grande. A majority of brush land has been converted to agriculture and urban development. Unfortunately, for the jaguarundi, the best soil types used for agricultural crops also grow the thickest brush and thus produce the best habitat for the jaguarundi. Less than five percent of the original vegetation remains in the Rio Grande Valley (Service 1990).

Range-wide trend

Nothing is known of jaguarundi population estimates or demographics in the U.S. Based on the natural history of this species, it is anticipated that the same ecological pressures that affect ocelot population dynamics apply to the jaguarundi as well. These pressures primarily include habitat loss, habitat fragmentation, and road mortality.

Critical Habitat

Critical habitat has not been designated for the jaguarundi

Climate Change

Variations in rainfall can influence the jaguarundi prey base, and sea level rise can destroy habitats and corridors used by jaguarundis (Service 2016a). Because of changes in the climate and changes in temperature and rainfall changes, predator-on-predator interactions may be rare, but may increase with time as they compete for water resources as witnessed in a video of a jaguar capturing a jaguarundi shown in *https://scitechdaily.com/climate-change-induced-conflict-rare-footage-captured-of-jaguar-killing-ocelot-at-waterhole*.

Sea Turtles

The Service has jurisdiction for protecting sea turtles in inland waters and on the nesting beaches. The National Marine Fisheries Service (NMFS) has jurisdiction for protecting sea turtles in the marine environment. Five species of sea turtles are found in U.S. waters and nest on U.S. beaches: leatherback, hawksbill, loggerhead, green and Kemp's ridley.

Climate Change

Marine system changes are associated with rising water temperatures, changes in ice cover, salinity, oxygen levels and circulation. For all sea turtles rising sea levels is the most certain consequence of climate change (Titus and Narayanan 1995). These changes could result in shifts in ranges and changes in algal, plankton, and fish abundance which could affect sea turtle prey distribution and abundance (IPCC 2007). Sea turtles may also change their migratory behaviors because of increasing water temperatures. Nesting habitat could also be degraded by increased frequency and intensity of tropical storms and hurricanes and sea level results in increased erosion rate along nesting beach and could impact areas with low-lying beaches where sand depth is a limiting factor as it will inundate nesting sites and decrease nesting habitat. Erosion control structures can result in permanent loss of dry nesting beach or deter nesting females from reaching suitable nesting sites (National Research Council 1990). Increasing global temperatures may result in warmer incubation temperatures and may also affect sex ratios since they exhibit temperature-dependent sex determination (Glen and Mrosovsky 2004).

Kemp's ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered throughout its entire range on July 28, 1978 (43 FR 32800).

Selected Life History

Kemp's ridleys are the smallest of the sea turtles, reaching about 2 feet (0.6 meter) in length and can weigh 70-100 pounds. The adult has an unusually broad, heart-shaped, keeled upper shell that is serrated behind the bridge or midsection, almost as wide as it is long, and is usually olive-gray. The upper shell has five pairs of scales or plates along the sides. In the bridge hooking the lower shell to the upper shell, there are four infra-marginal plates, each perforated by a pore. The lower shell is a light, yellowish color. The head has two pairs of prefrontal scales. The Kemp's ridley has a triangular-shaped head with a somewhat hooked beak with large crushing surfaces. Juveniles have a dark-charcoal colored shell that changes to olive-green or gray with age. Kemp's ridley sea turtles occurring in nearshore Gulf of Mexico waters, bays, and passes, where they feed mostly on crabs, some fish, sea jellies and mollusks.

The Kemp's ridley distribution is one of the most restricted (Wibbels and Bevan 2019). Kemp's ridley nesting occasionally occurs in Florida, Alabama, Georgia, South Carolina and North Carolina. Although, approximately 71.2 percent of nesting occurs along a 19 mile stretch of beach at Rancho Nuevo, Mexico (Wibbels and Bevan 2019), more Kemp's nest at Padre Island National Seashore than any other place in the United States. Nesting occurs primarily on beaches around Rancho Nuevo, Tamaulipas, Mexico, from April to June each year; however, Kemp's ridley nests have been recorded in Mexico as early as March and as late as August (Gaskil 2018). During preferred nesting conditions, which are precipitated by strong winds, the females come ashore, often in groups called “arribadas.” Kemp's ridleys are predominately daytime nesters. Although some females breed annually, this species is considered to nest biannually and may nest as many as three times in a single season (NMFS et al 2011), producing an average of 2.5 clutches. Clutch size averages between 100-110 eggs. Hatchlings emerge after approximately 50 days of incubation. Sexual maturity is believed to be reached between 10 to 15 years of age. Some fidelity to nesting sites has been shown by Kemp's ridleys, both within one nesting season, and between nesting seasons (Gredzens and Shaver 2020). If conditions are unsuitable on a nesting beach or the female is disturbed, she may return to the water and attempt to nest elsewhere within several kilometers of the first site. The disturbance could also cause her to switch nesting beaches entirely (Gredzens and Shaver 2020). After the nesting season, adults migrate to feeding areas in the Gulf of Mexico and remain there until the next reproductive season. Hatchlings that successfully emerge from the nest and enter the ocean are essentially pelagic for approximately two years (Ernst et. al. 1994). Approximately 99.9 percent of known nests are found on the coastal beaches of Tamaulipas and Veracruz, with approximately 21,000 nests protected in 2011. In 2017, approximately 27,000 nests were documented with 353 in Texas, 24,586 in Tamaulipas, and 2,000 located in Veracruz, Mexico (Gaskil 2018). In 2020, 262 nests were found and protected along Texas beaches (Pers. Comm., D. Shaver, Sea Turtle Coordinator, NPS, 2021).

<u>Habitat</u>

Habitat includes areas that shelter the turtle from high winds and waves, with forage areas that include seagrass, oyster reefs, sandy bottoms, mud bottoms, and rock outcroppings. Their diet consists primarily of crabs, shrimp, snails, sea urchins, sea stars, fish and occasionally marine plants. Preferred habitat for this species is shallow coastal and estuarine waters and occurs in the bays on the middle and upper Texas coast with regularity.

<u>Population Dynamics</u>

Kemp's ridley sea turtle numbers have precipitously declined since 1947, when more than 40,000 nesting females were estimated in a single arribada (Service and NMFS 2011). The nesting population produced a low of 702 nests in 1985 (Service and NMFS 2011). Since the mid-1980s, the number of nests laid in a season has been steadily increasing, primarily due to nest protection efforts and implementation of regulations requiring the use of turtle excluder devices (TEDs) in commercial fishing trawls. Less than 300 females were found nesting in Mexico in 1985 (NMFS 2011) but current estimates include 5,500 females nesting in Mexico annually and about 55 females nesting in Texas annually. Declining populations increased 12-19 percent annually in Texas and Mexico from 1997 through 2009 (NMFS et al 2011). Reduced numbers were found in 2010, 2013, 2014, and 2015; the numbers found in 2011 and 2012 were similar to 2009 levels. In 2017, the maximum annual abundance of nests over the past several decades was 25,654, and has averaged 21,156 from 2016 to 2018 (Wibbels and Bevan 2019). The reasons for this decline is unknown but could possibly be related to fisheries bycatch, the 2010 Deepwater Horizon oil spill and current carrying capacity of the Gulf of Mexico (Wibbels and Bevan 2019).

Status and Distribution

Reasons for Listing

Several factors contributed to the decline of sea turtle populations along the Atlantic and Gulf coasts, including commercial over-utilization of eggs and turtle parts, incidental catches during commercial fishing operations, disturbance of nesting beaches by coastal housing, marine pollution, and entanglement and ingestion of debris (Service and NMFS 2011). Additional threats are expanding human populations adjacent to important nesting beaches, degradation of coastal foraging habitats, and the potential effects of global warming on sex ratios (NMFS and Service 2007, NMFS 2020a). Red tide, caused by harmful algal blooms as well as strandings threaten the Kemp’s ridley (NMFS and Service 2016).

Range-wide Trend

Kemp’s ridley has no known subpopulations (Wibbels and Beven 2019). In 2007, the population seemed to be improving, however, in 2009 the population growth (measured by numbers of nests) stopped. In 2014, approximately 4,395 females nested at the three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos), not meeting the predicted downlisting criterion of 10,000 nesting females in a season predicted to occur by 2011. An unprecedented mortality in subadult and adult females post-2009 nesting season may have altered the 2009 age structure which impacted the annual nests numbers in 2011-2014. With the availability of long-term nests counts (as an index of population abundance), and comparing it to historic population estimates from 1947, the current nesting data indicates that the current population represents a greater than 80 percent reduction in historic population size (i.e. 82.6-88.3 percent) (Wibbels and Bevan 2019). The results indicate the population is not recovering and cannot meet recovery goals unless survival rates improve and qualifying the Kemp’s ridley as Critically Endangered under the International Union for Conservation of Nature and Natural Resources (IUCN) Red List Criterion A2BD.

Critical Habitat

Critical habitat has not been designated for this species.

Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species on July 28, 1978 (43 Federal Register [FR] 32800).

Selected Life History
The head is very large with heavy strong jaws and the brownish red carapace is bony without ridges and has a large, non-overlapping rough scutes (scales) with 5 lateral scutes. The carapace is heart shaped. Typically it is 2.5 to 3.5 feet in length and can weigh an average weight of about 200 pounds. It feeds mostly on shellfish that live on the bottom of the ocean. They eat horseshoe crabs, clams, mussels and other invertebrates. They prefer to feed in coastal bays and estuaries as well as shallow water along the continental shelves of the Atlantic, Pacific and Indian oceans. It occurs in temperate and tropical waters of both hemispheres. Historic nesting frequency on the Texas coast is poorly known.

Adult loggerhead sea turtles reach maturity in 25 to 30 years. Loggerheads are nocturnal nesters, although some daytime nesting occurs. They nest from one to seven times within a nesting season (average of approximately 4.1 clutches); clutch size averages 100-125 eggs along the southeastern U.S. coast (NMFS and Service, 1991b). Hatchling emergence typically occurs at night. In the Gulf of Mexico, there are distinct nesting populations on the coast of the Florida panhandle and the Yucatan Peninsula. Scattered nests can be found occasionally along other areas of the U.S. Gulf Coast from the Chandeleur Islands, Louisiana, south to the U.S./Mexico border.

Population Dynamics
Florida's long-term loggerhead nesting data (1989-2021) was analyzed. Observed nest counts on 27 core index beaches peaked at 65,807 in 20161998 to a low in 2007 of 28,876 (FWC 2021). These numbers do not represent Florida's total annual nest counts because they are collected only on a subset of Florida's beaches (27 out of 224) and only during a time window of 15 May through 31 August) (FWC 2021). Long-term loggerhead nesting data (1989-2021) showed three distinct phases: increasing (1989-1998), decreasing (1998-2007) and increasing (2007-2021). The fluctuations in annual nest counts are not fully understood. It may be a part of a long-term cycle (FWC 2021).

Status and Distribution
Reason for Listing
Threats include incidental take from channel dredging and commercial trawling, longline, and gill net fisheries; loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease.

Range-wide Trend
Hildebrand (1981) suggested that loggerhead nesting along the Texas coast has occurred within the last 300 years, but the earliest loggerhead nest that he was able to confirm for Texas was found in 1977. Total estimated loggerhead nesting in the U.S. is approximately 68,000 to 90,000 nests per year (NOAA 2013a). Long-term nesting data show the population is declining in southeast Florida, North Carolina, South Carolina and Georgia. However, in Texas, during the last decade, nesting has remained stable, with 1-13 nests per year (Pers. Comm., D. Shaver, Sea Turtle Coordinator, NPS, 2013). Nesting in the Caribbean is sparse. In the Mediterranean, nesting is almost exclusively confined to the eastern portion of the Mediterranean Sea. In the Indian Ocean, most trends on loggerhead nesting populations are unknown. In Honduras,

Mexico, Colombia, Israel, Turkey, Bahamas, Cuba, Greece, Japan, and Panama loggerhead nesting population have been declining (NOAA 2013a).

Critical Habitat
Critical habitat has not been designated for this species.

Green Sea Turtle
The green turtle (*Chelonia mydas*) was listed under the Act on July 28, 1978. Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico were listed as endangered; all other populations were listed as threatened.

Selected Life History
Adult green sea turtles can grow to a shell length of 4 feet and range from 250 to 450 pounds. Hatchlings generally have a black carapace, white plastron, and white margins on the shell and limbs. The adult carapace is smooth, keelless, and light to dark brown with dark mottling; the plastron is whitish to light yellow. Adult heads are light brown with yellow markings. It is distributed circumglobally in tropical and sub-tropical waters. Adult green sea turtles reach maturity at 30 to 50 years of age. Females nest at night. From one to seven clutches are deposited within a breeding season (the average number is usually two to three clutches) (NMFS and Service 1991a). Average clutch size is usually 110-115 eggs. Hatchling emergence occurs at night. Nesting sites include southern Florida and scattered locations in Mexico, although a few nests are found in south Texas annually.

Habitat
Green turtles are generally found in fairly shallow waters (except when migrating) inside reefs, bays, and inlets. The turtles are attracted to lagoons and shoals with an abundance of marine grass and algae. Open beaches with a sloping platform and minimal disturbance are required for nesting. Green turtles have strong nesting site fidelity and often make long distance migrations between feeding grounds and nesting beaches. Hatchlings have been observed to seek refuge and food in sargassum rafts.

Population Dynamics
Within the U.S., green sea turtles nest in small numbers in the U.S. Virgin Islands, Puerto Rico, and Texas, and in larger and growing numbers along the east coast of Florida (NMFS and Service 1991a). Total population estimates for the green turtle are unavailable, however, green turtle nests on 27 index beaches ranged from less than 300 in 1989 to 41,000 in 2019. In 2021, green turtle nest counts on the 27 core index beaches reached more than 24,000 nests (FWC 2021). Nesting green turtles tend to follow a two-year reproductive cycle with wide year-to-year fluctuations in numbers of nests. Record highs were in 201, 2013, 2015, 2017 and 2091. These numbers do not represent Florida’s total annual nest counts because they are collected only on a subset of Florida’s beaches (27 out of 224) and only during a time window of 15 May through 31 August) (FWC 2021). Populations in Surinam, and Tortuguero, Costa Rica, may be stable, but there is insufficient data for other areas to confirm a trend.

Status and Distribution Reason for Listing
Major factors contributing to the green sea turtle's decline worldwide is commercial harvest for eggs and food, fibropapillomatosis or the development of multiple tumors on the skin and

internal organs, loss or degradation of nesting habitat from coastal development and beach armoring, disorientation of hatchlings by beachfront lighting, excessive nest predation by native and non-native predators, degradation of foraging habitat, marine pollution and debris, watercraft strikes, and incidental take from channel dredging and commercial fishing operations.

Range-wide Trend
Globally there is a declining trend, however green turtle population growth rates are variable among nesting populations and regions (NOAA 2013b). Most green turtles in Texas waters are juveniles and their numbers are increasing (Pers. Comm., D. Shaver, Sea Turtle Coordinator, NPS, 2013). The Hawaiian green turtle population has increased 53 percent over the last 25 years (NOAA 2013b). The Martine Turtle Specialist Group indicates populations in all major ocean basins have declined over the past 100-150 years (NOAA 2013b).

<u>Critical habitat</u>
NMFS designated critical habitat for the green sea turtle on October 2, 1998. Critical habitat included waters extending seaward 3.5 miles from the mean high water line of Isla de Culebra (Culebra Island, Puerto Rico). Critical habitat has not been designated in Texas.

Atlantic Hawksbill Sea Turtle
The hawksbill was listed as an endangered species on June 2, 1970 (35 FR 8491). It primarily occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian oceans inhabiting coastal waters of more than 108 countries. Young hawksbills occur with some regularity in Texas waters, since northern currents carry them from nesting beaches in Mexico (Hildebrand, 1981). Historic nesting by this species on the Texas coast is unknown.

Hawksbills have a hawk-like beak, from which their name originates. They are small to medium-sized marine turtles, ranging from 176 to 279 pounds. Hawksbills are usually brown with ornate shells, which are dark amber with radiating streaks of brown or black. Their shells are also known as bekko or carey. The name "tortoise shell" was also given to their carapaces, which are made into many types of objects such as tortoise shell jewelry, combs, eyeglass frames, and tabletops. A combination of characters distinguish the hawksbill from other sea turtles: the pairs of prefrontal scales; thick, posterior overlapping scutes on the carapace; four pairs of costal scutes; two claws on each flipper; a beak-like mouth and, when on land, it has an alternating gait, unlike the leatherback and green sea turtles.

The nesting season for hawksbills varies geographically and may extend from April through October in the Caribbean and along the Gulf Coast of Mexico. Female hawksbill sea turtles nest mostly during the night, but rare daytime nesting is known, usually on small isolated beaches above the high tide. They nest an average of 4.5 times per season (up to 12 clutches); clutch size averages approximately 140 eggs (NMFS and Service, 1993). Hatchling emergence occurs at night. Hawksbills nest on scattered islands and beaches between 25° North and 25° South latitudes, including beaches in southeastern Florida and the states of Campeche and Yucatan in Mexico. Nesting does not regularly occur on the Texas coast.

<u>Habitat</u>
Atlantic hawksbills use different habitats, such as shallow coastal areas, lagoons and coral reefs, at different stages of their life cycle. Females exhibit strong fidelity in nesting sites (NMFS and

Service 2013). Post hatching hawksbills take shelter in weed lines at convergence zones and later re-enter coastal waters when their carapace length reaches to approximately 8 to 10 inches.

Population Dynamics

Since the 2007, trends and distribution of the species' nesting populations in the eastern Pacific, Nicaragua, and western Caribbean appears to have improved, but throughout the globe largely is unchanged (NMFS and Service 2013c). The hawksbill turtle has declined in most areas over the last century and represents only a fraction of its historical populations (NMFS and Service 2013c). The populations were analyzed by ocean basin at 88 nesting sites in 10 different regions of the world. Historic trends for 25 sites were unknown and the remaining 63 sites declined year 20 to 100 years. Recent trend data available for 41 sites was more optimistic with 10 (24 percent) increasing, 3 (7 percent) stable, and 28 (68 percent) decreasing (NMFS and Service 2013c).

Status and Distribution

Reason for Listing

Threats to hawksbills in their nesting environment include poaching, beach erosion, erosion control methods, sand mining, landscaping of privately owned sites, artificial lighting, beach cleaning, increased human presence, beach vehicular driving, and nest depredation. Marine threats include entanglement, ingestion of marine debris, commercial and recreational fishing, watercraft collisions, sedimentation and siltation, sewage, agricultural and industrial pollution, illegal exploitation, oil and gas exploration, development, transportation and storage, anchoring and vessel groundings, and increases in international shipping traffic.

Range-wide Trend

Determining population trends or estimates on nesting beaches is difficult since hawksbill sea turtles are solitary nesters. The largest populations are found in the Caribbean, the Republic of Seychelles, Indonesia, and Australia. The largest in the U.S. occurs in Puerto Rico and the U.S. Virgin Islands, with approximately 500-1000 nests on Mona Island, Puerto Rico and another 100-150 nests on Buck Island Reef National Monument off St. Croix in the U.S. Virgin Islands (NOAA 2013c). Nesting is restricted in the southeast coast of Florida and the Florida Keys. In addition a majority of nesting occurs in Mexico and Cuba with the largest nesting population of hawksbills in Australia, with approximately 2,000 nests on the northwest coast and 6,000 to 8,000 nests off the Great Barrier Reef each year (NOAA 2013c). Atlantic populations in general are doing better than in the Indian and Pacific Oceans and the Indian populations are doing better than the Pacific Ocean.

Critical Habitat

NMFS designated critical habitat for the hawksbill turtle on October 2, 1998. Critical habitat only included waters extending seaward 3.5 miles from the mean high water line of Mona and Monito Islands, Puerto Rico. No critical habitat has been designated in Texas.

Leatherback Sea Turtle

Description

The leatherback sea turtle is federally listed as an endangered species. It ranges throughout the tropical waters of the Atlantic, Pacific, and Indian oceans, but has also been recorded from the North Atlantic, North Pacific, South Atlantic, South Pacific and Gulf of Mexico. Leatherbacks are primarily found in the open ocean, as far north as Alaska and as far south as the southern tip of Africa and known to be active in water below 40° Fahrenheit. The leatherback is the largest and most pelagic sea turtle species and is normally found in the deeper waters of the Gulf of Mexico, where it may undertake extensive migrations, at times swimming over 10,000 miles a year between nesting and foraging grounds. They can also dive nearly 4,000 feet, deeper than most marine mammals.

Its shell is made of a layer of thin, tough, rubbery skin that looks like leather, thus the name leatherback. The carapace is about 1.5-inches thick, large, and elongated and strengthened by thousands of tiny bone plates. Seven narrow ridges run down the length of the carapace, which is typically black with many spots. The plastron is whitish to black and marked by five ridges. Weight can range from 500 to 1,500 pounds and length is about 5 to 6 feet. Both adults and hatchlings upper jaws have two tooth-like projections and each flanked by deep cusps. They feed almost exclusively on jellyfish.

Leatherback nesting grounds are distributed circumglobally. In the U.S. and Caribbean, nesting begins in February and continues through July. Nesting occurs primarily at night and diurnal nesting occurs only occasionally. They nest at intervals of two to three years and up to five to seven times per year, with an average clutch size between 110 to 116 eggs (NMFS and Service 1992). Eggs incubate for about 65 days. Hatchling emergence typically occurs at night.

<u>Population Dynamics</u>
Leatherback sea turtles historic population levels are unknown but in 1982 an estimated 115,000 females were estimated to occur in the global population, with about half of all females nesting in Pacific Mexico (NMFS and Service 1992). Current population are not know well, however in the North Atlantic the population is estimated to be 34,000 and 94,000 adults (Service 2018). Over the past 30 years 99.4 percent of all leatherback nesting was recorded in Florida (10,005 to 10,065 nests) revealing the number of nest has increased by 10.2 percent per year since 1979 across the state (Stewart et al 2011). Over the past three generations it is estimated that the global population has declined 40 percent over the past three generations (https://www.fisheries.noaa.gov/species/leatherback-turtle#overview). An assessment of 11 Atlantic Ocean rookeries showed an increase of 3-24 percent per year, one had remained stable, and one was decreasing slightly (Stewart et al 2011). This increase may be due to both the implementation of conservation measures and variable ocean climates. In contrast, the eastern Pacific nesting beaches in Mexico and Costa Rica have not been as successful with populations decreasing in recent decades with approximately 90 percent decline in nesting (https://www.fisheris.noaa.gov/species/leatherback-turtle#overview). This may be attributed to longer intervals between nesting years and a less consistent foraging environment.

<u>Status and Distribution</u>
Reason for Listing
Threats to the leatherback nesting environment include direct harvest of turtles and eggs through poaching, beach erosion, loss of habitat, beach armoring beach nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach vehicular driving and vessel strikes. Threats to the marine environment included entanglement or ingestion of marine debris, commercial fishing, oil and gas exploration, development, transportation and storage, boat collisions and pollution.

Range-wide Trend
In other areas some population trends are increasing or stable. In the U.S., nesting trends have been increasing in recent years (NOAA 2013d). The International Union for Conservation notes that most leatherback populations have declined more than 80 percent in the Pacific (NOAA 2013d). Over the past 3 generations, the global population is estimated to have declined 40 percent. The Pacific populations have declined 80-97 percent over that time; the Eastern Pacific population that nests in Mexico – once considered the world's largest leatherback nesting population – is now less than 1 percent of the size it was in 1980; Atlantic populations are smaller but are generally increasing (NMFS 2020b, Service 2018).

Critical Habitat
No critical habitat has been designated for this species.

Piping Plover
The piping plover was federally listed as endangered in the Great Lakes watershed, and as threatened elsewhere in its range, on January 10, 1986 (50 FR 50726) including migratory routes outside of the Great Lakes watershed and wintering grounds (Service 1985). Piping plovers were listed principally because of habitat destruction and degradation, predation, and human disturbance. Three separate breeding populations have been identified, each with its own recovery criteria: the northern Great Plains (threatened), the Great Lakes (endangered), and the Atlantic Coast (threatened). The piping plover winters in coastal areas of the U.S. from North Carolina to Texas, and along the coast of eastern Mexico and on Caribbean islands from Barbados to Cuba and the Bahamas (Haig and Elliott-Smith 2004). Piping plovers from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast may winter in the same coastal areas. There may be some overlap of birds on the wintering grounds. Piping plovers from the Atlantic population usually winter on the Atlantic coast of the United States as do a majority of the Great Lake breeding population. Birds from the northern Great Plains winter along the Gulf coast and Texas and Mexico (Gratto-Trevor and Abbott 2011). Mississippi, Louisiana, and Texas coast harbored 71 percent of observed birds from the northern Great Plains and 88 percent from Prairie Canada (Service 2020a). Only 2 percent of Great Lakes breeders were documented. No plovers from the Atlantic population have been recorded in the action area (Pers. Comm., D. Newstead, Biologist, CBBEP, 2021). For the purpose of this BO, discussions will be focused on the Texas wintering piping plover population and its designated critical habitat.

Selected Life History
The piping plover is a small North American shorebird approximately 7 inches (17.7 centimeters) long with a wingspread of about 15 inches (38.1 centimeters). Breeding birds have white under parts, light beige back and crown, white rump, and black upper tail with a white edge. In flight, each wing shows a single, white wing stripe with black highlights at the wrist joints and along the trailing edges. Breeding plumage characteristics are a single black breast band, which is often incomplete, and a black bar across the forehead. The black breast band and brow bar are generally more pronounced in breeding males than females. The legs and bill are orange in summer, with a black tip on the bill (Service 2003).

Within the year, piping plovers are usually monogamous, but may nest with another female or male if a nest is lost. Pairs do not usually migrate or winter together. They lay approximately four eggs over six days and both females and males incubate the eggs and hatch after 26-28 days. Chicks fledge in 21-35 days and then migrate to the wintering areas.

Piping plovers winter along southern Atlantic and Gulf Coasts of the United States and into Mexico, as well as in the Caribbean. Southward migration to the wintering grounds along the southern Atlantic coast and Gulf of Mexico shoreline extends from late July, August, and September. Piping plovers spend up to 10 months of their life cycle on their migration and winter grounds. They leave the wintering grounds and return north to breed as early as mid-February and as late as mid-May.

Behavioral observations of piping plovers on the wintering grounds suggest that they spend the majority of their time foraging (Nicholls and Baldisseri 1990, Drake 1999a, 1999b, Service 2003). When not foraging, plovers undertake various maintenance activities such as roosting, preening, bathing, aggressive encounters (with other piping plovers and other species), and moving among available habitat locations (Zonick and Ryan 1996).

Site fidelity appears to be strong on the wintering grounds and consists of Gulf beaches, and tidal flats. Individual plovers tend to return to the same wintering sites year after year (Nicholls and Baldassarre 1990, Drake 1999a, Service 2003). Breeding birds from the prairie Canada and the U.S. Great Plains winter on the Atlantic coast while the Canada and U.S. Great Plains primarily winter on the Gulf coast, Texas and Mexico (Gratto-Trevor and Abbott 2011). Piping plover's usage of a particular habitat largely depends on its availability. If tidal flats are inundated they will move to the Gulf beach (Newstead and Hill 2021).

<u>Habitat</u>

Atlantic Coast- Piping plovers breed mainly on gently sloping foredunes and behind primary dunes of coastal beaches and suitable dredge oil deposits (Service 1988).

Great Lakes – Piping plovers breed on sand and gravel shorelines and behind foredune among cobble and sparse vegetation on islands. In Michigan they preferred nesting near beach pools, lagoons or cuts (Cuthbert 1992).

Great Plains – Approximately 60 percent of breeding birds in this population used shorelines around small alkaline lakes, 18 percent in large reservoir beaches, 20 percent used river islands and sand pits, 2 percent used beaches on large lakes, and 0.4 percent used industrial pond shorelines (Haig and Plissner 1993).

Winter Habitat

Wintering plovers are dependent on a mosaic of habitat patches and move among these patches depending on local weather and tidal conditions (Nicholls and Baldassarre 1990). Maddock et al. (2009) observed shifts to roosting habitats and behaviors during high-tide periods in South Carolina. In South Carolina, exposed intertidal areas were the dominant foraging substrate (accounting for 94 percent of observed foraging piping plovers) (Service 2009).

Atlantic Coast and Florida studies highlighted the importance of inlets for non-breeding piping plovers. Almost 90 percent of observations of roosting piping plovers at ten coastal sites in southwest Florida were on inlet shorelines (Lott et al. 2009). Piping plovers were among seven shorebird species found more often than expected at inlet locations versus non-inlet locations in an evaluation of 361 International Shorebird Survey sites from North Carolina to Florida (Harrington 2008). In Texas, high numbers of piping plovers are typically found along the sides of unjettied inlets (Bolivar Flats, San Luis, Wolf Island, Dacros Point, Cedar Bayou, Mansfield Pass) (Pers. Comm., R. Cobb, Biologist. Ecological Services, 2010). In Texas, plovers use ocean beaches and bay shorelines and flats depending on the season and weather conditions.

This species exhibits a high degree of intra- and inter-annual wintering site fidelity (Nicholls and Baldassarre 1990, Drake et al. 2001, Noel et al. 2005, Stucker and Cuthbert 2006). On the lower Texas coast, individual plovers are known to use areas about 3,000 acres in size, moving two miles or more between foraging sites as tidal movements shift the availability of productive tidal flats (TPWD 2000). Recent studies show significantly more stringent site fidelity with individual birds returning to more precise locations (+/-400 feet in lateral distance on the beach) each year.

Foraging Habitat

Behavioral observation of piping plovers on the wintering grounds suggests that they spend the majority of their time foraging (Nicholls and Baldassarre 1990, Drake 1999a, 1999b). Feeding activities may occur during all hours of the day and night (Staine and Burger 1994, Zonick 1997), and at all stages in the tidal cycle (Hoopes 1993, Service 2009b). Wintering plovers primarily feed on invertebrates such as polychaete marine worms, various crustaceans, fly larvae, beetles, and occasionally bivalve mollusks (Bent 1929, Cairns 1977, Zonick and Ryan 1996). They peck these invertebrates on top of the sand or from just beneath the surface. Plovers forage on moist substrate features such as intertidal portions of ocean beaches, washover areas, mudflats, sand flats, algal flats, shoals, wrack lines, sparse vegetation, and shorelines of coastal ponds, lagoons, ephemeral pools and adjacent to salt marshes (Service 2009, Zivojnovich 1987, Nichols 1989, Nicholls and Baldassarre 1990, Loegering 1992, Zonick 1997, Service 2009).

Roosting Habitat

Several studies identified wrack (organic material including seaweed, seashells, driftwood, and other materials deposited on beaches by tidal action) as an important component of roosting habitat for nonbreeding piping plovers. In South Carolina, 45 percent of roosting piping plovers were in old wrack, and 18 percent were in fresh wrack. The remainder of roosting birds used intertidal habitat (22 percent), backshore (defined as zone of dry beach from mean high water line up to the toe of the dune)(8 percent), washover (2 percent) and ephemeral pools (1 percent) (Service 2009).

<u>Population Dynamics</u>

A consistent finding of all analyses of the demographic factors affecting the persistence and/or extinction of piping plover populations (Melvin and Gibbs 1994, Plissner and Haig 2000) is that vulnerability to extinction is greatly increased by even small declines in survival rates. Since piping plovers spend 55 to 80 percent of their annual cycle associated with wintering areas, factors that affect their well-being on the wintering grounds could substantially affect their survival and recovery (Service 1996).

Atlantic Coast - Between 2007 and 2008, the overall estimate of Atlantic Coast breeding pairs declined approximately 2 percent. Coast wide, 2008 productivity was slightly higher than in 2007, but remained below the long-term average. In 2010 Atlantic Coast piping plover population estimate was 1,782 pairs, more than double the 1986 estimate 790 pairs, increasing 86 percent between 1989 and 2010. In the Southern recovery unit, net growth was 54 percent between 1989 and 2010, with most of the increase occurring in 2003 to 2005. Annual productivity estimates were at their lowest in 2009 due to storm events, but rebounded in 2010, and remained low in New York (Service 2011). Atlantic Coast piping plovers rarely occur on Texas wintering grounds.

Northern Great Plains -The overall population on the U.S. Northern Great Plains remained relatively stable from 2007 to 2008. Adult numbers were down more than 10 percent in Nebraska in 2008, and the Kansas and Minnesota populations appear nearly extirpated. The 2009 reports from the Missouri River system and U.S. alkali lakes indicate a sharply declining net trend, with decreases on the Missouri River system substantially exceeding a gain on the alkali lakes. Approximately 10 percent of birds are banded. The northern Great Plains piping plover population size has increased, but remains below the recovery goals set out in the 1988 recovery plan. The Service is currently in the process of revising the recovery plan and associated recovery criteria.

Great Lakes – Approximately 200 piping plovers from the Great Lakes population have been banded. There were once nearly 800 pairs of piping plovers on the shores of the Great Lakes, but, dropped to 13 in the 1990s (https://www.greatlakespipingplover.org/). There are currently 71 breeding pairs in the Great Lakes population, but due to low abundance, limited distribution and threats from habitat degradation, human disturbance and predation remain in danger of extinction.

Status and Distribution

Reasons for Listing

Habitat destruction and degradation are pervasive and have reduced physically suitable habitat. Human disturbance and predators further reduce breeding and wintering habitat quality and affect survival. Contaminants, as well as genetic and geographic consequences of small population size, pose additional threats to piping plover survival and reproduction (Service 2003).

In the wintering grounds, the two greatest threats identified were habitat loss and degradation and human disturbance. For wintering birds along the Atlantic and Gulf coasts, loss of habitat to beach development and shoreline stabilization, beach grooming, beach nourishment, active vehicle use on the beach, dredging, dredge spoil placement, roads, oil and gas development, oil spills and disturbance by humans and dogs (Gratto-Trevor and Abbott 2011). In some areas, natural erosion of barrier islands may also result in habitat loss.

If an oil spill occurred on the coasts of Louisiana, Mississippi, Alabama and northern Gulf coast of Florida, about 16 percent of the breeding population from the U.S. Great Plains and 9 percent of the prairie Canada population would be affected. If the spill reached the Texas coast, almost all of the U.S. Great Plains and Canadian Prairie birds would be affected.

Range-wide Trend:
Total piping plover numbers have fluctuated over time, with some areas experiencing increases and others decreases. Five range-wide International Piping Plover censuses (late January to early February) have been conducted at five-year intervals with published findings: 1991 (Haig and Plissner 1992), 1996 (Plissner and Haig 1997), 2001 (Ferland and Haig 2002), and 2006 (Elliott-Smith et al. 2009), and 2011 (Elliott-Smith et al 2015). Findings from these range-wide studies are summarized in Table 3.

Table 3. Abundance of wintering (W) and breeding (B) piping plovers reported from the International Piping Plover Census in 1991, 1996, 2001, 2006, and 2011.

	1991	1996	2001	2006	2011	1991	1996	2001	2006	2011
	W	W	W	W	W	B	B	B	B	B
Range-wide Population	3,451	2,515	2,389	3,884	3,973	5,484	5,931	5,945	8,092	5,723
Northern Great Plains Population	n/a	n/a	n/a	n/a	n/a	3,469	3,286	2,953	4,564	2,249
Texas Wintering Population	1,904	1,333	1,042	2,090	2,145	n/a	n/a	n/a	n/a	n/a

The Texas winter population censuses resulted in 1,904 wintering piping plovers counted in 1991, 1,333 in 1996, 1,042 in 2001, and 2,090 in 2006, and 2,145 in 2011. Between December 2, 2008 and March 13, 2009, 78 locations from Marco Island, Florida to Boca Chica beach in Texas were visited to locate banded piping plovers. There were 397 banded piping plover observations with 295 of those observations in Texas. Banded piping plover observations by populations were, 170 from Great Plains Canada, 176 from Great Plains United States, 29 unknown, 22 from the Great Lakes, and 0 were from Atlantic Canada or Atlantic United States (Maddock 2009). The northern Great Plains population winters mostly in Texas. In 2014, 363 piping plovers were observed on the Land Cut, in the Laguna Madre and in 2015 approximately 50 piping plovers were found on the flats in east Matagorda Bay (Service 2020b).

A simulation study on the U.S. northern Great Plains population indicated that variations in adult survival have the strongest potential to affect population trends. Because individuals tend to remain at a wintering site despite disturbance and degraded habitat, it can also lead to lower site-level survival (Gibson et al. 2018).

Critical Habitat
Critical habitat for wintering piping plovers that included individuals from the Great Lakes and northern Great Plains breeding populations as well as birds that nest along the Atlantic coast, was designated on July 2001 and included 142 areas encompassing about 1,793 miles of mapped shoreline and 165,211 acres of mapped area along the North Carolina South Carolina Georgia, Florida, Alabama, Mississippi, Louisiana and Texas coast lines. Four units within Cape Hatteras National Seashore, North Carolina were reconsidered and re-designated on October 21, 2008 and 18 critical habitat units in Texas were revised on May 19, 2009, after the Courts vacated and

remanded the original designation.

Climate Change
Loss of habitat would increase with sea level rise and hurricane activity could result in mortality of actual birds. Armoring and other shoreline alterations may increase erosion and drought and flooding can make wetlands unavailable and diminish the water supply. An increased demand for wind power may also impact piping plovers as they potentially collide with wind turbines during migration (Service 2009).

Red Knot
There are six recognized subspecies of red knots, and on December 11, 2014, the Service published the final rule listing the rufa subspecies of red knot as a threatened species under the Act; that rule became effective on January 12, 2015.

Selected Life History
The red knot is a medium-sized shorebird about 9 to 11 inches in length. The red knot is easily recognized during the breeding season by its distinctive rufous (red) plumage. Nonbreeding plumage is dusky gray above and whitish below. Juveniles resemble nonbreeding adults, but the feathers of the scapulars and wing coverts are edged with white and have narrow, dark bands, giving the upperparts a scalloped appearance (Davis 1983).

The red knot's range spans 40 states and 24 countries and extends from the species' breeding grounds in the Canadian Arctic, to its migration stopover areas along the Atlantic and Gulf coasts of North America, to its wintering grounds throughout the Southeastern U.S., the Gulf coast, and South America (reaching as far south as Tierra del Fuego at the southern tip of South America). Little information is available about nonbreeding red knots. Unknown numbers of nonbreeding red knots remain south of the breeding grounds during the breeding season, and many, but not all, of these red knots are 1-year-old (i.e., immature) birds (Niles et al. 2008). Nonbreeding red knots, usually individuals or small groups, have been reported during June along the U.S. Atlantic and Gulf coasts, with smaller numbers around the Great Lakes and Northern Plains in both the United States and Canada (Niles et al. 2008). There is also little information on where juvenile red knots spend their winter months (Service and Conserve Wildlife Foundation of New Jersey 2012), and there may be at least partial segregation of juvenile and adult red knots on the wintering grounds. All juveniles of the Tierra del Fuego wintering region are thought to remain in the Southern Hemisphere during their first year of life, possibly moving to northern South America, but their distribution is largely unknown (Niles et al. 2008). Because there is a lack of specific information on juvenile red knots, the Service uses the best available data from adult red knots to draw conclusions about juvenile foraging and habitat use.

Rufa red knots feed on invertebrates, especially small clams, mussels, and snails, but also crustaceans, marine worms, and horseshoe crab (*Limulus polyphemus*) eggs. On the breeding grounds, red knots mainly eat insects. Migrating red knots can complete non-stop flights of 1,500 miles or more, converging on vital stopover areas to rest and refuel.

Habitat
Habitats used by red knots in migration and wintering areas are generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments and seagrasses. In many

wintering and stopover areas, quality high tide roosting habitat (i.e., close to feeding areas, protected from predators, with sufficient space during the highest tides, free from excessive human disturbance) (Service 2015). The supra-tidal (above the high tide) sandy habitats of inlets provide important areas for roosting, especially at higher tides when intertidal habitats are inundated (Harrington 2008). In some localized areas, red knots will use artificial habitats that mimic natural conditions, such as nourished beaches, dredged spoil sites, elevated causeways, and impoundments; however, there is limited information regarding red knot use of such artificial habitats.

In North America, red knots are commonly found along sandy, gravel, or cobble beaches, tidal mudflats, salt marshes, peat banks, and shallow coastal impoundments, ponds, and lagoons along the Atlantic coast (Cohen et al. 2010; Cohen et al. 2009; Niles et al. 2008; Harrington 2001; Truitt et al. 2001). In Florida, the birds also use mangrove and brackish lagoons. Along the Texas coast, red knots forage on beaches, oyster reefs, and exposed bay bottoms and roost on high sand flats, reefs, and other sites protected from high tides. Red knots also show some fidelity to particular migration staging areas between years (Duerr et al. 2011; Harrington 2001).

<u>Population Dynamics</u>

Except for localized areas, there have been no long-term systematic surveys of red knots in Texas or Louisiana, and no information is available about the number of knots that winter in northeastern Mexico. From survey work in the 1970s, Morrison and Harrington (1992) reported peak winter counts of 120 red knots in Louisiana and 1,440 in Texas, although numbers in Texas between December and February were typically in the range of 100 to 300 birds. Records compiled by Skagen et al. (1999) give peak counts of 2,838 and 2,500 red knots along the coasts of Texas and Louisiana, respectively, between January and June over the period 1980 to 1996, but these figures could include spring migrants. Morrison et al. (2006) estimated only about 300 red knots wintering along the Texas coast, based on surveys in January 2003 (Niles et al. 2008). Higher counts of roughly 700 to 2,500 knots have recently been made on Padre Island, Texas during October, which could include wintering birds (Newstead et al. 2013, Niles et al. 2009).

Foster et al. (2009) found a mean daily abundance of 61.8 red knots on Mustang Island, Texas, based on surveys every other day from 1979 to 2007. Similar winter counts (26 to 120 red knots) were reported by Dey et al. (2011a) for Mustang Island from 2005 to 2011. From 1979 to 2007, mean abundance of red knots on Mustang Island decreased 54 percent, but this may have been a localized response to increasing human disturbance, coastal development, and changing beach management practices (Newstead et al. 2013, Foster et al. 2009) (i.e., it is possible these birds shifted elsewhere in the region).

At several key sites, the best available data show that numbers of red knots declined and remain low relative to counts from the 1980s, although the rate of decline appears to have leveled off since the late 2000s. There are no current estimates for the size of the Northwest Gulf of Mexico wintering group as a whole (Mexico to Louisiana). The best available current estimates for portions of this wintering region are about 2,000 in Texas (Niles 2012a), or about 3,000 in Texas and Louisiana, with about half in each State and movement between them (Service 2015). Inferring long-term population trends from various national or regional datasets derived from volunteer shorebird surveys and other sources, Andres (2009) and Morrison et al. (2006) also concluded that red knot numbers declined, probably sharply, in recent decades.

Status and Distribution

Reasons for Listing/Threats to Survival

The Service has determined that the red knot is threatened due to loss of both breeding and nonbreeding habitat; likely effects related to disruption of natural predator cycles on the breeding grounds; reduced prey availability throughout the nonbreeding range; and increasing frequency and severity of asynchronies (‘‘mismatches’’) in the timing of the birds’ annual migratory cycle relative to favorable food and weather conditions. Main threats to the red knot in the United States include reduced forage base at the Delaware Bay migration stopover; decreased habitat availability from beach erosion, sea level rise, and shoreline stabilization in Delaware Bay; reduction in or elimination of forage due to shoreline stabilization, hardening, dredging, beach replenishment, and beach nourishment in Massachusetts, North Carolina, and Florida; and beach raking which diminishes red knot habitat suitability. These and other threats in Canada and South America are detailed in the final listing rule (Service 2014a). Unknown threats may occur on the breeding grounds.

Range-wide Trend

Strong historical evidence indicates that red knots were severely depleted by hunting in the 1800s, but at least partially recovered by the mid-1900s. During the 2000s, red knots from the Southern wintering population experienced a sharp decline that is generally attributed to the overharvest of the horseshoe crab and a resulting food shortage in the Delaware Bay staging area. The horseshoe crab harvest is now scientifically managed to avoid further impacts on red knots, but the southern wintering population shows no signs of recovery to date. Although less reliant on Delaware Bay, the Northwestern Gulf of Mexico/Central American wintering population is also thought to have declined in recent decades. Two additional wintering populations, one on the north coast of South America and another in the Southeast United States and the Caribbean, are considered stable relative to the 1980s. Rufa Red Knot Species Status Assessment Report 25 stated the decline of the Southern population drove a decline of the subspecies as a whole. Although less reliant on Delaware Bay, the Northwestern Gulf of Mexico/Central American wintering population is also thought to have declined in recent decades, while the other two wintering populations are considered stable (Service 2020b).

Critical Habitat

Critical habitat was proposed on July 15, 2021 for red knots (86 FR 37410). Currently the proposed critical habitat includes 120 units in Massachusetts, New York, New Jersey, Delaware, Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. A total of approximately 649,066-ac (262,667-ha) were proposed to be designated critical habitat. There were 11 proposed critical habitat units [approximately 186,241-ac (75,369-ha) proposed to be designated in Texas. These areas were believed to contain the essential physical and biological elements for the conservation of red knots, and the physical features necessary for maintaining the natural processes that provides appropriate foraging, roosting, and sheltering habitat components.

Climate Change

Red knot’s vulnerability to climate change indicates that loss or degradation of breeding habitat from artic warming and nonbreeding habitat, and loss of wintering habitat from sea level rise and increased frequency and severity of hurricanes increases the extinction rate (Service 2020b).

ENVIRONMENTAL BASELINE

Regulations implementing the Act (50 CFR § 402.02) define the environmental baseline as the condition of the listed species or its designated critical habitat in the Action Area, without the consequences to the listed species or designated critical habitat caused by the Proposed Action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the Action Area, the anticipated impacts of all proposed Federal projects in the action that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline.

The Lower Rio Grande Valley, also referred to as the Rio Grande Valley, or the Valley, is at the lower tip of Texas and the main counties include the Starr, Hidalgo, Willacy and Cameron. The Action Area is located in Cameron County within the Gulf Prairies and Marshes Ecoregion and the Rio Grande Valley region which has 11 biotic communities. The Action Area falls within the loma/tidal flats biotic community. This community is characterized by wooded islands surrounded by tidal flats that are periodically inundated by water from South Bay and the Gulf of Mexico. Lomas are unique features found in the coastal plains of eastern Cameron County and are characterized as scattered clay dunes that formed by windblown saline clay particles originating from local salt flats that are largely barren of vegetation. Lomas typically range from 5 to 30 feet above mean high tide and from 10 to about 250 acres in size (USDA 1977). Vegetation communities on lomas range from dense mixed thornshrub communities or grassland habitats to nearly barren ground, depending on factors such as soil salinity (which varies from low to very high), erosion, and grazing pressure. Loma systems located within the Action Area are: Loma de la Pita (closest to the VLA), Loma de la Lena Seca, Loma Plato, Loma de los Equios, Loma Silvan, Loma de las Gachupines, Loma del Potrero Cercado, Loma Tio Alejos, Loma de la Jauja and Loma de la Montusa Chica (Figure 18). The open water areas are fringed with black mangroves and vegetated with seagrasses. Dunes often form around the tidal flats.

The Action Area includes a large portion of a wide north-south coastal corridor along the Rio Grande delta with a matrix of native rangeland, wetlands and upland communities extremely valuable to wildlife. The Action Area is primarily used for recreation (Boca Chica State Park, Boca Chica Beach, LRGVNWR, South Bay Preserve, Brazos Island State Park, Isla Blanca Park, and Palmito Ranch Battlefield NHL). Major water bodies in the Action Area are South Bay, Laguna Madre, Rio Grande, and the Gulf of Mexico. The southern end of South Bay is approximately 0.5 mile north of the VLA and Boca Chica Bay is approximately 0.03 mile. Boca Chica Bay is a subdelta of the Rio Grande which is about 2 miles from the launch site. The Gulf of Mexico lies east of the VLA with miles of beach and dune habitats at the water's edge and the Brownsville Ship Channel is approximately 4 miles north.

The property boundary of the VLA is immediately adjacent to a critical dunes area, and a portion of the property is designated as an undeveloped coastal barrier by the Coastal Barrier Resource Act. The VLA and LLCC are also located in the Federal Emergency Management Agency (FEMA) designated 100-year flood hazard areas (i.e., 1 percent annual chance flood events) based on the Flood Insurance Range Map for Cameron County, the VLA is in Zone AE and Zone VE while the LLCC is in Zone AE. VE is designated as a special hazard area subject to inundation by 1 percent annual chance flood events with additional hazards subject to erosion and overtopping from high tides and waves during storms. The Service owns the next 8 miles beneath SH 4 within the ROW with the exception of 0.13 mile that is owned by the Port of Brownsville. Most stormwater runoff in the Action Area flows away from the Brownsville Ship Channel, across the flats, and into large depressional areas where it ponds until it evaporates. Based on the Cameron County soil survey, the depth to water table in the Action Area typically ranges from the surface to 12 inches in the low tidal flats, 20 to 48 inches in the flat coastal prairie covering most of the Action Area, and deeper on the lomas and areas containing dredged material deposits. The closest water well in the Action Area is approximately 2 miles south of the VLA and LLCC.

The LRGVNWR's Boca Chica Tract is within the Action Area and adjacent to the VLA. The Boca Chica tract is 1,665.53 acres and the broader LRGVNWR is approximately 11,000 acres. The LRGVNWR is one of the state's most pristine and undeveloped areas. SH 4 parallels the Boca Chica tract and VLA and ends at the entrance of Boca Chica Beach and crosses wide expanses of coastal grasslands, lomas, and runs along the edge of South Bay. Botteri's sparrows (*Peucaea botterii*) can be observed at the Border Patrol Checkpoint. As many as 100 ospreys (*Pandion haliaetus*) may be seen perched on transmission lines. It is also a migration stopover site for peregrine falcons (*Falco peregrinus*) (Maechtle 1987) and supports breeding snowy plovers (*Charadrius alexandrines*) and Wilson's plovers (*Charadrius wilsonia*) (Zdravkovic 2005). Snowy plovers and Wilson's plovers nest in the flats that border the road and adjacent to the VLA. Piping plovers are common on the beach and tidal flats and spring migration brings red knots to the area along with other shorebirds. Aplomado falcons have been reintroduced to the area and nest and forage through the area.

Typical plants found in loma/tidal flats at and around the Boca Chica Launch site are comprised of scrub shrub and emergent wetlands. Vegetation is primarily comprised of saltgrass (*Distichlis spicata*), shoregrass (*Monanthocloe littoralis*), saltwort (*Batis maritima*), glasswort (*Salicornia virginica*), shoreline sea purslane (*Sesuvium portulacastrum*), sea ox-eye daisy (*Borrichia frutescens*), and gulf cordgrass (*Spartina spartinae*) (USACE 2012, 2021). Berlandier's fiddlewood (*Citharexlyum berlandieri*), Texas ebony (*Pithecellobium ebano*) and yucca (*Yucca treculeana*) are on higher lomas (Jahrsdoerfer and Leslie 1988; Service 1997). Black mangrove was also observed during field surveys for the 2013 consultation.

Upland vegetation is typified by pricklypear (*Opuntia engelmannii*), honey mesquite (*Prosopis glandulosa*), little bluestem (*Schizachyrium scoparium*), bushy bluestem (*Andropogon glomeratus*), giant reed (*Arundo donax*) (a non-native invasive species), cuman ragweed (*Ambrosia cumanensis*), and golden tickseed (*Coreopsis tinctoria*).

On the eastern area of the Boca Chica Launch Site, dunes occupy the beach above the high tide mark about 1,000 feet from the VLA, and are characterized by marsh/barrier island subtype 4 (Seaoats- seacoast bluestem grassland). This vegetation type is generally dominated by beach croton (*Croton punctatus*), single-spike paspalum (*Paspalum monostachyum*), Pan American balsamscale (*Elionurus tripsacoides*), flat sedge (*Cyperus* spp.), sea purslane (*Sesuvium portulacastrum*), bulrush (*Scirpus* spp.), beach morning-glory

(*Ipomoea imperati*), goat's foot morning glory (*Ipomoea pes-caprae*), sea rocket (*Cakile edentula*), and lime pricklyash (*Zanthoxylum fagara*) (McMahan et al. 1984).

Over the past six years, SpaceX has constructed launch facilities, a LLCC and VLA. Since completion of the 2013 consultation, SpaceX developed 16.8 acres (of the entire 47.4 acre-parcel) for the VLA. The developed part of the VLA has been improved for development by soil surcharging (i.e., layering soil to compact the lower layers to make it more conducive for foundations and pad development). Existing infrastructure at the VLA includes one launch pad with a launch mount (Pad A), one landing pad, two suborbital test pads, a test stand, access roads and parking areas, commodity storage areas, a water tank, crane and crane staging areas, temporary support infrastructure (e.g. office trailers), lighting and security fencing, and employee restrooms. The Integration Tower has been fully constructed at Pad A and is approximately 480 feet tall with a 10-foot lightning rod on top and includes black cladding. The 450-foot-tall crane used to integrate Starship/Super Heavy will be stored at the VLA and remain upright the majority of the time and lowered to approximately 250 feet during launches. Following construction of the integration towers, the crane would be used to move large articles such as vehicles and tanks. Adjacent to the VLA there is parking along SH 4 and a parking lot north of SH 4, has been cleared and in use
.
Since 2019, SpaceX has been conducting static fire tests and suborbital launches and landings of Starship prototypes under an existing licenses at the VLA as part of its Starship experimental test program (LRLO 20-119; FAA 2019a, 2019c, 2020a, and 2020b). This involves a series of up to 20 Starship suborbital launches per year from just a few inches above ground level to up to 30 kilometers (18 miles) above ground level and up to 420 seconds of static fire engine tests (FAA 2020a). Typical static fire duration is 15 seconds. Suborbital hops last several minutes and the test vehicle flies up to 30 km and then lands back at the VLA (FAA 2020a). Activities allowed under this the experimental test program will also include 3 Super Heavy launches, and 23 Starship land landings. Activity at the VLA also includes tank tests and day-to-day SpaceX maintenance activities, construction activities. These activities will occur even if the FAA does not license the Starship/ Super Heavy launch operations that are part of the Proposed Action. If the FAA issues a license for activities under the Proposed Action, that license would replace the license for the experimental test program. The license for activities under the Proposed Action would reduce the number of annual launches to 10 (5 orbital and 5 suborbital) and reduce the number of seconds of static fire to 285 seconds per year (each static fire would still be approximately 15 seconds).

The LLCC consists of the existing Stargate building where command and control of operations at the launch pad occur and the associated parking lot. The solar farm area was developed and currently consists of solar arrays and batteries for power storage. The solar arrays are 6.5 feet tall and composed of non-highly–reflective materials.

SpaceX also operates a private manufacturing and production area adjacent to the LLCC. Infrastructure and improvements at the adjacent SpaceX's private manufacturing and production area include buildings and tents (ground fabrication building, propulsion building, dome/ring manufacturing tents, nosecone manufacturing tent, hydraulic press tent, storage tent), hydraulic, bays for storing stacked vehicle components (low bay, mid bay, high bay, and wide bay), a wind profiler, satellite tracking station, Starlink ground station, air separation unit and 12 MW natural gas power plant. SpaceX also conducted site improvements on privately owned land related to employee housing (Boca Chica Village and Mars Pathfinder Recreational Vehicle Park), employee dining (Prancing Pony Restaurant) and employee transportation.

Additional environmental baseline is available in the PEA. The environmental baseline contributes to the status of the species in the Action Area.

Status of the Species within the Action Area

Ocelot and Jaguarundi

The ocelot and jaguarundi are treated together here because the two are thought to exhibit similar habitat preferences in South Texas, although information from Mexico indicates that the jaguarundi may be more tolerant of open areas such as grasslands and pastures than the ocelot (Campbell 2003). The cats also suffer from similar causes of population decline and are believed to benefit from similar recovery efforts. Ocelots are thought to utilize tracts of brush habitat within the Action Area, particularly along the irrigation canals, irrigation drains, natural drainages, shorelines, fence lines, and brushy road margins and lomas as travel or dispersal corridors. Jaguarundis may use this type of habitat as well if they moved into the area.

Except for the Boca Chica Launch Site, Boca Chica Village and SpaceX's operations there, and the area north of the Brownsville Ship Channel that includes Port Isabel, Laguna Vista, and the Town of South Padre Island, SH 4, and several ranches and businesses, the majority of the land within the Action Area is undeveloped. The area lies within the Tamaulipan Biotic Province as described by Blair (1950). The dominant landforms in the area in and around VLA and LLCC include lomas (ridges or clay dunes) and tidal flats. The elevations of the lomas range from 5 to 30 feet above mean high tide and areas from 10 to about 250 acres in size (USDA 1977). The lomas are generally characterized by mixed thornshrub community and composed of dominant species such as Texas ebony (*Pithecellobium flexicaule*), honey mesquite, retama, brasil (*Condalia hookeri*), granjeno, lotebush, allthorn, acacias (*Acacia spp*.), and Spanish dagger (*Yucca treculeana*). The thornshrub on the lomas varies from dense thickets to nearly barren ground. The flats are broad, level and in some cases barren. Over 90 percent of this habitat in the Lower Rio Grande Valley has been altered by agriculture and urban development (Service 2016a) and one percent of south Texas supports the dense thornscrub used by ocelots. In addition to the loss of habitat, impacts to ocelots and jaguarundis include border activities, roadways, international bridges, night lighting effects, and increases in noise and pollution.

It was estimated there were 53 individual ocelots in two separate populations in south Texas (Service 2016a). One population occurs in Willacy and Kenedy counties and the other in eastern Cameron County on LANWR. A third larger population occurs in Tamaulipas, Mexico (Service 2016a). The LANWR supports a population of ocelots (10-25) on and adjacent to the Laguna Atascosa Unit of the refuge (Service 2010). Both Texas populations are isolated from each other by approximately 19 miles. Ocelots have been documented moving between the Willacy County and Cameron County ocelot populations in Texas (Service 2016a). Janecka et al. (2008, 2011) analyzed genetic variation of ocelots from Cameron and Willacy counties and Tamaulipas, Mexico. Korn (2013) analyzed samples to establish pedigree relationships and both concluded ocelots have lost genetic diversity and are becoming increasingly isolated and inbreeding and genetic drift will be problems. This region is also part of the Bahia Grande Coastal Corridor Project (BGCCP) (Figure 16) a bi-national, federal, state and private land acquisition effort to link the globally significant Laguna Madre region of south Texas with the northern Mexico Gulf Coast (BGCCP 2014). Connectivity through migration of individual ocelots, with varying levels of genetic diversity and establishing north-south and east-west corridors with habitat improvements would increase range and may also facilitate ocelot population growth and reduce extinction risk (Service 2016a).

Agricultural land has been converted to urban development due to rapid population growth in south Texas' LRGV, increasing land and habitat fragmentation (Service 2016a). The human population in the LRGV increased 39.8 percent from 1990 to 2000 and is projected to increase 130.1 to 181.1 percent from 2000 to 2040 (Service 2016a). Population numbers for the Valley were 1,402,512 in January 2021. (https://www.rgvhealthconnect.org/demographicdata?id=281259&sectionId=935). The rapid population growth has increased further land and habitat fragmentation resulting in only 1 percent of dense thornscrub used by ocelots in south Texas and decreased opportunities to conduct habitat restoration and/or purchase lands for conservation (Service 2016a).

Besides habitat loss, collisions with motor vehicles in the Action Area are the most significant factor of ocelot and jaguarundi mortalities. Vehicular mortality accounted for 45 percent of deaths of 80 radio-tagged ocelots between 1983 and 2002 (Service 2016a). Over a 10-month period in 2015-2016, seven ocelots were killed by cars north of the Brownsville Ship Channel (TPWD 2017, 2018). Sixteen wildlife friendly crossings, with vegetation and fencing to funnel the cats and other wildlife under major roads, with known mortalities, were constructed as part of TxDOT planned roadwork. Of the sixteen, one was built under SH 48, nine on FM 106, four on SH 100, west of Port Isabel, and two on LANWR interior roads. The SH 100 underpass was completed in 2017 and the first underpasses opened in 2017 (TPWD 2017). Some of the others around LANWR were completed in July 2019. Early in 2020 a five-year old male ocelot, OM331, was caught on camera using a crossing under FM 106, traveling north to south (TPWD 2020). Other wildlife has been documented using the crossings, such as armadillos, bobcats, alligators and javelinas, but this is considered the first documented use of an ocelot using an underpass in the United States (TPWD 2020). The construction of those wildlife crossings are within or adjacent to the edges of the Action Area. Roads also may reduce successful dispersal between suitable habitat patches thus increasing genetic isolation of populations (Service 2016a).

Blanton & Associates (1998) reported a young male ocelot trapped and radio-collared in the area in April 1998, approximately 3.5 miles west of the proposed control center area. The ocelot was captured on an unnamed loma located between SH 4 and the Brownsville Ship Channel. The ocelot often traveled across extensive areas of open flats and the brush associated with the lomas along SH 4 and the Service's Loma Ecological Preserve to move between lomas and north of the Brownsville Ship Channel, settling into an area south of LANWR. A recent study completed by Blanton & Associates for a proposed LNG, north of the VLA, but within the action area involving 36,000 camera trap nights found no ocelots. An ocelot roadkill occurred Approximately 2.3 miles north of SH 4 in 1989. Additional sightings of ocelots north of the Action Area include a 1970 sighting south-southwest of Laguna Larga, 2.5 miles north of SH 48.

Single ocelot roadkills occurred on FM 510 in 1984, 1986, 1987, 1995, and two were reported killed in 2001 between the towns of Laguna Vista and Bayview. In 1989, a road-killed ocelot was found on SH 48 near its intersection with San Martin Loma. The ocelot was not radio-collared, and its origin and landscape use were unknown. In 1992, an ocelot was also reported on SH 48, 3 miles from SH100. Ocelots occur near the Holly Beach community just south of the known LANWR population of ocelots. Holly Beach and LANWR are located between 5 and 10 miles north of SH 48, which is north of the Action Area. The Raymondville Chronicle (2014) reported four ocelots road mortalities documented on SH 100, with three killed 1999-2004.

A jaguarundi was killed on SH 4 near FM 511 east of Brownsville in 1986 (Service 2016a). A cat resembling a jaguarundi was photographed in 1989 at the Audubon Society's Sabal Palm Sanctuary near Brownsville. There are no other confirmed sightings of jaguarundi in the U.S. nor known jaguarundi populations in the U.S. A viable jaguarundi population exists in the state of Tamaulipas, Mexico (which is approximately 150 miles from the Action Area), and suitable habitat exists within the Action Area, so the future occurrence of the jaguarundi in the Action Area cannot be ruled out.

These documented sightings of cats and the presence of ocelots on established refuge lands indicate that habitat is available in the Action Area to support ocelots and jaguarundis on lomas interspersed within the tidal flats and west of the VLA or LLCC. Many researchers (Ideker 1984, Tewes and Everett 1986,) and the Service (1990) believe that the continued existence of the isolated ocelot and jaguarundi populations depends upon protecting travel corridors connecting the existing main coastal populations of ocelots to the interior subpopulations, as well as to suitable habitat that they may occupy in the future. The Tamaulipas, Mexico population of jaguarundis make maintaining a north/south travel corridor between Mexico and Texas important for jaguarundi populations. The continued use of scarce habitat fragments makes these cats highly vulnerable to vehicle strikes, reduces genetic viability, and minimizes the likelihood of their survival and recovery in the wild.

Sea Turtles

The eastern boundary of the VLA perimeter fence is over 500 feet west of and separated by dunes from sea turtle nesting areas on Boca Chica Beach. South Padre Island beach surveys have been conducted on a regular basis since 1978. Under permit from the Service, sea turtle surveys in the Action Area are conducted by Sea Turtle, Inc. April through August of each year. The surveys are conducted using all-terrain vehicles (ATV). Surveys begin at sunrise. Turtle eggs are relocated and incubated within a fenced off corral for protection. Table 5 represents documented numbers of Kemp's ridley, green, and loggerhead sea turtle nests by year over a 10-year period, 2012 to 2021. South Padre Island (SPI) is approximately 36 miles long, from Mansfield Pass to the Brazos Santiago Pass. The Action Area includes approximately 25 percent of SPI, about 8 miles, from the northern boundary of the Action Area boundary south to the northern side of Brazos Santiago Pass, and the number of nests in the column labeled .25SPI in Table 5 represents approximately 25 percent of all nests found within the SPI portion of the Action Area. The other section of beach is Boca Chica Beach (BCB). The BCB stretches south from Brazos Santiago Pass to the Rio Grande for a total of approximately 7.5 miles. The number of nests on the BCB represents 100 percent of nests found on BCB within the Action Area. The leatherback and hawksbill are not represented on the table because neither has a documented nest within the Action Area.

According to Sea Turtle, Inc. data, there were no false crawls on BCB from 2011-2016, but there were a total of 11 false crawls from 2017-2021. A false crawl is when a sea turtle comes ashore and attempts to lay a clutch of eggs, dig a nest, but not actually depositing her eggs and returns to the water. The data did not indicate which species, but it is assumed all were Kemp's ridley because there were no green or loggerhead sea turtles documented on BCB in the last 10 years. A total of 11 false crawls over five years represents a mean of 2.2 per year.

Table. 5. Sea turtle nest numbers by year and location on Boca Chica Beach and 25 percent of the Action Area on South Padre Island (SPI) (Bonka 2021).

	Kemp's ridley			**Green**			**Loggerhead**		
	BCB	SPI	.25SPI	BCB	SPI	.25SPI	BCB	SPI	.25SPI
2012	10	59	14.75	0	2	.5	0	1	.25
2013	3	39	9.75	0	2	.5	0	1	.25
2014	2	21	5.25	0	0	0	0	0	0
2015	0	34	8.5	0	0	0	0	2	.5
2016	9	63	15.75	0	0	0	0	1	.25
2017	23	70	17.5	0	6	1.5	0	1	.25
2018	7	58	14.5	0	0	0	0	1	.25
2019	6	40	10	0	0	0	0	3	.75
2020	6	72	18	0	7	1.75	0	0	0
2021	5	61	15.25	0	0	0	0	0	0
TOTAL	*71*	*517*	*129.25*	*0*	*17*	*4.25*	*0*	*10*	*2.5*

Leatherback sea turtle
In 2008, the first leatherback nest confirmed on the Texas coast since the 1930s was found on Padre Island National Seashore, approximately 24 miles north of the Action Area (Shaver 2009). On November 22, 2018, a 500-pound leatherback sea turtle was found injured on South Padre Island. It died after 48 hours of a traumatic head injury. In June 2021, a leatherback sea turtle nest was discovered on South Padre Island between mile marker 6 and 7, just outside the Action Area boundary. It was the first nest to be found in Texas and successfully produce hatchlings. The hatchlings were released in August 2021 (https://myrgv.com/local-news/2021/08/06/leatherback-hatchlings-leave-rescuers-overjoyed/).

Hawksbill sea turtle
The only hawksbill nest documented on the Texas coast was in 1998 at Padre Island National Seashore, approximately 24 miles north of the Action Area (NPS 2012). The nest contained 140 eggs and 132 hatchlings from the nest were later released into the Gulf of Mexico (Shaver, 1999b). No hawksbill sea turtles have been recorded nesting in the Action Area (Sea Turtle, Inc. 2021). It is possible that additional nests were undetected, especially when patrols were not conducted or were less comprehensive.

Kemp's ridley sea turtle
In the United States, Kemp's ridley nesting primarily occurs in Texas, especially at the Padre Island National Seashore, about 24 miles north of the Action Area (NMFS and Service 2015).

Within the Action Area, approximately 271 Kemp's ridley sea turtle nests were located within the Action Area over the 10-year period 2012-2021, of which 20 were documented in 2021 (STI 2021).

Green sea turtle
In Texas, green sea turtles are known to nest on the beaches of North Padre Island (approximately 24 miles north of the Action Area) and SPI. Over a 10-year period, 2012-2021, approximately 4 green sea turtle nests have been documented within the Action Area. No green sea turtles were found in 2021 (STI 2021).

Loggerhead sea turtle
Loggerhead sea turtles have nested on the Texas coast. Over the 10-year period of 2012-2021 approximately 3 loggerhead nests have been documented within the Action Area. No loggerheads were documented to occur in 2021 (STI 2021)

Piping Plover

To date, various levels of survey effort have yielded piping plover numbers along the lower Texas coast. In 2009, migratory and winter surveys for piping plovers were conducted within the Lower Laguna Madre region in south Texas with 801 piping plovers observed during migratory surveys and 881 documented during wintering surveys. Numbers during the International Censuses at Boca Chica were 60 in 1991, 117 in 1996, 0 in 2001, and few in 2006. Maddock (2010) observed 239 piping plovers on the west and south sides of South Bay, within the Action Area and piping plovers were seen between South Bay on the north side of the road, on the south side of the road, and Boca Chica beach. During a visit to the SpaceX site on December 11, 2012, a Service biologist observed over 200 piping plovers in the flats along SH 4, which is also designated critical habitat.

Biology students with the University Texas – Rio Grande Valley (UTRGV) performed surveys of piping plovers (and other avian species) at the Boca Chica Launch Site from May 2015 through November 2021 (Hicks, Alexander, and Berg 2015; Hicks, Gabler, and Berg 2017, 2018, 2019, 2020, and 2021), with monitoring reports shared annually with the Service. The UTRGV biologists reported piping plover detections along 4 survey routes along Boca Chica Beach, and in the flats to the north and south of SH 4 in the vicinity of the Boca Chica Launch Site, including information on survey date, time, location (route and coordinates), and group size. Their analysis found "some evidence of an effect of year on the abundance of target species, particularly Piping Plovers and Red Knots." They noted that more years of data would be required to detect whether the downward trend was significant, but that as "more data are gathered, analysis will likely yield significant, negative temporal trends." They also noted that the detection of a trend was hampered by issues of limited accessibility, and major delays in contracting that resulted in no surveys being conducted in 2020 until August. SWCA Environmental Consultants (SWCA) performed a preliminary analysis of the student observational data collected by UTRGV for potential trends in piping plover abundance over time (SWCA 2022). Based on the data collected by UTRGV, SWCA found little to no strong evidence of a downward trend in piping plover observations through time (Figure 19).

In the most rigorous study to date, biologists from the Coastal Bend Bays and Estuaries Program surveyed piping plovers in the LRGV NWR, Boca Chica State Park, Brazos Island State Park and state-owned submerged lands including the Gulf Beach, from 2018 to 2021 (Newstead and Hill 2021 and 2022). Newstead and Hill (2022) summarize the data collected from the field including detections of marked and unmarked piping plovers, the number of surveys, and the date range of surveys. Newstead and Hill reported modeled estimates of piping plover abundance, survival rates, and probability of detection for uniquely marked piping plovers. Newstead and Hill (2021) reported a 54 percent decline in piping plover abundance between 2018 and 2021 (from 308.0 piping plovers in 2018 to 141.8 piping plovers in 2021) and characterized the trend as significant due to non-overlapping confidence intervals in the abundance estimates. (Figure 20).

Incorporating additional survey data for the 2021 year gathered after the initial study, and inclusion of a covariate to account for between-year differences in launch activities, the updated analysis (Newstead and Hill 2022) continued to show evidence of decline in 2019 and 2020, when launch activities were frequent and ongoing throughout the wintering season. The mean estimate for 2021 – a year in which there were no launch activities – showed a slight increase in the population though it was not significantly different from the two previous years, and the 95 percent confidence interval overlapped partly with that of the "pre-launch" year 2018. The top model indicated that recruitment was negatively affected during launch years, which is of high concern for the persistence of the population in the future.

Critical Habitat Unit TX-1: South Bay and Boca Chica is comprised of 7,217 acres in Cameron County. The boundaries of the unit start at the Loma Ochoa, following the Brownsville Ship Channel to the northeast out into the Gulf of Mexico to mean lower low water, then south along a line describing mean lower low water to the mouth of the Rio Grande, proceeding up the Rio Grande to Loma de Las Vacas, then from that point along a straight line north to Loma Ochoa. The unit does not include densely vegetated habitat within those boundaries. It includes wind tidal flats that are infrequently inundated by seasonal winds and the tidal flats in South Bay. Beaches within the unit reach from the mouth of the Rio Grande northward to Brazos Santiago Pass, south of South Padre Island. The southern and western boundaries follow the change in habitat from wind tidal flat, preferred by the piping plover, to where densely vegetated habitat, not used by the piping plover begins and where the constituent elements no longer occur. The upland areas extend to where densely vegetated habitat not used by the piping plover begins and where the constituent elements no longer occur and include areas used for roosting by the piping plover. Portions of this unit are owned and managed by the LRGVNWR, the South Bay Coastal Preserve, Boca Chica State Park, and private citizens (Figure 21).

Unit TX-2: Queen Isabella Causeway unit, is comprised of 6 acres in Cameron County. The area extends along the Laguna Madre west of the city of South Padre Island. The southern boundary is the Queen Isabella State Fishing Pier, and the northern boundary is at the shoreline due west of the end of Sunny Isles Street. The Queen Isabella Causeway bisects the shore but is not included in critical habitat. The eastern boundary is where the developed areas and/or dense vegetation begin, and the western boundary is the mean lower low water line. This unit contains land known as wind tidal flats that are infrequently inundated by seasonal wind-induced tide events.

Unit TX–3: Padre Island is comprised of 29,983 acres in Cameron, Willacy, Kenedy, and

Kleberg counties. This unit consists of four subunits. Portions of two of the subunits, TX-3A and TX-3B, are in the Action Area.

Subunit TX-3A: The southern boundary of this subunit is at Andy Bowie County Park in South Padre Island, and the northern boundary is the south boundary of PAIS. The eastern boundary is MLLW in the Gulf of Mexico, and the western boundary is mean lower low water line in the Laguna Madre. Areas of dense vegetation are not included in critical habitat for this species. This subunit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Subunit TX-3B: The boundaries of this subunit extend from Rincon de la Soledad to the southeast point of Mesquite Rincon, continue from that point west to the Laguna Madre shoreline at its intersection with the King Ranch boundary, and from that point to Rincon de la Soledad. This subunit includes lands known as wind tidal flats that are infrequently inundated by seasonal winds.

Special management considerations or protections have been implemented to ameliorate the threats of discharging fresh water across unvegetated tidal flats; activities associated with residential and commercial development; recreational disturbance of foraging and roosting plovers by humans, vehicles, and domestic animals; increased predation due to recreational use; and modification and loss of habitat due to beach cleaning and nourishment for recreational use have been implemented.

Red Knot

Morrison et al. (2006) estimated only about 300 red knots wintering along the Texas coast, based on surveys in January 2003 (Niles et al. 2008). Higher counts of roughly 700 to 2,500 red knots have recently been made near the Action Area on Padre Island, Texas during October, which could include wintering birds (Niles 2009, Newstead et al. 2013). Foster et al. (2009) found a mean daily abundance of 61.8 red knots, approximately 100 miles north of the Action Area, on Mustang Island, based on surveys every other day from 1979 to 2007. Similar winter counts (26 to 120 red knots) were reported by Dey et al. (2011a) for Mustang Island from 2005 to 2011. From 1979 to 2007, mean abundance of red knots on Mustang Island decreased 54 percent, but this may have been a localized response to increasing human disturbance, coastal development, and changing beach management practices (Newstead et al. 2013, Foster et al. 2009) (i.e., it is possible these birds shifted elsewhere in the region).

During the migration period, although foraging red knots can be found widely distributed in small numbers within suitable habitats, birds tend to concentrate in those areas where abundant food resources are consistently available from year to year (Fraser et al. 2010; Cohen et al. 2010, Niles et al. 2008, Smith et al. 2008; Botton et al. 1994).

Several areas in Texas have been identified as important wintering and migration stop over areas for red knots. These areas are important because they meet most of the habitat characteristics needed by red knots and have consistent red knot observations over several years. One of the important areas is the Boca Chica area adjacent to the Boca Chica Launch Site. The red knot is not a transient winter visitor to BCB. Occurrences of the species in this area suggest it is much more common and that it uses the Gulf beach and extensive tidal flats both north and south of SH 4.

As part of implementing the terms and conditions of the 2013 BO, UTRGV most recently conducted bird surveys between October 10, 2018, and November 25, 2019, on accessible U.S. soil within 3 miles of the Boca Chica Launch Site construction area. The surveyors observed red knots in the survey area; however, their presence was erratic and unpredictable. The surveyors recorded an average group size of 4.66 individuals in each quadrant, with a maximum group size of 15 individuals; however, UTRGV noted that this estimate may underestimate actual numbers of individuals. On one occasion in early May 2019, the UTRGV surveyors observed a large group of red knots (>150 individuals) on the Boca Chica route, but the survey could not be completed due to flooding. UTRGV also found that the species exhibited widespread use of the survey area during the study period and exhibited narrow time windows of occupancy during the year (UTRGV 2019).

On September 29, 2021, a Coastal Bend Bays and Estuaries Program biologist sighted a flock of approximately 1,225 red knots foraging and roosting in the flats north of the LLCC. Proposed critical habitat is based on an estimate of 4,631 birds during migratory seasons (spring and fall), with 3,000 of those remaining to winter in Texas. Based on that, the flock constituted 26.4 percent of the entire population relying on the Texas coast in the fall or over one fourth of the presumed migratory and wintering population in the western Gulf of Mexico (Pers. Comm., D. Newstead, Biologist, CBBEP, 2021).

The Boca Chica Launch Site is located within proposed red knot critical habitat Unit TX-11 (Figure 21). Unit TX–11 consists of approximately 15,400 acres of occupied habitat in Cameron County. The Boca Chica gulf shoreline portion of this unit begins south of the Brownsville Ship Channel and extends approximately 6.5 miles to the south. Within the South Bay, the northern boundary is south of Brownsville Ship Channel dredge spoil placement areas, and the southern boundary is north of the Rio Grande River. The eastern boundary is the back or bayside of the Boca Chica Beach up to where dense vegetation begins, and the western boundary is west of the loma islands up to where dense vegetation begins along the wind tidal flats. The unit includes wind tidal flats and all seagrass beds that are infrequently inundated and/or exposed at low tides, and the tidal flats within South Bay. Specific habitat types within this unit include: estuarine (bayside) seagrass mud or sand flats that are subtidal and are nearly flat areas with rooted vascular plants (seagrass) growing below the water surface in subtidal mud or sand substrate; estuarine (bayside) algal mud or sand flats regularly inundated by tides and that are nearly flat areas with a layer of algae growing on a moist mud or sand substrate and are otherwise devoid of vegetation; estuarine (bayside) algal mud or sand flats irregularly inundated by tides; estuarine (bayside) sandy shore (beach/sandbar) rarely exposed due to tidal fluctuation; estuarine (bayside) sandy shore (beach/sandbar) irregularly or regularly inundated by tides, depending upon the location; estuarine (bayside) sandy shore (beach/sandbar) spoils irregularly inundated by tides; and marine sandy coastline (beach) irregularly or regularly inundated by tides, depending upon the location. Lands within this unit include approximately 5,536 acres in Federal ownership (LRGVNWR), 4,080 acres in State ownership, and 5,784 acres in private/other ownership.

Northern Aplomado Falcon

Suitable foraging and nesting habitat for this species exists within the Action Area (Hunt et al 2013). Captive-bred aplomado falcon fledglings were released along coastal prairie of south Texas (839 birds from 22 sites during 1993-2004) and monitored by the Peregrine Fund. The releases yielded two nesting populations 15-18 pairs near Brownsville and 15 pairs on two islands near Rockport (Hunt et al 2013). The Brownsville population currently extends about 35 miles northward from the Mexican border through LANWR, all within the Action Area (Hunt et al 2013). Individual and breeding pairs were observed using coastal grasslands, coastal dunes and tidal flats for feeding, breeding, and sheltering. Approximately 65 artificial nest structures are maintained along the Texas coast. The closest platforms in the Action Area are 1 mile south of the LLCC, and 4.3 miles to the northwest and 9.3 miles west of the LLCC. The nearest known aplomado falcon territory is approximately 5-6 miles from the Boca Chica Launch site (Figure 22). Five aplomado falcon nestlings, a pair of adult falcons, and a female falcon were observed in 2011 and 2012 at two different nest structures. One structure was located approximately 4-5 miles northwest of the proposed SpaceX site and the other nest structure was along Highway 4, approximately 8 miles away (Pers. Comm., T. Anderson, Biologist, Ecological Services, 2013). However there is suitable habitat on the Mesa del Gavilan (just northwest and north of the Boca Chica Launch Site) and Loma de la Pita (south of the VLA and other lomas (southwest and west) within 3 miles from the proposed facility. Researchers observed approximately 65 falcons in 2019, along the Texas coast, down from the 100 observed in 2018, due to the losses from hurricane Harvey (TPWD 2019). No aplomado falcons were observed in the UTRGV bird surveys (UTRGV 2020).

The Service has been working closely with The Peregrine Fund to clear mesquite and huisache from grassland habitat in an established falcon territory on the LANWR, Bahia Grande Unit, but this type of landscape improvement is difficult and a slow process. Recent brush removal projects at Bahia Grande have restored approximately 2,500 to 2,700 acres of coastal prairie habitat for the aplomado falcon. The goal is to restore approximately an additional 1,000 to 1,500 acres in the Bahia Grande area. It is anticipated that such projects will help improve the falcon's survival (Service 2014b). However, protection of existing suitable habitat within the historic salt prairie habitats is a key priority (pers. Comm., C. Perez, 2022)

Factors affecting species environment and designated critical habitat within the Action Area

<u>Land Ownership</u>
Land in the Action Area is in private, state, or federal ownership or management. Those include private homes in Boca Chica Village, Brownsville Navigation District (BND), TPWD and Service NWR lands, and U.S. Border Patrol bridges and stations. Future land use in the project area is expected to be driven by the goals, objectives and mandates of these landowners and may have a direct relationship on the effectiveness of any structural conservation measures. SpaceX activities may negatively or eventually beneficially affect the species environment within the Action Area. Negative effects include land development, land management, Customs and Border Patrol activities, fragmentation of habitat, and conversion or loss of habitat. Brush clearing continues to be major limiting factor for feline populations in the Lower Rio Grande Valley (Collins 1984; Rappole 1986). The ocelot and jaguarundi also depend on densely

vegetated travel corridors along resacas, ramaderos, and between brush tracts (Rappole 1988). Such corridors facilitate dispersal through an otherwise cleared landscape. Vegetation removal associated with "clean farming" and water storage, delivery, and drainage has negatively affected felid populations by preventing travel between remnant brush tracts.

Habitat Acquisition and Management

The South Texas Refuges Complex is situated in southernmost Texas and is made up of Santa Ana and the LRGVNWR. LANWR is managed separately and is located within the Action Area. A wide array of wildlife species and large numbers of individuals flourish in the extant diverse habitat of the Lower Rio Grande Valley, due in part to warm climate year-round, moderate amounts of precipitation, and the Rio Grande flowing into the Gulf of Mexico. This wildlife and habitat diversity is economically important to the international border region as approximately 200,000 tourists annually spend approximately $150 million. Because approximately 95 percent of the vegetation in the LRGV has been cleared or altered, NWRs, state parks and wildlife areas, properties purchased for conservation by nonprofit organizations, and some private holdings, are important links in the efforts to protect the tremendous biodiversity and related economics of the region. The Service established the South Texas Refuge Complex to preserve and manage remnants of these communities and attempt restoration of adjacent disturbed lands.

The Service is continuing to acquire and enhance native Tamaulipan brushland around LANWR to promote movements of endangered cats between known and suspected areas of occupation. The resource protection and management strategy consists of four integrated approaches to address complex resource needs. They include: concentration of biotic community needs; maintenance of a wildlife habitat corridor; safeguarding of anchor units of large size; and protection of strategically placed management units of smaller size.

The Mexican Government and a number of interested Mexican and U.S. conservation organizations are focusing their attention on the ecologically valuable areas to the south of the project, including the Laguna Madre of Tamaulipas, Mexico and the Sierra de los Picachos, Nuevo Leon, Mexico. The Service's Lower Rio Grande/Rio Bravo Binational Ecosystem Team has been working with Mexico to establish a wildlife corridor along the Rio Grande within the Action Area and in Tamaulipas between Falcon Dam and the Laguna Madre to connect important ecologically valuable areas along both sides of the U.S./Mexico border. They are also working to connect these acres to the large blocks of intact habitat on the LANWR and on South Texas ranches to the north.

The use of corridors is becoming prevalent in reserve design (Noss 1987) in an attempt to maintain or restore natural landscape connectivity. Wildlife crossings provide avenues of safe passage for animals that need to cross heavily traveled roadways where there has been a loss of habitat connectivity. Increased connectivity, along with increased effective habitat area, counteracts habitat fragmentation (Noss 1987). Corridors facilitate gene flow and dispersal of individual animals (Soule and Simberoff 1986). Life histories of wide-ranging animals suggest that maintenance or restoration of landscape connectivity is a good management strategy (Noss 1987). A network of refuges connected by corridors may allow the persistence of far-ranging species that need more resources than are found in one refuge site.

Potential disadvantages of corridors, such as human disturbance, can be avoided by enlarging corridor width (Noss 1987). Necessary width depends on habitat structure and quality within the corridor, the surrounding habitat, human use patterns, and the particular species that are expected to use it (Noss 1987). The ideal corridor width along the Rio Grande would be wide enough for target species to access sufficient food, water, and cover. In this way, genetic exchange could occur along the corridor, and populations could be maintained even though density at any particular place in the corridor might be low.

International Boundary and Water Commission (IBWC) Activities

Through a Biological Opinion (BO) and memorandum of understanding (MOU) between the Service and IBWC, the IBWC agreed to provide a 33-foot wide corridor in the Rio Grande Floodway and the Off-River Floodway System. The vegetated corridor was to be adjacent to the Rio Grande or the 75-foot mowed areas and could contain segments of less-than-mature/climax vegetation not less than 3-feet in height (e.g., native grasses, sunflower, some cactus species), only if these segments were not so long as to prevent the cats from utilizing the mature/climax vegetation corridor or the larger dense brush habitat "islands". No take has been reported. The IBWC developed a plan to insure a viable ocelot/jaguarundi travel corridor to benefit both cat species by helping to avoid genetic isolation of populations and promoting their dispersal into suitable habitat.

The significance of this corridor is further enhanced by its connectivity to other narrow vegetation corridors associated with waterways such as irrigation canals and drainage ditches. However, in places along the river, the 33-foot-wide corridor contains only sparse vegetation less than 3 feet tall. In some areas, such as near and beneath the Gateway Bridge at Brownsville, the corridor is largely in private ownership, and, while the IBWC possesses easements allowing it to mow the vegetation in the corridor, it has not acquired permission from the landowners to plant vegetation. The only area at this time where the 33-foot wide corridor has been established is on the Service's refuge lands.

It is important to note the 33-foot-wide corridor is not the sole avenue for ocelot/jaguarundi movement in the Action Area. In many places along the river, there are much wider, moderately to densely-vegetated patches of habitat on both public and private lands which augment the nominal cat corridor. These patches provide potential home range habitat, as well as travel routes. Even where the floodway narrows there is additional good cover from the river's normal edge to the top of the adjacent river channel banks. Although IBWC mows the area within 75 feet of the river once a year, this riparian zone is covered by a nearly continuous patch of Carrizo cane, a combination of common and giant reed that regrows after mowing and fires from extensive rhizomes at a phenomenal rate, returning within weeks to the density associated with optimal ocelot habitat. Owing to its density and resilience, as well as its remoteness from the flood levee where most of the roads, human activity, and floodlights are located, this Carrizo cane zone an important travel corridor. An incidental take statement has been issued by the Service for one ocelot and one jaguarundi for the life of the project (20 years) in the 2003 BO prepared for the IBWC. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Past and present federal actions near the proposed action are discussed under the Environmental Baseline Section. No take has been reported.

U.S. Border Patrol (USBP) Activities
Current and past USBP activities have affected the species habitat. Portable and permanent lighting incorrectly positioned illuminates brush vegetation and causes the species to avoid such areas. Clearing of brushland for patrol roads, drag roads, and construction of ports of entry (POEs) has resulted in fragmentation and loss of habitat. Multiple roads between the flood levee and the river further fragment the habitat. There are a number of roads traversing LRGVNWR tracts. Brush habitat along the toe of the levee is fragmented due to USBP vehicles going down the south side of the levee toward the river and cutting through the wildlife corridor. Development around the ports of entries also resulted in loss, avoidance or fragmentation of habitat. The construction of 56 miles of border fence/wall in Cameron and Hidalgo counties has impacted private landowners, TPWD, and NWR land. The Service issued an incidental take statement for one ocelot and one jaguarundi for the life of the project (20 years) in the 2003 BO prepared for the USBP Operation Rio Grande. No take has been reported.

U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS) Activities
The Service also issued a BO in August 28, 2013, for APHIS's BA *for the U.S. Department of Agriculture, Animal and Health Inspection Service, Veterinary Services Cattle Fever Tick Eradication Program Cooperative Agreement for Surveys for Tick Vectors of Equine Piroplasmosis in Wildlife in South Texas.* APHIS will survey for the host range and geographic distribution of the tick *Amblyomma cajennense* in Texas that may serve as vectors of equine piroplasmosis. Surveys are to be conducted in Cameron County, which is in the Action Area. An incidental take statement was issued for one ocelot and/or jaguarundi because of potential trapping and vehicle mortality and one northern aplomado falcon from harm and harassment due to trapping and mist netting activities. No take has been reported.

On August 30, 2013, the Service issued a BO to USDA/APHIS under the Cattle Fever Tick Eradication Program. APHIS patrols the river trails along the Rio Grande to search for stray or smuggled potentially cattle fever tick-infested livestock and wildlife from Mexico. This project proposed trail clearing and maintenance of a sufficient width for safe passage of APHIS inspectors on horseback to seek and capture the animals. The Service issued incidental take for one ocelot and/or jaguarundi from harm and harassment due to trail maintenance activities. No take has been reported.

On July 7, 2015, the Service issued a BO for the APHIS Cattle Fever Tick Eradication Program's Tick Control Barrier in Maverick, Starr, Webb, and Zapata counties, Texas plans to enhance the eradication effort against cattle fever ticks in South Texas. The Proposed Action includes installation of approximately 70 miles of non-contiguous game fencing along SH 83 from Roma, in Starr County to the beach area in Cameron County, under agreements for cost-sharing with landowners. Recurrent cattle fever tick outbreaks are increasing in locations either within the Permanent Tick Quarantine Zone or outside of the zone in the cattle fever tick-free area of South Texas. The proposed fence would also help prevent re-infestation of areas where the pest has been or is being eliminated. The Service issued incidental take for one ocelot or jaguarundi from harm and harassment due to fence construction and maintenance activities. No take has been reported.

On January 24, 2017, the Service completed formal section 7 consultation for APHIS proposing the use of IvomecA® or IvomaxA.® (lvermectin) pour-on cattle formulation mixed with whole kernel corn bait in feeding stations on private properties to deliver a systemically active acaricide to control ticks in deer and prevent fever tick infestation in cattle. Incidental take for one ocelot or jaguarundi was authorized. No take has been reported.

On January 31, 2018, the Service completed formal section 7 consultation for the South Texas Refuge Complex to issue a Special Use Permit (SUP) to USDA-APHIS/ TAHC for experimentally grazing cattle treated with injectable acaricides, and feeding white-tailed deer ivermectin-treated corn from feeding stations at LANWR. Incidental take for one ocelot or jaguarundi was authorized in the event that a cat was harmed from placement and management of ivermectin (extra label use) in deer corn feeders or harmed or harassed by experimental cattle grazing activities. No take has been reported.

U.S. Army Corps of Engineers (USACE) Activities

USACE permits some nourishment activities that can widen beaches, change sediments and stratigraphy, alter coastal processes, plug dune gaps, and remove overwash areas. Tractor tilling or scraping used to clean area beaches has increased and can artificially steepen beaches, destabilize dunes, and change sediment distribution patterns. This can alter the sea turtle nesting areas, disrupt or impact deposited nests and nesting sea turtles and cause hatchling mortality, as well as change roosting and sheltering areas used by plovers and knots. Both nourishment and scraping activities can bury and suffocate benthic fauna consumed by shorebirds and prolong benthic recruitment or re-establishment. Artificial dune systems are constructed and maintained to protect beachfront structures. Development and excessive recreational use of beaches and flats, such as walking jogging, walking pets unleashed and operating vehicles increases potential impacts to species utilizing these habitats. Such activities could result in a loss of habitat, interference in nesting for sea turtles, disorientation of adult sea turtles and hatchlings from artificial lighting on the beach. No take has been reported.

The Service prepared a BO for the issuance of a USACE Department of the Army permit and a Refuge SUP for beach maintenance activities on 6.22 miles of beach on South Padre Island and 7.48 miles of beach at Boca Chica by the Cameron County Parks and Recreation and the Cameron County Public Works Departments. Incidental take was issued for three adult Kemp's ridley sea turtles and three nests per year, including all hatchlings and/or eggs (up to approximately 200 eggs), one adult loggerhead sea turtle and one nest per year, including all hatchlings and/or eggs (up to approximately 200 eggs) and one adult green sea turtle and one nest per year, including all hatchlings and/or eggs (up to approximately 200 eggs). No take has been reported.

Weather

Hurricanes generally produce damaging winds, storm tides and surges, and rain and can result in severe erosion of the beach and dune systems. Hurricanes and other storms can result in the direct loss of sea turtle nests, either by washing away of nests by wave action or inundation or "drowning" of the eggs or hatchlings developing within the nest or indirectly through erosion of nesting habitat. Depending on their frequency and severity, storms can affect sea turtles on either a short-term (nests lost for one season and/or temporary loss of nesting habitat) or long-term basis (habitat unable to recover).

Climate Change and Sea Level Rise

According to the Intergovernmental Panel on Climate Change Report (IPCC 2007), warming of the Earth's climate is unequivocal, as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of snow and ice, and rising sea level. The IPCC Report (2007) describes changes in natural ecosystems with potential wide-spread effects on many organisms, including marine mammals, reptiles, and migratory birds. Average temperature is predicted to rise from 36°F to 41˚F for North America by the end of this century (IPCC 2007). Species live within a narrow temperature range; changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation (Esteban, N. et al 2018). Ocean acidification resulting from massive amounts of carbon dioxide and pollutants released into the air can have adverse impacts species which use calcium carbonate to build shells and reefs such as sea turtles (Esteban, N. et al 2018). Also, sea turtles exhibit temperature dependent sex determination and rapidly increasing global temperatures yield warmer incubation temperatures and highly female-biased sex ratios (Glenn and Mrosovsky 2004, Hawkes et al. 2009).

One of the most certain consequences of climate change is rising sea levels (Titus and Narayanan 1995). Montagna et al (2009) reports tide-gauge records in South Texas, including the effects of land subsidence, show relative sea level rising at a rate of 0.18 inches/year at Rockport since 1948, 0.08 inches/year at Port Mansfield since 1963, and 0.14 inches/year at South Padre Island since 1958. Rockport is approximately 200 miles north, Port Mansfield approximately 80 miles north, and South Padre Island approximately 40 miles north of the project area. Modeled projections in the IPCC (2007) report indicate that significant portions of the Texas coastline will be inundated and a major redistribution of coastal habitats is likely. After adding estimates for local land subsidence, the amount of projected relative sea-level rise by the year 2100 is 0.66 to 2.00 feet at Port Mansfield and 1.12 to 2.46 feet at South Padre Island (Montagna et al. 2009). In areas with low-lying beaches where sand depth and longshore transport of sand is a limiting factor, the sea would inundate sea turtle nesting sites and decrease available nesting habitat (Fish et al. 2005; Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Baker et al. 2006). On some undeveloped beaches, shoreline migration would have limited effects on the suitability of nesting habitat. Bruun (1962) stated that during a sea level rise; a typical beach profile would maintain its configuration but will be translated landward and upward. However, along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels would cause severe effects. Erosion control structures can result in the permanent loss of dry nesting beach or deter nesting sea turtles from reaching suitable nesting sites (National Research Council 1990). Nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. The demand for both nourishment and the placement of hardened structures on the beach as management options for beach erosion are likely to increase in the future in the face of projected sea level rise and more intense storm activity associated with global climate change. Increasing storms and rising sea levels could damage or destroy sea turtle nests and nesting habitat, and temperature changes could skew sex ratios.

All of these actions or factors may have adverse effects on: ocelots, jaguarundis, northern aplomado falcons, sea turtles, wintering non-breeding red knots, red knot proposed critical habitat, piping plovers and piping plover critical habitat by destroying, diminishing, or altering the habitats on which these species depend.

Other Federal Actions

Several other federal actions have resulted in formal section 7 consultations with the Service and the issuance of incidental take for the ocelot, jaguarundi, aplomado falcon, piping plover, red knot, and sea turtles within the Action Area.

A formal section 7 consultation was conducted with Federal Highway Administration (FHWA) for SH 48 in 2004. The action included widening and improving approximately 9.7 miles of SH 48. The limits of the proposed construction were from SH 100 in Port Isabel to the Shrimp Basin near Brownsville. The highway was a two lane undivided road, with 12-foot wide main lanes, 8-foot-wide shoulders, and a 4- foot-wide flush median. The project expanded the roadway to a four-lane divided highway, with four 12-foot wide main lanes, two 10-foot wide outside shoulders, and two 4-foot wide inside shoulders with a concrete traffic barrier in the center. To avoid and minimize impacts to the endangered ocelot and jaguarundi TxDOT implemented a number of measures that included a bridge design wildlife crossing and associated diversion fencing on both sides of the highway. The BND granted the Service a 19-year conservation easement, 1,000-foot wide from the highway to the ship channel. Incidental take was provided for one ocelot and one jaguarundi. This project has been completed, and there has been no reported take of an ocelot or jaguarundi to date. Monitoring of the wildlife crossing, using camera traps, has not indicated any attempts to use the crossing by either an ocelot or a jaguarundi, although bobcats have used this crossing regularly.

A formal section consultation was completed for FHWA on improvements to FM 106 and Buena Vista Road in January 2005, and revised in June 2013. This project is located in the most northern end of the Action Area. This action included improving the existing two-lane roadway to meet State highway standards by resurfacing the existing lanes and adding shoulders and graded ditches for approximately 12 miles between FM 1847 and FM 510. The proposed improvements would provide a 44-foot wide rural roadway consisting of two 12- foot wide travel lanes with 10-foot wide shoulders. These improvements would require approximately 10 feet of additional ROW on either side of the road. Construction of this project was started in November 2015 and completed in fall of 2019. TxDOT proposed to install eight wildlife crossings on FM 106 and Buena Vista Road to avoid and minimize effects to the ocelot and jaguarundi and loss of travel corridor habitat. ROW fencing would also be installed and since installation of the crossings there has been documented use by ocelots. Currently 13 ocelot wildlife crossings are installed within the LANWR boundary. In the near future, there will be 25 ocelot wildlife crossings throughout the Rio Grande Valley in Hidalgo, Cameron, Willacy, and Kenedy counties. Incidental take was provided for an aggregate of four endangered cats over any five-year period related to the construction and use of FM 106. No take has been reported.

In 2010, the Service conducted a formal section 7 consultation with the Department of Homeland Security for the installation of a waterline for the Port Isabel Detention Center. The new 12-inch water line connected to an existing line at the corner of FM 2480 and FM 510. The new line followed FM 510 east to the intersection with FM 106, then turned north along FM 106 until it reached the detention facility. Incidental take was provided for the harassment of one ocelot and one jaguarundi during construction. Lethal take was not provided. This project has been completed, and there has been no reported take of an ocelot or jaguarundi to date.

A 2013 formal consultation was completed with the Federal Aviation Administration (FAA) for the SpaceX Boca Chica Launch Site (previously referenced as the SpaceX Texas Launch Site). At that time the FAA proposed to issue launch licenses and/or experimental permits to authorize SpaceX to launch Falcon 9 and Falcon Heavy orbital or suborbital vehicles from the launch site. The proposed vertical launch area was to occupy 20 of the 56.5 acres owned or leased by SpaceX. The rest of the acreage was to remain undeveloped/open space. SpaceX has constructed facilities, structures, and utility connections to support and operate a vertical launch site on a 47.4 acre parcel, plus 1.7 acres at the solar field, of land in Cameron County.

The Service authorized incidental take of two endangered cats (ocelots and/or jaguarundi), three adult Kemp's ridley sea turtles and three nests per year, including all hatchlings and/or eggs (up to approximately 200 eggs), one adult loggerhead sea turtle and one nest per year, including all hatchlings and/or eggs (up to approximately 200 eggs), one adult green sea turtle and one nest per year, including all hatchlings and/or eggs (up to approximately 200 eggs), one adult leatherback sea turtle and one nest per year, including all hatchlings and/or eggs (up to approximately 200 eggs), one adult hawksbill sea turtle and one nest per year, including all hatchlings and/or eggs (up to approximately 200 eggs), one northern aplomado falcon, and direct and indirect loss of 6.18 acres from construction and the conversion of 8.66 acres of occupied piping plover critical habitat in Critical Habitat Unit TX-1, for a total take of 14.84 acres of piping plover critical habitat. The proposed construction is complete and launch operations have been conducted for several years, and there has been no reported take of any listed species to date.

On October 1, 2019, the Service issued a BO to the Federal Energy Regulatory Commission (FERC) for the proposed construction a natural gas liquefaction facility and liquefied natural gas (LNG) export terminal approximately 9.8 miles east of Brownsville and about 2.2 miles west of Port Isabel in Cameron County, along the north embankment of the Brownsville Ship Channel, and associated 135 mile long Rio Bravo Pipeline in Cameron, Willacy, Kennedy, and Kleberg counties which interconnects to Rio Grande LNG terminal in Cameron County. The Service issued incidental take one ocelot or jaguarundi in the form of harm and/or harassment from construction for the life of the project (30 years) on 750.4 acres of a 984.2-acre parcel and 73.3 acres of 135.9 acres for the pipeline. The Rio Grande LNG facility is not yet built, but is proposed for a location more than five miles from the SpaceX site and the Texas LNG is also not yet built but would be more than 6 miles from the SpaceX site. No take has been reported

On October 21, 2019, the Service conducted a formal section 7 consultation with the FERC to authorize the construction and operation of the Annova LNG Project. Incidental take was issued for the loss of ocelot/jaguarundi habitat, and one ocelot or jaguarundi may be harmed from the construction, and for the life of the project (30 years) on 491 acres of the 731-acre Brownsville Navigation District parcel. Annova subsequently surrendered their license to construct and operate an LNG facility. The Rio Grande LNG facility is not yet built, but is proposed for a location more than five miles from the SpaceX site and the Texas LNG is also not yet built but would be more than 6 miles from the SpaceX site. No take has been reported.

On April 21, 2021, the Service issued a BO to FERC for the proposed issuance of a permit to construct and operate the Texas LNG project on approximately 285 acres of a 625-acre parcel of land leased from the Brownsville Navigation District, with an additional 26.5 acres outside of the 625-acre parcel necessary to provide deepwater access to the Brownsville Ship Channel. The BO addressed impacts to the ocelot and jaguarundi and issued incidental take for the loss of ocelot/jaguarundi habitat and one ocelot or jaguarundi that may be harmed from the construction on the 285 acres of the 625-acre parcel from Brownsville Navigation District. Construction has not started on this project.

EFFECTS OF THE ACTION

In accordance with 50 CFR 402.02, effects of the action are all consequences to listed species or critical habitat that are caused by the Proposed Action, including the consequences of all other activities that are caused by the Proposed Action. A consequence is caused by the Proposed Action if it would not occur but for the Proposed Action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see §402.17).

Beneficial effects are those effects of the Proposed Action that are completely positive, without any adverse effects to the listed species or its critical habitat. Direct effects are the direct or immediate effects of the project on the species or its habitat. Indirect effects are those that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur.

Beneficial effects

The Proposed Action will result in beneficial effects to the ocelot, jaguarundi, sea turtles, piping plovers or its critical habitat, northern aplomado falcons, or red knots and proposed critical habitat by the installation of wildlife guzzlers and donations to the Friends of LANWR Adopt-an-Ocelot Program, the Peregrine Fund, and STI.

Adverse Effects

Loss of Habitat

The Boca Chica Launch Site is composed of approximately 47.4 acres. Currently, the entire developed area of the VLA is fenced in, totaling approximately 16.8 acres. The undeveloped portion of the VLA expansion area consists of vegetated wetlands and tidal flats that are inundated in high and Spring tides and fill from and drain to the southern portion of the site. Typical impacts from floodplain development and filling include increased flood levels because floodwaters have been obstructed or diverted to other areas. Stormwater discharges could also increase from new impervious surfaces. Invasive species may be introduced by construction equipment and operation activities and will degrade habitat by displacing native species. Launch failures could result in the spread of debris and/or fires from explosions removing habitat. Spills of hazardous materials could occur during transportation or flood events and adversely impact soil, surface water and ground water adjacent or downgradient from the vertical launch and control centers. Emergency cleanup of debris or spills could result in removal or degradation of habitat. Destruction, modification and loss of habitat continue affecting listed species in the Action Area. Direct and indirect loss of habitat reduces a species' ability to reproduce, find food, find shelter, and survive.

Construction – At the VLA, solar farm, and parking lot areas, SpaceX proposes construction that would result in the permanent loss of 14.5 acres of upland and 17.16 acres of wetlands would be filled and converted to uplands. Of the 17.16 acres, 16.97 acres would be filled and converted at the VLA, 0.19 acres at the proposed parking lot, and no wetlands would be filled at the solar farm area (Figure 23, 24). In connection with this planned construction, SpaceX will need to obtain a Clean Water Act (CWA) Section 404 permit from the U.S. Army Corps of Engineers (USACE) for the Boca Chica Launch Site. USACE will issue its decision on SpaceX's proposal after completion of its review and compliance with its own procedures.

The proposed addition of three pull-offs along SH-4 would be located alongside the highway on uplands (Figure 9). The pull-offs would be less than a quarter of an acre and would be adjacent to a paved two-lane highway. They would not likely result in the removal of listed species habitat, but depending on the design may result in runoff from the site into wind tidal flats in a large rainfall event.

The removal of 1.7 acres of land for the expansion of the solar farm consists of primarily mowed grass. In the event solar infrastructure leaks or hazardous material or battery malfunction, it would be difficult to predict how much, if any, impacts to wind tidal flats would result from runoff because of runoff direction and amount of leaks are unknown. However, in the event there is runoff from an infrastructure leak SpaceX will coordinate with the Service to address any potential impacts that may have occurred and implement corrective action.

Operational impacts – New impervious surfaces may result in an increase in stormwater discharges to adjacent wetlands could cause vegetation to grow within the wind-tidal flats or reduce available piping plover food and roosting habitat in piping plover Critical Habitat Unit TX-1. Critical Habitat Unit TX-2, 3a and 3b are also within the Action Area; however, no direct loss of habitat will occur in TX-2 and 3a as no construction is planned in those units but the units will be impacted by noise, sonic booms and vibration.

Anomalies and removal of debris impacts – An anomaly may result in the spread of rocket and potential infrastructure debris on the VLA and/or adjacent occupied piping plover and red knot habitat and designated and proposed critical habitat. Removal techniques may involve drones to document the location of debris, equipment (dozers, trucks, off-road vehicles (ORVs), helicopters) to remove or drag the debris off the wind tidal flats and/or beach. In 2008, Martin et al, used aerial photography and GIS to examine propeller and ORV scarring in seagrass and wind-tidal flats of the upper Laguna Madre in the Padre Island National Seashore (PINS), Texas. PINS provides critical habitat for many shorebirds, including the piping plover and red knot and ORV use on PINS create scars in adjacent wind-tidal flats. Damage from ORV tracks can destroy benthic organisms and alter organic matter recycling lowering nutrient levels in the sediments (Belnap 1995). ORV tracks can also alter the natural hydrology by channelizing water flow leading to increased runoff and erosion (Martin et al 2008, Belnap 1995, Hinckley et al 1993). The lack of studies on ORV track persistence on wind tidal flats are rare, but in a desert region algal crust recovery can range from 35-65 years and from soil compaction hundreds of years (Belnap 1995).

Ocelot and Jaguarundi: LANWR supports the largest known Texas population of the ocelot and portions of LANWR are 8 miles away, but, within the Action Area. The VLA and LLCC and surrounding tidal flats do not include suitable habitat for the ocelot and jaguarundi. However, there are lomas interspersed throughout the expansive wind tidal flats adjacent to the VLA. The lomas could act as a travel corridor as cats cross unsuitable habitat. The loss of 31.07 acres of upland habitat was estimated in the 2013 BCO. An additional 14.5 acres of uplands will be lost as part of construction under the Proposed Action. The loss of upland habitat fragments ocelot and jaguarundi habitat that could be used for the cats to travel through the area or hunt and rest. The spread of debris from an anomaly and its removal from lomas could result in death or injury to a cat if in the vicinity or loss of habitat on the lomas and the surrounding wind tidal flats.

Northern Aplomado Falcon: Occupied nesting territories and foraging habitat occur within the Action Area. The three closest platforms are approximately 1 mile to the south, 2.7 miles to the southwest and 4.6 miles to the northwest of the LLCC (Service 2012b.) Although surveys performed by UTRGV for SpaceX reported no aplomado falcons had been recorded since the surveys began in 2015 (UTRGV 2020), on June 8, 2016 Service and Peregrine Fund staff documented an unpaired female falcon at the nest platform closest to the LLCC, which is within the Action Area. No falcons have been documented at that nest platform since that date. As of 2021, there were two occupied territories and four nest platforms within the Action Area. And, in past years, there have consistently been at least two to three active territories within the Action Area. The removal of habitat from construction activities at the VLA, LLCC or solar farm will not result in a loss of habitat for the falcon. However, the noise, heat, lights, and vibration generated from construction and operational activities could result in the falcons breeding or feeding in the area to abandon nests, hack sites and territories. This would result in the loss of that habitat because it has been rendered unsuitable for the aplomado falcon. Other areas within the Action Area that may be suitable for reintroductions and/or establishment of nest boxes for recovery will also be eliminated. Additionally, habitat loss and degradation on the breeding and wintering grounds of migratory birds negatively impact important avian prey species for aplomado falcons, such as mourning doves (*Zenaida macroura*) and meadowlarks (*Sturnella* spp.) (DeSante and George 1994; Gulf South Research Corporation and La Tierra Environmental Consulting 2013).

Sea Turtles: SpaceX's most eastern property boundary is approximately 100 feet east of the Boca Chica Beach dune line. No construction is proposed to occur directly on Boca Chica Beach, however, noise, vibration, heat and lights radiating over the dunes may result in effects to sea turtles. Heat from the heat plume will repeatedly burn vegetation and will not be able to survive. Nesting sea turtles may false crawl because of the noise and vibration of an igniting rocket or lighting and noise associated with SpaceX 24-hour, 7 day a week work activities. Nesting sea turtles and/or hatchlings could also be injured if a heat plume advanced or anomaly debris fell on the beach during egg laying or and/or hatchlings emerging from a missed nest

Piping Plover, Piping Plover Critical Habitat, Red Knot and proposed Red Knot Critical Habitat: Piping plover critical habitat Unit TX-1 consists of 7,317 acres. Figure 26 identifies the Action Area within Unit TX-1, covering 903.65 acres in the debris and heat plume areas that could be impacted by SpaceX activities that generate noise, vibration, and overpressure. Of the 903.65 acres, 444.27 acres includes high use foraging and roosting habitat. This includes unconsolidated shore, bare land, water and estuarine aquatic beds. These areas carry an increased risk of direct mortality, and habitat loss from thermal stress, falling debris from anomalies, damage from removal of debris, alteration of hydrology and erosion. The effects may also destroy or alter abundance and distribution of benthic organisms (Martin et al 2008, Belnap 1995). This will result in the loss and degradation of foraging and roosting habitat, which could result in decreased fitness and survivorship of wintering piping plovers. In addition, 40.61 acres of occupied piping plover habitat which is also piping plover critical habitat (within 903.65 acres identified above) will be permanently lost from the VLA expansion through construction and stormwater runoff (23.2 acres) from impervious cover.

Red knot proposed critical habitat Unit TX-11 consists of 15,400 acres and contains important habitat for foraging, roosting and sheltering (86 FR 37410). TX-11 overlaps piping plover critical habitat Unit TX-1 and corresponds to the 444.27 acres previously identified in the action area for piping plovers. This 444.27 acres supports red knot foraging, roosting and sheltering and will be impacted by noise, vibration and overpressure. All 444.27 acres would be impacted from thermal stress, falling debris from anomalies, damage from removal of debris and alteration of hydrology and erosion and destroy or alter abundance and distribution of benthic organisms (Martin et al 2008, Belnap 1995). In addition, 23.2 acres (within the 444.27 acres identified above) of occupied red knot habitat and proposed critical habitat will be permanently lost from construction and stormwater runoff from impervious surfaces within the VLA expansion.

Considering the critical habitat designated for the piping plover and proposed for the red knot across their ranges in the United States, impacts to 903.65 acres and loss of 444.27 acres of piping plover Unit TX-1 and red knot habitat and proposed critical habitat in Unit TX-11 would not represent an adverse modification of piping plover critical habitat or red knot proposed critical habitat.

Measures to minimize: To minimize potential impacts to listed species and critical habitat units, SpaceX will implement Terms and Conditions outlined in the BCO and the practices outlined in associated management plans found in Appendix E attached associated plans. SpaceX agrees to continue to work with the Service and TPWD to select appropriate native plant species to revegetate temporarily disturbed areas. SpaceX will reduce impacts to vegetated wetlands and wind tidal flats include locating the parking area predominately in uplands and locating installing, and siting payload and processing facilities away from wetlands. SpaceX's Spill Prevention, Control and Countermeasure Plan (SPCCP), Hazardous Material Management Plan (HMMP) and conservation measures to avoid and minimize erosion and sedimentation and to control the spread of invasive species will be implemented to help reduce potential adverse impacts.

SpaceX agrees to continue to work with the Service and TPWD to select appropriate native plant species to revegetate temporarily disturbed areas. SpaceX will reduce impacts to vegetated wetlands and wind tidal flats including locating the parking area predominately in uplands and locating, installing, and siting payload and processing facilities away from wetlands.

SpaceX will also continue working with the Peregrine Fund to monitor and identify suitable areas to reintroduce aplomado falcons and nests boxes. SpaceX will also continue working on a solar powered Starlink system to provide 24/7 video coverage of northern aplomado falcons and their habitats. Starlink video cam help better understand apolmado falcon predators, habitat requirements in the coastal salt prairie, diet, and more ways to recover the aplomado falcons. These efforts are outlined in the Terms and Conditions of this BCO.

Reduced Dispersal, Fragmentation and Isolation

Habitat fragmentation is the separation of a landscape into various land uses (development, agriculture, etc.) resulting in numerous small, disjointed habitat patches left for use by wildlife (van den Berg et al. 2001). Habitat fragmentation and habitat loss have negative effects on biodiversity such as species richness, population abundance and distribution. Donovan and Flather (2002) found species showing declining trends occur in areas with high loss of habitat. Habitat fragmentation has a larger number of small patches making it difficult for species to cross nonhabitat areas, isolating them to the matrix of patches, and increasing mortality and reduction of the overall population size. Habitat fragmentation also causes an edge effect where species leave the patch and enter the matrix and may increase mortality and reduce reproduction rate of the population (Fahrig 2002).

Ocelot and Jaguarundi: In Texas, 95.8 percent of land is privately owned. The Lower Rio Grande Valley has three large NWRs managed by the Service, LANWR, Santa Ana NWR, and the LRGVNWR. For over thirty years it has been the goal to develop a conservation corridor system linking these NWRs and other protected lands through a matrix of private lands (Stilley and Gabler 2021). The VLA and LLCC areas are located within the Rio Grande Valley Wildlife Corridor (Figures 16 and 17) which comprises a north-south coastal corridor on the eastern boundary of the Rio Grande delta that supports rangeland, wetland, and uplands that may be suitable for ocelot and/or jaguarundi movement. SpaceX construction and operational activities, and noise and disturbance can fragment the corridor that contains areas needed for breeding, feeding, and sheltering for species like the ocelot and jaguarundi that require large, unbroken blocks of habitat. Fragmentation of the corridor can isolate cats and reduce dispersal for breeding. Dispersal of cats may be temporarily impacted by proposed actions if the disturbance is such that the cats would return to Mexico and attempt to return at a later time to seek a new corridor. It is also possible cats may not return to the U.S. due to SpaceX activities and reduce the opportunities to increase or improve the genetic viability in Texas populations.

Northern Aplomado Falcon, Piping Plover, Red Knot: Current human population in the Lower Rio Grande Valley is 1.2 million (Source: 2010 Census), and approximately 25 percent increase over population levels in 2000 and an expected continued growth of about 4 percent per year. The population of aplomado falcons in the Brownsville area contains the majority of nesting territories, but is impacted by fragmented habitat among farms, ranches, brushlands, wind farms and development. Large ranches are converting into residential development, the Port that holds a lot of the prairie habitat, is planning a second-access highway to connect South Padre Island with the mainland, along with SpaceX existing and proposed development. The small habitat patches resulting from fragmentation often do not provide the food and cover resources for many species. This can result in an increased risk of death by predation if the animal has to venture beyond the cover of the patch to find new food resources, or potentially face starvation (USFS 2004).

Sea Turtles: Lighting, noise, vibration and or beach impacts from anomalies could cause adult females to false crawl or missed hatchlings to become disoriented, trapped in ruts, or be run over and reduce nesting success and dispersal.

<u>*Piping Plover, Piping Plover Critical Habitat, Red Knot, and Red Knot proposed Critical Habitat*</u>: Banding efforts of the Northern Great Plains, Great Lakes, and Atlantic piping plovers populations suggest plovers wintering at Boca Chica are almost entirely associated with the Northern Great Plains population (Gratto-Trevor et al 2011, Newstead and Hill 2021). Plovers exhibited strong site fidelity to nonbreeding areas during a study that studied movements, habitat use, and survival rates of 49 radio-marked piping plovers overwintering in the Laguna Madre of Texas from August 1997 to February 1998. Piping plover and red knot use habitat at Laguna Madre seasonally. Plovers move between algal flats and beach. They used the algal flats more during fall and spring than during winter and used exposed sand flats more during winter than fall and spring (Drake et al. 2001). The piping plover's preference for one habitat type or another largely depends on whether it is available given current wind and tide conditions (Newstead and Hill 2021). The Action Area has multiple types of habitat available for red knot and piping plover. Both species have small home ranges and exhibit wintering area site fidelity. Newstead and Hill (2021) suggest that these factors increase the importance of the area for this wintering population (Newstead and Hill 2021).

Gibson et al (2018) monitored banded piping plovers throughout their annual cycle to assess variation in body condition, true survival, and site fidelity related to disturbance regimes in eight nonbreeding areas along the southeastern Atlantic Coast from 2012 to 2016. Piping plovers in disturbed sites were 7 percent lighter than those in less disturbed sites and true annual survival was lower in more disturbed areas. They also found that individuals associated with disturbed habitat, during the nonbreeding season suffered physiological and demographic consequences and were more likely to leave the population through mortality than emigration influencing the sustainability of the piping plover population. The study also revealed that site fidelity to nonbreeding grounds was high even if disturbed and piping plovers were physiologically impaired and cautioned implementing management objectives based on the expectation that piping plovers will move to better nonbreeding habitats. Hatch-year individuals will continue to use the below-average sites and will remain attractive sinks to piping plovers. Management actions that limit human access to critical foraging or roosting areas during the nonbreeding season may increase functionally available habitat, thus improving body condition and survival rates.

<u>Noise</u>

Prior to 2013 and the construction and operation of the Boca Chica Launch Site, noise levels were estimated at less than 49 A-weighted decibels (dBA), relative loudness to the human ear, which represented a quiet rural or remote setting. Table 6 estimates Day-Night Average Sound Level (DNL) for rural or remote areas and several different categories of suburban and urban residential land use which can be used to represent DNL for the land uses in the area.

Currently, the Boca Chica Launch Site and the surrounding areas experience ongoing increased noise levels from SpaceX personnel working on-site, traffic, and SpaceX test and launch operations. Construction and modification of the VLA and solar farm is expected to occur over 24 months during the day and maybe at night if required. Construction noise, static fires, suborbital and orbital launches would be loudest at the VLA site and adjacent wind tidal flats, lomas, and Boca Chica beach.

Table 6. Estimated Background Sound Levels

Example Land Use Category	Average Residential Intensity (people per acre)	DNL (dBA)	Leq (dBA)	
			Daytime	Nighttime
Rural or remote areas	<2	<49	<48	<42
Quiet suburban residential	2	49	48	42
	4	52	53	47
	4.5	52	53	47
Quiet urban residential	9	55	56	50
Quiet commercial, industrial, andnormal urban residential	16	58	58	52
	20	59	60	54

Source: American National Standards Institute/American Standards Association S12.0-2013/Part 3dBA = A-weighted decibels; Leq = equivalent sound level; DNL Day-Night Average Sound Level

Noise can be continuous (constant), transient (short duration), or impulsive (typically less than 1 second). A transient noise event has a beginning and an end and sound temporarily rises above the background and then fades back into it. It is usually associated with a sound source that moves, such as aircraft overflight (USACHPPM 2005). A launch noise is considered to be a transient noise event. An impulsive sound is high intensity but of short duration. It has an abrupt onset, rapid decay, and a rapidly changing spectral composition. Sonic booms are classified as impulsive noise events. A sonic booms consists of shock waves created from supersonic flight when a launch vehicle travels faster than the speed of sound and are considered impulsive noise events (USACHPPM 2005). Sonic booms associated with the ascent of SpaceX vehicles would be directed up and in front of the vehicle and would not be heard. A sonic boom would be heard during Starship and Super Heavy landings. Suborbital launches by Starship would not generate a sonic boom during descent towards the VLA. A sonic boom may be created during a suborbital launch in the Gulf of Mexico, but it would be over water and not impact land.

Construction activities that would increase noise levels include construction equipment operating at the sites and construction/delivery vehicles traveling to and from the sites on SH 4. In addition, generators are expected to be used as emergency power and may be required as supplemental power. Starship and Super Heavy static fire engine tests are planned with all 6 and 37 engines, respectively firing for approximately 15 seconds. Ignition of rockets or static tests will create instantaneous noise audible for a considerable distance from the VLA. Starship/Super Heavy orbital launch events will be the loudest single event of the proposed launch operations. Noise from Starship suborbital launches would be less than Starship/Super Heavy orbital launches because fewer engines are used.

On behalf of SpaceX, KBR conducted engine noise modeling to predict the noise levels generated during Starship/Super Heavy launches (KBR 2020; see Appendix D). The modeled noise levels are shown in Figure 13. The L_{Amax} represents the maximum A-weighted sound level measured during an event. A-weighting approximates the natural range and sensitivity of human hearing (USACHPPM 2005). The L_{Amax} is used for the analysis of noise impacts to humans and wildlife. The L_{max} represents the maximum instantaneous sound level. The maximum levels for each static fire, suborbital orbital launches, and orbital launches of Starship/Super Heavy range from LAmax of 90 decibels A-weighted (dBA) to 140 dBA. For static fire tests, the LAmax 90 dB contour extends about 2.5 miles west of the VLA. For orbital launches of Starship/Super Heavy, the higher LAmax contours (100-140 dBA) are located within about 7 miles of the VLA. The 100 dBA contour extends into parts of South

Padre Island and Port Isabel, including the 90 DBA contour extends into Laguna Vista and eastern parts of Brownsville. Piping plover critical habitat units TX-1, 2, 3a, 3b and proposed red knot critical habitat unit TX-11 would also be in the 90-140 contours dBA sound contours for orbital launches. For suborbital Starship launches, the 90 dBA contour extends into Port Isabel.

Super Heavy booster and Starship landings at the VLA during orbital missions would generate lower sound levels than orbital launches because of the much lower total engine thrust used for landing operations. For Starship landings at the VLA, the 90 dB LAmax contour is about 5 miles from the VLA into Port Isabel and part of South Padre Island. Super Heavy landings at the same contour would be about 7 miles from the VLA. Residents of Brownsville may hear booster landing events above 60 dB, particularly nighttime landings. Visitors at Isla Blanca Park, approximately 5 miles north of the VLA, would experience elevated sound levels during a landing event. Noise during offshore Super Heavy landing events is not expected to be noticed by residents along the coast.

Max overpressure is the force left after a sonic boom and predicted overpressure levels for a Starship landing range from 1.2 to 2.2 pounds per square foot (psf). The 2.2 psf contour is estimated to be less than 1 nautical mile from land and overpressure between 2.20 and 1 psf are predicted to impact areas of South Padre Island. Overpressure levels for a Super Heavy landing at the VLA range from 2.5 psf to 15 psf. A very small area of Boca Chica State Park to the south of the VLA would experience up to 15 psf. A small portion of Brazos Island State Park and portions of Boca Chica State Park would experience levels of 11-15 psf. Boca Chica Village would experience 9 psf. The southern portion of South Padre Island is expected to experience 6 psf and Port Isabel and Laguna Heights are expected to experience 4-6 psf. The remainder of South Padre Island is expected to experience between 2-4 psf, and Laguna Vista and Tamaulipas, Mexico is expected to experience 2 psf. Mammals and birds would also potentially be startled and birds appear to be more affected behaviorally by a sonic boom than domestic mammals (Manci, K.M, at al. 1988). Overpressures less than 1 psf are not expected to adversely affect animals.

Overpressure levels range from 1 psf to 15 psf for a Super Heavy landing at the VLA). Brazos Island State Park, Boca Chica Bay, Boca Chica State Park, and portions of LRGVNWR would experience levels up to 15 psf. Boca Chica and the southern tip of South Padre Island are within the 6.0 psf contour. South Padre Island, Port Isabel, and the Port of Brownsville ship channel are included in the 4.0 psf contour. Sonic booms up to 1.0 psf would be expected to reach up to 15 miles from the VLA. If the magnitude is great enough, a sonic boom can cause building damage. Sonic booms with an over pressure of 0.5 to greater than 10 psf can cause structural damage to buildings. Sonic booms greater than 0.5 psf can also cause a startle effect on humans. People on South Padre Island would be expected to notice sonic booms from vehicle landings following an orbital mission. Mammals and birds would also potentially be startled and birds appear to be more affected behaviorally by a sonic boom than domestic mammals (Manci, K.M, at al. 1988). Modeled overpressures for a Super Heavy booster landing that are greater than 1 psf extend about 13 miles from the launch pad (Figure 15). Beyond 13 miles, modeled overpressures are less than 1 psf. Overpressures less than 1 psf are not expected to adversely affect animals. The primary impact associated with noise generated from construction, traffic, and vehicle launches is the startle effect, when birds or other wildlife are surprised by sudden, unexpected loud noises and leave the area abruptly. Noise can cause stress in animals and the range of autonomic responses to noise could range from no reaction to alerting, disruption of feeding and/or breeding and flight. It could also arouse defensive behaviors or masking. Masking occurs when noise interferes with the perception of sounds of interest, such as predator avoidance or social signals (Bowles 1995). In response to sonic boom, birds may "occasionally run, fly, or crowd" (Manci et al 1998). Listed species in the Action Area would be exposed to sonic booms generated by Starship and Super Heavy up to ten times per year (sonic booms impacting land would only occur during Starship/Super Heavy orbital missions). The responses are also hard to predict because disturbance may depend on species.

Dorado-Correa et al (2018) investigated the effects of traffic noise on telomeres, a DNA-protein structures found at both ends of each chromosome, on zebra finches (*Taenopygia guttata*). Telomere loss can provide a link between early stress exposure and longevity. The study showed that chronic exposure to traffic noise increases rates of telomere loss in older juvenile zebra finches. It also suggests that anthropogenic noise increases telomere attrition rate and may be a biomarker for reduced long-term survival which may even effect population dynamics of birds in noise polluted areas.

For orbital launches of Starship/Super Heavy, the higher LAmax contour's (100-140 dBA) are located within about 7 miles of the VLA. Table 2 shows that Starship suborbital launches are proposed to occur up to 5 times a year and Starship/Super Heavy orbital launches are proposed to occur up to 5 times a year, which would result in up to 10 Starship landings and 5 Super Heavy landings a year.

Ocelots and Jaguarundi: There are no known studies that specifically address the effects of noise on ocelots or jaguarundis, in fact, information about the effect of noise on felines is lacking. Therefore, we have used studies of the effects of noise on other mammals as a surrogate to analyze the effects of noise caused by SpaceX activities on ocelots and jaguarundis. Studies of terrestrial mammals have shown that noise levels of 120 dBA can damage mammal's ears (NoiseQuest 2013). Levels at 95 dBA can cause temporary loss of hearing sensitivity (NoiseQuest 2013). Noise from aircraft has also affected large carnivores by causing changes in home ranges, foraging patterns, and breeding behavior (NoiseQuest 2013).

Ocelots and jaguarundis are known to use the lomas scattered throughout the Action Area to cross expansive tidal flats around and adjacent to the VLA. Noise levels at the lomas will reach between 100 and 120 dB, thereby possibly injuring the cat's ears and hearing ability. Noise from testing and launches could also startle the cats causing a negative effect of running and avoidance behavior and increased energy use. It is reasonable to assume that the cats could display a range of responses to noise; they could have no reaction, become alert, stop foraging, alter travel routes, or become startled and flee the area. Startle effects and alteration of travel routes could increase chances of vehicular mortality along SH 4.

Northern Aplomado Falcon: Ellis et al (1991) looked at effects of low-level military jet aircraft and mid-to high-altitude sonic booms on nesting peregrine falcons. Peregrine falcons are similar in size and behavior to aplomado falcons and are appropriate to use as surrogates. Jet passes and sonic booms often caused noticeable alarm, and peregrine falcons demonstrated crouching, or rare flushing from the perch or nest. Ellis et al (1991) also noticed negative responses became rarer and peregrine falcons potentially became habituated to the noises or types of noises that occur and stop exhibiting the startle response. Foraging, nesting, and perching habitat for the northern aplomado falcon exists within the Action Area. The closest known nest occurs 1 mile, from the LLCC and the closest active nest is within approximately 4.3 miles of the VLA. For orbital launches of Starship/Super Heavy, the higher L_{Amax} contours (100-140 dBA) are located within 7 miles of the VLA. These noise levels could cause adult aplomado falcons to flush from the nest leaving eggs or small chicks exposed to inclement weather or predators, although they may get habituated to the noise later in time. These noise levels may also reduce aplomado falcon foraging efficiency and feeding time. Falcons could also experience reduced communication ranges, interference with predator/prey detection, or habitat avoidance in the Action Area (NoiseQuest 2013). More intense impacts may include behavioral change, disorientation, or hearing loss if falcons are within closer range of the launch pad at the time of ignition of rockets.

Sea Turtles: Noise may cause sea turtles reaching nesting beaches to startle and return to the water, false crawl, and not lay eggs. The National Aviation Service conducted a study in 1990, on the impacts of the Zakynthos, Greece airport on nesting sea turtles. It revealed the disturbance of the low flying jets over loggerhead sea turtle nesting beaches caused females to return to the sea without successful laying (Euroturtle 2013). Given the distance between the launch pads and potential sea turtle nesting habitat on Boca Chica Beach is approximately 0.18 mile; noise levels at the nesting beach could reach 120 to 130 dBA and could adversely affect sea turtles.

Salas (2022) of Woods Hole Oceanographic Institution presented preliminary evidence of the effects of intense noise on aquatic turtles at the 2022 Ocean Science Meeting on 4 March 2022. Her findings were that underwater noise pollution can cause turtles to experience hearing loss that can last from minutes to days. The researchers focused their experiments on two non-threatened species of freshwater turtles and exposed them to noise. The induced noise caused a temporary threshold shift (TTS) which is the decrease in the animals hearing sensitivity due to noise. Turtles affected by the noise pollution in the wild would be less able to detect sounds in their environment for communication or detect approaching predators.

Piping Plover, Piping Plover Critical Habitat, Red Knot and Red Knot proposed Critical Habitat: Birds demonstrate startle effects when exposed to a sound pressure level (SPL) of 108 dBA (Burger 1981). Noise levels exceeding 108 dBA will occur during static fires, suborbital and orbital launches. High-noise events may cause birds to engage in escape or avoidance behavior and they may flush and expend energy that may affect survival or growth, or they may spend less time engaged in necessary activities like feeding and preening (NoiseQuest 2013).

Monitoring of snowy plovers at Vandenberg Air Force Base showed them to crouch and observe objects such as helicopters or launch vehicles that mimic avian predators, or flush at launch but soon return to normal behavior (FAA 2013). Piping plovers are expected to have a startle response that interferes with normal behaviors such as feeding or roosting.

Laboratory findings show that if a bird is exposed to continuous noise level above 110 dBA SPL, hearing will likely be damaged (Dooling and Popper 2007). However, highway noise above 93 dBA SPL might mask important communication signals used by birds, and possibly lead to behavioral or physiological effects (Dooling and Popper 2007). Piping plovers in Critical Habitat Unit TX-1 will be impacted by noise from construction and launches. Critical Habitat Units TX-2, TX-3a and 3b will not be directly affected by construction. However, these critical habitat units may be impacted by noise generated by a launch of the Starship/Super Heavy because piping plovers and red knots may disperse and stop using CH for feeding and roosting.

Measures to minimize: To reduce impacts, SpaceX has contracted with Sea Turtle, Inc. to remove nests for protected incubation and to document false crawls and/or missed nests. Surveying the beach prior to and after static fires or launch events assists Sea Turtle, Inc. in documenting false crawls and or missed nests to SpaceX and the Service.

Rocket Heat Plume

Ignition of the Starship and Super Heavy Raptor engines during static fire engine tests and launches (including landings) would generate a heat plume that would surround the launch pad and surrounding areas. The plume would appear clear and consist of heat (and steam if deluge water was used in the future) and extend radially from the center of the pad. The heat plume generated from Starship/Super Heavy orbital launches would travel away from launch pad, with temperatures of about 212 °F approximately 0.3 mile from the launch pad and temperatures reaching ambient temperatures (90 °F) approximately 0.6 miles from the launch pad (Figure 27). Orbital launches would create the largest and hottest plume from the ignition of all Super Heavy's 37 Raptor engines. Static fire engine tests, landings, and suborbital launches would all require fewer engines and would generate a smaller, cooler plume compared to an orbital launch. The highest heat levels are expected to occur directly around the launch mount and are not expected to exceed 300 degrees outside of the VLA.

Individual animals in the heat plume danger area would likely disperse before the heat spreads out due to the noise associated with engine ignition. However, less mobile animals unable to disperse quickly could be exposed to the heat plume and die or be injured. Potential impacts from the vegetative changes due to the heat plume include loss of sensitive species, loss of plant community structure, reduction in total cover and replacement of some native species with weed species.

Ocelot and Jaguarundi: Rocket plumes may injure or kill individual cats if they within the .3- or .6-mile radius at the time of ignition. However, operational noise from the launch vehicle tank preparing to ignite could cause the cats to startle and leave the area prior to ignition. The ignition phase would last approximately 30 seconds.

Northern Aplomado Falcon: The heat plume from engine ignition could harm or kill individual falcons; however, operational noise (e.g., gas venting from the launch vehicle tank) could cause falcons that are located near the launch vehicle during an operation to fly away prior to engine ignition.

Sea Turtles: The heat plume is not expected to affect sea turtle nests that are missed on prelaunch surveys because the eggs are buried in the sand and Sea Turtle, Inc. patrols the beach pre-and post-launches to detect nests. Post launch patrols would find any dead turtles and potentially damaged nests. If a nest is found, the eggs would be relocated to a corral or facility. Nesting females and hatchlings could be affected by the heat plume if they were on the beach at the time of engine ignition. Kemp's ridley is a daytime nester, although it has been known to nest at night occasionally. The remaining sea turtle species nest during the night when ongoing operations, static fires or launches occur, but not as often. Nests and hatchlings that are missed by patrollers will be subject to adverse effects including death or serious injury.

Piping Plover, Piping Plover Critical Habitat, Red Knot, and Red Knot proposed Critical Habitat: Piping plovers and red knots do not nest within the Action Area and so nesting would not be impacted. The heat plume generated by the Raptor engines would cause high temperatures to radiate from the launch pad. Temperatures would be temporary and not expected to cause permanent damage to the unvegetated flats used by piping plovers and red knots. However, piping plovers or red knots could be exposed directly to the exhaust plume and could be burned by the hot gas, but would need to be flying through the path of the exhaust plume at the time of ignition. It is also anticipated that the birds would startle and fly away by the noise of the launch engines. At this time no deluge water is being proposed, therefore an evaporative cloud is not anticipated that could result in the potential conversion of wind-tidal flats associated with piping plover Critical Habitat Unit TX-1 and red knot proposed Critical Habitat Unit TX-11.

Measures to minimize: The heat plume will last 2-3 seconds as it generated by the engines at launch. The rocket makes noise at is being prepared for launch and it is anticipated that cats, shorebirds and falcons will be startled and move away from the area. STI, will perform a pre- and post-launch survey for sea turtles that may be nesting or attempting to nest and launch will not occur until the sea turtle has completed nesting and the eggs removed. If a turtle was missed or a nest and hatchlings are seen emerging from a missed turtle prior to launch the launch will be delayed. If a missed turtle was injured and observed on a post-launch survey the Service will be notified and protocol followed.

Night Lighting

Night lighting represents a potential stressor to nesting sea turtles on nearby Boca Chica Beach as well as migrating birds and nocturnal species. Light emissions are light sources that illuminate an area in the surrounding environment. Sources of light emissions include launch site lighting, employee/customer parking lighting, airborne and ground-based aircraft operations and roadway lighting. Glare is light emission being redirected off of a reflective surface such as window glass in a facility. There are no state or local regulations that govern visual resources and light emissions in Texas. SpaceX would attempt to conduct most launches and tests between the hours of 7:00 a.m. and 7:00 p.m. However, there could be delays or missions that require launching at a specific time at night to achieve a particular orbital position. During nighttime launch activity, SpaceX would require bright spotlighting for short durations when illuminating the launch vehicle. In addition to nighttime launch activity, SpaceX would need to perform ground support operations 24/7 at the VLA throughout the year using white lighting for the safety of SpaceX personnel. SpaceX assumes that 20 percent of annual operations could occur at night.

Ocelot and Jaguarundi: Cats are predominately nocturnal, active overnight and at dawn and dusk and may avoid lit areas and seek other north-south travel corridors through the lomas, expending additional energy and increasing the potential for vehicular mortality on SH 4 if startled by lights or avoiding lighted areas of constructive or operational activities. Lighting could affect activity patterns of the ocelot and jaguarundis. Evening activity levels could be reduced or redirected to more dense vegetation reducing the availability of prey and restricting movements of the cats themselves (Grigione and Mrykalo 2004).

Northern Aplomado Falcon, Piping Plover, Piping Plover Critical Habitat, Red Knot and proposed Critical Habitat: Some birds may be attracted to light, especially when migrating during overcast nights, causing them to be disoriented and collide with buildings or other structures (FAA 2013). Aplomado falcons generally roost at night, so impacts should be minimal, however some falcons have exhibited some nighttime activity as they have been documented to hunt for insects under street lights in Palenque, Chiapas Mexico (personal comm. C. Perez, 2022). To minimize collisions with the four lightning towers and the water tower, these structures will be lit in accordance with the Federal Communications Commission's (FCC) guidelines.

Sea Turtles: All five species of sea turtles have been recorded nesting within the Action Area. Kemp's ridley sea turtles predominately nest during the day and is the most common species of sea turtle to nest in the Action Area. All other sea turtle species nest at night. Anthropogenic light sources have had documented negative effects on sea turtles. Adult females looking for nesting beaches seek dark stretches of suitable shoreline. Unshielded lights can deter females from crawling onto a beach to nest. When hatchlings emerge they seek the nearest available light source, which on an undeveloped beach is the horizon over the ocean. Lights shining in the vicinity of the nest can disorient emerging hatchlings, leading them away from the ocean making them more vulnerable to predation, desiccation, or crushing by vehicles. Hatchlings that have reached the surf can also become disoriented by lighting and have been documented to leave the surf (NMFS and Service 2007). Hatchlings whose sea-finding is disrupted by unnatural stimuli often die from exhaustion, dehydration, predation, or other causes (Witherington et al. 2014). Some of these behavioral effects on adult turtles and disorientation of young turtles are expected to occur.

Some structures within the launch complex, use amber LEDs or low pressure sodium bulbs for exterior night lighting. Most of these facilities are not located immediately adjacent to the beach, which limits the potential effects on listed species However they do contribute to elevated levels of ambient light and are some of the only lights on barrier islands within the Action Area. Such night lighting can negatively impact nesting sea turtles.

All sea turtle nests detected on Texas beaches are collected, and the eggs are incubated in facilities. However, it is possible that sea turtle patrol personnel could be unable to access the beach, thereby missing a sea turtle nest event and fail to collect and relocate eggs.

Piping Plover, Piping Plover Critical Habitat, Red Knot, and Red Knot proposed Critical Habitat: Anthropogenic lighting from construction or operation attracts migrating birds, especially during times of reduced visibility. Piping plovers and red knots effects can range in intensity from collisions with structures resulting in injury or mortality, to lesser effects including expenditure of energy or delay in arrival at wintering grounds (Gauthreaux and Belser 2006). Plover visual acuity and maneuverability are known to be good (Burger et al. 2011), including night vision (Staine and Burger 1994), suggesting that plovers may be able to identify and avoid structures in flight paths. Plover collisions with fixed structures in the coastal zones are rarely documented (Service 2008). Migrating red knots may be exposed to similar risks.

Measures to minimize: To minimize potential impacts SpaceX will implement the Lighting Management Plan (Appendix F) and doing regular inspections will help reduce the effects these lights have on turtles, but some adverse effects to sea turtles, either in the form of hatchling disorientations or reducing the likelihood of nesting may occur when launches occur within sea turtle nesting season.

Hazardous Materials

Hazardous materials have the potential to impact the listed species and the piping plover's critical habitat and red knot's proposed critical habitat in the Action Area. Construction and operational activities would require the use of hazardous materials. Most of the hazardous materials expected to be used are common to construction activities and include diesel fuel, gasoline, and propane to fuel the construction equipment; hydraulic fluids, oils, and lubricants; welding gases; paints; solvents; adhesives; and batteries. Processing and maintenance of launch vehicles may generate small quantities of hazardous waste. Those include waste oils, spent solvents, paint waste, spill response materials, and used batteries. The solar array infrastructure may generate small amounts of lithium cobalite and lithium hexaflorophosphate by charging too fast or physical mechanical damage causing a fire. Stormwater or wastewater runoff also has the possibility of accumulating spilled hazardous material into the adjacent tidal flats or lomas, contaminating those areas or resulting in a loss of habitat and vegetation.

Ocelots and Jaguarundi, Northern Aplomado Falcon, Sea Turtles, Piping Plover, Piping Plover Critical Habitat, Red Knot, Red Knot and proposed Critical Habitat: An accidental release of hazardous materials during construction (e.g., equipment fuel spill) could affect individual listed species if they were exposed to the contaminant, which could cause injury, sickness, or death. Accidental spills could also affect vegetated habitat, including designated critical habitat, by damaging or killing plants, which could affect plant density and diversity.

Measures to minimize: To reduce potential impacts, SpaceX's Spill Prevention, Control, and Countermeasures Plan (SPCC Plan) would be implemented in accordance with the Clean Water Act requirements included in 40 CFR Part 112 to outline proper management and spill response procedures for changes in the oils and fuels stored at the SpaceX Boca Chica Launch Site. Retired solar panels shall be handled as Recyclable Hazardous Waste and sent to a contracted recycler. If treatment or wastewater is needed, the water would be retained in retention ponds adjacent to the launch mount.

Ground Vibrations

Some energy from rocket launches and static tests will manifest as vibration in the ground near the launch pad. Vibration may be significant from rocket launches and engine tests. Effects from vibrations are likely to add to species disturbance and cause abnormal behaviors. However, vibrations from launch operations would only last a few minutes.

Ocelot, Jaguarundi, Northern Aplomado Falcon, Piping Plover, Piping Plover Critical Habitat, Red Knot, and Red Knot proposed Critical Habitat: Ground vibrations could result from a launch or static fire, or vehicular motion during construction and operations. Species reactions could vary depending on their proximity to the launch site or construction/operation activities. These species may experience some startle effect and/or habitat avoidance. Impacts should last only a few minutes and normal behavior would resume afterwards.

Sea Turtles: Vibrations caused by moving maintenance vehicles and/or equipment, launches, and static fire near the beach could frighten nesting turtles, causing them to false crawl (NMFS and Service 1991a, 1991b, 1992; Ernest et al. 1998). Vibrations could also harm incubating eggs, but this is difficult to assess because scientific data are lacking to fully understand the level of impact on sea turtles from vibrations or noise. The closest nesting sea turtle habitat to the proposed launch pad is at Boca Chica Beach, a distance of approximately 800-900 feet, and vibration from the rocket launches could cause nesting turtles to abandon their nesting attempt and potentially harm incubating eggs.

All sea turtle nests detected on Texas beaches are collected, and the eggs are incubated in facilities. However, it is possible that sea turtle patrol personnel could be unable to access the beach, thereby missing a sea turtle nest event and fail to collect and relocate eggs.

Increased Traffic and Human Presence

An increase in vehicle traffic during daily operations from construction and SpaceX operations personnel increases the potential for vehicle collisions with wildlife, including listed species. In addition, increased traffic and human presence could cause wildlife to avoid the area. Most of the traffic from construction and operations would occur during daylight hours. SpaceX anticipates that up to 55 construction vehicles a day would be associated with the construction period. In addition, up to 450 SpaceX staff vehicles would be expected per day in the area as well. The Proposed Action is anticipated to add up to 505 vehicles per day within the LRGVNWR and within SH 4 corridor providing access to Boca Chica Beach and the VLA. Table 7 provides data from TxDOT that illustrates steadily increasing traffic from 2013-2020. Data provided for cumulative vehicle activity period of October 1, 2021 to April 15, 2021 by CBP indicates the largest number of hourly vehicle crossings, leaving Boca Chica Beach traveling west towards Brownsville, occurs at 7 a.m. and 7 p.m., peak hours for species to be active (Figure 28). Increased traffic during these two time periods may be related to SpaceX shift changes.

Table 7. Daily Annual Average Traffic (AADT) (Traffic Web Viewer, TxDOT)

Year at 31H55A (about.30 miles west of the CBP Checkpoint) 25.919946, -97.374726 Object ID_1 7119, Pharr District, Cameron County, TX	Daily Annual Average	Total Annual vehicles
AADT_2020	1,428	521,220
AADT_2019	745	271,925
AADT_2018	708	258,420
AADT_2017	537	196,005
AADT_2016	383	139,795
AADT_2015	326	118,990
AADT_2014	273	99,645
AADT_2013	285	10,4025

(*Transportation Planning and Programming (TPP) Division's Traffic section at TxDOT, Data Source: Statewide Traffic Analysis and Reporting System (STARS II) May 3, 2022*)

Ocelot and Jaguarundi: Although not documented for the ocelot and jaguarundi, several responses to human disturbance can be expected in felines. For example, Florida panthers shifted their habitat use area in response to hunters although no changes related to energy intakes (activity rates, movement rates or predation success) were noted (Janis and Clark 2002). In another study, lynxes were found to have a median tolerance limit to approaching humans of 164 feet and they tolerated a closer approach by humans when in denser habitats than in more open areas (Sunde et al 1998 as cited by Tempel et al 2006). In general, typical wildlife responses to human disturbance may be fleeing, increased vigilance, and changes in habitat selection (Frid and Dill 2002).

Ocelots have been seen crossing paved linear structures such as roads and have been documented on SH 4. Data indicates that vehicular collisions are a significant source of ocelot mortality, with 44 percent (12 of 27) of known ocelot mortalities from 1982 to 1996 likely being vehicle related (Hewitt et al. 1998) and 45 percent of the total ocelot mortality documented in South Texas between 1983 and 2002 likely being vehicle related (Haines et al. 2005) (Figure 29).

Peak ocelot activity is around sunset and sunrise with continued activity during the night hours, the exact time periods hourly vehicle crossings are at their peak. Heavy traffic at this time with other noise effects could startle the cats and/or lighting effects could cause the cats to adjust their feeding or transitioning habits and increase the risk of road mortality if forced to cross SH 4. Posting of wildlife crossing signs by TxDOT may educate workers and public about reducing speeds, however greater law enforcement presence is recommended.

Northern Aplomado Falcon: Mortality from bird-vehicular collisions are estimated at the lowest range to be between 62 and 275 million birds each year. Only predation by free ranging domestic cats and collisions with buildings and windows cause greater annual bird mortality in the United States (Loss et al. 2014, Service 2020c). Although possible, there has not been any documented vehicular mortality of the northern aplomado falcon within the Action Area.

Human presence and disturbance from testing or launches could also displace adult aplomado falcons from established nesting structures approximately 1 mile from the LLCC and 2.7 miles from the VLA. Disturbance during nesting may cause the adult to leave the nest, exposing eggs or small young to inclement weather or predators. Disturbance may also reduce foraging efficiency and feeding time. Human disturbance or noise from pre-launch operations would likely cause aplomado falcons to take flight prior to launch.

Sea Turtles: Vehicle collisions with sea turtle hatchlings during the daytime have been recorded near and adjacent to the VLA. Beach visitors found *in situ* nest hatching on Boca Chica Beach and attempted to provide safe passage, but some hatchlings were killed by passing vehicles driving on the beach and later taken by gulls (Pers. Comm., D. Shaver, Sea Turtle Coordinator, NPS 2006). Additionally, there was a report of a stranded turtle being hit by a vehicle on South Padre Island (Pers. Comm., D. Shaver, Sea Turtle Coordinator, NPS 2007).

Sea turtles reaching Boca Chica Beach, just 1,000 feet east of the VLA, to nest may return to the water, false crawl, and not lay eggs due to vehicular movement or human disturbance (Bonka 2021, FAA 2017, 2020). Operation of Sherriff patrols or SpaceX security vehicles during or after launch closures and during anomaly closures on the Boca Chica Beach can crush nesting turtles or stranded turtles, as well as eggs in and/or hatchlings emerging from a missed nest (Mann 1977; NMFS and Service 1991a, 1991b, 1992, 1993; Ernest et al. 1998). Adult loggerhead and green sea turtles nest at night and most female Kemp's ridley nest during daylight hours and may be caught in the morning hours on the beach at some stage of nesting: oviposition, covering the nest, or exiting and returning to the ocean. Hatchlings may also emerge at night or early in the morning from any nests missed by the daily sea turtle patrols. Hatchlings could get disoriented by vehicular or construction and operational lights and turn away from the ocean or get caught in tire ruts possibly incurring dehydration, injury, or death.

Species which prey on sea turtle nests or young turtles, such as coyotes (*Canis latrans*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis)* and fire ants *(Solenopsis invicta),* may be attracted to the construction area by garbage generated by employees, and may increase in number as a result of the increased food resources provided by the garbage, thus posing a greater risk to the sea turtles

Piping Plover, Piping Plover Critical Habitat, Red Knot and proposed Critical Habitat: Driving is allowed in many areas of the piping plover and red knot wintering grounds in the Action Area from the mean low tide line to the line of vegetation on the shore. Increased vehicular access due to recreation or Sheriff or SpaceX security patrols may increase ruts or berms. SpaceX vehicles driving on the beach could cause injury to plovers that may be resting in ruts, or next to a berm, especially during inclement weather, and/or expose critical habitat to further erosion and removal of organic matter and food sources. Direct mortality from construction equipment may occur if plovers and red knots do not disperse prior to equipment or vehicular use during construction at the VLA.

Zonick and Ryan (1996) found that in Texas, human disturbance decreases the amount of undisturbed habitat and appears to limit local piping plover abundance. Piping plovers and red knots will likely be flushed from the Action Area expending energy and interrupting foraging or roosting. This is expected to be a temporary disturbance.

Measure to minimize impacts: SpaceX will educate its personnel on the potential for vehicle collisions with ocelots and jaguarundis and other endangered species and encourage personnel to utilize the employee shuttle and, if a personal or company vehicle must be used, encourage personnel to reduce speeds along SH 4. Vehicles would be restricted to existing paved and unpaved roads, parking areas, and authorized construction sites. Vehicle operators within the VLA would not exceed 25 miles per hour. Beach clearing activities prior to a closure are handled by Sheriff Deputies. SpaceX security patrols are only on the beach during anomaly events. When they are present on the beach they will use 4X4 pickup trucks and require their staff to travel at 10-15 mph.

Tall Structures

The construction of new structures could pose a potential collision impact to birds. During the daytime, birds collide with windows because they see reflections of the landscape in the glass (e.g., clouds, sky, vegetation, or the ground); or they see through glass to perceived habitat (including potted plants or vegetation inside buildings) or to the sky on the other side (Service 2016b). Research indicates that collision mortality increases with structure height for most structures (e.g., communication towers and wind turbines) (Loss et al. 2014, Service 2020c). At night, during spring and fall bird migrations when inclement weather occurs, birds can be attracted to lighted structures resulting in collisions, entrapment, excess energy expenditure, and exhaustion (Manville 2009). Lighting could also attract raptors or other migratory birds to the vertical launch area for perching.

Ocelot and Jaguarundi: No impacts are expected from tall structures, unless lights from the tall structures are illuminating the lomas or travel corridor. Lighting could affect activity patterns of the ocelot and jaguarundis. Evening activity levels could be reduced or redirected to more dense vegetation reducing the availability of prey and restricting movements of the cats themselves (Grigione and Mrykalo 2004).

Northern Aplomado Falcon, Piping Plover, Piping Plover Critical Habitat, Red Knot, and Red Knot proposed Critical Habitat: The falcon could perch on taller structures seeking prey or collide with the structures and windows during flight. Piping plovers and red knots are subject to collisions with tall structures during flight, they may be attracted to the lights during foggy periods or during low light causing injury or mortality.

Sea Turtles: No direct impacts are expected from glass effects. However, lighting of the 480-foot tall integrated tower, rocket and other taller structures having lights on during the night may shine on onto the beach during sea turtle nesting season and cause a false crawl or cause hatchlings to get disoriented and result in injury or mortality.

Measures to minimize: To minimize potential impacts of incidental take from taller structures, lighting would be reduced by complying with established lighting plan (Appendix E) for minimizing disorienting effects on migratory birds. Nest building and perching will be discouraged by the use of visual fright devices and monopole technology.

Invasive Species Introductions

Proposed construction activities have the potential to degrade habitat or change vegetation and habitat structure and spread invasive plants. Invasive species could be introduced to the area through construction equipment brought to the launch site or from traffic associated with deliveries and shipments of supplies.

Ocelots and Jaguarundi: Lomas used by the cats to transit through the area may experience loss of vegetation or conversion to non-native species in the event an anomaly occurs and disturbed by efforts to remove fallen debris.

Northern Aplomado Falcon: Coastal prairie grasslands could experience changes in plant species composition or abundance including increased woody species thereby, reducing the coastal prairie foraging habitat for falcons. Fires and fallen debris change the landscape and plant community.

Sea Turtles: Construction will not be performed on the beach and is not expected to result in the loss of beach habitat for sea turtles.

Piping Plover, Piping Plover Critical Habitat, Red Knot and proposed Critical Habitat: Project activities could convert wind tidal flats, which the piping plovers and red knots use for foraging, to vegetated flats. This could result in the loss of 444.27 acres of occupied piping plover critical habitat which occurs within the 903.65 acres of piping plover critical habitat to be impacted. Impacts would occur to 444.27 acres of red knot proposed critical habitat in TX-11 which overlays piping plover critical habitat Unit TX-1.

Measures to minimize: SpaceX would continue to perform routine inspections of construction areas to identify and remove any invasive plant species in an effort to reduce impacts and restrict the spread of invasive species within the Action Area. Vegetation monitoring will be implemented as outlined in the Biological Monitoring Plan and reported annually.

Anomaly

Anomalies and removal of debris impacts – An anomaly may result in the spread of rocket and potential infrastructure debris on the VLA and/or adjacent occupied piping plover and red knot habitat and designated and proposed critical habitat. Removal techniques may involve drones to document the location of debris, equipment (dozers, trucks, off-road vehicles (ORVs), helicopters) to remove or drag the debris off the wind tidal flats and/or beach. In 2008, Martin et al, used aerial photography and GIS to examine propeller and ORV scarring in seagrass and wind-tidal flats of the upper Laguna Madre in the Padre Island National Seashore (PINS), Texas. PINS provides critical habitat for the piping plover and red knot and ORV use on PINS creates scars in adjacent wind-tidal flats. Damage from ORV tracks can destroy benthic organisms and alter organic matter recycling lowering nutrient levels in the sediments (Belnap 1995). ORV tracks can also alter the natural hydrology by channelizing water flow leading to increased runoff and erosion (Martin et al 2008, Belnap 1995, Hinckley et al 1993). The lack of studies on ORV track persistence on wind tidal flats are rare, but in a desert region, algal crust recovery can range from 35-65 years and recovery from soil compaction takes hundreds of years (Belnap 1995).

A Starship/Super Heavy test operation or launch could fail (referred to as an anomaly) and of 17 recorded Starship/Super Heavy tests and launch operations 11 different types of anomalies have occurred since SpaceX began its experimental activity. Seven anomalies have resulted in the spreading of debris to state and refuge lands, including LRGVNWR and four occurred on the VLA.

Piping plover and red knot wind tidal flat habitat and piping plover critical habitat and red knot proposed critical habitat was damaged by fallen rocket debris and removal efforts. If additional anomalies or explosions occur, listed species adjacent to the launch pad or within areas impacted by falling debris could be injured or killed. In addition, fires could start from an explosion which could result in a loss of habitat. The habitat would be lost until vegetation has been restored.

Ocelots and Jaguarundi: Cats in the area or passing through may be killed or injured by an explosion or by falling debris. They also could be startled and caused to disperse. Habitat on the lomas could be damaged or destroyed by falling debris, fires or the cleanup efforts. Measures to reduce damage from fire and anomalies are included in the Fire Management Plan and the Anomaly Response Plan (Appendix E).

Northern Aplomado Falcon: Coastal prairie grasslands could experience changes in species composition or abundance because of falling debris, fires, and cleanup efforts reducing the foraging habitat for falcons. A falcon could also be killed, injured or startled from its nest site causing it to abandon chicks or eggs during an explosion or fire.

Sea Turtles: Debris and fire from anomalies has not occurred on the beach, but could in the future. Sea turtles on the beach at the time of the explosion or during debris removal could be killed or injured or a nest missed for protected incubation could be crushed.

Piping Plover, Piping Plover Critical Habitat, Red Knot, and Red Knot proposed Critical Habitat: Piping plover and red knot habitat and critical habitat could be reduced or lost or converted by debris and retrieval and removal of debris. This could result in the loss of 444.27 acres of piping plover critical habitat which occurs within the 903.65 acres of piping plover critical habitat to be impacted. Impacts would occur to 444.27 acres of red knot proposed critical habitat in TX-11 which overlays piping plover critical habitat Unit TX-1.

Measures to minimize: To reduce impacts, immediately following an anomaly, SpaceX would coordinate with TPWD and the Service prior to any attempt of cleanup to: minimize damage to the Refuge lands and sensitive historic, biological, and geological resources. SpaceX would also follow the emergency response and cleanup procedures outlined in the Hazardous Materials Emergency Response Plan and Fire Mitigation and Response Plan (if a fire occurs) and the Anomaly Plan.

Monitoring

The intent of conducting frequent surveys, implementing area closures and posting signage, and similar actions is to reduce or avoid impacts to listed species by detecting them early. However, these activities, could result in some adverse effects to listed species because they result in increased human access and activity within the beach, loma and wind-tidal habitats.

Ocelots and Jaguarundi: The cats could be startled by human activity during monitoring, a temporary impact.

Northern Aplomado Falcon: Falcons could be disturbed and foraging or nesting activities interrupted. It is expected to be a temporary impact.

Sea Turtles: Sea Turtle, Inc. is experienced in performing sea turtle surveys and it is unlikely that there would be any effects to sea turtles from monitoring efforts. However, sea turtle patrollers may drive up on a sea turtle crawling onto the beach and trained monitors may have to dig into a nest and remove the eggs but these activities are currently covered under a Section 10(a)(1)(a) scientific permit.

Piping Plover, Piping Plover Critical Habitat, Red Knot and proposed Critical Habitat: Piping plovers and red knots are generally disturbed to some degree during monitoring. Habitat and critical habitat could be impacted if survey efforts result in an ATV or vehicle being used to perform the surveys veers off into the flats. Human disturbance could startle or flush the birds during foraging or roosting.

Critical Habitat

The total impact (construction and/or operational) of 903.65 acres within piping plover Units TX-1, TX-2, TX-3A and TX-3B represents .5 percent of all designated wintering critical habitat (165,211acres) in the United States. Considering the effects of SpaceX's activities being authorized by the issuance of FAA's experimental permit or launch license on these units of critical habitat, the fact that only 444.27 acres is being impacted together with the effects on the other 141 designated units, the overall effect on wintering piping plover critical habitat is expected to be minimal. The affected critical habitat would continue to serve its intended conservation role for the wintering piping plover and would retain the current ability for the physical and biological features and not appreciably reduce the conservation value of all proposed and designated critical habitat for the winter piping plover.

Red knot critical habitat is being proposed to be designated over 127 units (18 of which are further subdivided into 46 subunits) across 13 states totaling 683,405 acres (personal comm., Moni Belton, Service, 2022). The total impact of 444.27 acres of red knot proposed critical habitat Unit TX-11, and overlaps piping plover critical habitat Unit TX-1 represents 6.5 percent of all habitat across 13 states in the wintering and migration area of the red knot.

Measures to minimize: Biologist familiar with surveys for cats, sea turtles, aplomado falcons piping plovers and red knots will conduct required monitoring and will implement monitoring as outlined in the Biological Monitoring Plan. Results will be submitted annually to the Service for review and if necessary revised.

CUMULATIVE EFFECTS

Cumulative effects considered in this Opinion are those "effects of future State or private activities, not involving federal activities that are reasonably certain to occur within the Action Area of the Federal action subject to consultation" (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Past and present federal actions near the proposed action are discussed under the Environmental Baseline Section. The October 2021 BA includes a review of future non-federal activities that are reasonably certain to occur in the Action Area and that may contribute cumulative effects relevant to the Services' BCO, which is incorporated here by reference.

Wind energy projects have increased in the Rio Grande Valley and impact listed species habitat by clearing thornscrub habitat and fragmenting the landscape. Wind energy projects do not have a federal nexus and conservation measures are voluntary unless they pursue a Habitat Conservation Plan and receive an Endangered Species Act section 10(a)(1)(b) permit from the Service.

Urban development brings increased noise, light, fencing, and human disturbance. Customs and Border Protection operations that include roads with high speed traffic, drag roads, off-road traffic impacts, lights, fencing, and road maintenance will also likely result in the loss of habitat. Customs and Border operations were waived from federal consultation for the construction of the border wall.

Privately funded activities that include rehabilitation and construction of buildings and parking areas and rehabilitation of existing buildings such as at the Port of Brownsville (Port of Brownsville 2020) may not require federal permits or section 7 consultation.

The TxDOT is planning multiple transportation improvement projects within the Action Area that may result in potential cumulative effects to listed species or critical habitat when combined with the Proposed Action. Most of the projects consist of pavement rehabilitation and preventative maintenance activities on the existing roadway (SH 4). In addition, TxDOT proposes improvements at two locations along SH 4 entirely within TxDOT's 200 foot-wide ROW. One location would involve a turn-around to be located approximately 750 feet west from the end of the existing roadway. The purpose is to create a turnaround for larger vehicles along the entrance to Boca Chica Beach, near the end of the state-maintained roadway. The second location would involve a proposed Cameron County pull-out parking area to be located approximately 1,120 feet further west of the proposed turnaround. The parking area will consist of approximately nine parking spaces to be entirely within TxDOT's 200-foot–wide ROW. "No Parking" signs will be placed between the pull-out parking areas and the turnaround and west of the pull-out area/SpaceX launch area to the end of the State maintained roadway (Figure 25).

The City of South Padre Island is planning to improve Laguna Boulevard with 11 foot-travel lanes and an elevated 8-foot shared use path on the west side of the street. The project will improve the drainage and incorporate low impact development so the City can become more resilient (South Padre Island 2020). Road expansions to accommodate the Rio Grande Valley development and road network, North American Free Trade Agreement, and border crossings will likely increase loss and fragmentation of habitat and increase road mortality for the cats.

Other SpaceX Activities

As explained above, SpaceX has constructed launch-related infrastructure, including the VLA, the LLCC, a solar farm and other support infrastructure, and has been conducting licensed launch operations, including suborbital launches, since 2019. SpaceX has also built and continues to operate a production and manufacturing facility on privately owned property near the LLCC. SpaceX has developed large production tents and support buildings and plans to build an additional production tent and high bays. Further west of the production area, SpaceX has developed office space, storage areas assembled for Starship and Super Heavy vehicles, and water wells. Both areas are operated 24 hours a day, 7 days a week, and are staffed by approximately 450 people.

SpaceX's manufacturing and processing activities and associated development are occurring on private land, are privately funded, they do not require federal approval, and are planned to continue regardless of whether the FAA issues SpaceX licenses for Starship/Super Heavy operations. FAA determined it considers these ongoing and anticipated to have independent utility from the FAA's Proposed Action. For example, the components manufactured and processed in Boca Chica could be shipped to support launch and test activities at any of SpaceX's facilities, including Vandenberg Air Force Base; McGregor, Texas; or Cape Canaveral Air Force Station.

Climate Change

The latest Intergovernmental Panel on Climate Change (IPCC) Report projects that in the coming two decades the global temperature may rise by 1.5 degrees Celsius (2.7 degrees Fahrenheit). For 1.5°C of global warming, there will be increasing heat waves, longer warm seasons and shorter cold seasons. At 2°C of global warming, heat extremes would more often reach critical tolerance thresholds for agriculture and health. (IPCC 2021)

Climate change has a multitude of different changes in different regions. These changes may include changes in wetness and dryness, to winds, snow and ice, coastal areas and oceans. Climate change is intensifying the water cycle bringing more intense rainfall and flooding as well as more intense drought in some areas. Changing rainfall patterns high latitudes, precipitation is likely to increase, while it is projected to decrease over large parts of the subtropics. Coastal areas will see continued sea level rise contributing to more frequent and severe coastal flooding in low-lying areas and coastal erosion. Further warming will amplify permafrost thawing, and the loss of seasonal snow cover, melting of glaciers and ice sheets, and loss of summer Arctic sea ice. Changes to the ocean, include warming, ocean acidification, and reduced oxygen levels. (IPCC 2021)

Climate changes are also projected to affect individual organism, populations, species distribution and ecosystem composition and function both directly through increases in temperature or precipitation, as well as sea level rise and storm surges in the case of marine and coastal ecosystems. Such changes will affect habitat loss, modification and fragmentation, and the introduction and spread of non-native species and the organisms to respond to climate change during migration (IPCC 2002).

The Texas coast is disappearing an average of 4.1 feet per year, though over 60 percent of the coast is losing over 6 feet per year and some areas lose 30 feet of beach every year (TGLO 2017). The TGLO Coastal Resiliency Master Plan is attempting to identify and implement projects that will reduce the region's overall risk to coastal issues of concern, including climate change and sea level rise. The Texas General Land Office, Region 4 consists of three counties, Cameron, Kenedy and Willacy counties. The three top concerns outlined in the

Coastal Resiliency Master Plan for Region 4 are: 1) Gulf Shoreline change, 2) Degraded or lost habitat and 3) Degraded water quality. Some of the projects being considered in Cameron County are the Bahia Grande Hydrologic Restoration, Paso Corvinas Wetlands and Hydrologic Restorations, Development of the Lower Laguna Madre and Brownsville Ship Channel Watershed Protection Plan, South Padre Island Beach and Dune Management and Restoration, Bird and Heron Island Restoration, Restore Laguna Madre Rookery Islands, Bahia Grande Living Shorelines, Restore Barrier Island Bayside Wetlands on South Padre Island, City of South Padre Island Living Shoreline, and South Padre Island Park Development (TGLO 2017).

CONCLUSION AND EFFECT OF TAKE

Ocelot, Jaguarundi, Northern Aplomado Falcon, Piping Plover, Red Knot, Kemp's ridley, Loggerhead, Hawksbill, Green and Leatherback sea turtles

After reviewing the current status of each of the species above, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects it is our BCO that the action as proposed, is not likely to jeopardize the continued existence of the species nor adversely modify piping plover critical habitat or modify red knot proposed critical habitat. We base this conclusion on the following:

1. The action area encompasses a relatively small portion of the rangewide habitat of each of the species addressed in this opinion and small portion of each species' population.
2. The proposed action includes a variety of protective measures that are intended to minimize incidental take of individual sea turtles or damage to habitat resulting from falling debris or removal of such. Some of the measures include:
    a. implementing measures that lessen noise and lighting impacts,
    b. monitoring of species reactions or impacts to the species and/or their habitat,
    c. reducing impacts to habitat from anomalies and removal of debris,
    d. monitoring the effectiveness of the implemented measure, and
    e. partnering with the Service and its conservation partners to implement recovery plan actions.

For these reasons, the effect of the take anticipated in this BCO is not expected to significantly affect the species considered.

Ocelot and Gulf Coast Jaguarundi

The effect of the take anticipated in this BCO is not expected to significantly affect these species for the following reasons:

- The ranges of the ocelot and the jaguarundi are large. The ocelot ranges from extreme southern Texas and southern Arizona through the coastal lowlands of Mexico to Central America, Ecuador, and northern Argentina (Service 2016a). The jaguarundi ranges from southern Texas into the eastern portion of Mexico in the states of Coahuila, Nuevo Leon, Tamaulipas, San Luis Potosi, and Veracruz (Service 2013). The Action Area encompasses a very small portion of the ranges of these species at the very northern end of their respective ranges.

- The Service believes that the range-wide populations of the ocelot and jaguarundi are declining and the number of ocelots and jaguarundis that reside in Texas is a small proportion of the total populations of these species.
    - The Service (2016a) estimates ocelot abundance in the United States and northern Mexico (only a portion of the species' range) may include as many as 1,850 individuals. The Service (2016a) estimates that the current population of ocelots in Texas is approximately 53 individuals, with approximately 39 individuals in the Willacy/Kenedy County population and approximately 14 individuals in the Cameron County population. Only one ocelot mortality, which occurred in 1998, has been documented along State Highway 4 in the Action Area.
    - The range-wide abundance of the jaguarundi is not known but no jaguarundis are currently proven to reside in Texas although much speculation exists that they are present. The last confirmed record of a jaguarundi in Texas was documented in 1986 with a road-killed individual near Brownsville, Texas (Service 2013).
- The Service issued a Biological and Conference Opinion on December 18, 2013, concluding that construction of the existing facilities at the Boca Chica Launch Site and operation of SpaceX's Falcon 9 and Falcon Heavy orbital vertical launch vehicles were not likely to jeopardize the continued existence of the ocelot or the jaguarundi (Service 2013, Consultation No. 02ETCC00-2012-F-0186).
- The Action Area contains scattered patches of dense thornscrub and other densely vegetated strips of habitat that could support dispersal movements by ocelots and jaguarundis. But the Action Area lacks relatively large patches of dense thornscrub habitat comparable to those that support the Texas breeding population of ocelots (Service 2016a). Habitat for ocelots and jaguarundis in the Action Area is already fragmented by highways, ship channels, urban and other developed areas, and agricultural conversion. The effects of the action would result additional slight loss and physical fragmentation of ocelot or jaguarundi habitat.
- The effects of the action would increase the risk of ocelot and jaguarundi mortality from vehicle collisions on existing highways, particularly SH 4, through increased traffic to and from the VLA and LLCC. Other adverse effects would arise from exposure to the rocket heat plume and falling debris or anomaly-response activities. These effects would be minimized through the conservation measures included in the proposed action and the terms and conditions of the incidental take statement. Specific conservation measures that would minimize effects to ocelots and jaguarundis implemented by SpaceX include:
    - Operation of an employee shuttle between Brownsville and the project site and between parking areas at the LLCC and the VLA. SpaceX will offer incentives to further encourage employees to take the shuttle.
    - Installation of wildlife crossing signs along SH 4 to alert drivers to the risk of collision with ocelots and jaguarundis.
    - Installation of vehicle barriers at select locations along SH 4 to deter vehicles or ATVs from driving into the refuge where ocelots or jaguarundis may be sheltered.
    - Litter control and clean-up activities along SH 4 to avoid attracting prey to roadside areas.
    - Coordination with TxDOT to help ensure timely right-of-way vegetation maintenance along SH 4.
    - Restricting public access to the vicinity of the VLA during launch operations and providing notification of closures to refuge staff in advance of ground access

closures.
    - Sourcing gravel or topsoil from already disturbed areas or previously used sources to minimize the extent of potential habitat loss or modification.
    - Environmental worker educational briefings to promote the implementation of conservation measures and minimize habitat modification.
- The activities contributing cumulative effects to this analysis involve existing facilities or structures (e.g., existing TxDOT rights-of-way) and previously developed areas (e.g., activities at the Port of Brownsville or within the City of South Padre Island). Activities that do not otherwise have federal involvement but that would result in take of an ocelot or jaguarundi (such as wind energy developments or urban expansion) may seek incidental take authorization from the Service. Increased traffic on highways in the Action Area resulting from general urban expansion could increase the risk of vehicle collision mortality. The amount of any such increased vehicle collision mortality from activities not otherwise addressed by the Service is not known. But the risk of vehicle collision mortality would also be offset, at least in part, by ongoing recovery efforts to increase the number of wildlife crossing structures on highways that are expected to a significant improvement in the conservation of ocelots in Texas (Service 2016a).

For the above reasons, the Service does not expect that the proposed action will reduce the overall reproduction, numbers, or distribution of the ocelot or the jaguarundi so that the likelihood of survival and recovery in the wild of any of these species is appreciably reduced.

Kemp's ridley, Loggerhead, Green, Hawksbill, and Leatherback Sea Turtles
The effect of the take anticipated in this BCO is not expected to significantly affect these species for the following reasons:

- The status of sea turtles in the Action Area is monitored through counts of sea turtle nests on Boca Chica Beach and South Padre Island (Table 3). Kemp's ridley account for 100 percent of the sea turtle nests on Boca Chica Beach and 95 percent of the sea turtle nests detected on South Padre Island in the last 10 years. All five sea turtle species have been documented nesting on South Padre Island in the last 10 years, but only Kemp's ridley, loggerhead, and green sea turtles nested in the Action Area. Nests by loggerhead or green sea turtles in the Action Area over the last 10 years were relatively uncommon, representing less than 5 percent of all documented sea turtle nests in the Action Area, and were not detected every year.
- The Service issued a Biological and Conference Opinion on December 18, 2013, concluding that construction of the existing facilities at the Boca Chica Launch Site and operation of SpaceX's Falcon 9 and Falcon Heavy orbital vertical launch vehicles were not likely to jeopardize the continued existence of these sea turtles (Consultation No. 02ETCC00-2012-F-0186).
- At baseline condition, there are approximately 15.5 miles of beach nesting habitat for sea turtles in the Action Area: 7.5 miles on Boca Chica Beach and 8 miles on South Padre Island. The beaches in the Action Area represent a relatively small portion of the nesting habitat for the Kemp's ridley sea turtle, a species that is distributed throughout the Gulf of Mexico and U.S. Atlantic seaboard with 95 percent of nesting occurring in the state of Tamaulipas, Mexico (NMFS and Service 2015). The other four species of sea turtle considered in this BCO have larger ranges, being globally distributed throughout

subtropical and temperate regions. While each of these sea turtle species are declining range-wide, the proportion of these sea turtles that nest in Texas is a small proportion of the total populations of these species.

- The Service finds that the Proposed Action is likely to adversely affect each of the five species of sea turtles considered in this BCO. Adverse effects include increased noise, light, vibrations, heat, and vehicle traffic that may kill, wound, or harm adult or hatchling sea turtles or sea turtle nests or eggs. Adverse effects would be minimized by implementation of the conservation measures included in the proposed action and the terms and conditions of the incidental take statement.
    - SpaceX will update and execute its Lighting Management Plan to account for Starship/Super Heavy launches and related infrastructure that is the subject of the Proposed Action. These updates will minimize the modification of sea turtle habitat by light pollution and minimize the likelihood of false crawls and disoriented hatchlings.
    - SpaceX will continue to collaborate with Sea Turtle, Inc. by supplying and storing field equipment and to provide sea turtle survey data within the Action Area to the Service annually as described in the Sea Turtle Monitoring Plan. This measure supports activities that reduce the likelihood of death or injury to individual sea turtles, or their nests, eggs, and hatchlings. Sea Turtle, Inc.'s biological monitors inspect Boca Chica Beach daily during the nesting season and relocate all sea turtle eggs to a facility where they hatch. The hatchlings are then released directly to the ocean. This relocation minimizes the time and number of sea turtle nests, eggs, or hatchlings would be exposed to construction and operational activities associated with the Proposed Action.
    - In coordination with NWR staff, SpaceX will develop a protocol (e.g., Access Restriction Notification Plan) providing as much advance notice as practicable to minimize disruption to refuge and land management activities. The access restrictions would also minimize traffic within the restricted zone during launch activities and minimize modification of habitat for sea turtles.
    - If an anomaly occurs, SpaceX will comply with its Anomaly Response Plan, Security Plan, and Fire Mitigation and Response Plan, as applicable. This measure minimizes modification of habitat for sea turtles during beach clean-up.
    - SpaceX will provide all on-site personnel, including staff and contractors, with environmental worker education briefings prior to construction activities, prior to onsite work, and periodically during operations. This measure will promote the implementation of conservation measures and minimize habitat modification for sea turtles. It will also minimize the potential for the take of adult sea turtles by educating SpaceX personnel about the risks of vehicle collisions with these animals.

  With these conservation measures enacted, the remaining effects that can be reasonably anticipated are increased numbers of false crawls on Boca Chica Beach and the loss of nests, eggs, or hatchlings missed by the biological monitors. Adverse effects of the Proposed Action to sea turtles on South Padre Island are minimized by distance and more proximal existing disturbances.

- The activities contributing cumulative effects to this analysis involve existing facilities or structures (e.g., existing TxDOT rights-of-way) and previously developed areas (e.g., activities at the Port of Brownsville or within the City of South Padre Island). Activities that do not otherwise have federal involvement but that would result in take of a piping plover or red knot (such as wind energy developments or urban expansion) would require incidental take authorization from the Service.

For the above reasons, the Service does not expect that the proposed action will diminish the number, reproduction, or distribution of Kemp's ridley, loggerhead, green, hawksbill, or leatherback sea turtles so that the likelihood of survival and recovery in the wild of any of these species is appreciably reduced.

Northern Aplomado Falcon

The effect of the take anticipated in this BCO is not expected to significantly affect these species for the following reasons:

- There are 2 to 3 mated pairs of northern aplomado falcons with territories in the Action Area. Two active territories were documented in 2021. Mated pairs reside in their territories year-round and will raise one brood of two chicks, on average, per season. The falcons do not currently occupy the immediate vicinity of the LLCC or VLA, where there are limited perching and nesting sites. Only one northern aplomado falcon has been recorded (in 2016) within 3 miles of the Boca Chica Launch Site since the Service initiated surveys in 2015 (UTRGV 2020). The nearest artificial nest platforms, neither of which have been used by nesting falcons, are approximately 1 mile and 4.3 miles from the LLCC.
- The Texas coast population was observed to be at least 65 falcons in 2019 (TPWD 2019). Threats to the northern aplomado falcon in the United States are identified as depredation by great horned owl, grassland degradation, and drying climatic conditions (Service 2014a). The latter two threats indirectly affect the falcon by negatively impacting avian species populations that are important prey for the northern aplomado falcon. While the aplomado falcon is rare in the United States and northern Mexico (the northern population), the global range of this species extends all the way south to Tierra Del Fuego, Argentina. At the global level, the IUCN lists the aplomado falcon as a species of Least Concern but notes a decreasing population trend (IUCN 2018).
- The Proposed Action could result in adverse effects to the falcons residing in the Action Area. Effects of the action that are reasonably certain to cause incidental take of one or more northern aplomado falcons are associated with habitat loss or modification in the form of noise, lighting, potential fires started by anomaly debris, and increased human activity that could (a) kill nestlings if they startle and fall from the nest or (b) injure individuals, including adults. Take would be minimized through the execution of the conservation measures included in the proposed action and the terms and conditions of the incidental take statement as follows:
    - Conducting pre-, during, and post-construction biological monitoring within 1 mile of construction areas.
    - Conducting pre- and post-launch biological monitoring.
    - Enhanced satellite monitoring via solar powered Starlink to the Peregrine Fund for continuous video coverage of falcon habitat.
    - Monitoring will be conducted within 1 mile of the VLA up to a week before a Starship or Super Heavy launch and the day after the launch.
    - If an anomaly occurs, complying with its Anomaly Response Plan Security Plan,

and Fire Mitigation and Response Plan, as applicable.

  - Providing all on-site personnel, including staff and contractors, with an environmental worker education briefing(s) prior to the start of construction activities, prior to onsite work, and periodically during operations.
  - Performing litter control, clean-ups, and containment at the VLA and along SH 4 to may attract animals that prey on or compete with falcons.

  Due to minimal northern aplomado falcon presence in the Action Area, any effects from the Proposed Action that increase the above-mentioned threats would be limited to a few individual falcons. With these conservation measures enacted, which minimizes the effects to the resident falcons and address threats to the species outside the Action Area, it can be reasonably anticipated there will be no population level effect to the species.
- The activities contributing cumulative effects to this analysis involve existing facilities or structures (e.g., existing TxDOT rights-of-way) and previously developed areas. Activities that do not otherwise have federal involvement but that would result in take of a northern aplomado falcon (such as wind energy developments or urban expansion) would require incidental take authorization from the Service.

For the above reasons, the Service does not expect that the proposed action will diminish the number, reproduction, or distribution of northern aplomado falcon so that the likelihood of survival and recovery in the wild of this species is appreciably reduced.

Piping Plover and Piping Plover Critical Habitat and Red Knot and Proposed Critical Habitat

The effect of the take anticipated in this BCO is not expected to significantly affect these species for the following reasons:

- The range of the piping plover extends from Canada through Mexico and the Caribbean. The range of the red knot extends from the Arctic regions of Canada through the Atlantic Coasts of Argentina and Chile. The Action Area contains only a very small portion of the ranges of these species and is only used for wintering, as a migration stopover, and/or (for some juvenile red knots) a potential temporary year-round residence (Service 2020a).
- Both species contain multiple sub-populations that provide redundancy and resiliency to the total range-wide populations of piping plovers and red knots. Piping plovers that winter or migrate through the Action Area are part of the Northern Great Plains breeding population, one of three identified sub-populations of the piping plover. Red knots that use the Action Area are part of the Western Gulf of Mexico/Central America wintering population, which is one of four identified wintering populations of this species.
- The Service believes that the range-wide population of red knots is declining, but the range-wide trend (if any) for the piping plover is unclear.
- The number of piping plovers and red knots that use the portions of the Action Area where the effects of the action are likely to cause incidental take is small compared to the total populations of these species.
  - The range-wide breeding population of piping plovers in 2011 was estimated at 5,723 birds. The number of piping plovers that migrate through or winter in the Boca Chica/South Bay area has been estimated at between 308 and 142 birds (Newstead and Hill 2021); although this may be an overestimate of the true

    number of piping plovers that use this area during the non-breeding season. Using the Newstead and Hill (2021) estimates, approximately 2 percent to 5 percent of the estimated range-wide breeding population would be affected by the Proposed Action.
  - The range-wide population of red knots is estimated at approximately 63,600 birds (Service 2020a). Presence of red knots in the Boca Chica/South Bay area has been described as erratic and unpredictable. Many survey visits to the Boca Chica/South Bay area reported zero red knots (UTRGV 2019). But occasionally large groups are detected. A Coastal Bend Bays and Estuaries Program biologist reported a flock of approximately 1,225 red knots foraging and roosting in the flats north of the LLCC in 2021. A reliable estimate of the red knot population that uses the Action Area is not available, but the largest group of red knots reported in the Action (1,225 birds) could represent approximately 2 percent total range-wide population.
- The piping plover and red knot habitat that may be modified by the effects of the action (approximately 444.27 acres of habitat exposed to effects that may result in permanent or temporary habitat loss or habitat degradation) is a small portion of the total amount of wintering habitat available to these species, as measured by the area of their final (for piping plovers) or proposed (for red knots) critical habitat designations. The impacted habitat is less than 0.5 percent of the 165,211 acres of piping plover designated critical habitat used for wintering and .065 percent of the 683,405 acres of red knot proposed critical habitat used for wintering (personal comm., Moni Belton, Service, 2022).
- The effects of the action leading to incidental take through permanent or temporary habitat loss or habitat degradation would be minimized by conservation measures included in the proposed action and the terms and conditions of the incidental take statement. Specific measures to be implemented by SpaceX that would minimize adverse effects and incidental take include:
  - Implementation of stormwater management and monitoring activities to minimize the transport of sediment or discharge of fresh stormwater runoff into the wind tidal flats adjacent to the VLA that could promote the growth of dense vegetation.
  - Installation and use of construction shakers or rumble plates at construction entrances/exits to help prevent the introduction and spread of non-native plants that could modify habitat conditions.
  - Marking site boundaries to ensure that construction limits are not exceeded and installing vehicle barriers along SH 4 to deter vehicles or ATVs from driving into the refuge where habitat for piping plovers and red knots occurs.
  - Litter control and clean-up activities along SH 4 and Boca Chica Beach to avoid attracting predators.
  - Restricting public access to the vicinity of the VLA during launch operations and providing notification of closures to refuge staff in advance of ground access closures.
  - Constructing a barrier around a portion of the VLA to assist in keeping debris from entering the refuge, help deflect off-gassing of liquid nitrogen, reduce sound

transmission.
  - Abating noise from the use of generators at the VLA.
  - Sourcing gravel or topsoil from already disturbed areas or previously used sources to minimize the extent of potential habitat loss or modification.
  - Environmental worker educational briefings to promote the implementation of conservation measures and minimize habitat modification.
- The activities contributing cumulative effects to this analysis involve existing facilities or structures (e.g., existing TxDOT rights-of-way) and previously developed areas (e.g., activities at the Port of Brownsville or within the City of South Padre Island). Activities that do not otherwise have federal involvement but that would result in take of a piping plover or red knot (such as wind energy developments or urban expansion) would require incidental take authorization from the Service.

Critical Habitat
Although piping plover critical habitat Unit TX-1 (7,217 acres) is one designated unit out of 141 total units totaling 165,211 acres, the Service must base its analysis on the value of critical habitat as a whole for the conservation of the listed species.

Our determination of no adverse modification is based on the fact that impact of 903.65 acres which includes loss of 444.27 acres within that total acreage (construction and/or operational) to piping plover critical habitat Unit TX-1 represents only .5 percent of all designated wintering critical habitat in the United States.

Red Knot Proposed Critical Habitat
Although red knot proposed critical habitat Unit TX-11 is one designated unit out of 127 total units totaling 165,211 acres, the Service must base its analysis on the value of critical habitat as a whole for the conservation of the listed species.

Our determination of no adverse modification is based on the fact that the impact of 444.27 acres within that total acreage (construction and/or operational) to red knot proposed critical habitat Unit TX-11 represents only .065 percent of all designated and proposed wintering critical habitat in the United States.

For the above reasons, the Service does not expect that the proposed action will reduce the overall reproduction, numbers, or distribution of the piping plover or the red knot so that the likelihood of survival and recovery in the wild of any of these species is appreciably reduced.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. “Take” is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. “Harm” is further defined (50 CFR § 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. “Harass” is defined (50 CFR § 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. “Incidental take” is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary and must be undertaken by the FAA and/or SpaceX as appropriate, for the exemption in section 7(o)(2) to apply. The FAA has a continuing duty to regulate the activity covered by this incidental take statement. If the FAA (1) fails to assume and implement the terms and conditions or (2) fails to require SpaceX to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or license the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the FAA and/or SpaceX must report the progress of the action and its impact on the species as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

Ocelot and Jaguarundi

Incidental take of an ocelot and a jaguarundi is expected as a consequence of the proposed action. Effects of the action that are reasonably certain to cause incidental take of these species are associated with habitat modifications from increased noise and human activity in the vicinity of SH 4 that impair breeding, feeding, or sheltering activities, including dispersal movements, and cause injury through decreased fitness (i.e., harm). Incidental take is also expected through increased vehicle traffic on SH 4 that increases risk of death or wounding from vehicle collisions.

The Service estimates the amount or extent of incidental take of the ocelot and jaguarundi in terms of the number of individuals of each species that are detected (alive or dead) along SH 4 to the east of the CBP Station (soft checkpoint). Individuals detected along this section of SH 4 would be exposed to the effects of the action that are likely to cause incidental take. While no ocelots or jaguarundis are currently known to reside in habitat along this section of SH 4, it is possible for dispersing individuals to travel through the area and be at increased risk of death or wounding from vehicle collisions.

It is not practical to estimate take in terms of the actual number of ocelots or jaguarundis that would be taken by the Proposed Action because: 1) the species is wide-ranging, 2) elusive, 3) nocturnal, and 4) finding a cat that has been harmed due to injury from impaired essential behavioral patterns like breeding, feeding or sheltering is unlikely.

- Therefore, the Service estimates that no more than 1 individual of each species would be taken by the proposed action via death, wounding, or harm.

Take would be exceeded if more than 1 ocelot or if more than 1 jaguarundi is detected (alive or dead) along SH 4 east of the soft checkpoint. Any such potential detections for this purpose must be confirmed by the Service as an ocelot or jaguarundi. Unconfirmed detections will not count against the amount of take.

Sea Turtles

During sea turtle nesting season, it is Sea Turtle Inc.'s practice to conduct daily inspections of Boca Chica Beach, where Kemps' ridley, loggerhead, green, leatherback, or hawksbill sea turtles may lay eggs, and identify nests and collect eggs and bring them to a facility until they hatch. Sea Turtle Inc. then returns the hatchlings to Boca Chica Beach for release into the Gulf. Incidental take of adult sea turtles or nests, eggs, or hatchlings missed by Sea Turtle Inc.'s daily inspection of Boca Chica beach is expected as a consequence of the Proposed Action. Effects of the action that are reasonably certain to cause incidental take of one or more adult sea turtles or their missed nests, eggs, or hatchlings on Boca Chica beach are associated with increased noise, light, vibrations, and vehicle traffic that may kill, wound, or harm adult sea turtles using, or their missed nests and eggs, or hatchlings on, the beach. Killing or wounding of adult sea turtles or their missed nests, eggs would occur if increased security patrols or clean-up efforts on Boca Chica beach or increased public use of the beach connected with the Proposed Action cause a vehicle collision with a sea turtle adult, or missed nest, egg, or hatchling. Increased noise, light, and vibrations caused by the Proposed Action would harm sea turtles by degrading nesting and hatching habitat in ways that could lead to false crawls by adults seeking to nest on the beach or disorientation of hatchings that emerge from nests on the beach that increases their vulnerability to death by desiccation, exhaustion, or predation.

- Therefore, the Service estimates that no more than 2 individual adult Kemp's ridley sea turtles and 1 individual adult green, loggerhead, hawksbill or leatherback sea turtle would be taken by the proposed action via death or harm due to vehicular collisions or crushing by SpaceX security patrols or other SpaceX vehicles or machinery that may be necessary to use on the beach in the future.

The Service also estimated the amount or extent of incidental take of sea turtles caused by the Proposed Action using two surrogate metrics (false crawls and number of nests hatched from Boca Chica Beach) that are causally related to the take of individuals:

(a) the number of documented false crawls by adults on Boca Chica beach as a surrogate for the number of adult sea turtles harmed through habitat degradation leading to injury by decreased reproductive output, and

(b) the number of nests that hatch from Boca Chica beach (i.e., nests laid on Boca Chica beach that are not collected and relocated by Sea Turtle Inc.) as a surrogate for the number of hatchlings or eggs that may be killed or wounded by increased vehicle traffic or harmed by habitat degradation leading to injury by decreased survival.

The Service estimates take for each of the sea turtle species considered in this BCO as follows:

- Kemp's ridley sea turtle
    - False Crawls: Up to 15 false crawls documented by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO. This estimate is calculated based on the 11 false crawls documented by Sea Turtle, Inc. between 2017 and 2021 (5 years), averaged by year (i.e., 2.2 false crawls per year), rounded up to the nearest whole number (i.e., 3 false crawls per year), and multiplied by 5 years as the duration of

this BCO (i.e., 3 false crawls per year multiplied by 5 years equals 15 false crawls over the duration of the BCO).
    - Nests Hatched: Up to 5 hatched nests documented by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO. This estimate is calculated based on the 71 nests documented and relocated by Sea Turtle, Inc. from Boca Chica beach between 2012 and 2021 (10 years), averaged by year (i.e., 7.1 nests per year), rounded up to the nearest whole number (i.e., 8 nests per year), and multiplied by 5 years as the duration of this BCO (i.e., 8 documented nests multiplied by 5 years equals 40 nests over the duration of the BCO). This estimate is then multiplied by 11 percent, which represents the amount of time each year that Boca Chica beach may be subject to access restrictions (i.e., 8,760 hours per year divided by 800 hours per year of access restrictions equals 11 percent), and then rounded up to the nearest whole number (i.e., 40 nests multiplied by 11 percent equals 4.4 nests, rounded up to 5 nests). The relative duration of the access restrictions relates to the amount of time in which biological monitors may miss sea turtle nesting attempts and fail to collect and relocate the eggs.
- Loggerhead sea turtle and green sea turtle
    - False Crawls: For each species, up to 5 false crawls documented by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO. This estimate is based on the observation that while neither the loggerhead nor the green sea turtle was observed nesting on Boca Chica beach between 2012 and 2021, both species were documented nesting elsewhere within the Action Area. Nesting on nearby South Padre Island makes it more likely that nesting by one or both of these species on Boca Chica beach could be attempted in the future. The Service assumes that at least 1 false crawl per year by each species could be documented by Sea Turtle Inc. for each year of the BCO (i.e., 1 documented false crawl per species multiplied by 5 years).
    - Nests Hatched: For each species, up to 2 hatched nests documented by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO. Neither loggerhead nor green sea turtles were observed nesting on Boca Chica beach between 2012 and 2021, but both species did nest elsewhere within the Action Area on nearby South Padre Island. The Service estimates the number of loggerhead or green sea turtle nests that may hatch from Boca Chica beach as approximately 50 percent of the number of estimated Kemp's ridley sea turtle nests, rounded down to the nearest whole number (i.e., 5 hatched nests multiplied by 50 percent equals 2.5 nests, rounded down to 2 nests).
- Hawksbill sea turtle and leatherback sea turtle
    - False Crawls: For each species, up to 1 false crawl documented by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO. This estimate is based on the observation that neither species has ever been documented nesting on Boca Chica beach or elsewhere in the Action Area. However, both species have been documented nesting on South Padre Island outside of the Action Area and could use Boca Chica beach in the future.
    - Nests Hatched: For each species up to 1 hatched nest documented by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO. This estimate is based on the observation that neither species has ever been documented nesting on Boca Chica beach or elsewhere in the Action Area. However, both species have

been documented nesting on South Padre Island outside of the Action Area and could use Boca Chica beach in the future.

The Service acknowledges that each of the sea turtle species considered in this BCO has been documented nesting on South Padre Island and that the loggerhead and green sea turtles have nested on portions of South Padre Island that occur in the Action Area. Noise, light, and vibrations associated with the Proposed Action may be detected by individual sea turtles that use the portions of South Padre Island that occur within the Action Area. However, urban and commercial development and public use of the beaches on South Padre Island are a more proximate cause of noise, light, and vibration affecting sea turtles on South Padre Island, such that incidental take caused by the incremental effects of the Proposed Action is not reasonably certain to occur. Furthermore, none of the South Padre Island beaches will be affected by security patrols or beach clean-ups driving on the beach or the ground access restrictions that might cause biological monitors to miss sea turtle nesting attempts. Therefore, the Service estimates take of sea turtles caused by the Proposed Action in terms of nesting activities on Boca Chica beach only. Take of sea turtles that results from the monitoring, collection, and relocation of sea turtle nests is addressed by the enhancement of survival permits held by Sea Turtle Inc. It is not practicable to estimate or monitor the precise number of individual sea turtles (adults, hatchlings, or eggs) that are likely to be taken. First, not all nesting attempts (including false crawls) are likely to be detected by Sea Turtle Inc. since the loggerhead, green, leatherback and hawksbill sea turtles nest primarily at night and although the Kemp's Ridley sea turtles primarily nest during the day, some have been known to nest at night. Second, not all nests are certain to be located because natural factors (such as rainfall, wind, and tides) and human-caused factors (such as pedestrian and vehicular traffic) may obscure crawls and some nests laid on the beach could be destroyed by vehicle traffic before the eggs hatch. Third, the total number of hatchlings per undiscovered nest is unknown and the number of hatchlings that do not make it to the sea after hatching is unknown. Finally, the number of adult females that may avoid Boca Chica beach and be forced to nest in a less optimal location is also unknown.

The estimated amount of take using the surrogate metrics provides a clear standard for understanding when take has been exceeded. Estimated take would be exceeded in the following circumstances:

- More than 15 false crawls or more than 5 hatched nests of the Kemp's ridley sea turtle are detected by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO.
- More than 5 false crawls or more than 2 hatched nests of the loggerhead sea turtle or green sea turtle are detected by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO.
- More than 1 false crawl or more than 1 hatched nest of the hawksbill sea turtle or leatherback sea turtle are detected by Sea Turtle Inc. on Boca Chica beach over the duration of the BCO.
- More than 2 Kemp's ridley and 1 green, loggerhead, hawksbill or leatherback sea turtles are killed or injured by SpaceX vehicles conducting security patrols on the beach and any other SpaceX vehicles or machinery that may traverse the beach in the future.

The estimated quantities of take are based on detections of sea turtle nesting activities made by Sea Turtle, Inc. biological monitors under an approved monitoring plan. Since these estimates are based on the level of effort and methods prescribed by this monitoring plan, only detections of sea turtles by these biological monitors will count towards the estimated limits of take.

Northern Aplomado falcon

Incidental take of the northern aplomado falcon is expected as a consequence of the Proposed Action. Effects of the action that are reasonably certain to cause incidental take of one or more northern aplomado falcons are associated with habitat loss or modification in the form of noise, lighting, potential fires started by anomaly debris, and increased human activity that could (a) kill nestlings if they startle and fall from the nest or (b) injure individuals, including adults, if normal foraging activities are disrupted.

The Action Area typically contains two or three nesting pairs of northern aplomado falcons each year. Mated falcon pairs remain within their home range year-round, typically raise no more than 1 brood per season, and have an average brood size of approximately 2 young. These nesting pairs and their offspring would be exposed to effects of the action that could rise to the level of take. However, the Service does not expect that all of the individuals exposed to effects that cause take will actually be taken due to the distance between the known and potential falcon nesting sites and the VLA (i.e., where the most intense effects of the action would occur).

- Over the duration of this BCO, the Service estimates that no more than 2 adult northern aplomado falcons and three falcon chicks would be taken by harm, expressed as either actual death or injury of an individual, as a consequence of the Proposed Action.

Take would be exceeded if:

- More than 2 adult northern aplomado falcons are killed or injured.
- More 3 falcon chicks are found to have fallen from an active nest within the Action Area as a likely result of noise or increased human activity associated with the Proposed Action, anomaly debris or debris response activities, or fires started by anomaly debris.
- More than one active and previously successful northern aplomado falcon nest in the Action Area fails produce a clutch of eggs as a likely consequence of the Proposed Action (i.e., each of the two adults of the nesting pair would be taken via harm through injury expressed as reduced reproductive success).

Nest failures likely attributable to causes other than the Proposed Action would not be counted against the estimated take.

Piping Plovers and Piping Plover Critical Habitat

Incidental take of piping plovers is expected as a consequence of the proposed action. Effects of the action that are reasonably certain to cause incidental take of one or more piping plovers are associated with permanent habitat loss, temporary habitat loss, or habitat degradation. Permanent habitat loss would occur with development of land for purposes of the Proposed Action. Temporary habitat loss would occur with episodic modifications to the habitat that make it unavailable for use by piping plovers temporarily. Habitat degradation would occur with a reduction in the suitability or quality of the habitat due to the Proposed Action.

Individual piping plovers exposed to such habitat loss or degradation may be killed, wounded, or harmed via impairment of essential behavior patterns, including breeding, feeding, or sheltering. The Service estimated the amount or extent of incidental take using the area of habitat loss or significant habitat modification as a surrogate for the number of piping plovers likely to be taken. This surrogate metric meets the regulatory requirements at 50 CFR 402.14(i)(1)(i) in that the surrogate metric is causally linked to the actual taking of piping plovers caused by the Proposed Action, as described below. It is not practicable to estimate or monitor the number of individual piping plovers likely to be taken (as described further below), and the surrogate metric sets a clear standard to determine if estimated take has been exceeded.

Permanent habitat loss is expected to occur at the VLA and at the parking lot under the Proposed Action. Expanded development at the VLA and at the parking lot would result in the loss of approximately 11 acres of unvegetated flats. This permanent habitat loss would permanently reduce the amount of feeding and roosting habitat available to piping plovers.

Temporary habitat loss or habitat degradation is expected to occur at locations within the rocket heat plume (i.e., a 0.6 mile radius around the VLA) and at locations where debris from anomalies may fall (i.e., within a 700-acre debris area). These areas partially overlap. Together, the rocket heat plume and the potential anomaly debris field are approximately 903.65 acres of land and coast. While the entire 903.65 acres of the rocket heat plume and potential anomaly debris field are within the boundary of piping plover critical habitat unit TX-1, the critical habitat designation does not include densely vegetated habitat within that boundary. The amount of piping plover habitat within the 903.65 acres of the rocket heat plume and potential anomaly debris field is 444.27 acres, as estimated by the extent of modeled land covers associated with estuarine aquatic beds, unconsolidated shore, water, and bare land shown in Figure 25. Excluding the 11 acres of habitat subject to permanently habitat loss, approximately 433.27 acres of piping plover habitat would be subject to temporary habitat loss and/or other habitat degradation from the Proposed Action.

Within the 0.6-mile rocket heat plume radius static fire, launch, and landing operations would create temporary habitat loss when the rocket heat plume briefly increases the air temperature above ambient conditions (estimated to be 90 degrees Fahrenheit). In addition, static fire, launch, and landings would increase the amount of noise and human activity impacting piping plover habitat in this area. Any piping plovers using habitat within the rocket heat plume radius would be expected to temporarily relocate to other habitat areas within their individual home ranges (which can be as large as 3,000 acres) due to increased heat and increased noise and human activity. This temporary habitat loss would occur during each static fire, launch, and landing and would likely last less no more than a few days. This would result in a temporary loss of feeding and roosting habitat available to piping plovers.

Anomalies are not planned but are possible consequences of commercial space launches. If an anomaly occurs near the VLA, temporary habitat loss would occur if debris lands on piping plover habitat or debris removal activities impact such habitat. Temporary habitat loss associated with anomalies, if they occur, would result from any debris footprint or any footprint associated with debris removal, such as ruts. The potential anomaly debris field is approximately 700 acres and partially overlaps with the 0.6-acre rocket heat plume radius. Debris falls and response activities could occur anywhere within this area. Although anomalies are not planned, piping plover habitat not converted to development could also be impacted by debris falls and response activities. For the purpose of this analysis, the Service assumes that temporary habitat loss associated with anomalies could impact the equivalent of all piping plover habitat in the anomaly debris field outside of the rocket heat plume (i.e., 36 acres) at least one time. All piping plover habitat within the 0.6-mile rocket heat plume radius is already assumed to experience permanent or temporary habitat loss as described above.

The 433.27 acres of temporary habitat losses are limited to a duration of no more than 800 hours under the Proposed Action each year, based on an assumption that the duration of static fire, launch, landing, and anomaly access restrictions approximate the time period in which increased noise, debris, and human activity, and heat plume disruptions would disrupt the feeding and sheltering activities of piping plovers.

Habitat degradation resulting from increased vegetation growth, including invasive or nonnative vegetation, in the wind tidal flats caused by potentially increased volumes of fresh stormwater or sediment discharged from the expanded development for the Proposed Action may occur. Ground surface disturbances (e.g., ruts) in piping plover habitat from debris footprints and the footprints of debris response activities may also cause increased vegetation growth by changing the microtopography of unvegetated flats. This could result in a reduction of the quality or suitability of feeding and roosting habitat used by piping plovers. Habitat degradation could impact any or all of the approximately 433.27 acres of piping plover habitat within the 0.6-mile rocket heat plume and potential anomaly debris field study area that was not permanently lost to development under the Proposed Action.

Given the site fidelity of piping plovers on their wintering grounds, it is not certain that piping plovers impacted by permanent habitat loss, temporary habitat loss, or habitat degradation would move to alternate wintering sites or modify their home range boundaries to replace the lost habitat resources. Thus, permanent habitat loss or temporary habitat loss or habitat degradation could reduce the fitness of the individuals that previously relied on the impacted habitat resources. The precise number of piping plovers either exposed to or actually injured as a consequence of this permanent habitat loss or temporary habitat loss or habitat degradation is not practicably determinable (as explained below).

Therefore, the Service estimates incidental take of the piping plover in an amount equivalent to (a) 11 acres of piping plover habitat permanently lost due to development of land for the Proposed Action, (b) the temporary loss and/or degradation of 433.27 acres of piping plover habitat from the rocket heat plume, potential anomalies, potential vegetation changes, and increased noise and human activity (approximately 399 acres within the rocket heat plume radius and 36 additional acres within the debris field study area). Temporary habitat losses are limited to no more than 800 hours under the Proposed Action each year, based on an assumption that the duration of static fire, launch, landing, and anomaly access restrictions approximate the time period in which increased noise, debris, and human activity, and heat plume disruptions would disrupt the feeding and sheltering activities of piping plovers. Other activities under the Proposed Action are not reasonably certain to rise to the level of take.

This measure of incidental take is causally connected to the circumstances wherein at least some individual piping plovers are reasonably certain to be taken via killing, wounding, or harm through habitat loss or significant habitat modification.

The Service acknowledges that the effects of the Proposed Action may have other adverse consequences on piping plovers in the Action Area (e.g., increased noise and activity on the beach due to security patrols or biological monitoring; fires in non-habitat vegetated areas caused by anomalies). While these adverse effect pathways are not discountable, they are also not reasonably certain to cause the actual death or injury of one or more piping plover because individual birds will be alerted and will take flight to other areas of the beach or tidal flats. As described in the effects of the action, adverse consequences are either too speculative or the impacts not significant enough to be reasonably certain that they would cause actual death or injury.

It is not practicable to express incidental take as the number of individual piping plovers that are likely to be taken as a consequence of the proposed action. The number of piping plovers that use the areas where habitat loss or degradation will occur is not known with precision and the number varies by year (individuals are lost from and recruited into the population each year), season (the action area is used by migrating and wintering individuals), and day (individuals move within their home ranges to utilize available habitat resources). Prior surveys of nonbreeding piping plovers in the vicinity of Boca Chica Beach and the South Bay also document substantial variation in the number of individuals detected, including years prior to SpaceX activities in the area. No dead or wounded piping plovers have been detected in connection with biological monitoring and other activity monitoring for SpaceX activities. Piping plovers travel thousands of miles each year between breeding and wintering habitat areas and are exposed to numerous threats that could result in death or injury independent of the proposed action. Therefore, changes in the number of piping plovers detected at Boca Chica Beach and South Bay, even if precise counts could be practicably made, is not a reliable measure of individuals that are likely to be taken.

In contrast, the expression of incidental take in terms of the acres of habitat exposed to habitat loss or habitat modification from certain elements of the proposed action does set a clear standard for understanding if the amount of estimated take has been exceeded.

Take would be exceeded in the following circumstances:

- SpaceX exceeds the 11 acres of piping plover permanent habitat loss associated with new construction activities under the Proposed Action.
- SpaceX exceeds 800 hours of access restrictions under the Proposed Action in a given year.
- Change detection monitoring concludes, with field verification, that more than 0.1 acre of piping plover habitat within the combined 0.6-mile rocket heat plume radius and the potential anomaly debris field area has become densely vegetated and is a permanent loss of habitat as a result of the Proposed Action.

Red Knot

Incidental take of red knots is expected as a consequence of the proposed action. Effects of the action that are reasonably certain to cause incidental take of one or more red knots are the same as those described for the piping plover (i.e., permanent or temporary habitat loss or habitat degradation). Individual red knots exposed to such habitat loss or modification may be killed, wounded, or harmed. Harm of individual red knots would be expressed as injury through decreased fitness and, therefore, decreased survivorship during migration to breeding grounds.

Given the similarity of effects leading to incidental take and the similarity of habitats used by piping plover and red knot in the Action Area, the Service applied the same surrogate metric and supporting rationale, and the same habitat-based estimate of incidental take described for piping plover to the red knot. The Service estimates incidental take of the red knot in an amount equivalent to the permanent loss of 11 acres of red knot habitat and the temporary loss and/or degradation of 433.27 acres of red knot habitat. Temporary habitat losses are limited to no more than 800 hours each year, based on an assumption that the duration of the ground access restrictions approximates the time period in which increased noise, human activity, and heat plume disruptions that would disrupt the feeding and sheltering activities red knots occur.

It is not practicable to express incidental take as the number of individual red knots that are likely to be taken as a consequence of the proposed action. The number of red knots that use the areas where habitat loss or significant habitat modification will occur is not known with precision and the number varies by year (individuals are lost from and recruited into the population each year), season (the action area is used by migrating and wintering individuals, as well as some potentially year-round residents), and day (individuals move within their home ranges to utilize available habitat resources). UTRGV researchers noted that the distribution of red knots in the vicinity of the VLA was erratic and unpredictable, that the species occurs at the site during narrow windows of time during the year. Red knot group sizes detected in the vicinity of the VLA vary from an average of 4.66 individuals per study area quadrant (UTRGV 2019) to a flock of 1,225 individuals (Pers. Comm., D. Newstead, Biologist, CBBEP, 2021). No dead or wounded red knots have been detected in connection with biological monitoring and other activity monitoring for SpaceX activities. Red knots travel thousands of miles each year between breeding and wintering habitat areas and are exposed to numerous threats that could result in death or injury independent of the proposed action. Therefore, changes in the number of red knots detected at Boca Chica Beach and South Bay, even if precise counts could be practicably made, is not a reliable measure of individuals that are likely to be taken.

As described for the piping plover, take of the red knot would be exceeded in the following circumstances:

- SpaceX exceeds the 11 acres of red knot permanent habitat loss associated with new construction activities under the Proposed Action.
- SpaceX exceeds 800 hours of access restrictions under the Proposed Action in a given year.

Change detection monitoring concludes, with field verification, that more than 0.1 acre of red knot habitat within the combined 0.6-mile rocket heat plume radius and the potential anomaly debris field area has become densely vegetated and is a permanent loss of habitat as a result of the Proposed Action.

EFFECT OF THE TAKE

In the accompanying BCO, we have determined that the level of anticipated take is not likely to result in jeopardy to the ocelot, jaguarundi, northern aplomado falcon, piping plover, red knot, Kemp's ridley, green, loggerhead, hawksbill and leatherback sea turtles. Although we anticipate some incidental take to occur, the implementation of the conservation measures proposed should ultimately result in avoidance and minimization of adverse effects. We have also determined that there will be no adverse modification of piping plover critical habitat and proposed red knot critical habitat.

REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITOINS

As part of the project description, the FAA and/or SpaceX will implement measures to avoid and minimize impacts to the ocelot, jaguarundi, northern aplomado falcon, piping plover, red knot and sea turtles. The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the impact (i.e., amount or extent) of incidental take on these species and to monitor incidental take to ensure that the anticipated amount or extent is not exceeded:

1. Minimize the extent, severity, frequency, and/or likelihood of modifying habitat for the ocelot, jaguarundi, northern aplomado falcon, piping plover, red knot, and sea turtles.
2. Minimize the risk of vehicle collisions by project-related traffic with ocelots or jaguarundis.
3. Monitor and report on the implementation of project activities that cause incidental take and the conservation measures included in the project description.
4. Monitor and report on the abundance of the listed species addressed in this consultation.
5. Monitor and report on the condition of vegetation adjacent to the project boundary that contributes to habitat for the piping plover and red knot.
6. Establish a protocol to notify the Service of direct take of a federally threatened or endangered species.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the FAA and/or SpaceX must comply with these terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary

1. FAA will ensure that any license or permit to SpaceX related to the Proposed Action will include a condition that SpaceX implement all of the terms and conditions of the BCO.

2. SpaceX will implement the conservation measures, many of which include related monitoring and reporting measures, described in the Proposed Action that address aspects of construction, operation, anomaly response, educational briefings, and other conservation measures and voluntary offsets. These measures minimize habitat modification, which can cause take via harm, for the ocelot, jaguarundi, northern aplomado falcon, piping plover, red knot, and/or sea turtles. These conservation measures require implementation, with updates as described, of certain facility and operational plans:
    a. Lighting Management Plan

b. Fire Mitigation and Response Plan
c. Spill Prevention, Control, and Countermeasures Plan (SPCC)
d. Stormwater Pollution Prevention Plan (SWPPP)
e. Anomaly Response Plan
f. Access Restriction Notification Plan
g. Site Security Plan
h. Traffic Control Plan
i. Biological Monitoring Plan

SpaceX will provide the Service and FAA with written notice of updates to these plans on a quarterly basis.

3. In addition to implementing the conservation measures included in the Proposed Action, SpaceX will also implement the following additional conservation measures proposed by the Service to implement the reasonable and prudent measures:

   a. Litter Control, Clean-ups, and Containment
      i. SpaceX will conduct quarterly SH 4 cleanup efforts east of the first public hard checkpoint to reduce garbage and litter along the road. The cleanup efforts will take place within the SH 4 right-of-way. SpaceX will keep all vehicles used to support clean-ups on designated roadways. SpaceX will report the dates of the cleanups in the annual monitoring report submitted to the Service. This measure minimizes the severity of habitat modifications (i.e., the presence of litter or garbage) that may attract animals that prey on or compete with northern aplomado falcons, piping plovers, red knots, or sea turtles. This measure also benefits ocelots and jaguarundis by minimizing the likelihood or severity of increased prey concentrations along SH 4 that could lead to increased vehicle collision mortality.
      ii. SpaceX will ensure that staff and contractors place non-hazardous waste materials, litter, and other discarded materials, such as construction waste, on the VLA in containers until removed from the site. All trash containers will have predator-proof secured lids and be kept closed at all times and trash will be removed regularly. This measure minimizes the severity of habitat modifications (i.e., the presence of litter or garbage) that may attract animals that prey on or compete with northern aplomado falcons, piping plovers, red knots, or sea turtles. This measure also benefits ocelots and jaguarundis by minimizing the likelihood or severity of increased prey concentrations along SH4 that could lead to increased vehicle collision mortality.
      iii. SpaceX will perform quarterly beach cleanups of Boca Chica Beach to reduce the likelihood of attracting predators (i.e., minimizing habitat modification) of the piping plover, red knot, and sea turtles to the beach. SpaceX will perform these beach cleanups for 1.5 miles north and south of the VLA. SpaceX will provide the opportunity for resource agencies (i.e., TGLO, Service) to participate and teach the community about the area's wildlife, sensitive areas, beach debris, and beach cleanup. Space X will report the dates of the cleanups in the annual monitoring report submitted to the Service.

iv. SpaceX will coordinate with TxDOT to help ensure that the shoulders of SH 4 east of the first public hard checkpoint are maintained by regular mowing and trimming to keep vegetation shorter than 12 inches. SpaceX will notify TxDOT that maintenance may be warranted when vegetation along SH 4 exceeds approximately 9 inches. TxDOT will be responsible for performing roadway vegetation maintenance. This measure minimizes vegetation cover along SH 4 and minimizes the likelihood of vehicle collisions with ocelots or jaguarundis.
v. SpaceX will construct a barrier along the northern boundary of the VLA to assist in keeping debris from entering the refuge, help deflect off-gassing of liquid nitrogen, reduce sound transmission. Construction of the barrier wall will be completed prior to the start of launch operations. This measure will minimize the extent and severity of habitat modification for piping plovers and red knots that use areas adjacent to the VLA.
vi. Cryogenic testing and other pressure tanks used under the Proposed Action will be tethered by cables when practicable to the VLA site to help prevent debris from leaving the VLA. This measure will minimize the extent and severity of habitat modification for piping plovers and red knots that use areas adjacent to the VLA.

b. Noise and Lighting Management
i. SpaceX will minimize noise from generators that may be used during construction and/or operations at the VLA under the Proposed Action. SpaceX will ensure that generators are placed within baffle boxes (a sound-resistant box that is placed over or around a generator), have an attached muffler, or use another noise-abatement method consistent with industry standards. This measure minimizes the severity of habitat modification for piping plovers and red knots that use areas adjacent to the VLA.
ii. SpaceX will perform inspections of the lighting installed as part of the Proposed Action on a biweekly basis during the sea turtle nesting and hatching season (March 15 to October 1) to ensure that the minimization measures specified in the Lighting Management Plan are installed and in good working order. SpaceX will document compliance with the Lighting Management Plan and note any deviations. SpaceX will address deviations with the Service on a timely manner to implement corrective actions. SpaceX will report any deviations and responsive actions to the Service in its annual report. This measure minimizes the severity of habitat modification for sea turtles.
iii. SpaceX will monitor nighttime light levels on the beach within 1.5 miles of the VLA at least once before the start of the sea turtle nesting season and biweekly during the sea turtle nesting and hatching season (March 15 to October 1). SpaceX will perform this monitoring at least once per year at a time when there is a launch vehicle at the VLA (i.e., a condition when more lighting at the site is needed for safety and security), even if this monitoring event occurs outside of the sea turtle nesting and hatching season. SpaceX will perform this monitoring between 9:00pm and 5:00am. SpaceX will use the information to identify any practicable opportunities for modifying lighting at the VLA (with updates to the Lighting Management Plan, as appropriate) that reduce light levels at the beach while maintaining operational needs for safety and security. SpaceX will

document and summarize its monitoring and any responsive actions in the annual report to the Service. This measure minimizes the severity of habitat modification for sea turtles.

c. Stormwater Management and Monitoring
    i. SpaceX will implement the water resources mitigation measures described in the final PEA. These measures address compliance with TCEQ Texas Pollution Discharge Elimination System permits, updates and/or implementation of its SPCC and SWPPPs, and development and implementation of associated water quality monitoring in coordination with TCEQ. These conservation measures are part of the proposed action and will minimize modification of habitat for piping plovers and red knots that use areas adjacent to the VLA (e.g., habitat modification resulting from discharges of sediment and freshwater runoff into the wind tidal flats adjacent to the VLA).
    ii. SpaceX will seek input from the Service on updates to its SWPPP prior to the start of construction activities under the proposed action. SpaceX will ensure that the updated SWPPP includes best practices appropriate to coastal ecosystems that minimize the transport of sediment and the discharge of freshwater runoff outside of the VLA and maximize the retention or infiltration of runoff within the VLA. This measure will minimize modification of habitat for piping plovers and red knots that use areas adjacent to the VLA (e.g., habitat modification resulting from discharges of sediment and freshwater runoff into the wind tidal flats adjacent to the VLA).

d. Site Boundaries and Limits of Construction Disturbance
    i. SpaceX will clearly demarcate the perimeter of all areas to be disturbed during construction activities under the Proposed Action using flagging or temporary construction fence and no disturbance outside that perimeter will be authorized. This measure minimizes the extent of habitat modification for the piping plover and red knot that use area adjacent to the VLA.
    ii. SpaceX shall use areas within the project boundary or other area subject to prior disturbance for staging, parking, and equipment storage in connection with the Proposed Action. This measure minimizes the extent of habitat modification for the piping plover and red knot that use area adjacent to the VLA.
    iii. SpaceX will obtain any gravel or topsoil needed during construction activities under the Proposed Action from existing developed or previously used sources, and not from undisturbed areas that provide habitat for the ocelot, jaguarundi, piping plover, or red knot. The measure minimizes the extent of habitat modification for ocelots, jaguarundis, piping plovers and red knots.

e. Erosion, Sedimentation, and Rutting
    i. Consistent with TCEQ stormwater permit conditions, during construction activities associated with the Proposed Action SpaceX will ensure that best practices are applied at the VLA that minimize the deposit of eroded materials outside the boundary of the VLA. This measure minimizes the severity of habitat modification for the piping plover and red knot (via deposit of materials that could alter the microtopography of adjacent flats) that use areas adjacent to

the VLA.

f. Traffic and Trespass Management
    i. In coordination with TxDOT and the Service, SpaceX will install five signs along SH 4 to inform the public on areas (such as sensitive areas of the Refuge and the dunes) where they may not watch ongoing activities and launches. Signs would be installed within 6 months of issuance of the BCO.
    ii. SpaceX will initiate coordination with TxDOT within 30 days of issuance of the BCO regarding the installation of up to 5 additional wildlife crossing signs along SH 4 for a total of 10 signs (5 in each direction) to reduce the risk of collision mortality for ocelots and jaguarundis. SpaceX has already installed 5 wildlife crossing signs. Pending TxDOT approval, SpaceX will purchase and install the additional 5 signs. Installation of the signs will be completed within 6 months of issuance receiving TxDOT approval of the sign locations.
    iii. SpaceX security patrol vehicles or other necessary SpaceX vehicles on Boca Chica Beach will be driven above the "wet line" (i.e., the line on the beach where waves reach and repeatedly wet the sand at the time the driver passes by) and at a speed not to exceed 15 mph. This measure minimizes the severity of habitat modification for piping plovers and red knots.

g. Biological Monitoring
    i. SpaceX will continue to implement the SpaceX Boca Chica Launch Site Biological Monitoring Plan to survey for sea turtles, birds, and vegetation changes. Monitoring reports will be included as part of the SpaceX's annual monitoring report submitted to the Service. After five years of monitoring, and when SpaceX applies for a renewal or extension of its license or permit, the Service, the FAA, and SpaceX will evaluate the need to modify, adapt, or discontinue the monitoring. Sea turtle monitoring on Boca Chica Beach will be conducted prior to implementation of access restrictions and security sweeps for, and as soon as practicable after, suborbital and orbital launches. Post-launch monitoring can be conducted by Sea Turtle Inc.; however, the use of drones is acceptable if Sea Turtle Inc. is unable to conduct monitoring in-person. Findings will be included in the annual report to the Service.
    ii. SpaceX will continue to offer enhanced satellite monitoring via solar powered Starlink to the Peregrine Fund for continuous video coverage of northern aplomado falcon habitat to aid in biological monitoring.
    iii. If sea turtle nests are discovered prior to closure and security sweeps, SpaceX will coordinate with Sea Turtle Inc. to remove eggs prior to launch. Findings will be included in the annual report to the Service.
    iv. SpaceX will provide a dedicated space for Sea Turtle, Inc. volunteers on SpaceX property to monitor Boca Chica Beach use and to conduct pre-and post-launch surveys at Boca Chica Beach.

h. Annual Reporting and Coordination
    i. If SpaceX plans to conduct more than 2 of the 10 annual launches under this Proposed Action at night during the sea turtle nesting and hatching season (March 15th – October 1st), SpaceX and the FAA will contact the Service within 30 days of the third nighttime launch (and any subsequent

nighttime launches planned during that year) to discuss if there is a need for additional take authorization.

ii. SpaceX will submit an annual monitoring report to the Service by March 1st for the preceding calendar year. The annual report will include monitoring results, measures implemented during project activities, success of such measures, incidences, and any recommendations on improvements to those measures. Reports should be sent to: U.S. Fish and Wildlife Service, Texas Coastal Ecological Services Field Office, ATTN: Field Supervisor, 4444 Corona, Suite 215, Corpus Christi, Texas 78411 or email to dawn_gardiner@fws.gov.

iii. If the FAA issues SpaceX a vehicle operator license for Starship/Super Heavy launch operations at the Boca Chica Launch Site, this BCO would expire concurrent with the expiration of the FAA's license. SpaceX will notify the Service if SpaceX plans to continue FAA-licensed activities (i.e., applying for license renewal or a new license) no later than 6 months before FAA's license expires. FAA would conduct its consultation obligations as required under ESA Section 7 as part of its evaluation of SpaceX's license application.

Disposition of Dead or Injured Listed Species

Upon locating a dead, injured, or sick listed species on refuge lands contact Refuge Law Enforcement, Iriz Elizondo-Navarro or Romeo Garcia at (956) 784-7520 located at 3325 Green Jay Road Alamo, Texas 78516. If the species is found off refuge contact Special Agent Alejandro Rodriguez at (956) 686-8591, 4500 N. 10th Street #400, McAllen, TX 78504, within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph if possible, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy sent to: U.S. Fish and Wildlife Service, Texas Coastal Ecological Services Field Office, ATTN: Assistant Field Supervisor, 4444 Corona, Suite 215, Corpus Christi, Texas 78411. Care must be taken in handling sick or injured animals to ensure effective treatment and care, and in handling dead specimens to preserve the biological material in the best possible state.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1) In coordination with the Service, SpaceX would identify and voluntarily acquire, protect, and/or preserve suitable habitat in and near the SpaceX Action Area, for ocelots, jaguarundis, piping plover, and/or red knots and ensure management in perpetuity.

2) In coordination with the Service SpaceX would voluntarily implement various measures for the monarch butterfly, a candidate species. Measures may include:
   - Seeding and planting native milkweed (Zizote family), to restore or create monarch habitat. This should occur outside of the areas that could be affected by LLCC and VLA operations to avoid potential impacts to the restored or created habitat (e.g.,

outside areas that could be damaged falling debris or potential fire).
- Implementing best management practices to control invasive plant species. An example of such a measure could be to follow seed recommendations from the Caesar Kleberg Wildlife Research Institute. This would allow native plant species to outcompete any invasive plants.
- Working with various groups, such as Learning Landscapes and Friends of the Wildlife Corridor, to construct some outdoor pollinator gardens and plant pollinator rich plants. A good contact would be Allen Williams at (956) 460-9864.

3) Develop design specifications and monitoring for restoring, creating, and enhancing roosting and foraging habitat for piping plovers and red knots.

The Service requests notification of the implementation of any conservation recommendations or actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

REINITIATION NOTICE

This also concludes the conference for the SpaceX Starship/Super Heavy Launch Vehicle Program. You may ask the Service to confirm the conference opinion as a BO issued through formal consultation if the proposed species is listed or critical habitat is designated. The request must be in writing. If the Service determines there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the BO for the project and no further section 7 consultation will be necessary.

After listing red knot proposed critical habitat any subsequent adoption of this conference opinion, the FAA shall re-initiate consultation if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may affect the species in a manner or to an extent not considered in the conference opinion; 3) the agency action is subsequently modified in a manner that causes an effect to the species that was not considered in this opinion or written concurrences; or 4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference opinion does not become effective until the red knot proposed critical habitat is listed and the conference opinion is adopted as the BO issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the proposed red knot critical habitat has occurred.

Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the proposed red knot critical habitat may occur between the listing of the species and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation. Although not required, we recommend that the FAA implement the reasonable and prudent measures and terms and conditions herein prior to our final listing decision. If the species is subsequently listed, implementation of reasonable prudent measures and terms and conditions in any conference opinion adopted as a BO, is mandatory.

This concludes formal consultation on the SpaceX Starship/Super Heavy Launch Vehicle Program. As provided in 50 CFR §402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this BCO or written concurrence; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Please refer to the consultation number, 02ETCC00-2012-F-0186-R001 in future correspondence concerning this project. Should you require further assistance or if you have any questions please contact Dawn Gardiner at (361) 533-6765 or via email at dawn_gardiner@fws.gov.

Sincerely,

Charles Ardizzone
Field Supervisor

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Figure 1. Location

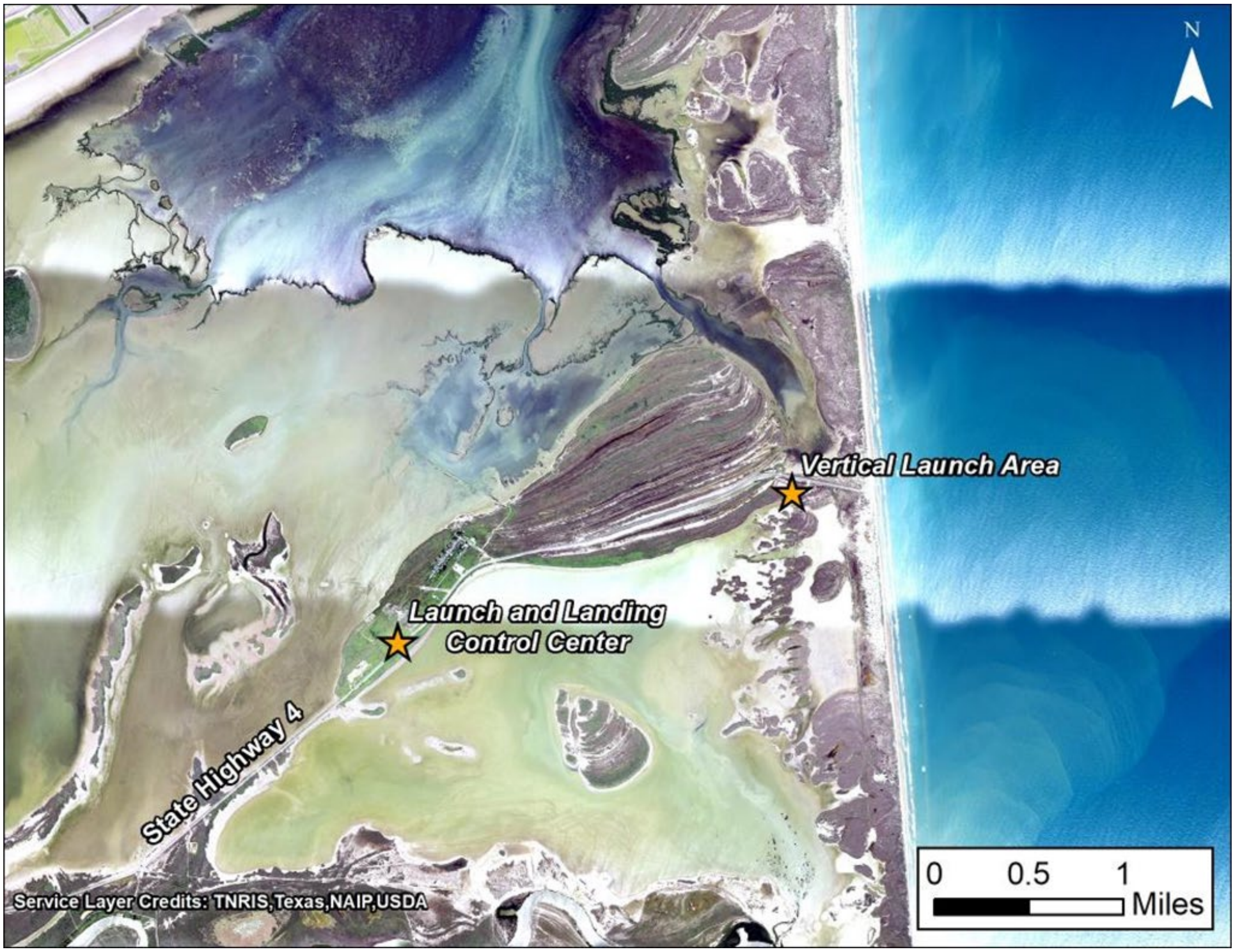

Figure 2. Location of Vertical Launch Area and Launch and Landing Control Center

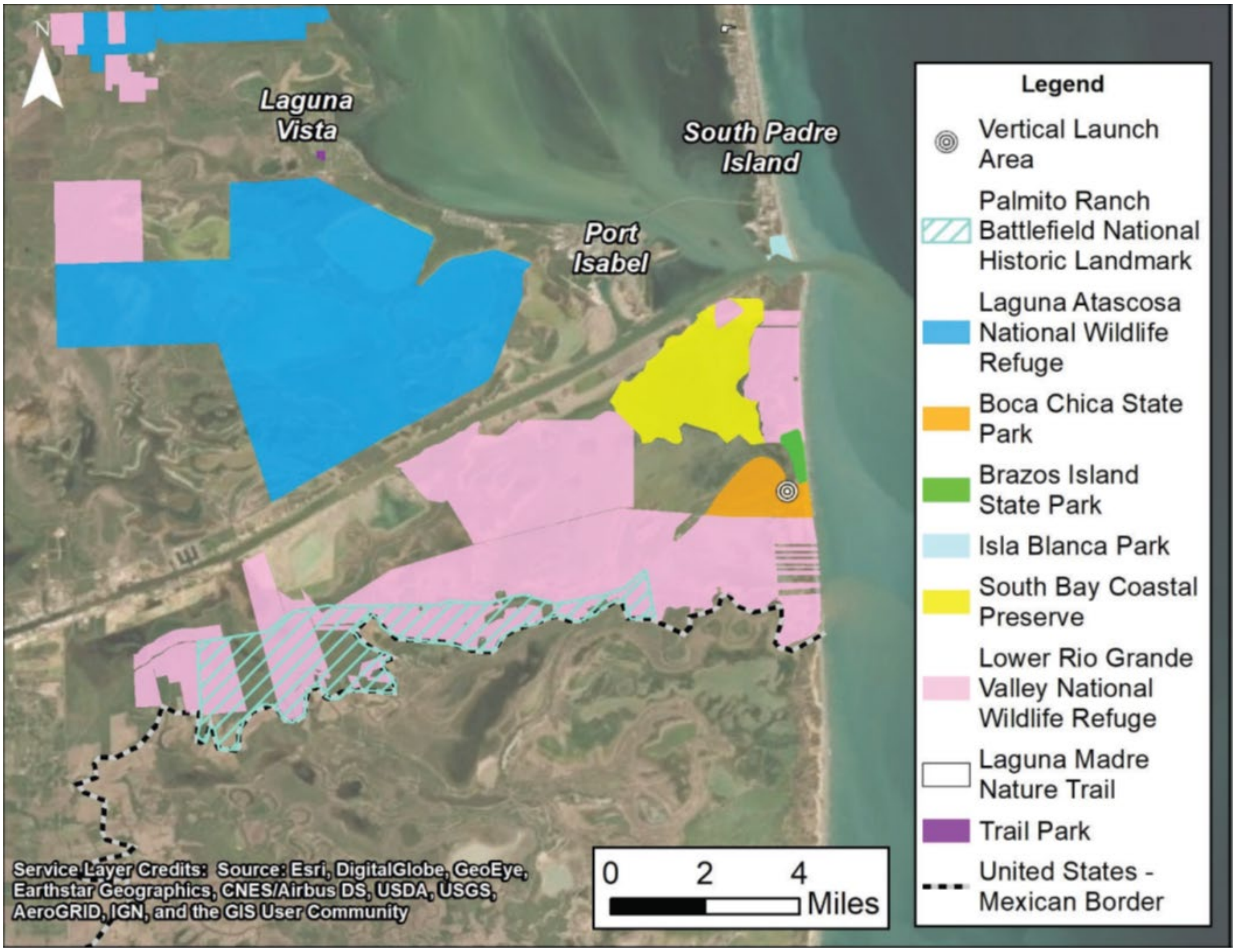

Figure 3. Landownership

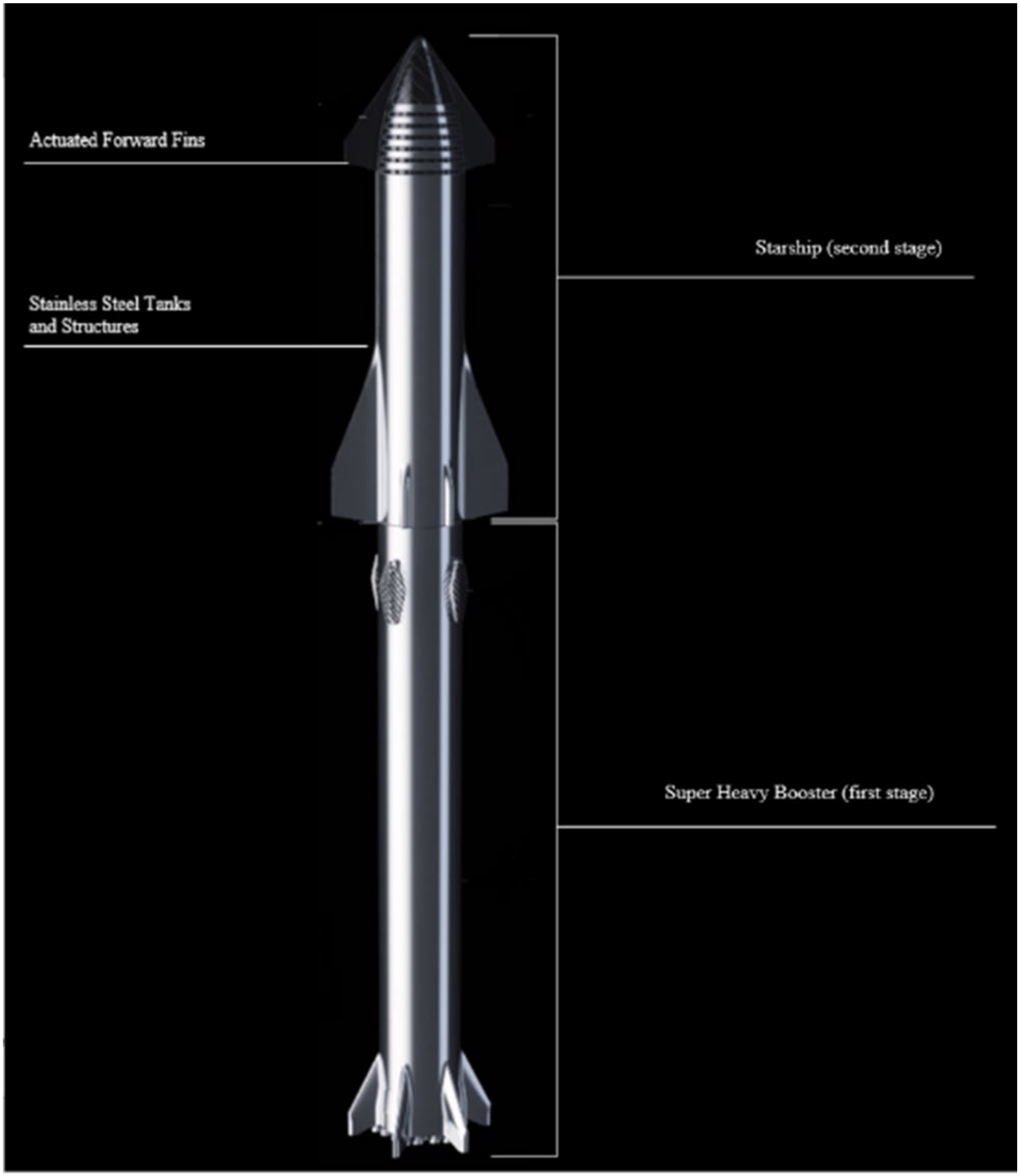

Figure 4. Starship/Super Heavy Design Overview

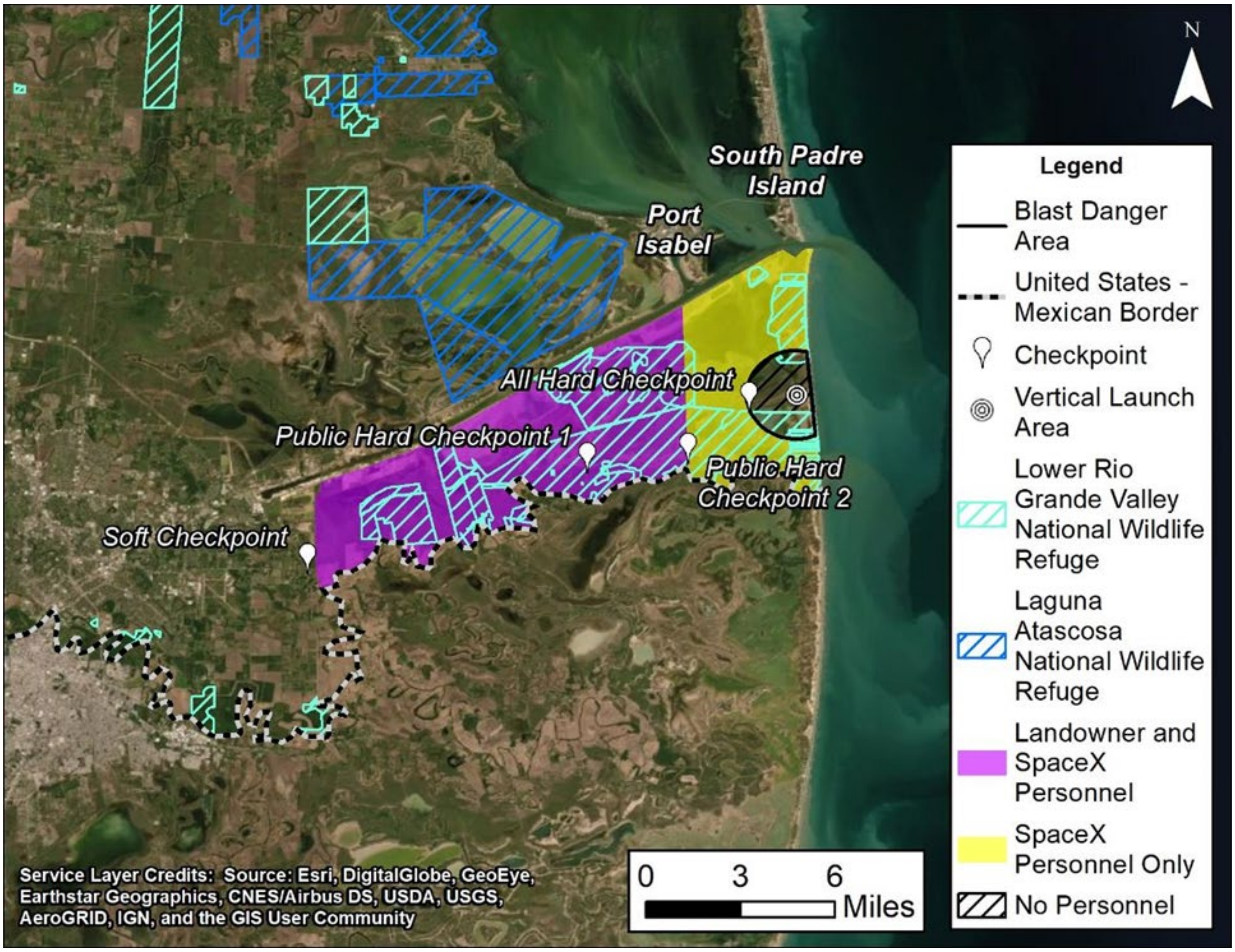

Figure 5. Closure Area/Checkpoints in Relation to National Wildlife Refuges

Eddie Treviño, Jr.

County Judge

For Immediate Release
January 18, 2022
Contact: Eddie Treviño, Jr.

COUNTY'S TEMPORARY CLOSURE OF
BOCA CHICA BEACH AND STATE HIGHWAY 4

On March 15, 2019, the Commissioners' Court approved an Order authorizing County Judge Eddie Treviño, Jr., to execute any and all necessary or appropriate notices or orders of temporary closure of State Highway 4, and/or Boca Chica Beach in connection with space flight activity, now or in the future.

Cameron County Judge Eddie Treviño, Jr., has ordered the temporary closure of access to Boca Chica Beach as well as State Highway 4 from FM 1419 (Oklahoma Ave.) to the entrance of Boca Chica Beach due to anticipated testing activities for SpaceX.

"I have ordered the closure of Boca Chica Beach and Hwy 4 for the purpose of protecting Public Health and Safety during SpaceX non-flight testing activities January 21, 2022, in the time period between 6:00 a.m. C.S.T. to 4:00 p.m. C.S.T. and in the alternative on January 24, 2022, from 10:00 a.m. C.S.T. to 10:00 p.m. C.S.T. and/or January 25, 2022, from 10:00 a.m. C.S.T. to 10:00 p.m. C.S.T., of the same day. Should SpaceX not complete its planned non-flight testing on January 21, 2022, then SpaceX may use the alternate dates to complete its testing activities," Treviño stated.

SpaceX and law enforcement authorities will be coordinating to ensure that no individuals or vehicles are allowed access to these areas during these times of the day. In coordination with the County, SpaceX will establish a safety zone perimeter that will include two temporary checkpoints on Highway 4. Individuals who provide proof of residence between the two checkpoints will be allowed to proceed through the soft checkpoint and access their homes during testing. Access beyond the hard checkpoint to the beach will not be permitted during temporary closures. The beach will be closed and those wishing to visit a beach during the closures may do so on South Padre Island at County parks: Cameron County Beach Access No. 3, Cameron County Beach Access No. 4, Cameron County Beach Access No. 4 (West) or Cameron County Beach Access No. 5 (West).

If you have any questions or concerns please refer to the Cameron County website, www.cameroncountytx.gov/spacex/.

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Cameron County Courthouse
Oscar C. Dancy Building | *1100 E. Monroe Street, Suite 218* | *Brownsville, Texas 78520*
Phone (956) 544-0830 | *etrevino@co.cameron.tx.us* | *Fax (956) 544-0801*

Figure 6. Example of Temporary Closure Order

Figure 7. Survey-Verified Vertical Launch Area Parcel

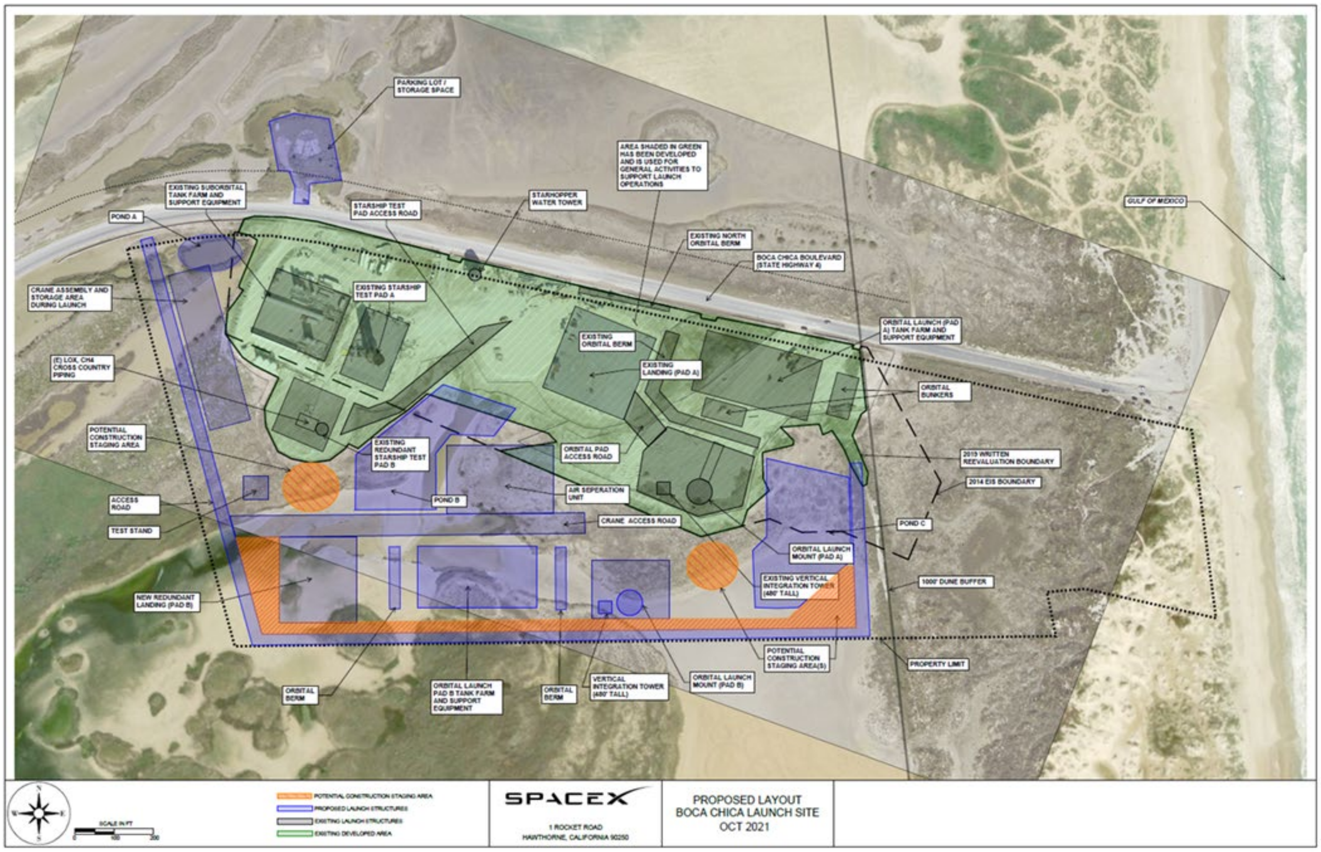


Figure 8. Proposed Vertical Launch Area Layout

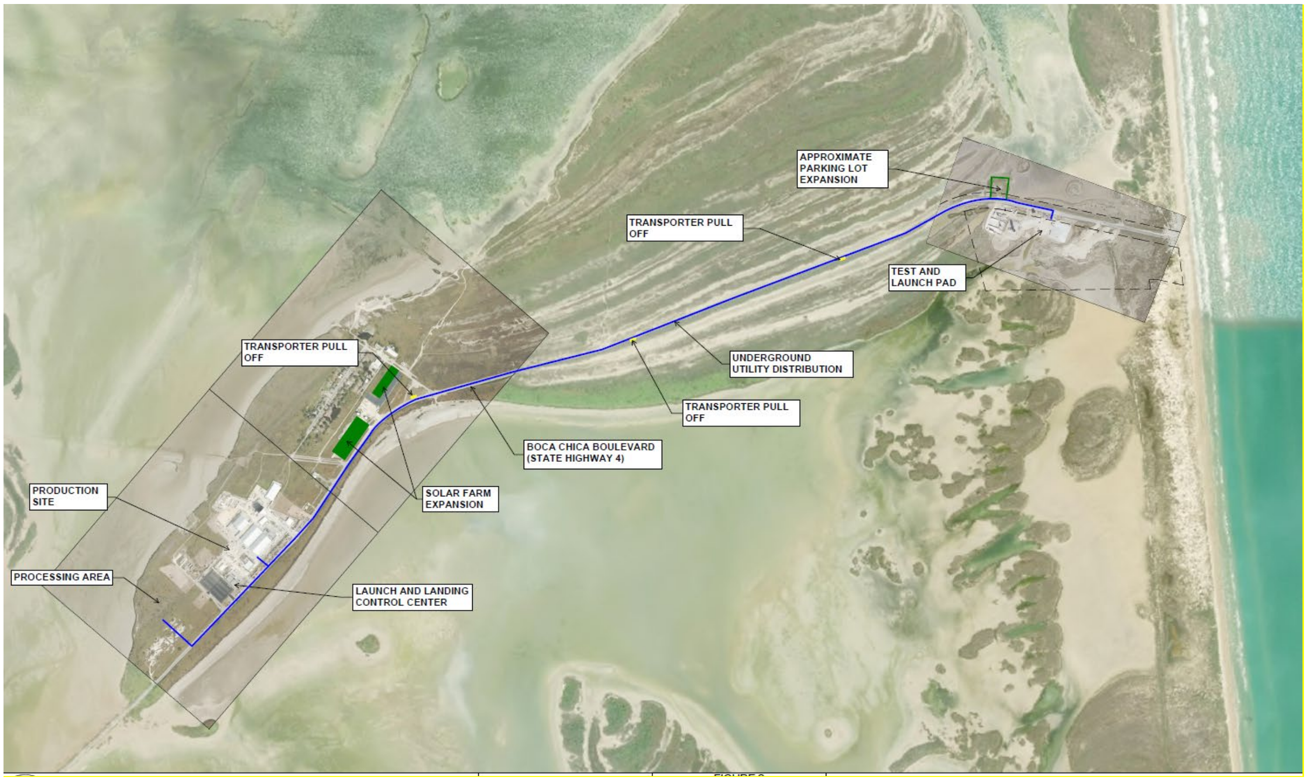


Figure 9. Site Overview

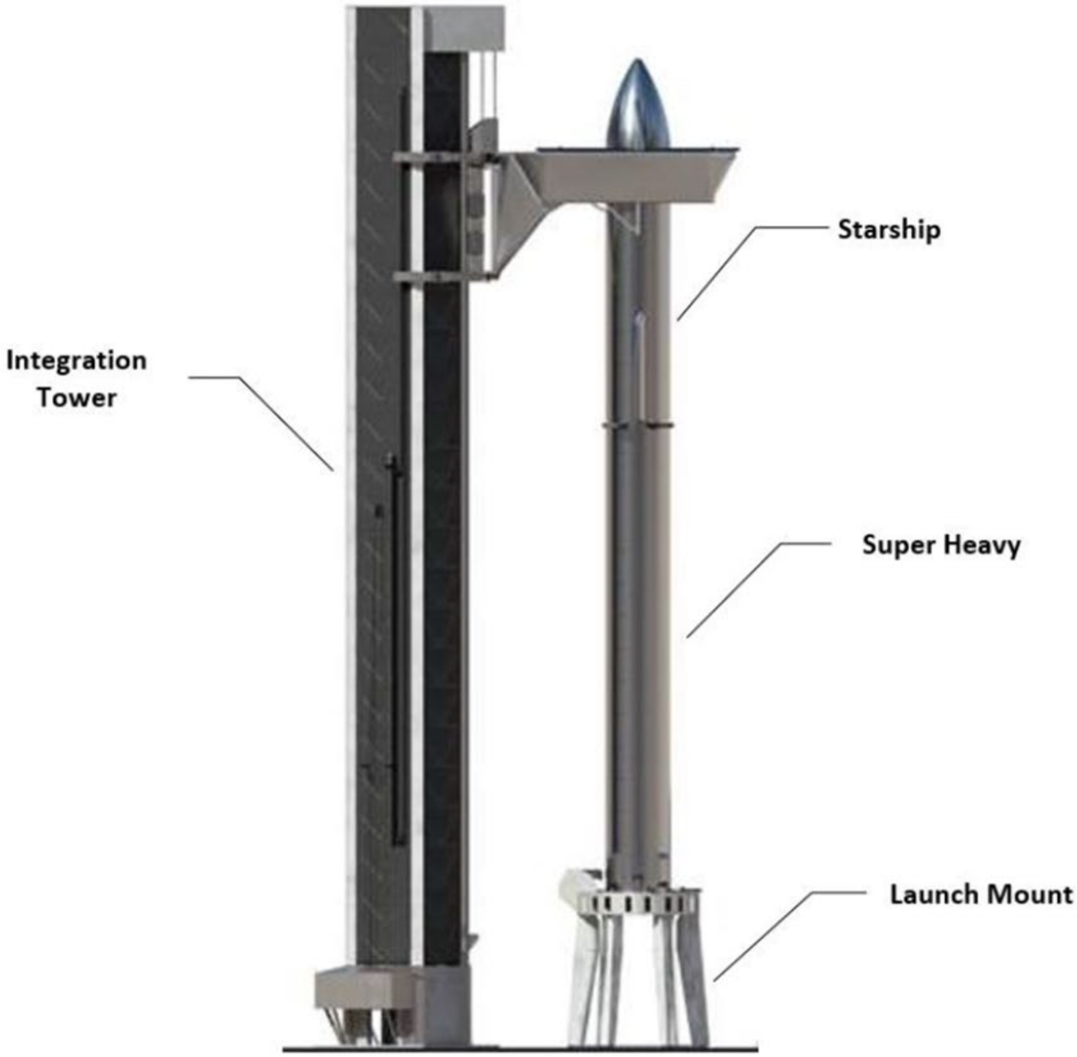


Figure 10. Launch Mount, Launch Vehicle, and Integration Tower

Figure 11. Proposed Solar Farm Layout

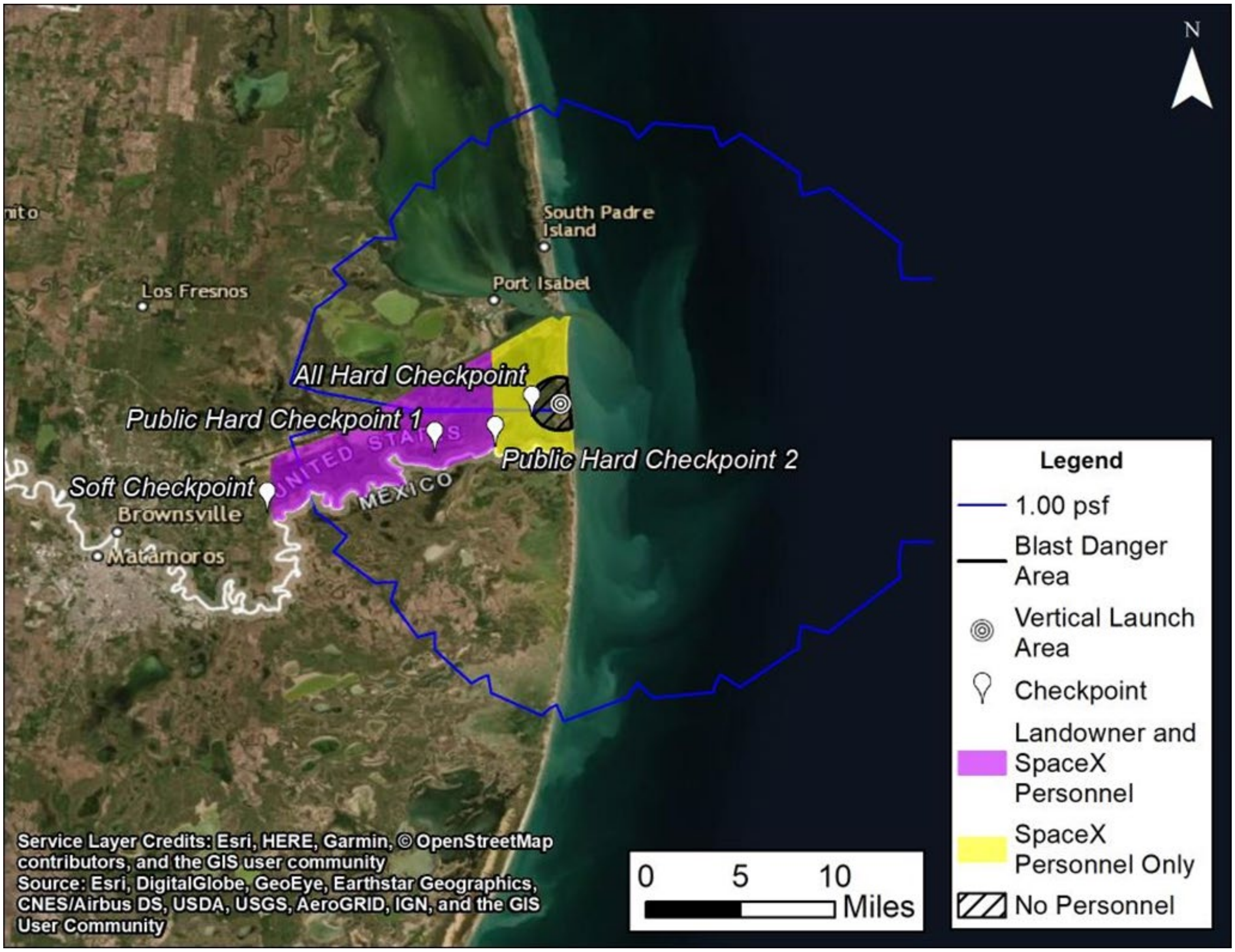


Figure 12. Action Area

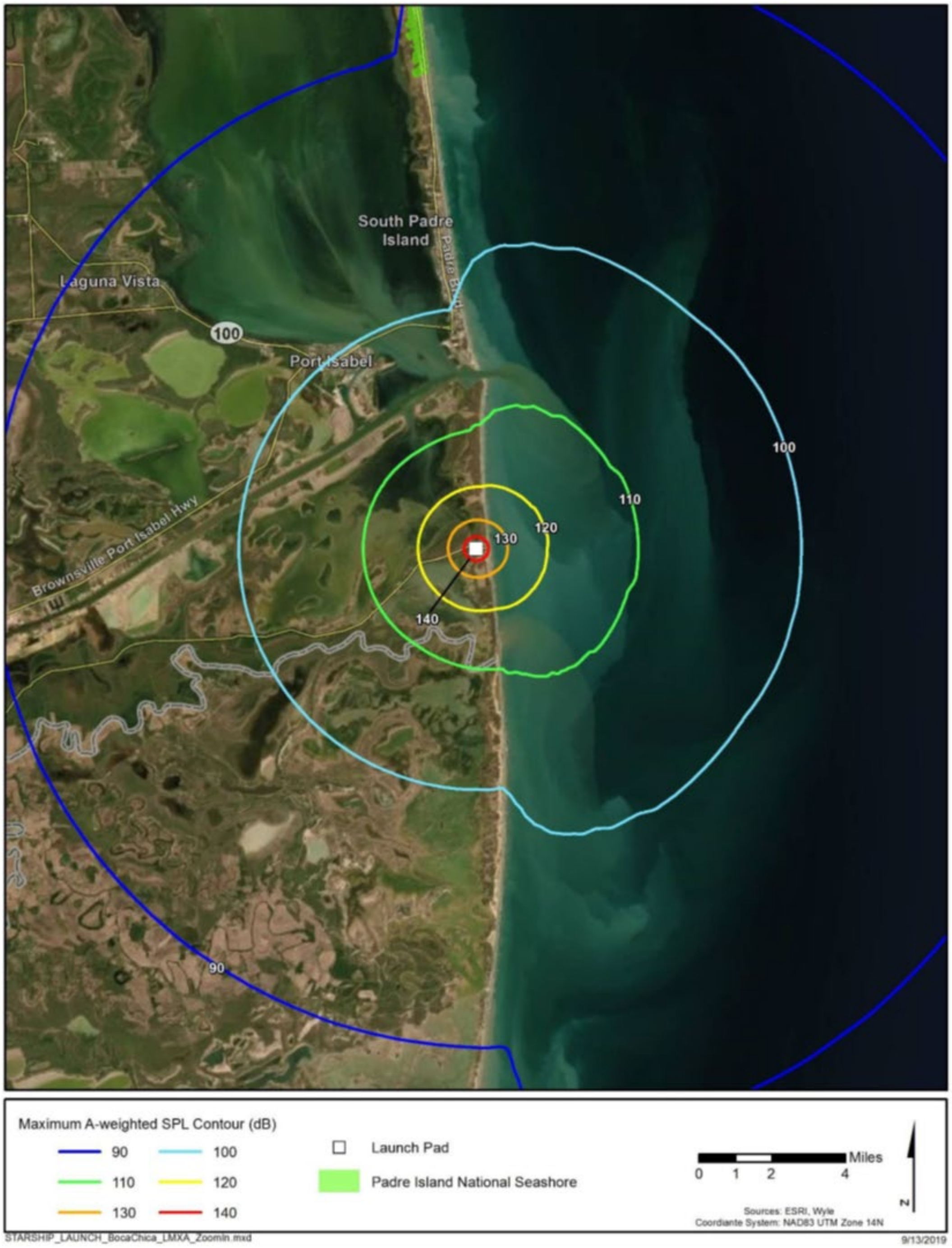


Figure 13. Starship/Super Heavy Launch from the Boca Chica Launch Site: Maximum A-Weighted Sound Levels

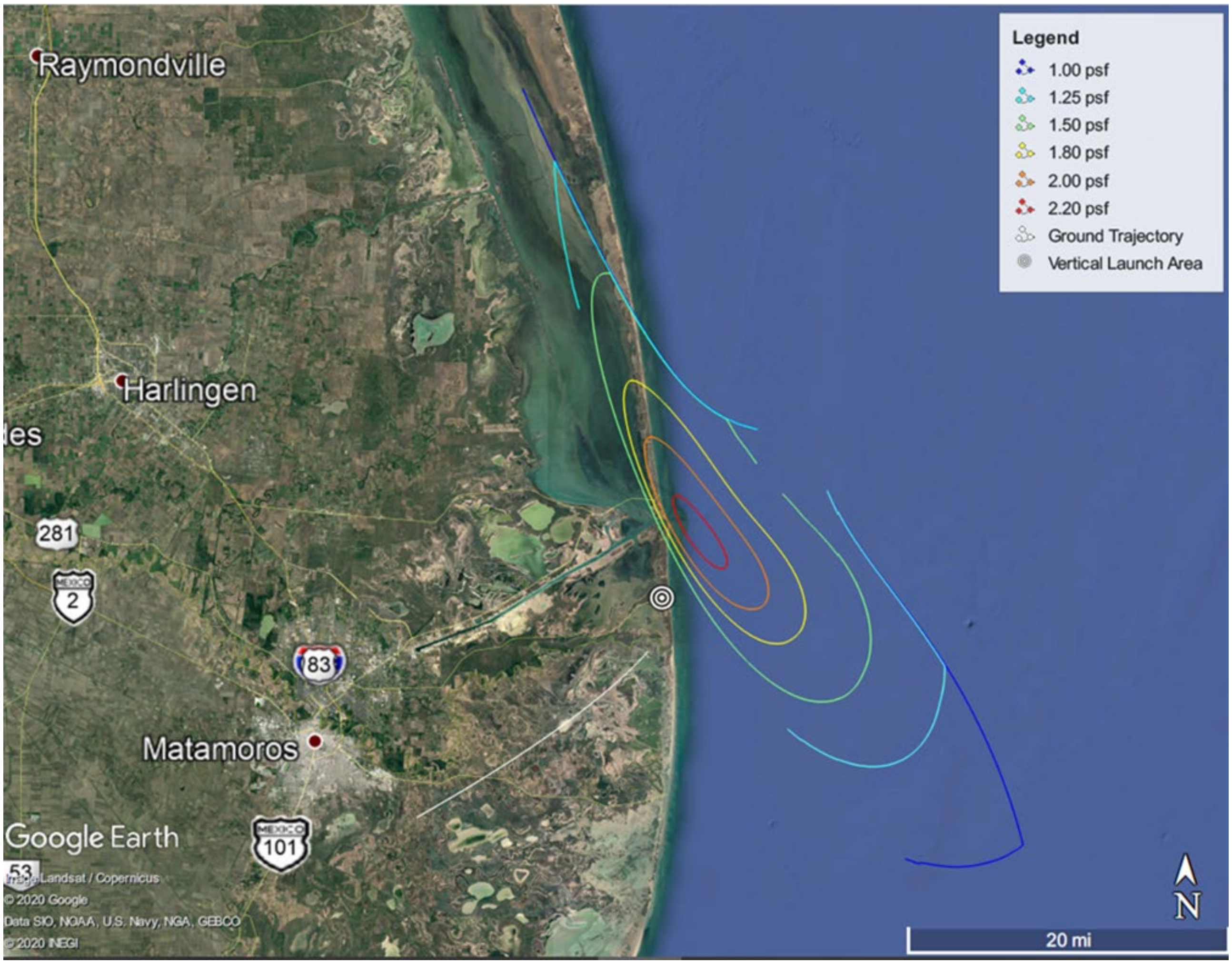


Figure 14. Sonic Boom Contours for Starship Landing at the VLA

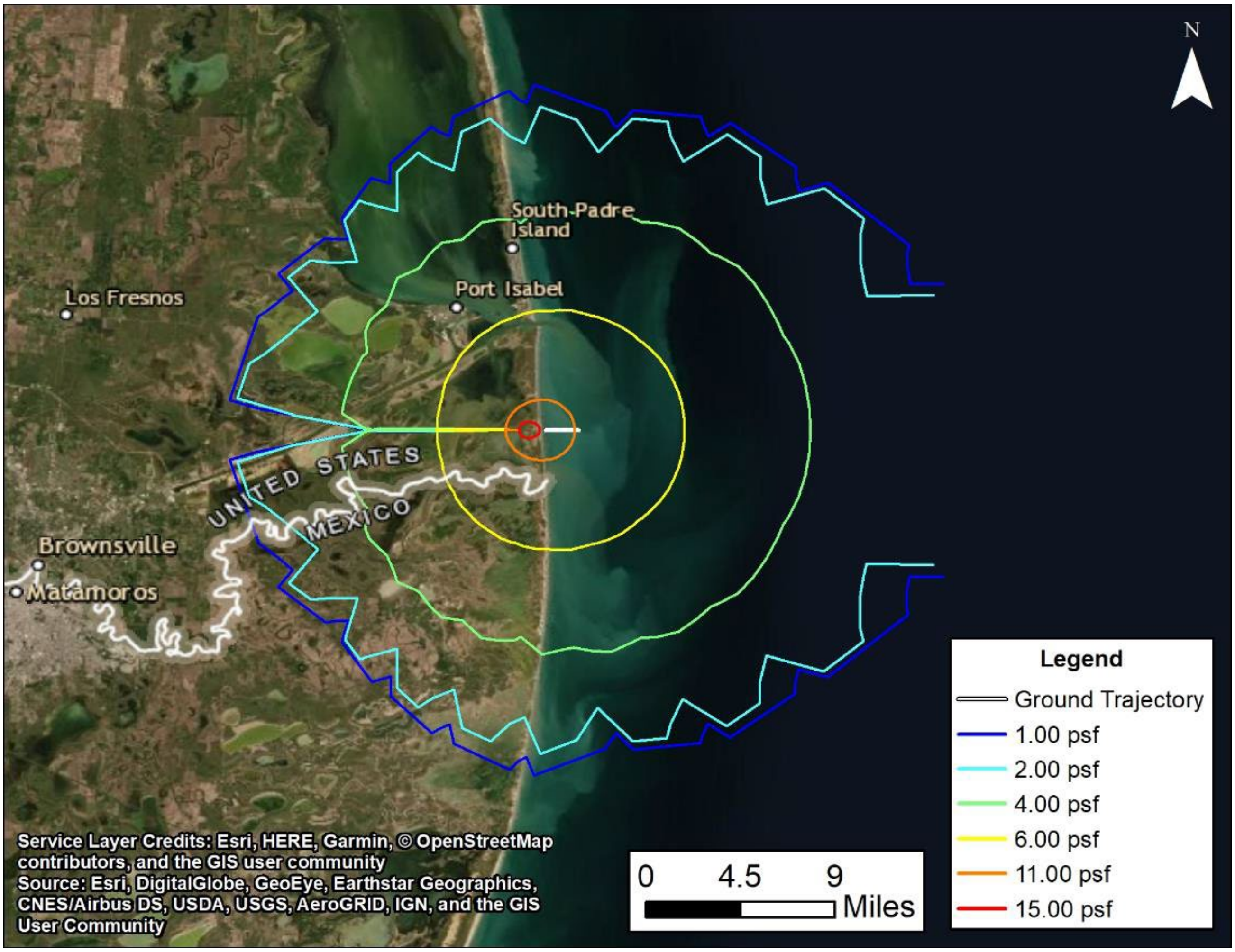


Figure 15. Sonic Boom Contour for Super Heavy Landing at the VLA

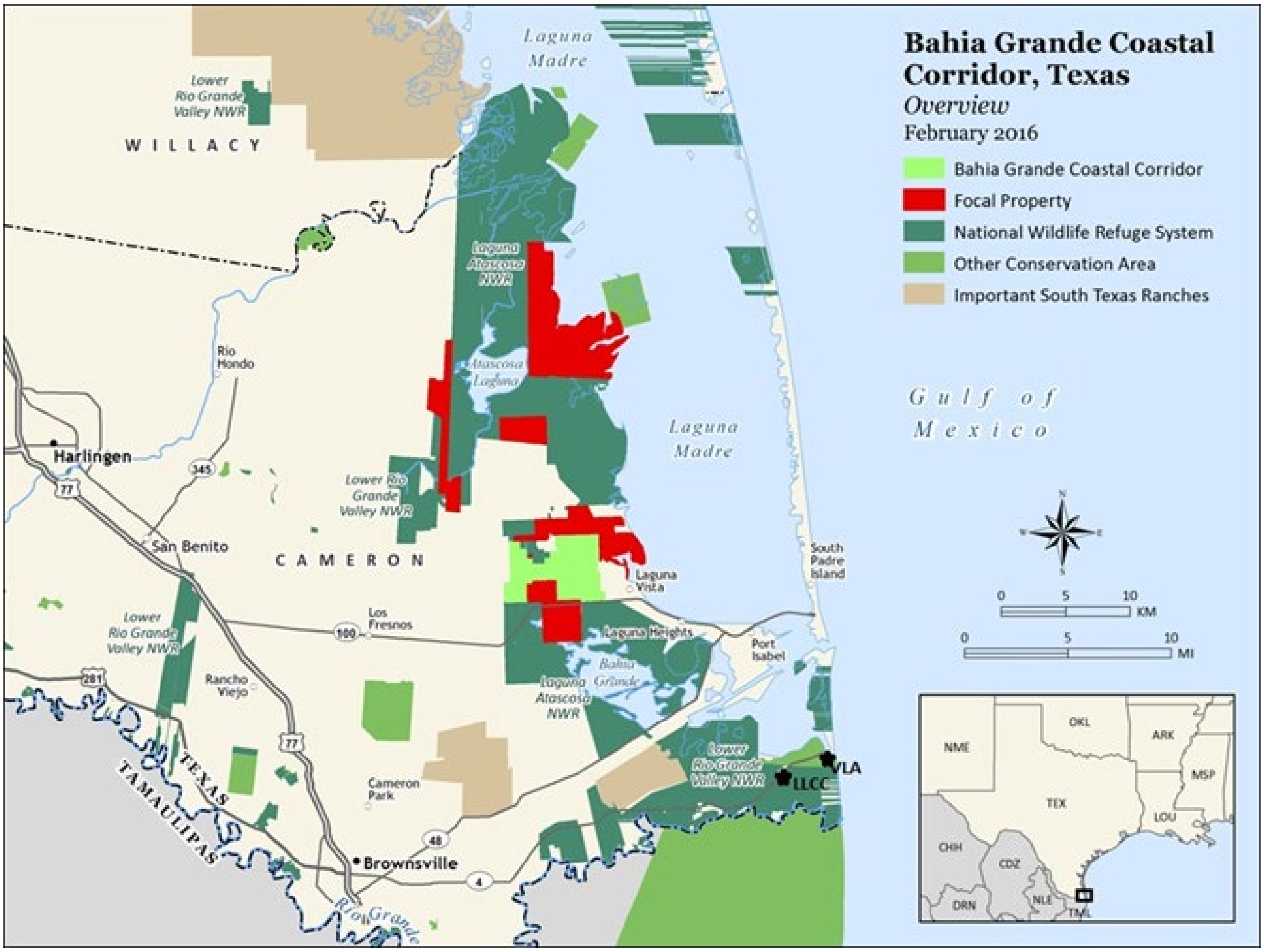


Figure 16. Bahia Grande Coastal Corridor, Texas (BGCCP)

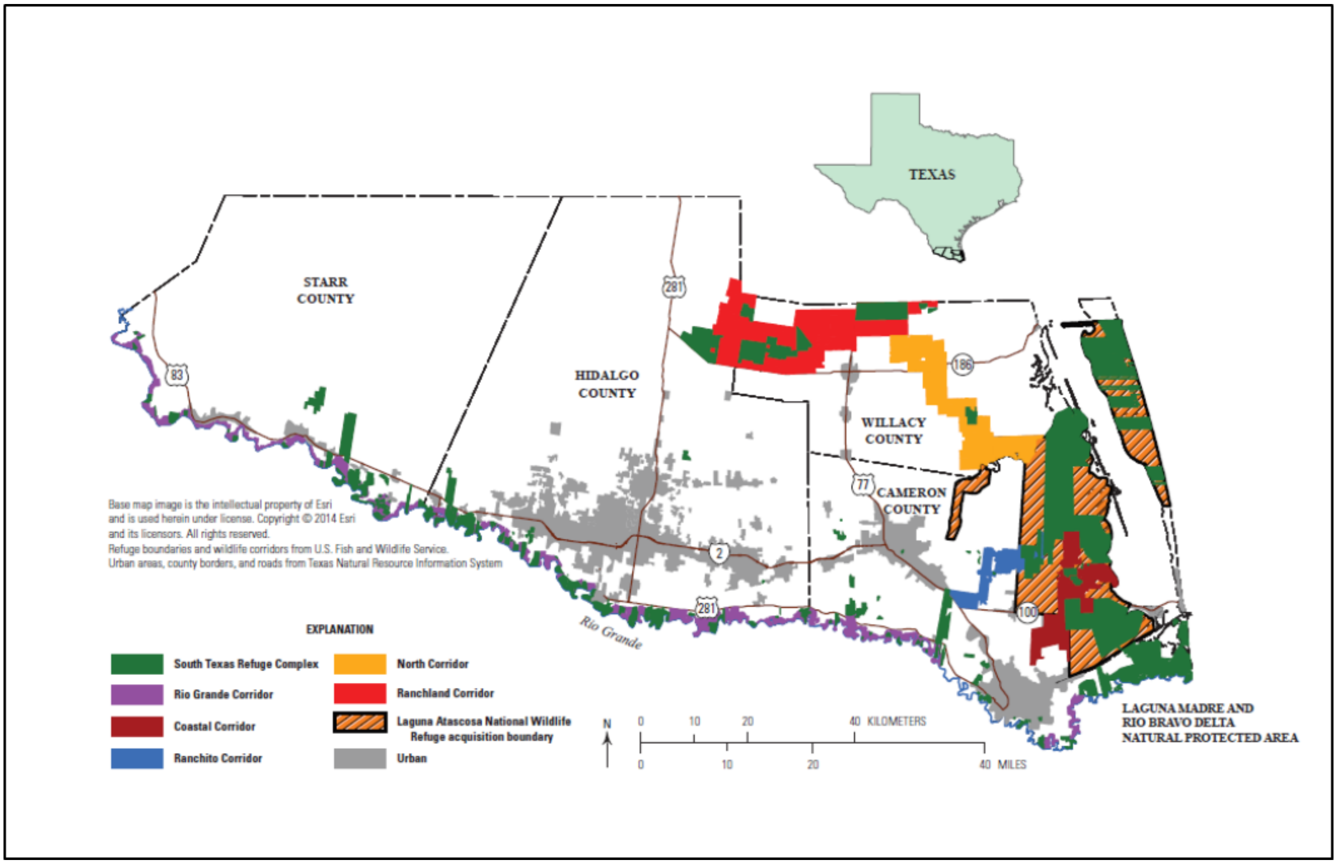


Figure 17. Thornscrub Protection, Enhancement and Restoration Cooperative Agreement Conceptual Ocelot and Jaguarundi Corridor Map

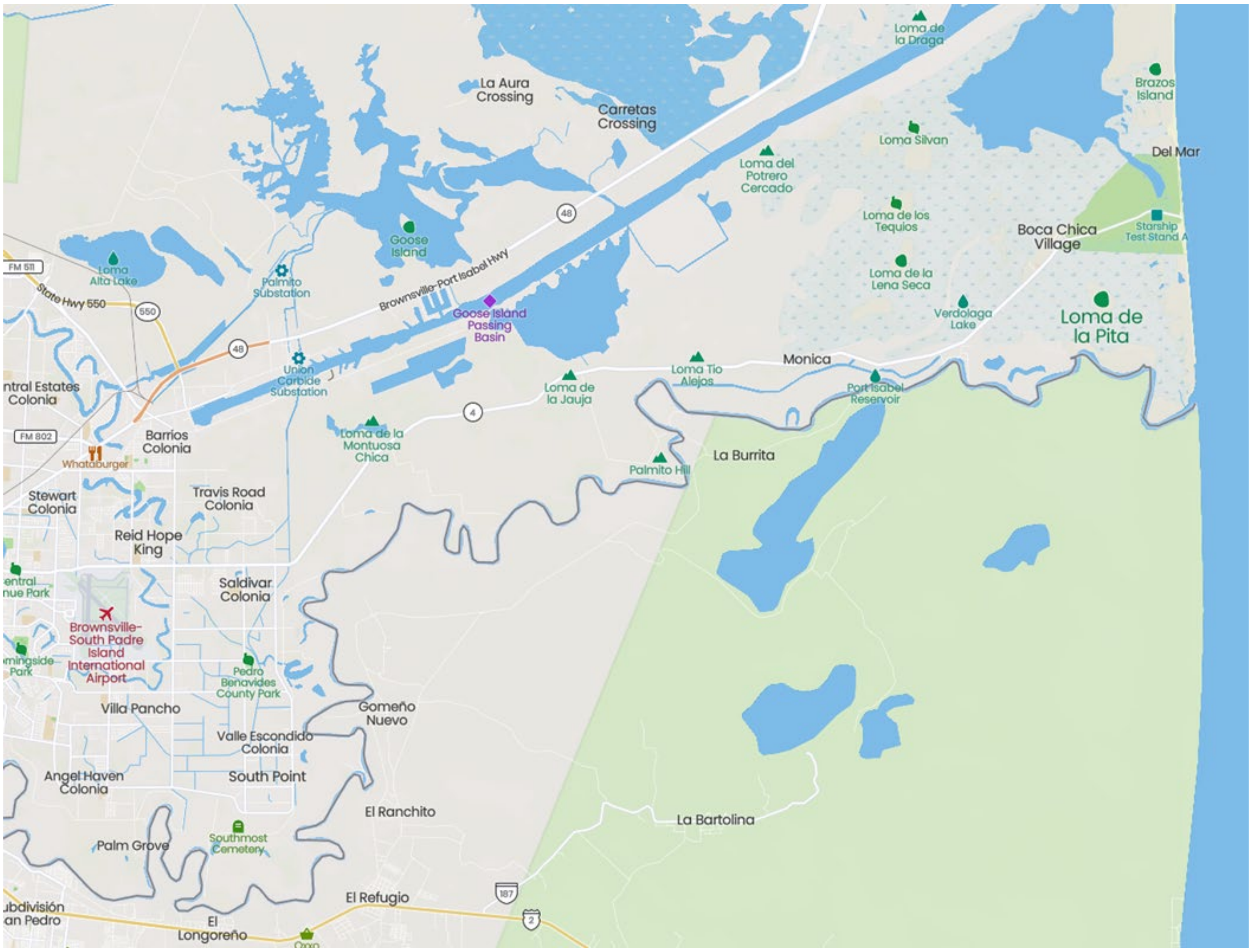


Figure 18. Lomas of the Bahia Grande

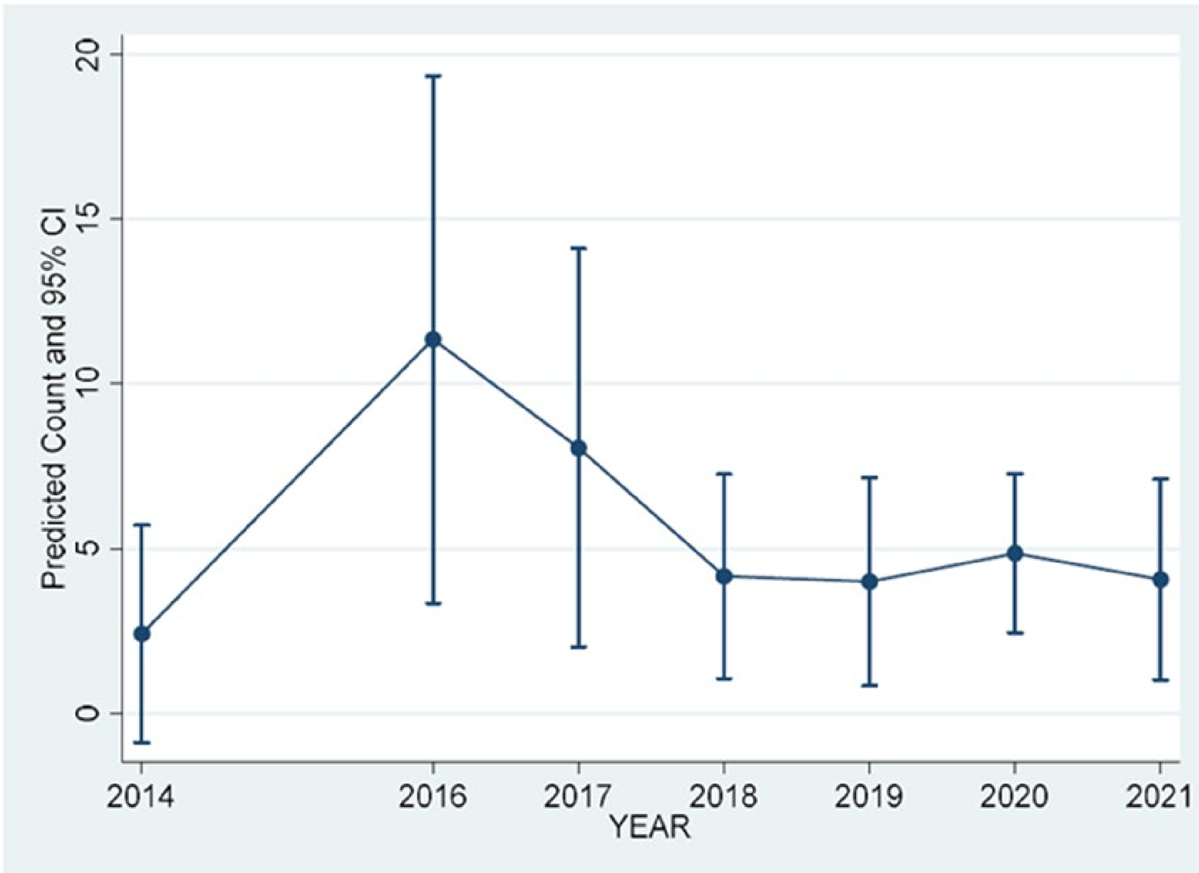


Figure 19. UTRGV. Predicted mean counts of piping plover (expressed as the number of piping plovers observed per 100 m of survey route traveled) by biological year from the discrete Poisson Model. From SWCA (2022).

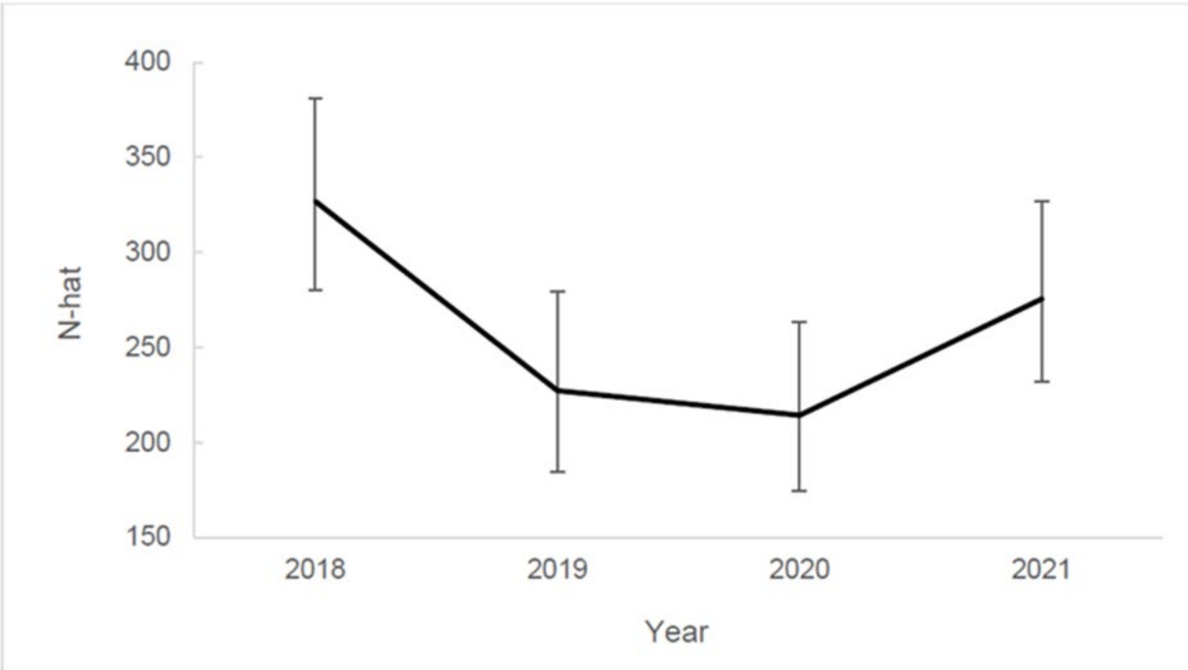


Figure 20. N&H. Population estimates (N-hat) and 95 percent confidence intervals for Boca Chica 2018-2021 based on the top model. “Year” is the calendar year of the beginning of the nonbreeding period (i.e. “2018” is fall and winter beginning 2018, ending 2019). From Newstead and Hill (2022).

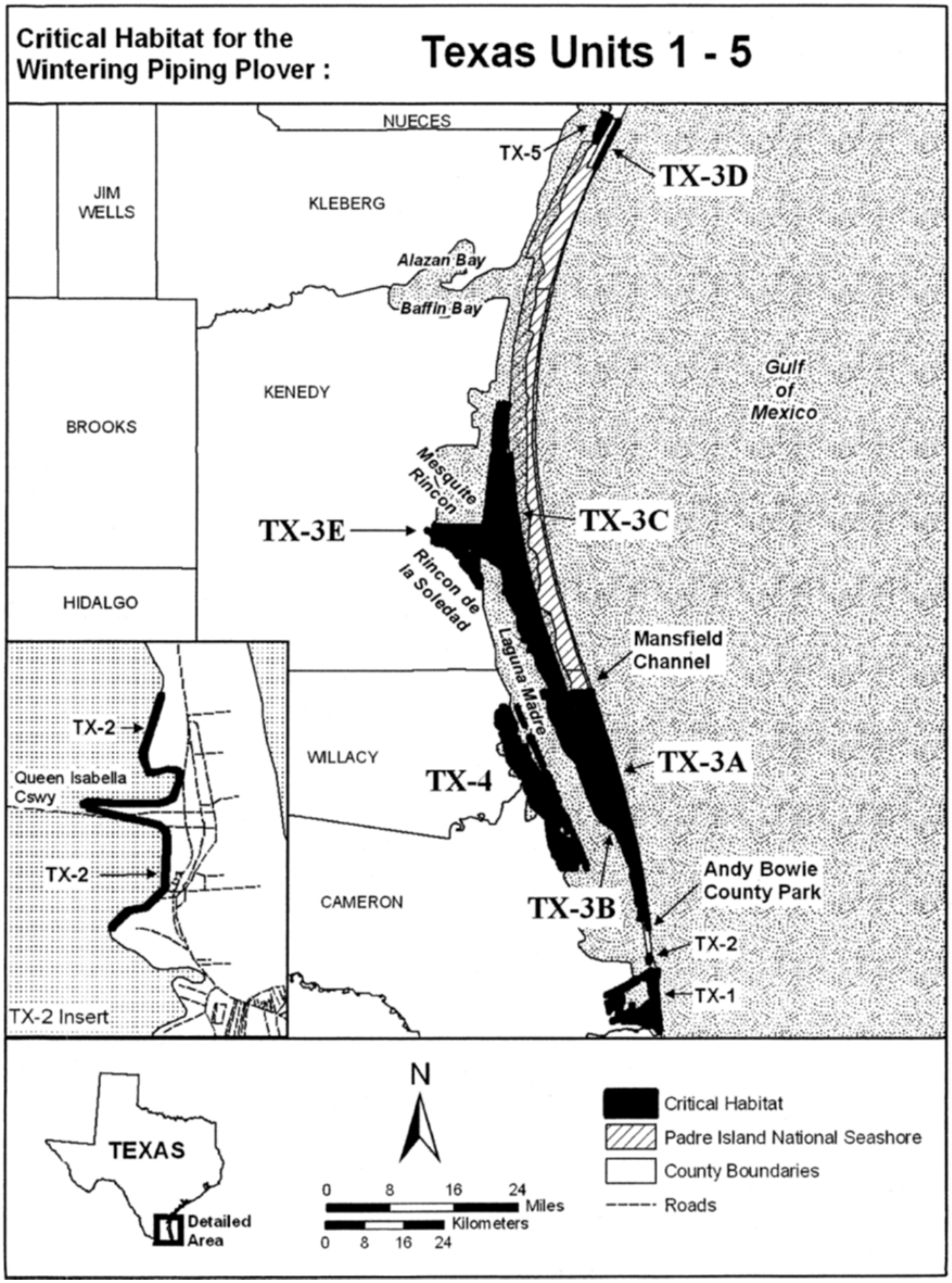


Figure 21. Piping Plover Critical Habitat

Figure 21. Red Knot Proposed Critical Habitat

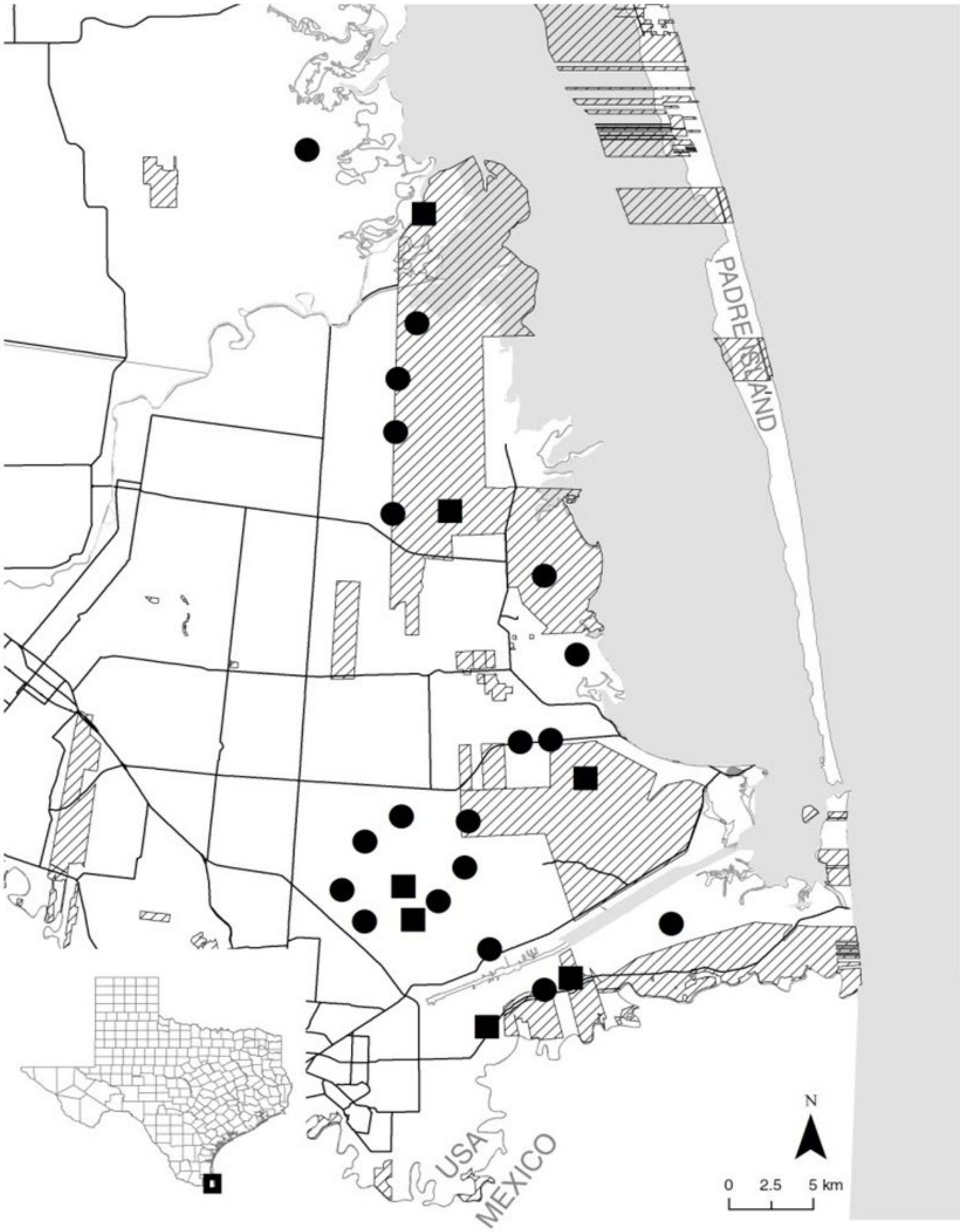


Figure 22. Falcon breeding territories-Brownsville subpopulation. Circles depict sites regularly occupied by adult pairs; squares indicate sites of intermittent occupancy (Hunt et al 2013).

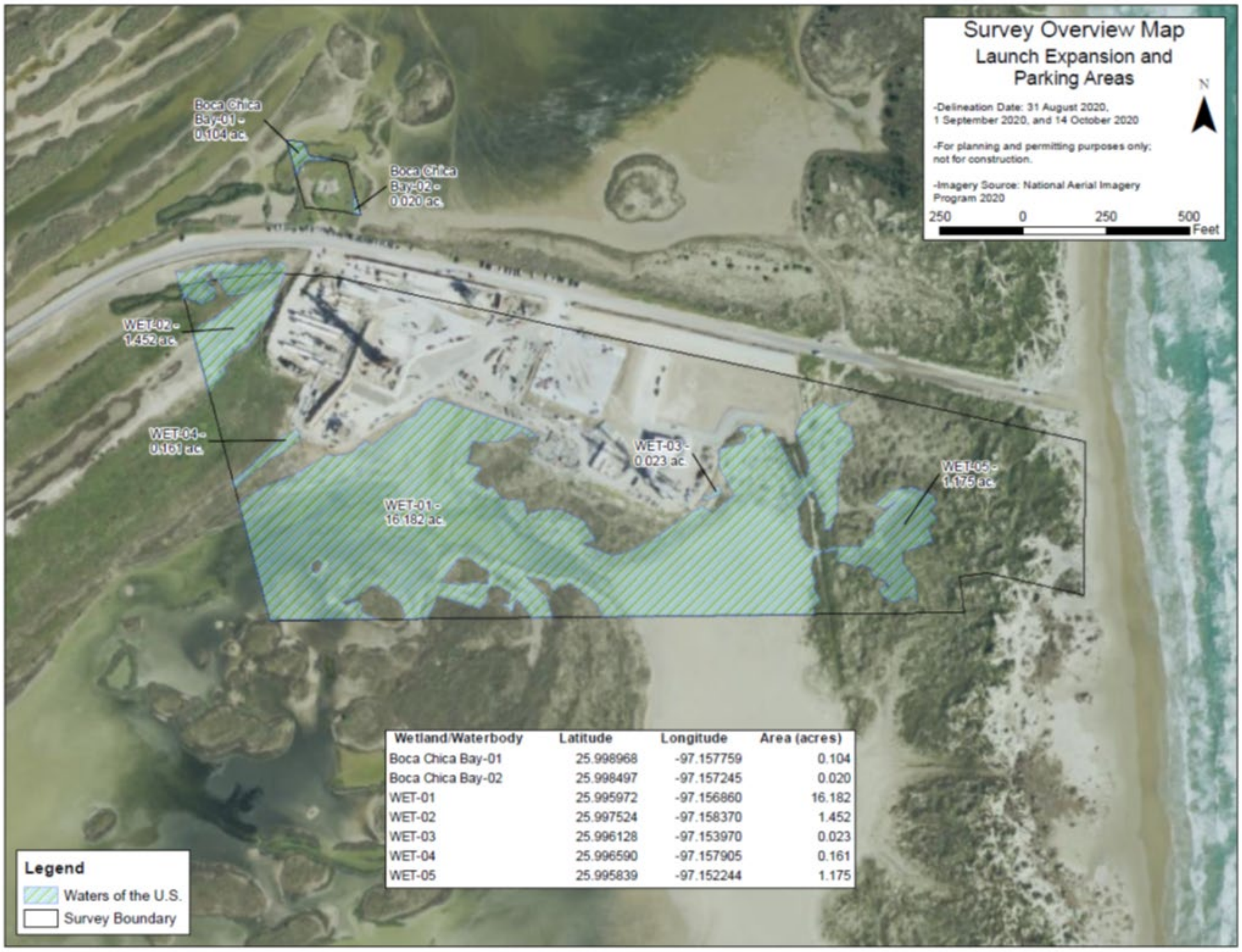


Figure 23. U.S. Army Corps of Engineers Jurisdictional wetland determination – VLA

Figure 24. Solar Expansion Sites Wetland Delineation Results SE1 1.15 acres, SE2 0.06 acres

Figure 25. SH 4 Boca Chica Turnaround

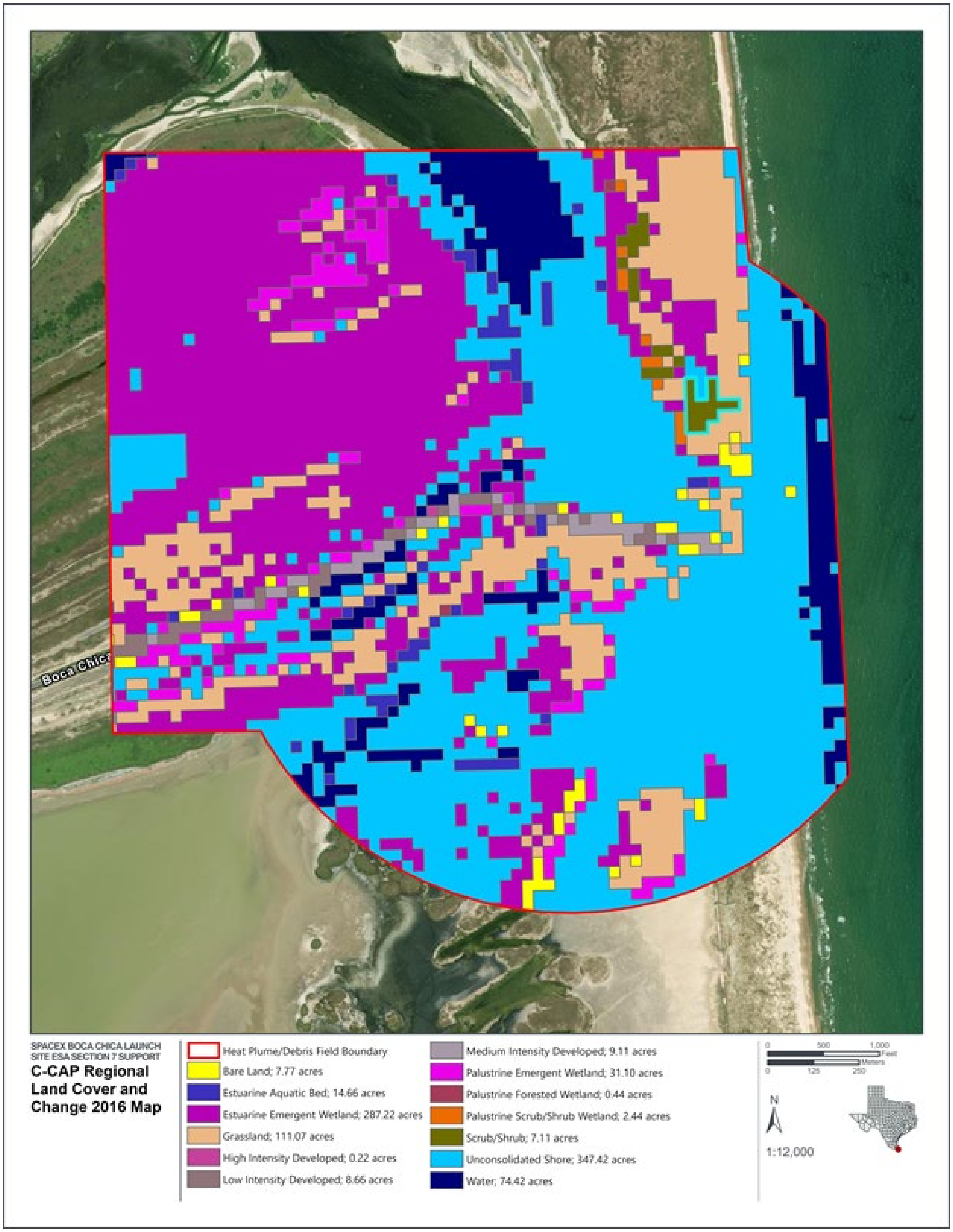


Figure 26. Impacted Piping Plover Habitat and Critical Habitat and Red Knot Habitat and Proposed Critical Habitat

Figure 27. Heat Plume and Debris Field

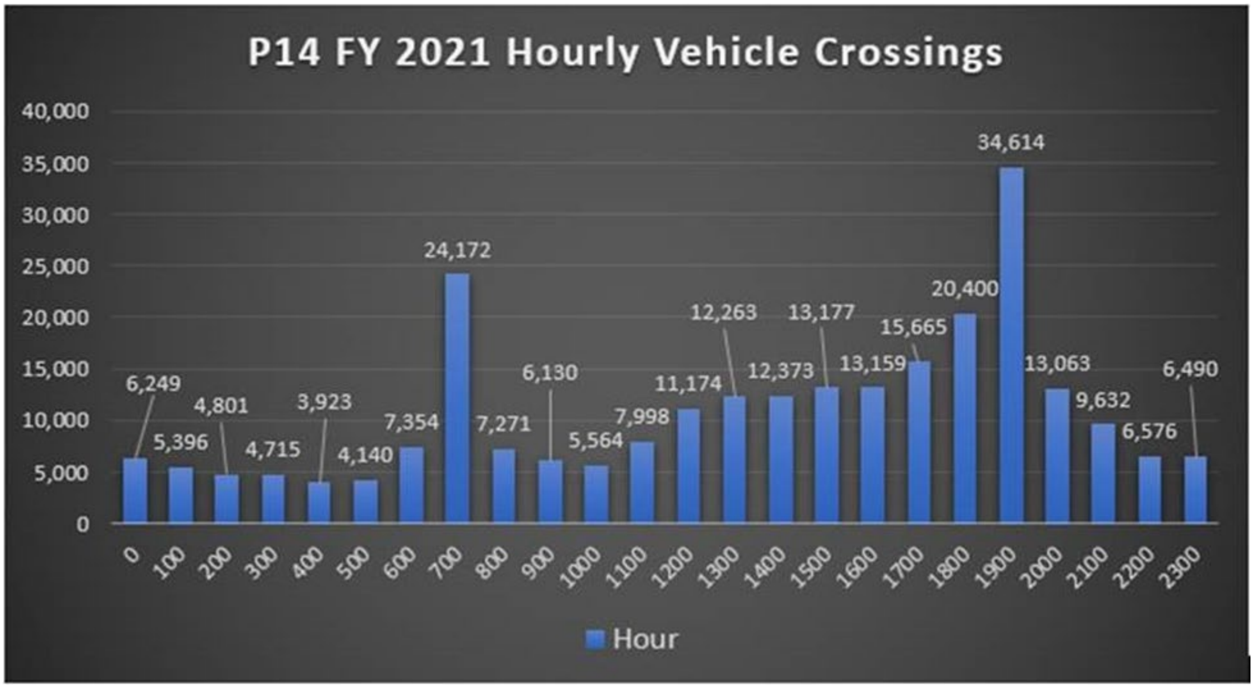


Figure 28. Annual number of vehicles passing through the Customs and Border Patrol Checkpoint Station (P14) by hour October 1-April 14, 2021. (*Data provided by: Pedro Caballero III, (A) Special Operations Supervisor, Fort Brown Station, TX, April 14, 2021*).

Figure 29. Ocelot Road Mortality

Appendix A
Concurrences

Appendix A. Concurrences

Species	Determination	Occurrence	Conservation Measures
West Indian Manatee	May affect, but is not likely to adversely affect	About 90 percent of manatees occur in Florida but occasionally seen about once every other year as they travel from Florida and Mexico heading towards warmer waters for the winter. Seagrasses and warm water attract them into the jetties or ports. Manatees have been spotted within the Action Area in and around South Padre Island and Port Isabel in 2004, 2005, 2006, 2014, 2018, July 26, South Padre Island. https://www.mysanantonio.com/lifestyle/travel-outdoors/article/Texas-captain-sees-rare-manatee-South-Padre-Island-16345753.php The most current occurrences of manatees have been reported on December 16, and 17, 2021 on SPI and another on December 21, 2021 in Port Mansfield Harbor Marina. Based on photographs, it appears the SPI manatee reported on the 16th and 17th and the Port Mansfield manatee are different individuals. There was also a manatee in Port Aransas that had an injured flipper and a manatee was rescued from the Houston area earlier. Therefore, five manatees reported in 2021. Other sightings have occurred in Corpus Christi and along the upper coast in similar years. It is possible more have occurred within the Action Area just not been documented. Potential effects include increased boat traffic on launch days, which could result in boat strikes, damage to seagrass beds and reduced food source. However, sightings are sporadic and SpaceX access restriction procedures includes notification of the Coast Guard to clear boats from the area prior to launches, and they are willing to implement conservation measures to reduce the effects.	Educational outreach program to inform vessel operators about manatees in the area and why to avoid them. Employees will a. be advised that manatees may approach the proposed Action Area, b) be provided materials, such as a poster, to assist in identifying the mammal, c) be instructed not to feed or water the animal, and d) contact the Service and the Texas Marine Mammal Stranding Network (TMMSN) if a manatee is sighted.
Eastern black rail	May affect but is not likely to adversely affect	Potential suitable habitat occurs within the Action Area and there is a possible presence of eastern black rail in Cameron County. Noise and human presence from construction and operations may temporarily disturb or displace eastern black rails and the heat plume could injure or kill black rails if it was present within	If an eastern black rail was recorded within the action are, the FAA would

		0.6 miles of the vertical launch area during a Starship/Super Heavy launch. Effects to the black rail could be reduced because of a lack of habitat at and near (within 0.6) the vertical launch area and there is no recent documented presence of eastern black rain the Action Area. No recent indication there is breeding in Cameron County.	immediately reinitiate section 7 consultation with the Service.
South Texas ambrosia	No effect	Suitable habitat does not occur within the Action Area where construction would occur.	None
Texas ayenia	No effect	Suitable habitat does not occur within the Action Area where construction would occur.	None

The FAA determined the Proposed Action may affect but was not likely to adversely affect the threatened West Indian manatee and eastern black rail. With the implementation of conservation measures to avoid and minimize potential impacts outlined in the associated SpaceX Starship/Super Heavy Launch Vehicle Program at the SpaceX Boca Chica Launch Site, Cameron County, Texas, June 2021 BA, amended October 2021, the Service believes potential impacts are insignificant and discountable and therefore concurs with FAA's determination of "may affect but is not likely to adversely affect". The Service provided this concurrence on October 6, 2021.

The FAA further determined the Proposed Action would have no effect on the endangered South Texas ambrosia and Texas ayenia. The Service does not provide concurrences with no effect determinations but by making a determination the Service believes the FAA has complied with section 7(a)(2) of the Act.

Appendix B.
Consultation History

CONSULTATION HISTORY

December 18, 2013 – Service transmitted the Final BCO to the FAA for launch licenses and or experimental permits for SpaceX to launch Falcon 9 and Falcon Heavy at Boca Chica, Cameron County, TX.

May 29, 2014 - FAA published the *Final Environmental Impact Statement for the SpaceX Texas Launch Site* and Record of Decision (ROD).

December 22, 2014 – Letter from FAA requesting the Service to confirm its 2013 BCO as a BO for the red knot as the red knot was listed.

April 20, 2015 – The Service agreed via letter to adopt the BCO as a BO including red knot.

December 30, 2016 – FAA submitted SpaceX Annual Report via email.

January 25, 2017 – USACE requested FAA reinitiate consultation with the Service for SpaceX's 404 permit. FAA determined SpaceX would not increase take in the BO and terms and conditions would avoid or minimize potential effects to listed species.

December 19, 2017 – FAA submitted 2017 annual report for BO via email.

November 5, 2018 – Letter from FAA to the Service regarding SpaceX's plans for a suborbital test program and the development of (Big Falcon Ship and experimental vehicle test program. The Service requested reinitiation of consultation. Service recommended SpaceX consider a section 10 Habitat Conservation Plan for any additional development on the manufacturing and production site.

February 19, 2019 – FAA committed to reinitiating section 7 consultation in phone conversation.

April 3, 2019 - The Service provided written comments on a written Re-evaluation and recommended the BO be amended to reflect the proposed action. Nighttime construction had exceeded the 2-week period allowed in the BO and inspections had not been occurring as outlined in the BO.

March 23, 2019 – Email to FAA from the Service stating closure notification system was not being implemented correctly and future closures should not occur until corrected.

April 3, 2019 - The Service provided written comments on a written Re-evaluation and recommended the BO be amended to reflect the proposed action. Nighttime construction had exceeded the 2-week period allowed in the BO and inspections had not been occurring as outlined in the BO.

April 30, 2019 – Letter from FAA to Service responding to concerns about Starship construction and operation. They were willing to address and resolve issues.

November 29, 2019 – FAA request Service review another written Re-evaluation to support

FAA's decision to issue launch licenses and/or experimental permits to SpaceX.

March 2, 2020 – Letter from the Service to FAA reviewing the written Re-evaluation for experimental test program to develop Starship and Super Heavy. The Service did not concur and recommended a new BA be prepared and consultation reinitiated.

March 4, 2020 – The Service noted inconsistencies with closure notices, tallying of closure hours, length of closure, nighttime activities and stated a new or amended BO was needed.

April 3, 2019 – The Service recommended amendment of the BO.

April 5, 2019 – Email to FAA from the Service that vegetation monitoring may need revisiting, closures were not being implemented correctly and requested they cease.

May 29, 2020 – Email to FAA from Service informing them that SN4 had exploded. The Service did not have a full report as of yet but assumed debris had fallen on the Refuge again. Reiterated need for reinitiation to address explosions, noise generated 24/7, night illumination and traffic on SH 4.

December 2, 2020 – Species Monitoring Report received.

December 13, 2020 – FAA's 2019 Annual Summary Report was received.

June 21, 2021 – FAA requested initiation of formal section 7 consultation on the issuance of a launch license to SpaceX at the Boca Chica Launch Site for the Starship/Super Heavy Launch Vehicle Program and provided a BA to the Service.

July 15, 2021 – Service requested additional information before consultation could be initiated.

July 23, 2021 – FAA forwarded Management Plans and requested by August 23.

September 15, 2021 –Consultation workshop: FAA notified of salt flats that seem to be vegetating from runoff.

September 27, 2021 – SpaceX Agency update meeting.

October 5, 2021 – Site visit and meeting.

October 6, 2021 – The Service initiated formal consultation.

October 13, 2021 – FAA delivers an amended Final BA to the Service.

October 14, 2021 – Letter to FAA from the Service committing BCO by December 31, 2021, contingent on regular coordination with FAA and SpaceX and no substantial changes to the Proposed Action.

October 20, 2021 – FAA provided a revised BA and Terms and Conditions.

October 25, 2021 – SpaceX Starship/Super Heavy at Boca Chica Launch Site ESA section 7 consultation meeting to discuss proposed action, status of the species, effects, terms and conditions, monitoring, and schedule.

November 1, 2021 – DOI provided FAA comments on the Starship/Super Heavy PEA.

November 2, 2021 – Provided FAA information on the Monarch Butterfly and asked if FAA and SpaceX could include it in the consultation. FAA agreed.

November 4, 2021 – The Service emailed draft language for a term and condition regarding land acquisition for FAA/SpaceX review and approval.

November 8, 2021 – FAA provided comments on draft proposed project section. Notified SpaceX of a video of a UTV on SpaceX site driving in flats.

December 2, 2021 – FAA emailed request for update on BO sections for review and offered assistance from ICF consultants.

December 3, 2021 – Service emailed FAA the Status of the Species section for their review.

December 6, 2021 – SpaceX section 7 consultation working session. FAA provided comments on the Cumulative Effects section.

December 9, 2021- Email from the Service to FAA requesting updated management plans

December 10, 2021 – Service requested status of updated plans. Email response from FAA to the Service stating they had not received the plans from SpaceX.

December 16, 2021 – Emailed FAA, SpaceX and ICF a draft copy of the baseline for their review and comment.

December 20, 2021 – SpaceX section 7 consultation working session. Service requested specific dates for receiving the updated plans.

December 27, 2021 – SpaceX section 7 consultation working session.

January 3, 2022 – SpaceX provided power plant details. Weekly SpaceX section 7 consultation workshop was held.

January 4, 2022 – SpaceX provided information, requested on Dec. 31, 2021, on solar array and potential hazardous material.

January 6, 2022 – TxDOT informed Service of plans for a turnaround in ROW at the end of SH4 and a small parking area near it.

January 12, 2022 – Service informed FAA of proposed TxDOT turnaround.

January 18, 2022 – Weekly FAA SpaceX section 7 consultation discussion, draft BCO due to FAA by January 31st.

January 24, February 7, February 14, February, 2022– SpaceX section 7 weekly consultation workshops.

February 25, 2022 – Letter to FAA regarding from the Service regarding documentation of agreed upon extensions to the consultation timeline.

February 28, 2022 – The Service delivers draft BCO to FAA for review and comment.

March 7, March 14, 2022 – SpaceX section 7 weekly consultation workshop to discuss timeline and status of review.

March 15, 2022 – FAA gave draft BCO comments to the Service.

March 16, 2022 – The Service requested an extension for FAA to complete Monitoring Plans and to finalize the BCO and requested a due date of March 28, 2022.

March 21, 2022 – SpaceX section 7 weekly consultation workshop meeting. Discussed the Draft BCO comments.

March 24, April 4, and April 18, 2022 – SpaceX section 7 workshops to discuss BCO.

April 22, 2022 – Final BCO sent to FAA.

April 28, 2022 – FAA and SpaceX provided comments on the Final BCO.

May 9, 2022 – The Service responded to FAA/SpaceX comments. FAA sent the Service the completed 2021 Annual Report.

May 10, 2022 – FAA accepted the Service's responses. SpaceX provided an updated Biological Monitoring Plan.

May 12, 2022 - Revised Final BCO sent to FAA.

Appendix C
Memorandum of Agreement
Between
Texas Parks and Wildlife Department and Space Exploration Technologies Corporation

MEMORADUM OF AGREEMENT
between
Texas Parks and Wildlife Department and Space Exploration Technologies Corporation

This Memorandum of Agreement (Agreement) is entered into between Texas Park and Wildlife Department (TPWD) with an address of 4200 Smith School Road, Austin, Texas, 78744, and Space Exploration Technologies Corporation (SpaceX) with an address of Rocket Road, Hawthorne, California, 90250 (collectively the Parties).

I. PURPOSE

1.1 The Parties own adjacent properties at Boca Chica, Texas. TPWD owns Boca Chica State Park, which is managed through a lease with the U.S. Fish and Wildlife Service (USFWS) in conjunction with its Lower Rio Grande Valley National Wildlife Refuge. SpaceX owns adjacent properties on which it has constructed and is constructing facilities for the purpose of designing, constructing, testing, launching, and landing rockets. The nature of SpaceX development-related anomalies has resulted in and may result in future impacts to the state park should further anomalies occur. The purpose of this Agreement is to serve as guidance to the Parties for developing protocols to respond to events that result in impacts to the state park and/or necessitate entry to the state park for any reason, including but not limited to fire suppression, reconnaissance, rocket debris retrieval, post-response site restoration, and impact mitigation.

The Parties acknowledge the need to restore impacts to TPWD lands following certain rocket test and launch activities. While such restoration efforts are as yet unproven, the Parties are committed to implementing, monitoring, and learning from such restoration efforts in order to develop adaptive management strategies that will minimize or offset long-term impacts to the natural, cultural, and recreational values of TPWD lands. The Parties agree that the benefits realized from these restoration efforts should provide appropriate compensation for the associated damages, including damages associated with the March 30, 2021 explosion of the rocket designated SN11.

This Agreement is intended to be a dynamic, working document and the Parties agree to periodically amend and update the Agreement in response to changing conditions, new data and information, and lessons learned. The Parties are committed to working together in good faith to meet the intent of this Agreement.

II. ANOMALY RESPONSE

2.1 In the event of an anomaly TPWD staff will be notified as per the procedures outlined in the current Federal Aviation Administration (FAA) Anomaly Response Plan for Boca Chica.

III. STATE PARK RESTORATION

3.1 The Parties agree that the appropriate mitigation for impacts to the state park will be coordinated efforts to restore damaged algal flat and loma habitats to pre-anomaly conditions. TPWD will identify subject matter experts to assist SpaceX or a contractor with development and implementation of a restoration plan. It is understood that restoration of these habitats is untested. SpaceX agrees to include monitoring protocols in the restoration plan, to adopt an adaptive management approach to restoration until the most beneficial restoration methodologies have been determined, and to apply those methodologies to restoration of habitats following any future impacts to the state park resulting from SpaceX activities.

3.2 The Parties anticipate that initial restoration efforts may include grooming of tracks and other scars using hand tools and native soils, establishing desired slopes and contours, and potentially inoculating the soils with appropriate species of algae and microbes, or other approach(es) as determined by the subject matter experts and TPWD and agreed to by SpaceX.

In addition, a good faith effort will be made to restore lost upland vegetation in state park uplands by seeding or transplanting appropriate grasses and other indigenous vegetation from seed or plant sources approved by TPWD. All recovery and restoration efforts will be monitored for introduction of non-native species, which will be removed by SpaceX using methods approved by TPWD. All soil disturbance resulting from anomaly impact or recovery efforts will be monitored for the presence and/or disturbance of cultural resources.

3.3 SpaceX agrees that in the event restoration measures prove impractical or agreed monitoring protocols indicate that restoration activities have not resulted in demonstrable recovery of native pre-anomaly species compositions and ecological services, the Parties will come together in good faith to agree on other means of compensating TPWD for loss of fish, wildlife and recreation values resulting from damages to the state park.

IV. ACCESS AND CLOSURES

4.1 SpaceX will perform notifications prior to a planned closure and in accordance with the current FAA Closure Notification Plan for Boca Chica.

4.2 SpaceX will provide TPWD a forecast of planned closures two weeks in advance when possible. Information about proposed closures will be available on Cameron County's website and through real time status and updates via a text message alert service.

SpaceX will send closure notifications to the regulatory and public land-managing agencies as closure plans finalize (typically 24–48 hours prior to the closure). The agencies will continue to receive updates immediately when the closures go into place and when the closures end, as well as cancellations of requested closures. SpaceX personnel will timely send these notifications to ensure the most up-to-date information is distributed.

This Agreement is effective upon the date of the last signature herein.

Space Exploration Technologies Corp.	Texas Parks and Wildlife Department
By: Shyamal Parikh	By:
Title: Sr. Director Starship Ops	Title: Chief Operating Officer
Date: 9/1/2021	Date: 9/2/21

Appendix D
Noise Assessment

(Please refer to Appendix B in FAA's Programmatic Environmental Assessment)

STARSHIP ROCKET NOISE ASSESSMENT FOR FLIGHT AND TEST OPERATIONS AT THE BOCA CHICA LAUNCH FACILITY

TN 20-02

December 2020

Prepared for:

Space Exploration Technologies Corporation

Appendix E.
Plans

Fire Mitigation and Response Plan

April 20, 2022

Table of Contents

1 PURPOSE AND SCOPE

The purpose of this policy is to establish written procedures to provide guidance on fire mitigation and response. The Fire Mitigation and Response Plan's goals are to ensure that a system is in place for the planning and implementation of emergency procedures. This plan also provides information to assure immediate response to protect life and minimize property damage.

This policy shall comply with the requirements of Occupational Safety and Health Administration's (OSHA) standard on fire prevention, 29 Code of Federal Regulations (CFR) § 1910.39.

2 APPLICATION

Space Exploration Technologies (SpaceX) in Boca Chica, South Texas is committed to minimizing the threat of fire to employees, visitors, and property. SpaceX complies with all applicable laws, regulations, codes, and good practices pertaining to fire prevention. Our separate Hazardous Materials Emergency Response Plan provides additional details regarding the procedures for responding to fires. This Fire Mitigation and Response Plan serves to reduce the risk of fires at the Boca Chica Launch Site in the following ways:

- Identifies materials that are potential fire hazards and their proper handling and storage procedures;
- Distinguishes potential ignition sources and the proper control procedures of those materials;
- Describes fire protection equipment and/or systems used to control fire hazards;
- Identifies persons responsible for maintaining the equipment and systems installed to prevent or control ignition of fires;
- Identifies persons responsible for the control and accumulation of flammable or combustible material;
- Describes good housekeeping procedures necessary to insure the control of accumulated flammable and combustible waste material and residues to avoid a fire emergency; and
- Provides training to employees with regard to fire hazards to which they may be exposed.

3 ASSIGNMENT OF RESPONSIBILITY

Fire safety is everyone's responsibility. All employees should know how to prevent and respond to incipient fires, and are responsible for adhering to company policy regarding fire emergencies. Specific roles and responsibilities are, however, assigned as described below.

3.1 Management

Management determines SpaceX Boca Chica Launch Site fire prevention and protection policies. Management will provide adequate controls to provide a safe workplace, and will provide adequate resources and training to its employees to encourage fire prevention and the safest possible response in the event of a fire emergency.

3.2 Fire Prevention Plan (FPP) Administrator

The Environmental Health and Safety (EHS) Department acts as the Fire Prevention Plan (FPP) Administrator for SpaceX Boca Chica Launch Site, and shall maintain all records pertaining to the plan. The FPP Administrator shall also:

- Develop and administer the SpaceX fire prevention training program.
- Ensure that fire control equipment and systems are properly maintained.
- Control fuel source hazards.
- Conduct daily inspections, identifying potential fire hazards through SpaceX's 'unsafe condition' tracking system (SafetyNet).

3.3 Supervisors

Supervisors are responsible for ensuring that employees receive appropriate fire safety training, and for notifying the FPP Administrator when changes in operation increase the risk of fire. Supervisors are also responsible for enforcing SpaceX Boca Chica Launch Site fire prevention and protection policies.

3.4 Employees

All employees shall:

- Complete all required training before working without supervision.
- Conduct operations safely to limit the risk of fire.
- Report potential fire hazards to their supervisors.
- Follow fire emergency procedures.

This procedure is applicable to all employees working at Boca Chica Launch Site, Texas.

4 POTENTIAL TYPES OF HAZARDS

The following sections address the major workplace fire hazards at SpaceX Boca Chica Launch Site facilities and the procedures for controlling the hazards.

4.1 Electrical Fire Hazards

Electrical system failures and the misuse of electrical equipment are leading causes of workplace fires. Fires can result from loose ground connections, wiring with frayed insulation, or overloaded fuses, circuits, motors, or outlets. To prevent electrical fires, the following control procedures are implemented:

- Make sure that worn wires are replaced.
- Use only appropriately rated fuses.
- Never use extension cords as substitutes for wiring improvements.
- Use only approved extension cords [i.e., those with the Underwriters Laboratory (UL) or Factory Mutual (FM) label].
- Check wiring in hazardous locations where the risk of fire is especially high.

- Check electrical equipment to ensure that it is either properly grounded or double insulated.
- Ensure adequate spacing while performing maintenance.

4.2 Office Fire Hazards

Fire risks are not limited to SpaceX Boca Chica Launch Site industrial facilities. Fires in offices have become more likely because of the increased use of electrical equipment, such as computers and monitors.

To prevent office fires, the following control procedures are implemented:

- Avoid overloading circuits with office equipment.
- Avoid 'daisy-chaining' power strips.
- Turn off nonessential electrical equipment at the end of each workday.
- Keep storage areas clear of rubbish.
- Ensure that extension cords are not placed under carpets.
- Ensure that trash and paper set aside for recycling is not allowed to accumulate.
- Immediately report exposed wires or electrical outlets.

4.3 Cutting, Welding, and Open Flame Work

To prevent cutting, welding, and open flame work related fires, the following control procedures are implemented**:**

- All necessary hot work permits have been obtained prior to work beginning.
- Cutting and welding are done by authorized personnel in designated cutting and welding areas whenever possible.
- Adequate ventilation is provided.
- Torches, regulators, pressure-reducing valves, and manifolds are UL listed or FM approved.
- Oxygen-fuel gas systems are equipped with listed and/or approved backflow valves and pressure-relief devices.
- Cutters, welders, and helpers are wearing eye protection and protective clothing as appropriate.
- Cutting or welding is prohibited in sprinkled areas while sprinkler protection is out of service.
- Cutting or welding is prohibited in areas where explosive atmospheres of gases, vapors, or dusts could develop from residues or accumulations in confined spaces.
- Cutting or welding is prohibited on metal walls, ceilings, or roofs built of combustible sandwich type panel construction or having combustible covering.
- Confined spaces such as tanks are tested to ensure that the atmosphere is not over ten percent of the lower flammable limit before cutting or welding in or on the tank.

- Small tanks, piping, or containers that cannot be entered are cleaned, purged, and tested before cutting or welding on them begins.
- Fire watch has been established where needed.
- Grinding, cutting, and welding around open vegetation or high fire days (Red Flag) is discouraged.

4.4 Flammable and Combustible Materials

All SpaceX employees regularly evaluate the presence of combustible materials at SpaceX Boca Chica Launch Site. Certain types of substances can ignite at relatively low temperatures or pose a risk of catastrophic explosion if ignited. Such substances obviously require special care and handling.

4.4.1 Class A Combustibles.

These include common combustible materials (wood, paper, cloth, rubber, and plastics) that can act as fuel and are found in non-specialized areas such as offices.

To handle Class A combustibles safely, the following control procedures are implemented**:**

- Dispose of waste daily.
- Keep trash in metal-lined receptacles with tight-fitting covers (metal wastebaskets) that are emptied every day do not need to be covered).
- Keep work areas clean and free of fuel paths that could allow a fire to spread.
- Keep combustibles away from accidental ignition sources, such as hot plates, soldering irons, or other heat- or spark-producing devices.
- Store paper stock in metal cabinets.
- Store rags in metal bins with self-closing lids.
- Do not order excessive amounts of combustibles.
- Make frequent inspections to anticipate fires before they start.

Water, multi-purpose dry chemical (ABC), and halon 1211 are approved fire extinguishing agents for Class A combustibles.

4.4.2 Class B Combustibles.

These include flammable and combustible liquids (oils, greases, tars, oil-based paints, and lacquers), flammable gases, and flammable aerosols.

To handle Class B combustibles safely, the follow control procedures are implemented:

- Use only approved pumps, taking suction from the top, to dispense liquids from tanks, drums, barrels, or similar containers (or use approved self-closing valves or faucets).

- Do not dispense Class B flammable liquids into containers unless the nozzle and container are electrically interconnected by contact or by a bonding wire. Either the tank or container must be grounded.
- Store, handle, and use Class B combustibles only in approved locations where vapors are prevented from reaching ignition sources such as heating or electric equipment, open flames, or mechanical or electric sparks.
- Do not use a flammable liquid as a cleaning agent inside a building (the only exception is in a closed machine approved for cleaning with flammable liquids).
- Do not use, handle, or store Class B combustibles near exits, stairs, or any other areas normally used as exits.
- Do not weld, cut, grind, or use unsafe electrical appliances or equipment near Class B combustibles.
- Do not generate heat, allow an open flame, or smoke near Class B combustibles.
- Know the location of and how to use the nearest portable fire extinguisher rated for Class B fire.

a. Water should NOT be used to extinguish Class B fires caused by flammable liquids. Water can cause the burning liquid to spread, making the fire worse. To extinguish a fire caused by flammable liquids, exclude the air around the burning liquid.

b. The following fire-extinguishing agents are approved for Class B combustibles: carbon dioxide, multi-purpose dry chemical (ABC), halon 1301, and halon 1211. (NOTE: Halon has been determined to be an ozone-depleting substance and is no longer being manufactured. Existing systems using halon can be kept in place.)

4.5 Smoking

Smoking is prohibited inside all SpaceX buildings. Smoking is only allowed in designated (and properly identified) SMOKING AREAS. These areas have been properly evaluated and placed to not be near flammable materials or other fire risks.

5 PLAN IMPLEMENTATION

5.1 Good Housekeeping

To limit the risk of fires, employees shall take the following precautions:

- Minimize the storage of combustible materials.
- Make sure that doors, hallways, stairs, and other exit routes are kept free of obstructions.
- Dispose of combustible waste in covered, airtight, metal containers.
- Use and store flammable materials in well-ventilated areas away from ignition sources.
- Use only nonflammable cleaning products.

- Keep incompatible (i.e., chemically reactive) substances away from each other.
- Perform "hot work" (i.e., welding or working with an open flame or other ignition sources) in controlled and well-ventilated areas.
- Keep equipment in good working order (i.e., inspect electrical wiring and appliances regularly and keep motors and machine tools free of dust and grease.
- Ensure that heating units are safeguarded.
- Report all gas leaks immediately.
- Repair and clean up flammable liquid leaks immediately.
- Keep work areas free of dust, lint, sawdust, scraps, and similar material.
- Do not rely on extension cords if wiring improvements are needed, and take care not to overload circuits with multiple pieces of equipment.
- Ensure that required hot work permits are obtained.
- Turn off electrical equipment when not in use.

5.2 Maintenance

The EHS Department ensures that equipment is maintained according to manufacturers' specifications. SpaceX South Texas will also comply with requirements of the National Fire Protection Association (NFPA) codes for specific equipment. Only properly trained individuals shall perform maintenance work. The following equipment is subject to the maintenance, inspection, and testing procedures:

- Equipment installed to detect fuel leaks, control heating, and control pressurized systems;
- Portable fire extinguishers, automatic sprinkler systems, and fixed extinguishing systems;
- Detection systems for smoke, heat, or flame;
- Fire alarm systems; and
- Emergency backup systems and the equipment they support.

5.3 Fire Hazard Locations

The intent of FPP to assure that hazardous accumulations of combustible materials are controlled so that a fast developing fire, rapid spread of toxic smoke, or an explosion will not occur. Employees are to be made aware of the hazardous properties of materials in their workplaces, and the degree of hazard each poses. Following are examples of these hazards:

- **Launch Pad** – Restricted during vehicle launch operations. During normal launch operations, Methane may be present due to potential leaks in piping, pumps and tanks. During launch operations, the area shall be cleared of all personnel, vehicles, loose debris and non-essential equipment. State Highway 4 is closed to all traffic for duration of launch.

- **Stargate Building** – General hazard area containing combustible material, i.e., paper, cardboard, plastic, and construction activities.
- **Solar Farm** – General hazard area containing combustible material, batteries, solar panels, paper, cardboard, plastic.

6 FIRE MITIGATION MEASURES AT THE VERTICAL LAUNCH AREA

The following mitigation measures have been implemented at the SpaceX Boca Chica Launch Site:

- Vegetation inside the fence line near the launch pad, flare, and fuel commodity farms property has been removed to prevent any wildfire.
- Additional water cannon southwest of the Launch Pad (Figure 1).
- Additional water cannons on each side of the Landing Pad (Figure 1).
- Additional Long Reach Irrigation System along Launch Pad South fence line (Figure 1).
- Additional water fill station for wildland fire apparatus south of water farm (Figure1).

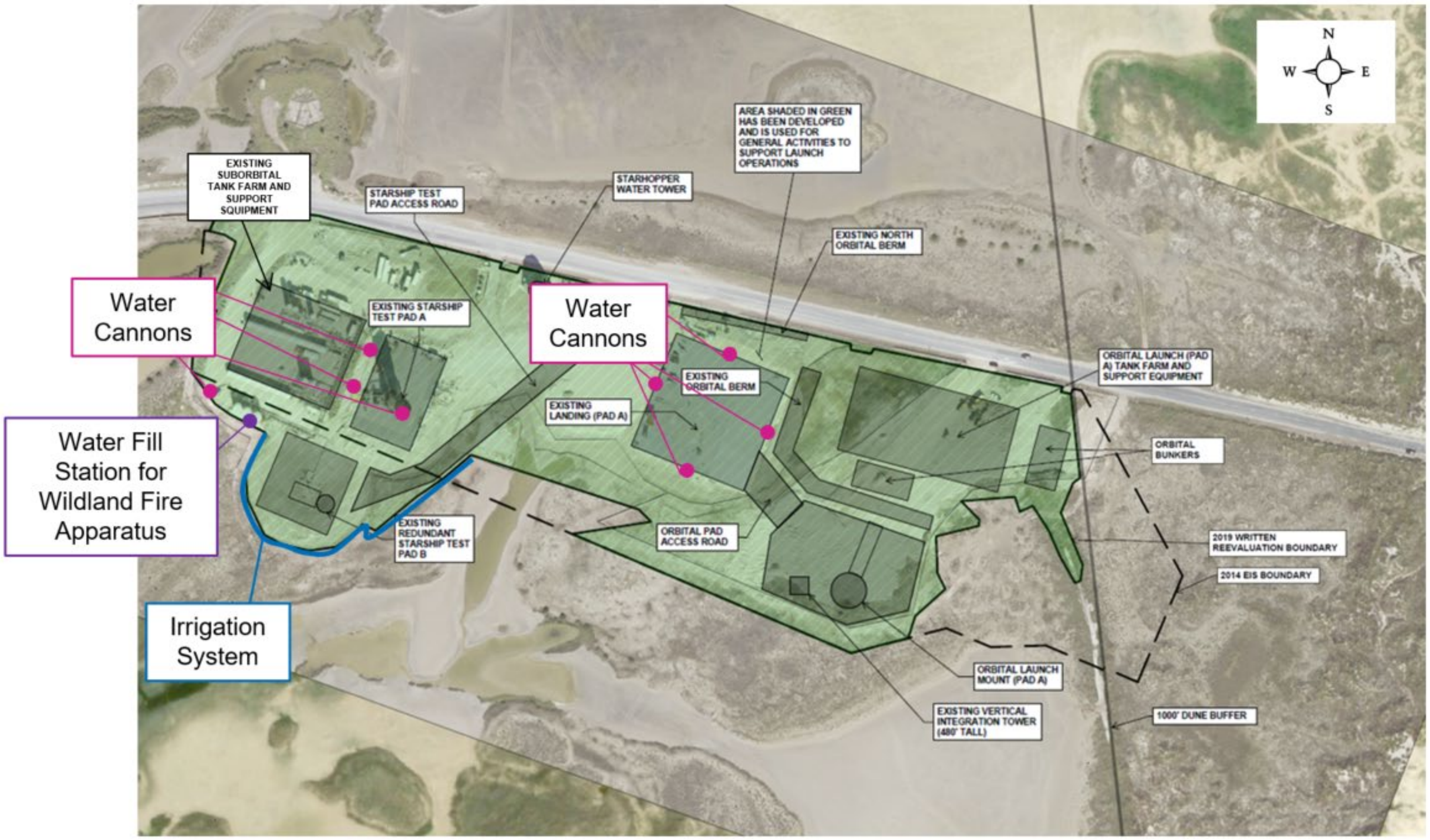


Figure 1. Location of Additional Fire Mitigation Measures

7 OPERATIONS PREPARATION/FIRE RESPONSE

In order to prepare for a launch operation, SpaceX will prepare a National Incident Management System (NIMS) Incident Command System (ICS) form 201. The Starship Hopper at Boca Chica Launch Site ICS form is included as an example in Appendix A; a blank form for future operations is included in Appendix B.

This form is familiar to all emergency response agencies that would be responding to an incident, and will enable swift and effective communication and response. This approach establishes the communication structure and first actions to be taken in the event of an incident. Should no incident actually occur, nothing more than this document shall result; however, in the event of an actual incident, the NIMS framework allows for the Incident Command structure to be adapted and augmented to fit the size and scope of the actual incident.

SpaceX will coordinate with the following entities while facilitating this structure:

- Cameron County Emergency Management
- Brownsville Fire Department
- U.S. Fish & Wildlife Service, National Wildlife Refuge System, Lower Rio Grande Valley National Wildlife Refuge
- U.S. Fish & Wildlife Service, South Texas Refuge Complex, Fire Management Program
- Valley Regional Medical Center
- Valley Baptist Medical Center - Harlingen

As presented in Section 8 of the Starship Hopper at Boca Chica Launch Site ICS form, a detailed test day schedule will be included in the Incident Action Plan. A representative day of test schedule is included below:

- 0800: Working Incident Action Plan released to agency partners
  - Cameron County Emergency Management
  - Brownsville Fire Department
  - US Fish and Wildlife Refuge Management
  - US Fish and Wildlife Fire Services
- 1000: Test scope communicated to agency partners via text, and/or email
- 1400: Current test status/test updates communicated to agency partners
- 1600: Planned T-0 of test
- 1610: Site safing operations
- 1700: Approach for methane offload
- 2000: Release of resources

SpaceX will be responsible for ensuring that contact information and personnel assignments are accurately documented prior to day of test activities.

In the event of a fire, SpaceX personnel will immediately be in communication with the Refuge Fire Management Office to place USFWS Wildland Firefighters on standby so Refuge fire crews can prepare strategies to control and extinguish the fire. SpaceX personnel at the site and standard fire fighting vehicles will not attempt to enter Texas Parks and Wildlife Division/USFWS managed land to control a wildfire without coordination with the Refuge. Tidal flats will be protected from trampling or driving during a fire response. SpaceX will also take all reasonable precautions to ensure deluge water or firefighting water does not enter the tidal flats.

SpaceX coordinates with USFWS's Federal Wildlife Officer and the Lower Rio Grande Valley National Wildfire Refuge (LRGVNWR) Refuge liaison (Chris Perez), law enforcement, and county officials on an as-needed basis in order to brief and work with Law Enforcement and Emergency management personnel who will be impacted by Space Flight Operations as they pertain to the launch site and to coordinate, communicate, and respond in the event of an unforeseen incident at the launch site. These meetings are coordinated by SpaceX but may also be requested by partner entities.

This command structure and planned response tactics shall be utilized when SpaceX determines the need for resources from outside agencies. Liaison with the agencies will begin with direct person to person communication within the Launch and Landing Control Center (LLCC). This communication, if determined necessary, will begin the actual activation of the Incident Action Plan. The plan includes communication planning, responder staging location(s), and incident response planning.

Each incident will have specific nuances unique to that event and thus all scenarios cannot be fully planned in advance. If a fire were to occur during nesting season, response would be different and additional precautions would be followed to minimize disturbance to biological resources. The framework established herein will guide the command staff through the development of a response plan and resource allocation.

Hazards identified during pre-planning have been included, along with typical mitigations to the hazards. Mitigations include procedure controls, engineering controls, and Personal Protective Equipment. Initial mitigation of known fire hazards will begin with remote controlled mitigation activities (from the LLCC) including water cannons, irrigation systems, and inert gas purges.

8 TRAINING

Basic fire prevention training is required for all employees upon employment, the training is administered and course completion tracked though the SpaceX Bridge. In addition, a fire prevention training refresher course is required annually. Training topics include:

- Good housekeeping practices
- Proper response and notification in the event of a fire
- Instruction on the use of portable fire extinguishers (as determined by company policy in the Emergency Response Plan)

- Recognition of potential fire hazards

SpaceX has implemented the South Texas Space Flight Security (SOTXSFS) Task Force that includes SpaceX security staff, LRGVNWR law enforcement officers, local law enforcement and county officials that are to meet quarterly to discuss this plan and issues that have occurred.

9 PROGRAM REVIEW

An annual review of this Plan is performed by the EHS Department.

10 POINTS OF CONTACT

Organization	Name, Position	Contact Information	Responsibility
Cameron County Emergency Manager	Tom Husehen, Emergency Manager	Cell: (956)-454-5887, Desk: (956)-547-7000	Coordinate Response
Brownsville Fire Dept.	Jarrett Sheldon, Fire Chief	Cell: (956)-337-3917, Desk: (956)-546-3195	Coordinate Response
U.S. Coast Guard (USCG)	Sector/Air Station Corpus Christi Command Center	(361)-939-0450	Report any affect to safety of the waterway and the last known vehicle position
U.S. Fish and Wildlife	Chris Perez	24h dispatch: (956)-784-7520 Cell: (956) 475-1372 Desk: (956) 784-7553	Service Liaison

11 APPENDICES

APPENDIX A: STARHOPPER ICS 201 FORM

Example ICS 201 Form for Starhopper.

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Starship Hopper Boca Chica Launch S	2019.08.12-01	Date: 08/12/2019 Time: 0001

4. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment)**:**

5. Situation Summary and Health and Safety Briefing (for briefings or transfer of command)**:** Recognize potential incident Health and Safety Hazards and develop necessary measures (remove hazard, provide personal protective equipment, warn people of the hazard) to protect responders from those hazards.

Liquid / Gaseous Methane - Liquid / Gaseous Oxygen - Liquid / Gaseous Nitrogen - Gaseous Helium - High Power - Lithium Ion Batteries - Diesel Fuel

- Risks

Flammable Commodity - Cryogenic Liquids - Oxygen Displacement - High Pressure (stored) - High Power (stored)

- Mitigating Actions / Systems

Facility FireX System - Facility Atmospheric Monitoring - Directed vents and Thrust Ts on relief systems - High pressure flexline restraints - PPE (FR Clothing, Personal gas monitoring, Hearing protection, Hard Hat, Safety Glasses, Cryo Gloves, Face shield, Fall protection harness) - Arc Flash Suit for High Power - PAPR respiratory protection

6. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature: ____________

 Date/Time: 08.07.2019 1410

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Starship Hopper Boca Chica Launch	2019.08.12-01	Date: 08/12/2019 Time: 0001

7. Current and Planned Objectives:

- Provide Support Operations to the Launch Operations Team for the Safe and Successful flight of the Starhopper Test Vehicle.

- Ensure General Public are not placed at risk during any flight operations (including Pre and Post flight operations.

- Provide an environment free of general combustibles (including vegetation) within the bounds of the SpaceX improved land areas surrounding the launch and landing areas (including wetting of existing vegetation immediately surrounding the launch area that is within the Texas Parks and Wildlife lands)

- Provide a plan for Emergency Response to unintended fire scenarios around the launch and landing areas that may occur during periods of flight operations.

- Provide a framework for incident communications between SpaceX and partner responding agencies for scenarios that include SpaceX facilities and the surrounding lands.

- Ensure a safe environment for all emergency response personnel.

8. Current and Planned Actions, Strategies, and Tactics:

Time:	Actions:
8/6 & 8/7	Tabletop Planning including SpaceX / CC Emergency Management / Brownsville Fire / USFW Fire
8/8 - 8/10	Site Familiarization Training for Response Personnel (Field)
8/8 - 8/16	Review of Incident Action Plan with Revision Requests
0800	Working Incident Action Plan Released to Agency Partners
1000	Test Scope communicated to Agency Partners via text and/or email
1400	Current Test Status / Test Updates communicated to agency partners
1600	Planned T-0 of Test
1610	Site Safing Operations
1700	Approach for Methane Offload
2000	Release of Resources
HH:MM	ANOMALY RESPONSE - General Incident (times are estimated based on prior similar events)
00:00	Recognition of Anomaly and need for Incident Response Team - Begin eProc 3.911
00:05	Communication with partner agencies and call for initial resources
00:05 - 00:45	Pad and/or Vehicle Safing actions and Remote Incident Mitigation - Development of Approach Strategy
00:45	Staging of Response Assets and Pre-Task Briefing (STARGATE Facility)
00:55	Incident Response Team advances to Hard Roadblock
01:00	Incident Response Team enters Blast Danger Area and proceeds to Field Assessment Point
01:15	Field Evaluation Complete and Communicated to Launch Control - Incident Mitigation Plan Established
01:30	Incident Response Team Initiates Mitigation per Mitigation Plan and Launch Control Concurrence

6. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature:

Date/Time: 08.13.2019 1230

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Starship Hopper Boca Chica Launch Sit	2019.08.12-01	Date: 08/12/2019 Time: 0001

9. Current Organization (fill in additional organization as appropriate)**:**

Incident Commander(s)
-SpaceX Launch Director: Muratore

- CC Emergency Mngmt: Hushen

Liaison Officer
SpaceX: Dave Libbey

Safety Officer
SpaceX Emerg Ops: Rees

Public Information Officer
SpaceX: Verdell Wilson

Operations Section Chief	Planning Section Chief	Logistics Section Chief	Finance/Admin Section Chief
Brownsville Fire: Sheldon	SpaceX: John Hunt	SpaceX: James Hirsch	James Hirsch

If Incident extensively involves Non-SpaceX property / resporces a Unified Command will be established with Cameron County (including primary response agency Brownsville Fire) and US Fish and Wildlife Fire Services. SpaceX will provide available resources and Subject Matter Expertise to the Command Staff.

All operations within the Hazard Control Area (including Blast Danger Area and Flight Caution Area) will be coordinated through the SpaceX Launch Control, regardless of response location within the Hazard Control Area. All Responders shall also have participated in a Pre-Task briefing before entry to fully understand proximate hazards.

No personnel from any agency will be permitted access through the Hard Checkpoint without a communication link with SpaceX Launch Control.

6. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature:

Date/Time: 08.07.2019 1410

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated:
Starship Hopper Boca Chica Launch S	2019.08.12-01	Date: 08/12/2019 Time: 0001

10. Resource Summary:

Resource	Resource Identifier	Date/Time Ordered	ETA	Arrived	Notes (location/assignment/status)
SpaceX Engine 1 Type 1 Engine	SpaceX 1			☒	Available
SpaceX ATV C ATV w/ Water Unit - 20gal	SpaceX 2			☒	Available
SpaceX ATV D ATV - Scouting	SpaceX 3			☒	Available
SpaceX UTV Attack 1 UTV w/ Water Unit - 80gal	Attack 1			☒	Available
SpaceX UTV Attack 2 UTV w/ Water Unit - 40gal	Attack 2			☒	Available
SpaceX ATV B ATV - Scouting	SpaceX 4			☒	Available
Brownsville Fire Engine 8 Type 1 Engine	Engine 8			☐	
Brownsville Fire Brush 1 Type 5 Engine	???			☐	
Brownsville Fire Brush 2 Type 5 Engine	???			☐	
Brownsville Fire Medic ALS Medic Unit	???			☐	
Brownsville Fire Chief	???			☐	
USFW Chief	???			☐	
				☐	
				☐	
				☐	
				☐	
				☐	

6. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature: ____________________

ICS 201, Page 4 Date/Time: 08.07.2019 1530

INCIDENT OBJECTIVES (ICS 202)

1. Incident Name: Starship Hopper	**2. Operational Period:** Date From: 08/12/19 Date To: 11/12/19 Time From: 0001 Time To: 2359

3. Objective(s):

- Provide Support Operations to the Launch Operations Team for the Safe and Successful flight of the Starhopper Test Vehicle.

- Ensure General Public are not placed at risk during any flight operations (including Pre and Post flight operations.

- Provide an environment free of general combustibles (including vegetation) within the bounds of the SpaceX improved land areas surrounding the launch and landing areas (including wetting of existing vegetation immediately surrounding the launch area that is within the Texas Parks and Wildlife lands).

- Provide a plan for Emergency Response to unintended fire scenarios around the launch and landing areas that may occur during periods of flight operations.

- Provide a framework for incident communications between SpaceX and partner responding agencies for scenarios that include SpaceX facilities and the surrounding lands.

- Ensure a safe environment for all emergency response personnel.

- Limit negative environmental impact to wildlife, vegetation, and surrounding habitats.

4. Operational Period Command Emphasis:

No Personnel or Response Equipment / Property shall be placed at risk during any mitigation activities.

All responses will be planned and executed methodically. If the environment changes or additional hazards develop, personnel will retreat (with equipment whenever possible) and a modified mitigation plan will be developed.

No SpaceX property is worth risking life safety.

General Situational Awareness

Many potential hazards are present within the Launch Ground Support Equipment and on the Launch Vehicle. Occasional venting from the Launch Vehicle is Nominal, however, may occur without warning and can be very loud.

5. Site Safety Plan Required? Yes ☒ No ☐

Approved Site Safety Plan(s) Located at: SpaceX Environmental Health and Safety - Site Safety Briefing

6. Incident Action Plan (the items checked below are included in this Incident Action Plan)**:**

☒ ICS 203	☐ ICS 207	Other Attachments:
☒ ICS 204	☒ ICS 208	☐ ______
☒ ICS 205	☐ Map/Chart	☐ ______
☒ ICS 205A	☒ Weather Forecast/Tides/Currents	☐ ______
☒ ICS 206		☐ ______

7. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature: ______

8. Approved by Incident Commander: Name: ______ Signature: ______

ICS 202	**IAP Page** 5	Date/Time: 08.07.2019 1630

ORGANIZATION ASSIGNMENT LIST (ICS 203)

1. Incident Name: Starship Hopper Boca Chica Launch Site	**2. Operational Period:** Date From: 08/12/19 Date To: 11/12/19 Time From: 0001 Time To: 2359

3. Incident Commander(s) and Command Staff:

IC/UCs	John Muratore
CC Emrg Mgmt	Tom Hushen
Deputy	Mark Soltys
Safety Officer	Randy Rees
Public Info. Officer	Verdell Wilson
Liaison Officer	Dave Libbey

4. Agency/Organization Representatives:

Agency/Organization	Name

5. Planning Section:

Chief	John Hunt
Deputy	
Resources Unit	
Situation Unit	
Documentation Unit	
Demobilization Unit	
Technical Specialists	

6. Logistics Section:

Chief	James Hirsch
Deputy	Matt Chermak
Support Branch	
Director	
Supply Unit	
Facilities Unit	
Ground Support Unit	
Service Branch	
Director	
Communications Unit	
Medical Unit	
Food Unit	

7. Operations Section:

Chief	Jarrett Sheldon	Don DeVriendt
Deputy		Reynaldo Navarro
Staging Area	STARGATE	STARGATE
Branch		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Branch		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Branch		
Branch Director		
Deputy		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Division/Group		
Air Operations Branch		
Air Ops Branch Dir.		

8. Finance/Administration Section:

Chief	Caleb Mann
Deputy	
Time Unit	
Procurement Unit	
Comp/Claims Unit	
Cost Unit	

9. Prepared by: Name: Randy Rees Position/Title: Chief Emergency Operations Signature: ____________

ICS 203 **IAP Page** 6 Date/Time: 08.07.2019 1550

ASSIGNMENT LIST (ICS 204)

1. Incident Name:	2. Operational Period:	3.
Starship Hopper Boca Chica Launch Site	Date From: 08/12/19 Date To: 11/12/19 Time From: 0001 Time To: 2359	Branch: Operations Division: Fire Ops Group: Staging Area: STARGATE

4. Operations Personnel: Name / Contact Number(s)

Operations Section Chief: Jarrett Sheldon 956-337-3917

Branch Director:

Division/Group Supervisor:

5. Resources Assigned:

Resource Identifier	Leader	# of Persons	Contact (e.g., phone, pager, radio frequency, etc.)	Reporting Location, Special Equipment and Supplies, Remarks, Notes, Information
Engine 8		3	Reg Event 4	Type 1 Structural
Brush 1		2	Reg Event 4	Type 5 Wildland
Brush 2		2	Reg Event 4	Type 5 Wildland
SpaceX 1		2	ST - A	Type 1 Structural - 700gal
SpaceX 2		1	ST - A	ATV w/ Water Unit - 20gal
SpaceX 3		1	ST - A	ATV - Scout Unit
Attack 1		1	ST - A	UTV w/ Water Unit - 80gal
Attack 2		1	ST - A	UTV w/ Water Unit - 40gal

6. Work Assignments:

Fire Mitigation / Exposure Control

7. Special Instructions:

Water Re-Supply via 2" Gated line from SpaceX Water Farm or Brownsville PUB Water Truck

8. Communications (radio and/or phone contact numbers needed for this assignment):

Name/Function	Primary Contact: indicate cell, pager, or radio (frequency/system/channel)
Don DeVriendt / USFW Fire	956-330-5902 Reg Call / Reg Event 4
/	
/	
/	

9. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature:

ICS 204 **IAP Page** 7 Date/Time: 08.07.2019 1630

INCIDENT RADIO COMMUNICATIONS PLAN (ICS 205)

1. Incident Name:	**2. Date/Time Prepared:**	**3. Operational Period:**
Starship Hopper Boca Chica Launch Site	Date: 08/07/2019 Time: 1623	Date From: 08/12/19 Date To: 11/12/19 Time From: 0001 Time To: 2359

4. Basic Radio Channel Use:

Zone Grp.	Ch #	Function	Channel Name/Trunked Radio System Talkgroup	Assignment	RX Freq N or W	RX Tone/NAC	TX Freq N or W	TX Tone/NAC	Mode (A, D, or M)	Remarks
C	5	Emergency Services	Regional Event 4	Interop	851.912 5c		854.537 5a		D	60304 eb90
C	6	Law Enforcement Security Ops	Regional Event 5	Interop	851.912 5c		854.537 5a		D	60305 eb91
	1	Pad Operations	ST - A	Operations						SpaceX Proprietary Digital VHF
	2	Vehicle Operations	ST - B	Operations						SpaceX Proprietary Digital VHF
C	1	Regional Call	Regional Call Channel	Dispatch / Interop	851.912 5c		854.537 5a		D	60300 eb8c

5. Special Instructions:

6. Prepared by (Communications Unit Leader)**:** Name: Randy Rees Signature: ______

ICS 205	**IAP Page** 8	Date/Time: 08.07.2019 1623

COMMUNICATIONS LIST (ICS 205A)

1. Incident Name: Starship Hopper Boca Chica Launch Site	**2. Operational Period:** Date From: 08/12/19 Time From: 0001 Date To: 11/12/19 Time To: 2359	
3. Basic Local Communications Information:		
Incident Assigned Position	Name (Alphabetized)	Method(s) of Contact (phone, pager, cell, etc.)
Responsible Engineer - Fluids	Ball, David	805-757-7007
Logistics Deputy Chief	Chermak, Matt	
USFW Fire Management Officer	DeVriendt, Don	956-330-5902
Chief Engineer	Hazen, Derek	206-790-6958
Logistics Chief	Hirsch, James	805-452-1139
Planning Chief	Hunt, John	281-979-5311
CC Emergency Management	Hushen, Tom	956-454-5887
Liaison Officer	Libbey, Dave	321-361-7062
Finance Chief	Mann, Caleb	713-834-2585
CC Fire Marshal	Martinez, Juan	956-708-5110
Launch Director - IC	Muratore, John	832-387-0788
USFW Asst. Fire Mgmt Officer	Navarro, Reynaldo	956-566-2249
Safety Officer	Rees, Randy	515-943-3924
Responsible Engineer - D&C	Rench, Phil	407-433-0317
Government Affairs	Santos, Alma	956-708-2135
Brownsville Fire Chief	Sheldon, Jarrett	956-337-3917
Launch Director - Deputy IC	Soltys, Mark	816-721-2977
Public Information Officer	Wilson, Verdell	323-353-4551
USFW Refuge Manager	Winton, Bryan	956-874-4304
USFW Lower RGV	Dispatch	956-7894-7520 (0600 - 2200 / 7 days a week)

4. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature: ____________

ICS 205A | **IAP Page** 9 | Date/Time: 08.07.2019 1745

MEDICAL PLAN (ICS 206)

1. Incident Name: Starship Hopper Boca Chica Launch Site	**2. Operational Period:** Date From: 08/12/19 Date To: 11/12/19 Time From: 0001 Time To: 2359

3. Medical Aid Stations:

Name	Location	Contact Number(s)/Frequency	Paramedics on Site?
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No

4. Transportation (indicate air or ground)**:**

Ambulance Service	Location	Contact Number(s)/Frequency	Level of Service
Brownsville Fire Dept. -Gnd	Various	Regional Call	☒ ALS ☐ BLS
Los Fresnos Fire -Gnd	200 N Brazil St, Los Fresnos, TX 78566	Regional Call	☒ ALS ☐ BLS
			☐ ALS ☐ BLS
			☐ ALS ☐ BLS

5. Hospitals:

Hospital Name	Address, Latitude & Longitude if Helipad	Contact Number(s)/ Frequency	Travel Time		Trauma Center	Burn Center	Helipad
			Air	Ground			
Valley Regional Medical Center	25.9778361/-97.5159889	F5 VREG MC BR	15min	45min	☒ Yes Level: III	☐ Yes ☒ No	☒ Yes ☐ No
Velley Baptist Medical Center	26.1750778/-97.6695861 Rooftop	F4 VBMC HAR	22min	60min	☒ Yes Level: II	☐ Yes ☒ No	☒ Yes ☐ No
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No
					☐ Yes Level:_____	☐ Yes ☐ No	☐ Yes ☐ No

6. Special Medical Emergency Procedures:

Valley Regional Medical Center and Valley Baptist Medical Center - Harlingen have a Pre-Planned response (trauma resources, PR, and patient privacy) to inbound patients from the SpaceX facility.

☐ Check box if aviation assets are utilized for rescue. If assets are used, coordinate with Air Operations.

7. Prepared by (Medical Unit Leader)**:** Name: Ramiro Gamboa Signature: ____________________

8. Approved by (Safety Officer)**:** Name: Randy Rees Signature: ____________________

ICS 206	**IAP Page** 10	Date/Time: 08.07.2019 1830

SAFETY MESSAGE/PLAN (ICS 208)

1. Incident Name: Starship Hopper Boca Chica Launch Site	**2. Operational Period:** Date From: 08/12/19 Date To: 11/12/19 Time From: 0001 Time To: 2359

3. Safety Message/Expanded Safety Message, Safety Plan, Site Safety Plan:

General Site Safety Requirements
- All actions must be coordinated through the Launch Control Center

- Personnel will not perform tasking that they have not been trained to perform

- PPE will be worn by all field personnel as established by Safety

- Personnel shall report to rehab for downtime as required by the environmental conditions and designated by Safety

- All injuries shall be immediately reported to a supervising officer

- Any Emergency messages broadcast over the radio will be broadcast on both Regional Event Channels

- When working within SpaceX fence line, personnel shall carry person gas monitoring equipment

- Obtain information regarding your mission. Receive a good briefing.

- Scout the work area and surrounding areas

- Identify hazards (likely to result in negative impacts)

- Consider all aspects of current and future situations

- Keep hydrated; drink enough water. If drinking Gatorade or similar products use a 2:1 ratio (2 quarts water to 1 quart of Gatorade).

- Maintain communications with adjoining teams, supervisors and crew. Test your communications, use human repeaters when necessary.

- Personnel should utilize tick and bug spray. A product containing DEET is recommended. Make a supervisor aware of tick bites.

- Snakes, poisonous and non-poisonous, are known to the area. Look before walking or placing your hand into an area.

Fire Prevention / Remote Mitigation Program
- Removal of General Combustibles throughout the Launch and Landing areas
- Removal of Fuel Load vegetation throughout the Launch and Landing areas
- Re-Design of ablative and fire blanket systems in use covering the Launch Ground Service Equipment
- Addition of Remote Southern Water Cannons at the Launch Pad / Farms area
- Addition of Remote Water Cannons (NW and SE corners) at the Landing Pad area
- Addition of Remote Irrigation System along Southern fence line of the Launch Pad area (including around flare stack)
- Addition of Water Fill station for ATV / UTV apparatus on South Side of Water Farm - 2" line

4. Site Safety Plan Required? Yes ☒ No ☐ SpaceX Environmental Health and Safety - Site Safety Briefing
Approved Site Safety Plan(s) Located At:

5. Prepared by: Name: Randy Rees Position/Title: Chief Emerg Ops Signature: ____________

ICS 208	**IAP Page** 11	Date/Time: 08.07.2019 1933

INCIDENT STATUS SUMMARY (ICS 209)

***1. Incident Name:** Starship Hopper Boca Chica Launch Site		**2. Incident Number:** 2019.08.12-01	
***3. Report Version** (check one box on left)**:** ☒ Initial Rpt # (if used): ☐ Update ☐ Final	***4. Incident Commander(s) & Agency or Organization:** SpaceX: John Muratore IC CC Emergency Management: Tom Hushen IC	**5. Incident Management Organization:**	***6. Incident Start Date/Time:** Date: 08/12/2019 Time: 0001 Time Zone: Central Daylight Time
7. Current Incident Size or Area Involved (use unit label – e.g., "sq mi," "city block")**:**	**8. Percent (%) Contained** ______ **Completed** ______	***9. Incident Definition:**	**10. Incident Complexity Level:**
***11. For Time Period:** From Date/Time: ______ To Date/Time: ______			

Approval & Routing Information

***12. Prepared By:** Print Name: ______ ICS Position: ______ Date/Time Prepared: ______	***13. Date/Time Submitted:** **Time Zone:**
***14. Approved By:** Print Name: ______ ICS Position: ______ Signature: ______	***15. Primary Location, Organization, or Agency Sent To:**

Incident Location Information

***16. State:**	***17. County/Parish/Borough:**	***18. City:**
19. Unit or Other:	***20. Incident Jurisdiction:**	**21. Incident Location Ownership** (if different than jurisdiction)**:**
22. Longitude (indicate format)**:** **Latitude** (indicate format)**:**	**23. US National Grid Reference:**	**24. Legal Description** (township, section, range)**:**
***25. Short Location or Area Description** (list all affected areas or a reference point)**:**		**26. UTM Coordinates:**
27. Note any electronic geospatial data included or attached (indicate data format, content, and collection time information and labels)**:**		

Incident Summary

***28. Significant Events for the Time Period Reported** (summarize significant progress made, evacuations, incident growth, etc.)**:**

29. Primary Materials or Hazards Involved (hazardous chemicals, fuel types, infectious agents, radiation, etc.)**:**

30. Damage Assessment Information (summarize damage and/or restriction of use or availability to residential or commercial property, natural resources, critical infrastructure and key resources, etc.)**:**

A. Structural Summary	B. # Threatened (72 hrs)	C. # Damaged	D. # Destroyed
E. Single Residences			
F. Nonresidential Commercial Property			
Other Minor Structures			
Other			

 ** Required when applicable.*

INCIDENT STATUS SUMMARY (ICS 209)

***1. Incident Name:** Starship Hopper Boca Chica Launch Site	**2. Incident Number:** 2019.08.12-01

Additional Incident Decision Support Information

***31. Public Status Summary:**	A. # This Reporting Period	B. Total # to Date	***32. Responder Status Summary:**	A. # This Reporting Period	B. Total # to Date
C. Indicate Number of Civilians (Public) Below:			*C. Indicate Number of Responders Below:*		
D. Fatalities			D. Fatalities		
E. With Injuries/Illness			E. With Injuries/Illness		
F. Trapped/In Need of Rescue			F. Trapped/In Need of Rescue		
G. Missing *(note if estimated)*			G. Missing		
H. Evacuated *(note if estimated)*			H. Sheltering in Place		
I. Sheltering in Place *(note if estimated)*			I. Have Received Immunizations		
J. In Temporary Shelters *(note if est.)*			J. Require Immunizations		
K. Have Received Mass Immunizations			K. In Quarantine		
L. Require Immunizations *(note if est.)*					
M. In Quarantine					
N. Total # Civilians (Public) Affected:			*N. Total # Responders Affected:*		

33. Life, Safety, and Health Status/Threat Remarks:

35. Weather Concerns (synopsis of current and predicted weather; discuss related factors that may cause concern)**:**

***34. Life, Safety, and Health Threat Management:**	A. Check if Active
A. No Likely Threat	☐
B. Potential Future Threat	☐
C. Mass Notifications in Progress	☐
D. Mass Notifications Completed	☐
E. No Evacuation(s) Imminent	☐
F. Planning for Evacuation	☐
G. Planning for Shelter-in-Place	☐
H. Evacuation(s) in Progress	☐
I. Shelter-in-Place in Progress	☐
J. Repopulation in Progress	☐
K. Mass Immunization in Progress	☐
L. Mass Immunization Complete	☐
M. Quarantine in Progress	☐
N. Area Restriction in Effect	☐
	☐
	☐
	☐
	☐

36. Projected Incident Activity, Potential, Movement, Escalation, or Spread and influencing factors during the next operational period and in 12-, 24-, 48-, and 72-hour timeframes:

12 hours:

24 hours:

48 hours:

72 hours:

Anticipated after 72 hours:

37. Strategic Objectives (define planned end-state for incident)**:**

 ** Required when applicable.*

INCIDENT STATUS SUMMARY (ICS 209)

***1. Incident Name:** Starship Hopper Boca Chica Launch Site	**2. Incident Number:** 2019.08.12-01

Additional Incident Decision Support Information *(continued)*

38. Current Incident Threat Summary and Risk Information in 12-, 24-, 48-, and 72-hour timeframes and beyond. Summarize primary incident threats to life, property, communities and community stability, residences, health care facilities, other critical infrastructure and key resources, commercial facilities, natural and environmental resources, cultural resources, and continuity of operations and/or business. Identify corresponding incident-related potential economic or cascading impacts.

12 hours:

24 hours:

48 hours:

72 hours:

Anticipated after 72 hours:

39. Critical Resource Needs in 12-, 24-, 48-, and 72-hour timeframes and beyond to meet critical incident objectives. List resource category, kind, and/or type, and amount needed, in priority order:

12 hours:

24 hours:

48 hours:

72 hours:

Anticipated after 72 hours:

40. Strategic Discussion: Explain the relation of overall strategy, constraints, and current available information to:

1) critical resource needs identified above,
2) the Incident Action Plan and management objectives and targets,
3) anticipated results.

Explain major problems and concerns such as operational challenges, incident management problems, and social, political, economic, or environmental concerns or impacts.

41. Planned Actions for Next Operational Period:

42. Projected Final Incident Size/Area (use unit label – e.g., "sq mi")**:**

43. Anticipated Incident Management Completion Date:

44. Projected Significant Resource Demobilization Start Date:

45. Estimated Incident Costs to Date:

46. Projected Final Incident Cost Estimate:

47. Remarks (or continuation of any blocks above – list block number in notation)**:**

INCIDENT STATUS SUMMARY (ICS 209)

1. Incident Name: Starship Hopper Boca Chica Launch Site	**2. Incident Number:** 2019.08.12-01

Incident Resource Commitment Summary

48. Agency or Organization:	**49. Resources** (summarize resources by category, kind, and/or type; show # of resources on top ½ of box, show # of personnel associated with resource on bottom ½ of box):																				**50. Additional Personnel** not assigned to a resource:	**51. Total Personnel** (includes those associated with resources – e.g., aircraft or engines – *and* individual overhead):
52. Total Resources																						

53. Additional Cooperating and Assisting Organizations Not Listed Above:

ICS 209, Page ___ of ___	** Required when applicable.*

APPENDIX B: ICS 201 FORM

Blank ICS 201 Form.

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated: Date: Time:

4. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment)**:**

5. Situation Summary and Health and Safety Briefing (for briefings or transfer of command)**:** Recognize potential incident Health and Safety Hazards and develop necessary measures (remove hazard, provide personal protective equipment, warn people of the hazard) to protect responders from those hazards.

6. Prepared by: Name: ____________________ Position/Title: ____________________ Signature: ____________________

ICS 201, Page 1 Date/Time: ______________________________

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	**2. Incident Number:**	**3. Date/Time Initiated:** Date: Time:

7. Current and Planned Objectives:

8. Current and Planned Actions, Strategies, and Tactics:

Time:	Actions:

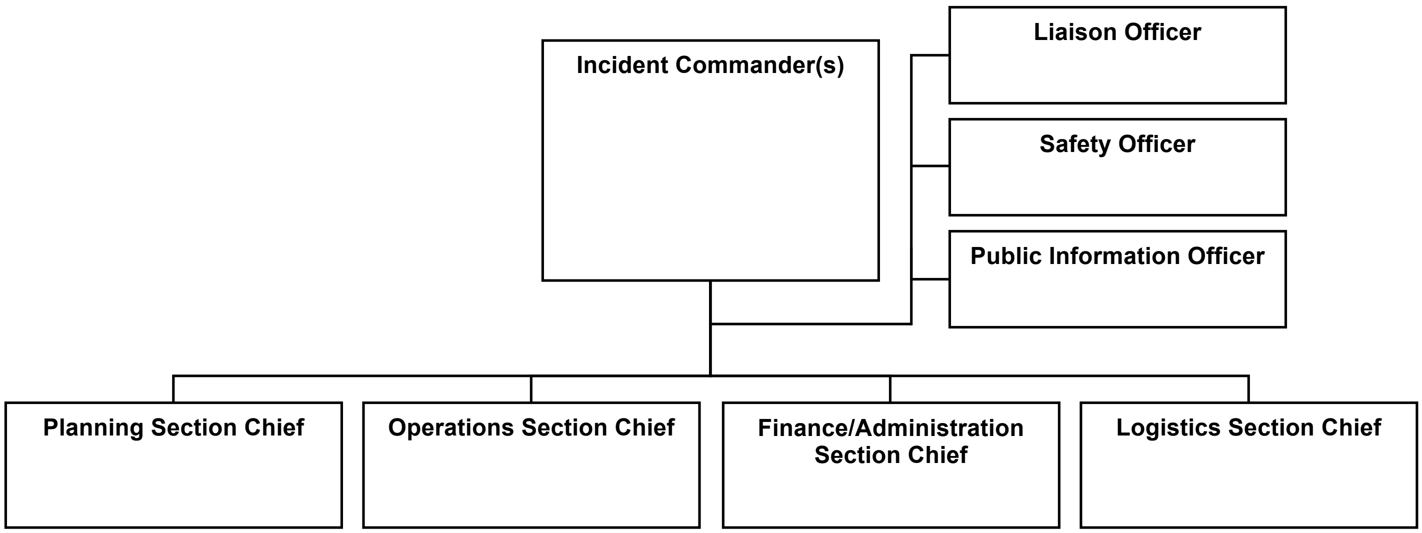
6. Prepared by: Name: ____________________ Position/Title: ___________________ Signature: ____________________

ICS 201, Page 2 Date/Time: ____

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated: Date: Time:

9. Current Organization (fill in additional organization as appropriate)**:**



6. Prepared by: Name: ________________ Position/Title: ________________ Signature: ________________

ICS 201, Page 3 Date/Time:

INCIDENT BRIEFING (ICS 201)

1. Incident Name:	2. Incident Number:	3. Date/Time Initiated: Date: Time:

10. Resource Summary:

Resource	Resource Identifier	Date/Time Ordered	ETA	Arrived	Notes (location/assignment/status)
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	

6. Prepared by: Name: ____________________ Position/Title: ____________________ Signature: ____________________

 Date/Time: ____

ICS 201
Incident Briefing

Purpose. The Incident Briefing (ICS 201) provides the Incident Commander (and the Command and General Staffs) with basic information regarding the incident situation and the resources allocated to the incident. In addition to a briefing document, the ICS 201 also serves as an initial action worksheet. It serves as a permanent record of the initial response to the incident.

Preparation. The briefing form is prepared by the Incident Commander for presentation to the incoming Incident Commander along with a more detailed oral briefing.

Distribution. Ideally, the ICS 201 is duplicated and distributed before the initial briefing of the Command and General Staffs or other responders as appropriate. The "Map/Sketch" and "Current and Planned Actions, Strategies, and Tactics" sections (pages 1–2) of the briefing form are given to the Situation Unit, while the "Current Organization" and "Resource Summary" sections (pages 3–4) are given to the Resources Unit.

Notes:
- The ICS 201 can serve as part of the initial Incident Action Plan (IAP).
- If additional pages are needed for any form page, use a blank ICS 201 and repaginate as needed.

Block Number	Block Title	Instructions
1	**Incident Name**	Enter the name assigned to the incident.
2	**Incident Number**	Enter the number assigned to the incident.
3	**Date/Time Initiated** • Date, Time	Enter date initiated (month/day/year) and time initiated (using the 24-hour clock).
4	**Map/Sketch** (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment)	Show perimeter and other graphics depicting situational status, resource assignments, incident facilities, and other special information on a map/sketch or with attached maps. Utilize commonly accepted ICS map symbology. If specific geospatial reference points are needed about the incident's location or area outside the ICS organization at the incident, that information should be submitted on the Incident Status Summary (ICS 209). North should be at the top of page unless noted otherwise.
5	**Situation Summary and Health and Safety Briefing (**for briefings or transfer of command): Recognize potential incident Health and Safety Hazards and develop necessary measures (remove hazard, provide personal protective equipment, warn people of the hazard) to protect responders from those hazards.	Self-explanatory.
6	**Prepared by** • Name • Position/Title • Signature • Date/Time	Enter the name, ICS position/title, and signature of the person preparing the form. Enter date (month/day/year) and time prepared (24-hour clock).
7	**Current and Planned Objectives**	Enter the objectives used on the incident and note any specific problem areas.

Block Number	Block Title	Instructions
8	**Current and Planned Actions, Strategies, and Tactics** • Time • Actions	Enter the current and planned actions, strategies, and tactics and time they may or did occur to attain the objectives. If additional pages are needed, use a blank sheet or another ICS 201 (Page 2), and adjust page numbers accordingly.
9	**Current Organization** (fill in additional organization as appropriate) • Incident Commander(s) • Liaison Officer • Safety Officer • Public Information Officer • Planning Section Chief • Operations Section Chief • Finance/Administration Section Chief • Logistics Section Chief	• Enter on the organization chart the names of the individuals assigned to each position. • Modify the chart as necessary, and add any lines/spaces needed for Command Staff Assistants, Agency Representatives, and the organization of each of the General Staff Sections. • If Unified Command is being used, split the Incident Commander box. • Indicate agency for each of the Incident Commanders listed if Unified Command is being used.
10	**Resource Summary**	Enter the following information about the resources allocated to the incident. If additional pages are needed, use a blank sheet or another ICS 201 (Page 4), and adjust page numbers accordingly.
	• Resource	Enter the number and appropriate category, kind, or type of resource ordered.
	• Resource Identifier	Enter the relevant agency designator and/or resource designator (if any).
	• Date/Time Ordered	Enter the date (month/day/year) and time (24-hour clock) the resource was ordered.
	• ETA	Enter the estimated time of arrival (ETA) to the incident (use 24-hour clock).
	• Arrived	Enter an “X” or a checkmark upon arrival to the incident.
	• Notes (location/ assignment/status)	Enter notes such as the assigned location of the resource and/or the actual assignment and status.

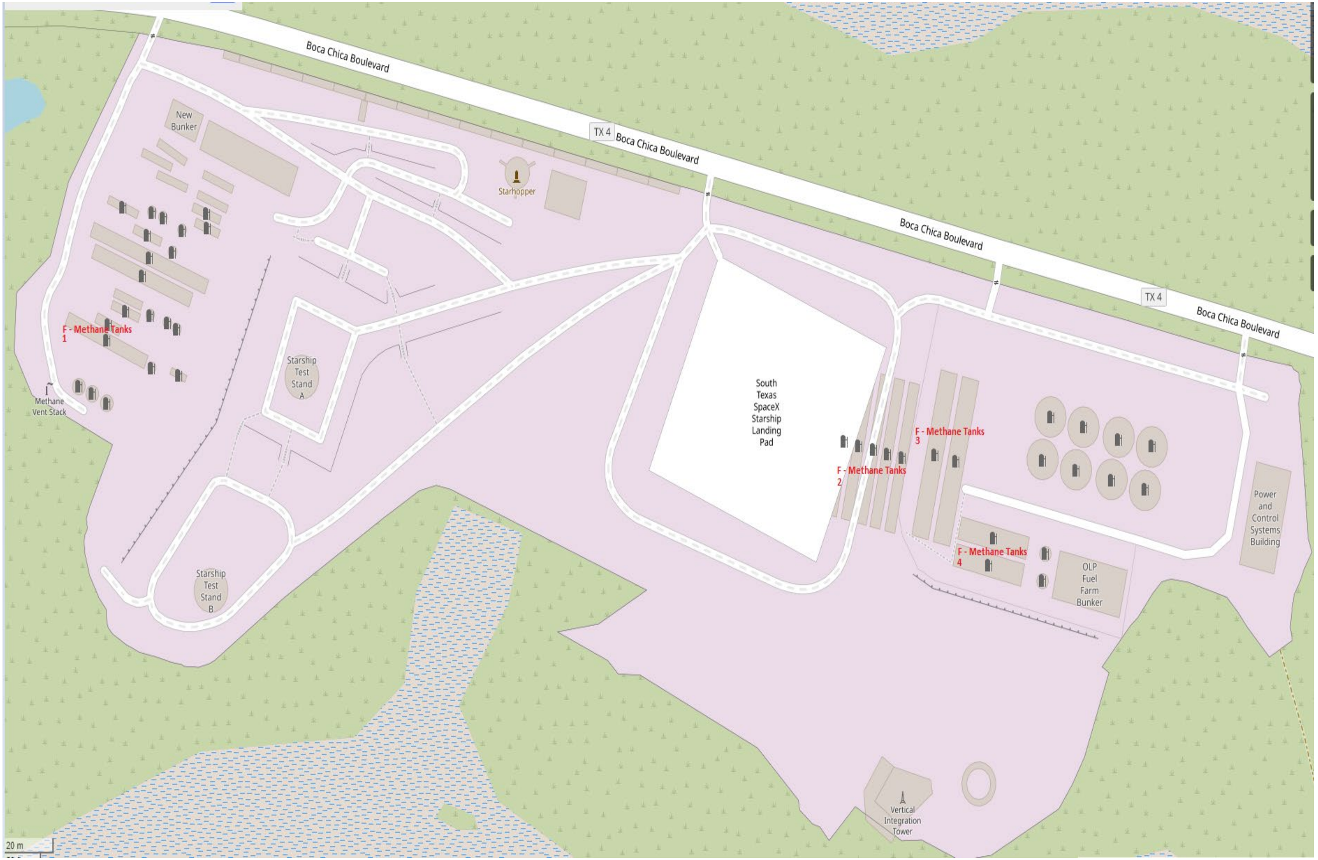
APPENDIX C: FLAMMABLE CONTENTS AND COLLECTION POINTS

This site layout identifies where flammable contents are located and major collection points.

BUILD SITE

Location	Flammable Content Description
High Bay	Solvent (Isopropyl alcohol, acetone, naphtha dye) Contaminated Debris
Mid Bay	Solvent (Isopropyl alcohol, acetone, naphtha dye) Contaminated Debris
Production Tent 1	Solvent (Isopropyl alcohol, acetone, naphtha dye) Contaminated Debris
Production Tent 2	Solvent (Isopropyl alcohol, acetone, naphtha dye) Contaminated Debris
Production Tent 3	Solvent (Isopropyl alcohol, acetone, naphtha dye) Contaminated Debris
Storage Tent (Now Bakery)	Denatured Alcohol
Ground Fabrication	Paint & Paint Contaminated Debris
Propulsion Shop	Solvent (Isopropyl alcohol, acetone, naphtha dye) Contaminated Debris
Paint Storage	Paints & Thinner
GSE Equipment Storage	Welding Acetylene Tanks

LAUNCH PAD SITE



Location	Flammable Content Description
F1 – Methane Tank	Suborbital Liquid Methane Tanks
F2 – Methane Tank	Orbital Liquid Methane Tanks (100,000 gal x5)
F3 – Methane Tank	Orbital Liquid Methane Tanks (265,000 gal x5)
F4 – Methane Tank	Orbital Liquid Methane Tanks (80,000 gal x2)

SANCHEZ LOT

Location	Flammable Content Description
Waste Central Accumulation Area (Collection Point)	Waste - Solvent (Isopropyl alcohol, acetone, naphtha dye) Contaminated Debris, Diesel, Gas, Isopropyl Alcohol, Acetone
Methane Tanker	Methane Tanks – Fuel supply for generators
Methane Pad	Methane Truck Storage

ESPERSON AREA

Location	Flammable Content Description
Fuel Storage Area	Fuel including diesel, gas,
Propane Storage	Propane tank (1000 gallon)

APPENDIX D: LARGE PRESSURIZED CONTAINERS

This site layout identifies where large pressurized containers are located throughout the site

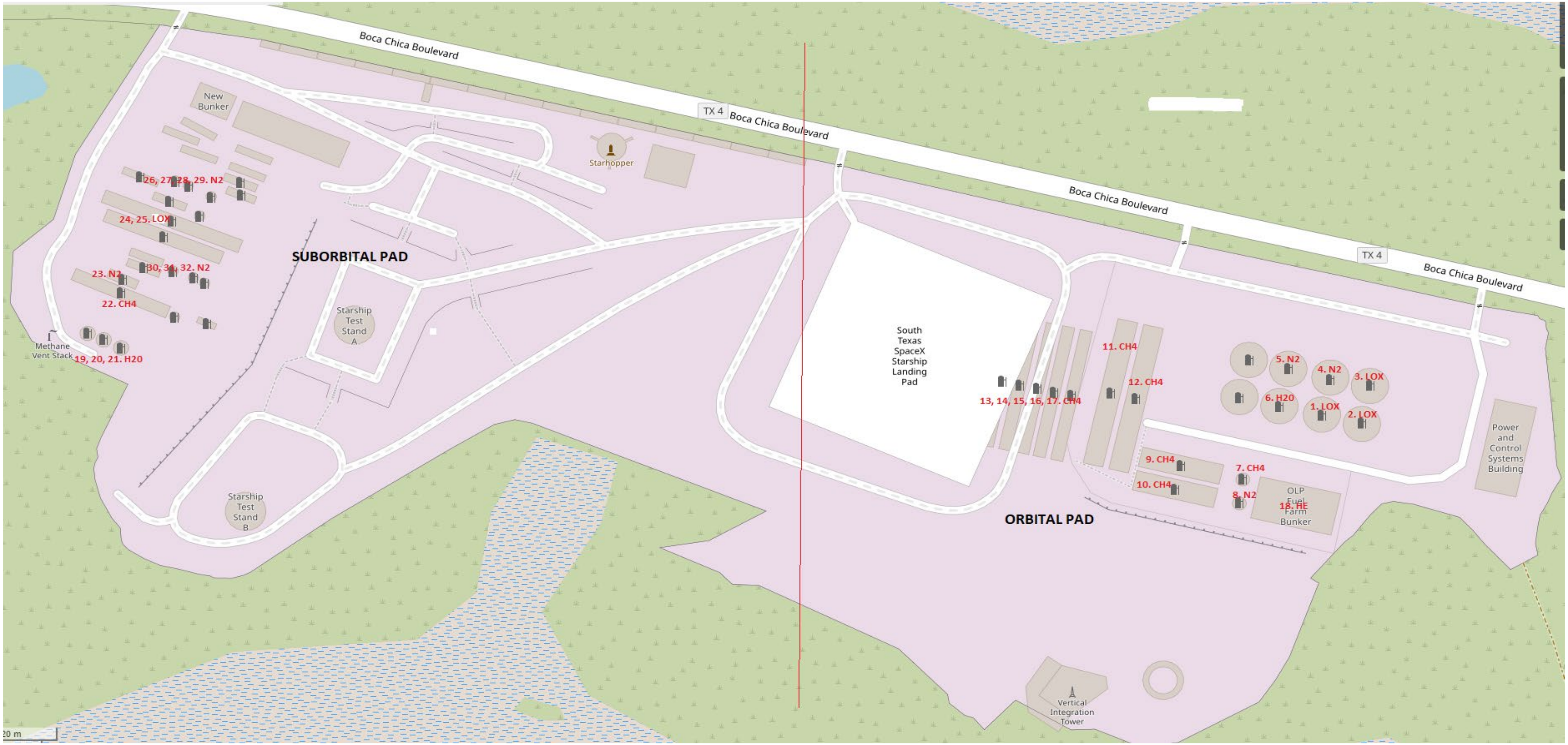
SANCHEZ LOT

Location	Pressurized Container Content
1. N2 Tank South ASU	Liquid Nitrogen
2. N2 Tank South ASU	Liquid Nitrogen
3. N2 Tank South ASU	Liquid Nitrogen

BUILD SITE

Location	Pressurized Container Content
North High Bay	Argon (850 gal)
West Tent 2	Argon (11000 gal)
North East Storage Tent (Now Bakery)	Argon (3000 gal)
Propulsion Building	Argon (3000 gal)
Ground Fabrication	Argon (600 gal)

LAUNCH PAD SITE



Location (Orbital)	Pressurized Container Content
19, 20, 21. H20	Water
22. CH4	Liquid Methane
23. N2	Liquid Nitrogen
24, 25. LOX	Liquid Oxygen
26, 27, 28, 29. N2	Liquid Nitrogen
30, 31, 32. N2	Liquid Nitrogen

Location (Suborbital)	Pressurized Container Content
1. LOX 2. LOX 3. LOX	Liquid Oxygen
4. N2 5. N2	Liquid Nitrogen
6. H20	Water
7. CH4	Gaseous Methane
8. N2	Gaseous Nitrogen
9. CH4 10. CH4	Liquid Methane
11. CH4 12. CH4	Liquid Methane
13, 14, 15, 16, 17. CH4	Liquid Methane

APPENDIX E: FIRE EXTINGUISHERS

This site layout identifies where fire extinguishers are throughout the site

BUILD SITE

LOCATION	TYPE OF EXTINGUISHER
Stargate	20 lbs. ABC
High Bay	20 lbs. ABC
Mid Bay	20 lbs. ABC
Tent 1	20 lbs. ABC
Tent 2	20 lbs. ABC
Tent 3	20 lbs. ABC
Storage Tent	20 lbs. ABC
Wind Break	20 lbs. ABC
Prop Shop	20 lbs. ABC
GSE	20 lbs. ABC
Sea-van Wall	20 lbs. ABC

SANCHEZ LOT

LOCATION	TYPE OF EXTINGUISHER
ASU	20 lbs. ABC
90 Day Waste Area	20 lbs. ABC
Generators	20 lbs. ABC 2- 150 lbs. wheel units
Sea-Van Wall	20 lbs. ABC

ESPERSON AREA

LOCATION	TYPE OF EXTINGUISHER
Solar Farm	20 lbs. ABC
Fuel Farm	150 ABC wheel unit
HUB	20 lbs. ABC
Solar Farm	20 lbs. ABC
Astro Pub	3- class K 20 lbs. ABC

APPENDIX F: SMOKE DETECTORS

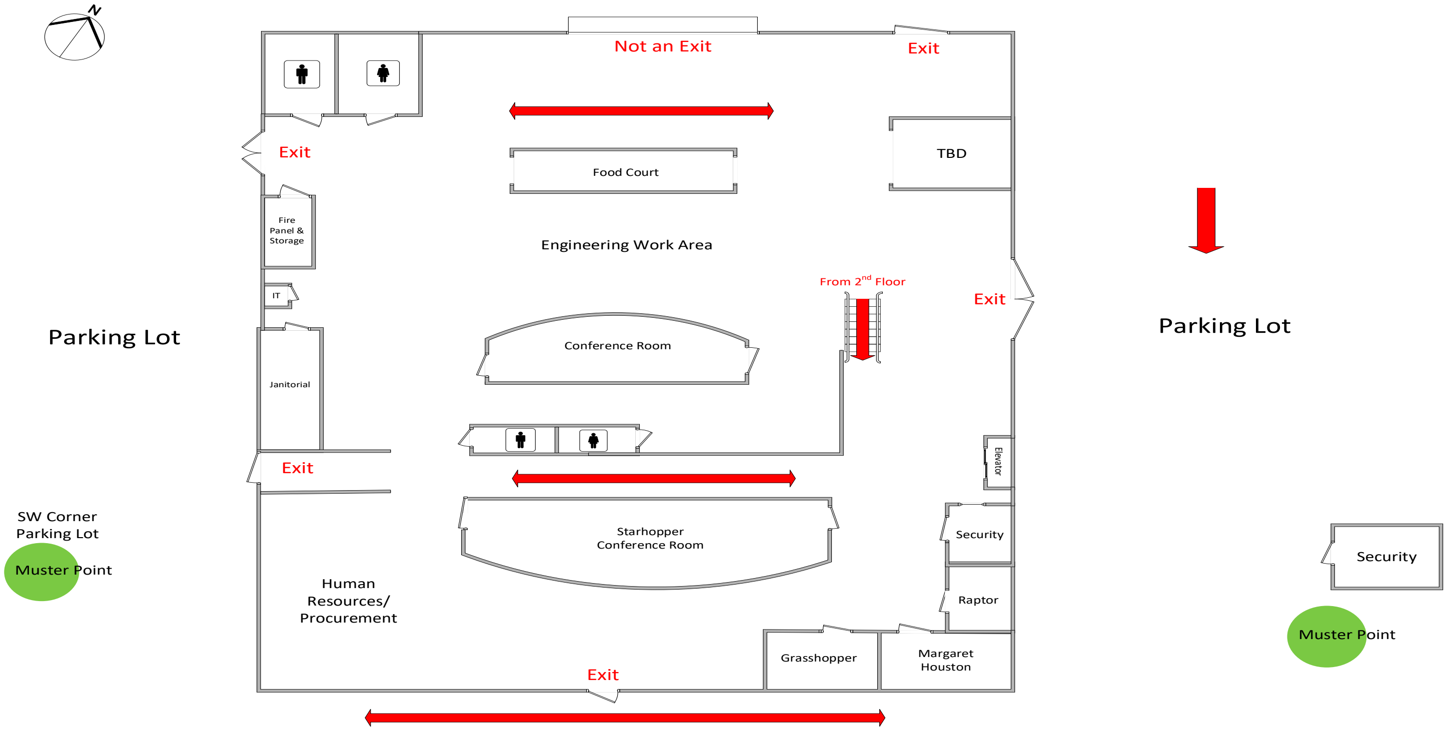
This site layout identifies where smoke detectors are throughout the site

Site layout is under development

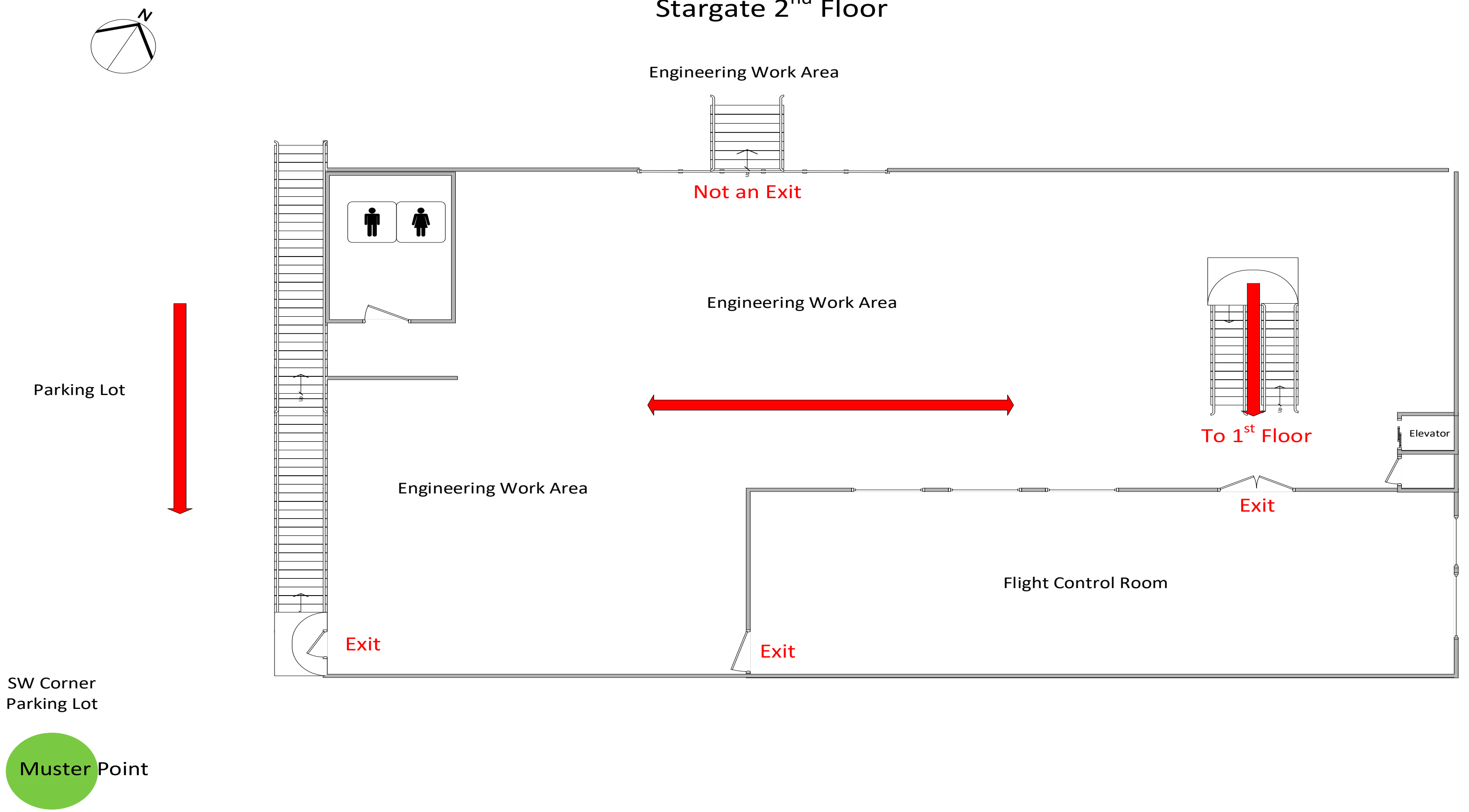
APPENDIX : EVACUATION ROUTES

This consists of all evacuation routes

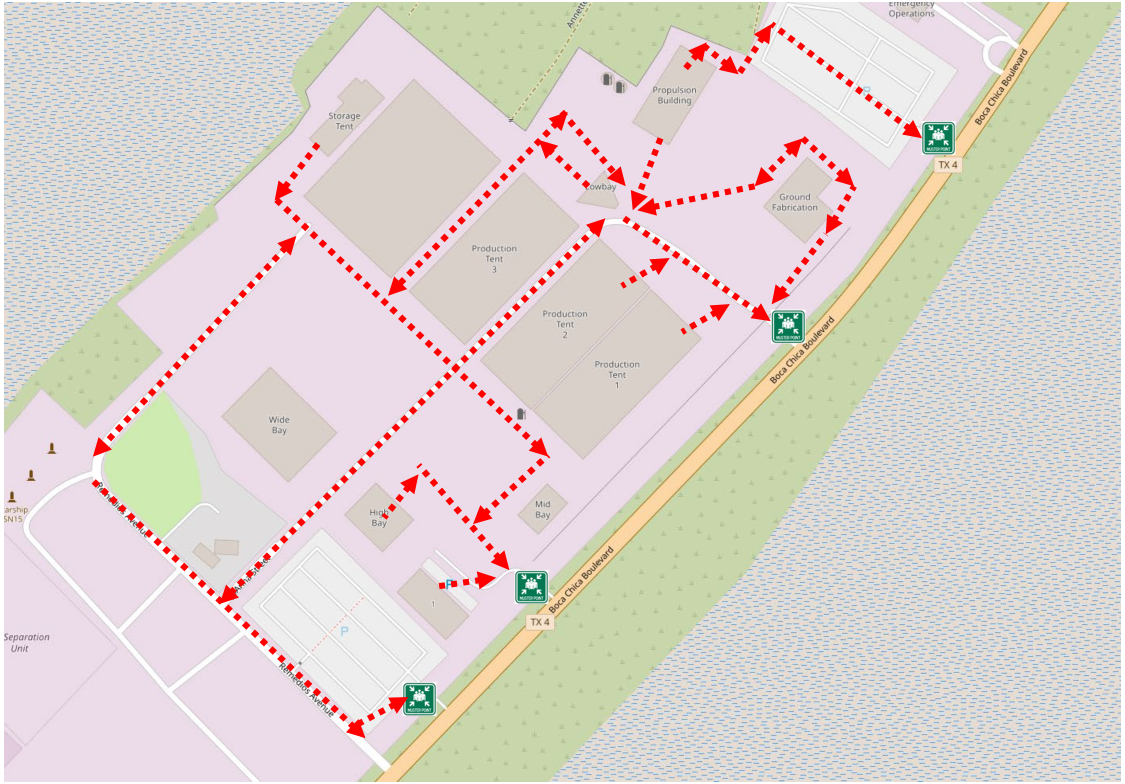
Stargate First Floor



Stargate 2nd Floor



BUILD SITE

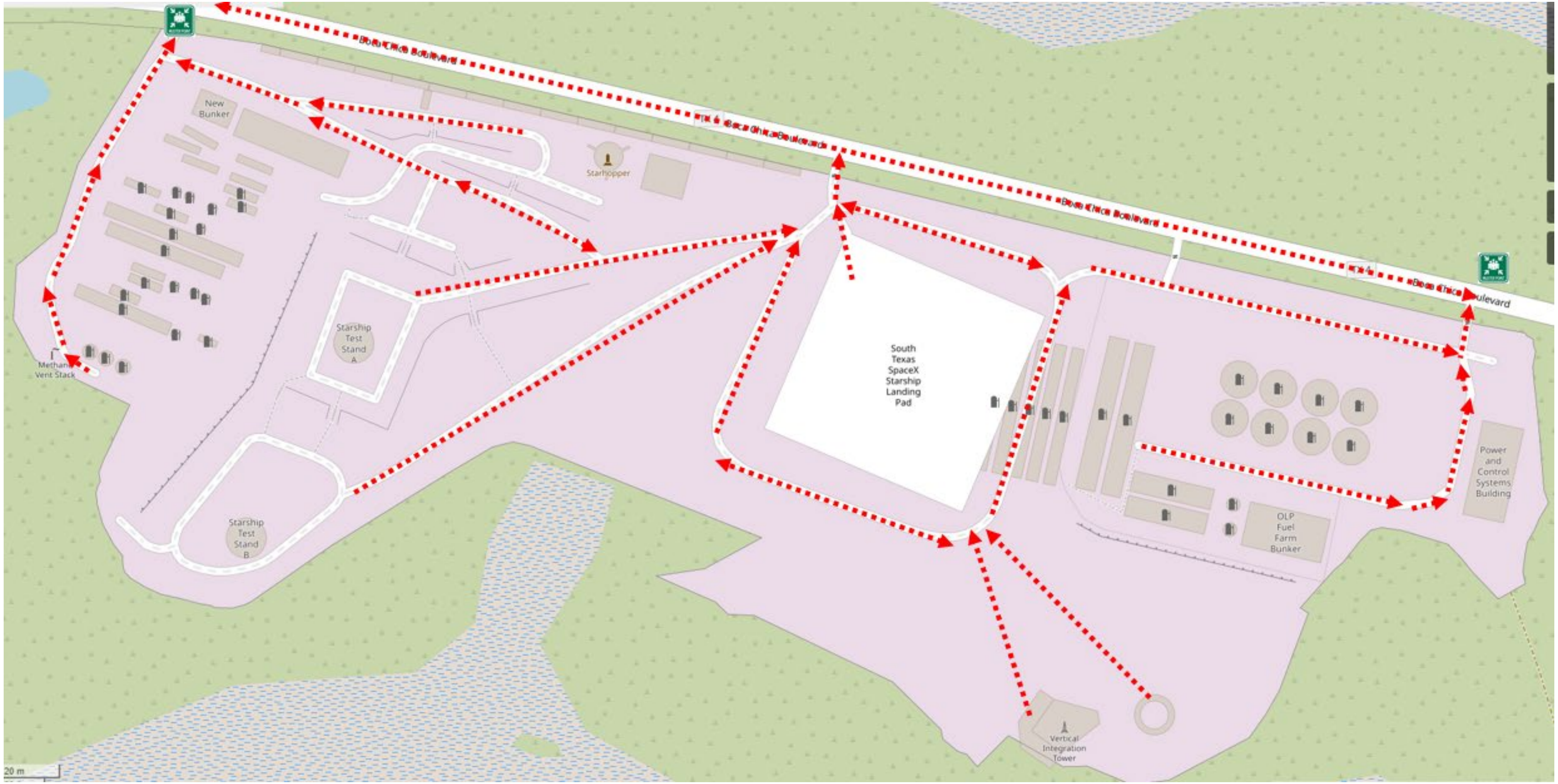

Emergency
Operations
Storage
Tent
Propulsion
Building
Cowbay
Ground
Fabrication
Production
Tent
3
Production
Tent
2
Production
Tent
1
Wide
Bay
High
Bay
Mid
Bay
Boca Chica Boulevard
TX 4
Separation
Unit
Remedios Avenue

SANCHEZ LOT

Starship SN15
Super Heavy B5
Air Separation Unit
SN2
High Bay
JoAnna Street
TX 4
Boca Chica Boulevard
Boca Chica Boulevard

ESPERSON AREA

LAUNCH PAD SITE



APPENDIX H: STAR ATE A ARM S STEM

Th on t of the hemat of the f re alarm tem at Star ate l n .

This schematic is under development

SpaceX Texas Launch Site

Construction Storm Water Pollution Prevention Plan

Revision 14

December 2021

Contents

1.0 Purpose

This Storm Water Pollution Prevention Plan (SWPPP) was prepared to comply with Texas Pollutant Discharge Elimination System (TPDES) permit as defined in the Construction General Permit TXR 150000 Part III Section F. The purpose of this SWPPP is to:

1. Describe and ensure the implementation of practices that will be used to reduce the pollutants in storm water discharges associated with construction activity at the construction site and assure compliance with the terms and conditions of the Permit;
2. Identify potential pollutants that are reasonably expected to affect the quality of storm water discharges from the construction site, including off-site material storage areas, overburden and stockpiles of dirt, borrow areas, equipment staging areas, vehicle repair areas, fueling areas, etc., used solely by the permitted project;
3. Identify non-storm water discharges and eliminate unauthorized non-storm water discharges, illicit connections, and dumping; and
4. Outline an inspection and maintenance program to determine the effectiveness of site best management practices (BMPs).

Implementation of the components of this SWPPP is required as a condition of compliance with the General Permit, a copy of which is attached in Appendix D. The Texas Commission on Environmental Quality (TCEQ) has been granted authority to administer the TPDES program and is therefore the regulatory authority overseeing the implementation of this SWPPP.

2.0 General Requirements

2.1 Availability

The SWPPP shall remain on-site at all times during business hours and readily available for review by State, Federal, local or other agencies having authority upon request. These include the City of Brownsville, Cameron County, Texas Commission on Environmental Quality (TCEQ), and the U.S. Environmental Protection Agency (EPA), SpaceX representatives, and all operating personnel for the duration of the project. If the site is inactive or does not have an on-site location to store the plan, a notice must be posted describing the location of the SWPPP.

2.2 Approved State and Local Plans

This SWPPP was prepared to comply with TPDES permit as defined in the Construction General Permit TXR 150000 Part III Section F. Currently, there are no erosion and sediment or storm water permits issued by the City of Brownsville, or Cameron County, Texas for this site.

2.3 Deadlines

The SWPPP provides for compliance with the terms and schedule of the General Permit beginning with the initiation of construction activities and following through to the completion of construction activities and final stabilization. A Notice of Intent (NOI) is required to be submitted to the TCEQ at least seven (7) days prior to commencing construction activities, or prior to commencing construction activities if an electronic NOI is submitted. An NOI can be submitted electronically through the State of Texas Environmental Electronic Reporting System (STEERS) at the following web address: https://www3.tceq.texas.gov/steers/index.cfm. The Notice of Termination (NOT) addressed in Section 2.5 of this plan can also be submitted through the STEERS.

2.4 SWPPP Updates

The SWPPP will be amended whenever there is a change in design, construction, operation or maintenance of the construction site that has a significant effect on the potential for the discharge of pollutants to surface waters and that has not been addressed in the normal implementation of the SWPPP. The SWPPP will also be updated if there are changing site conditions based on updated plans and specifications, new operators, new areas of responsibility, and/or changes in BMPs. In the event a State, Federal, local or other agency, or the BMP inspector notifies the Permittee that this SWPPP does not meet one or more of the provisions of the General Permit, within a period of seven days, the Permittee will make the required changes to the SWPPP or individual BMPs.

The SWPPP will also be updated and the U.S. Fish and Wildlife Service (USFWS) notified if there are any changes in the Plan/project that may affect listed species or critical habitat. These changes include:

1. Construction sequencing, including clearing and re-vegetation.
2. Project end date.

3. Any changes to coordinated area of disturbance/vegetation removal.
4. Changes to planned construction related storm water outfalls (addition or removal).
5. Construction related lighting modifications.
6. Any major changes to construction laydown/staging areas.

2.5 Guidance

Large Construction Activities (>5 disturbed acres):

1. Develop a SWPPP and implement prior to commencing construction activities;
2. Maintain with the SWPPP a copy of the General Permit, completed maintenance and inspection forms, and all records of compliance;
3. Primary operators must submit an NOI at least seven (7) days prior to commencing construction activities, or if utilizing electronic submittal, prior to commencing construction activities. A copy of the NOI along with the acknowledgement certificate can be found in Appendix A. If an additional primary operator is added after the initial NOI is submitted, the new primary operator must submit an NOI at least seven (7) days before assuming operational control, or if utilizing electronic NOI submittal, prior to assuming operational control. If the primary operator changes after the initial NOI is submitted, the new primary operator must submit a paper NOI or an electronic NOI at least ten (10) days before assuming operational control;
4. All primary operators must also post a copy of the signed NOI at the construction site in a location where it is readily available for viewing by the general public and local, state, and federal authorities prior to commencing construction activities, and must maintain the NOI in that location until completion of the construction activity;
5. All operators of large construction activities must post a site notice in accordance with Part III.D.2. of this permit. The site notice must be located where it is safely and readily available for viewing by the general public and local, state, and federal authorities prior to commencing construction, and must be maintained in that location until completion of the construction activity (for linear construction activities, e.g. pipeline or highway, the site notice must be placed in a publicly accessible location near where construction is actively underway; notice for these linear sites may be relocated, as necessary, along the length of the project, and the notice must be safely and readily available for viewing by the general public and local, state, and federal authorities); (Appendix B)
6. All primary operators must provide a copy of the signed NOI to the operator of any municipal separate storm sewer system (MS4) receiving the discharge and to any secondary operator, at least seven (7) days prior to commencing construction activities, and must list in the SWPPP the names and addresses of all MS4 operators receiving a copy. NOTE: this site does not discharge to a MS4;
7. All persons meeting the definition of “secondary operator” in Part I of this permit are hereby notified that they are regulated under this General Permit, but are not required to submit an NOI, provided that another operator(s) at the site has submitted an NOI, or is required to submit an NOI and the secondary operator has provided notification to the operator(s) of the need to obtain coverage (with records of notification available upon request). Any secondary operator notified under this provision may alternatively

submit an NOI under this General Permit, may seek coverage under an alternative TPDES individual permit, or may seek coverage under an alternative TPDES general permit if available;

8. Submit a Notice of Change (NOC) if any information submitted on the NOI changes or is inaccurate. An NOC must be submitted to TCEQ at least 14 days before the change occurs, or within 14 days of discovering the inaccuracy. See Part II Section E.6 in the permit for the list of eligible changes;
9. Submit the NOT to TCEQ, and a copy of the NOT provided to the operator of any MS4 receiving the discharge, within 30 days after any of the following:
    a. Final stabilization has been achieved on all portions of the site that are the responsibility of the permittee;
    b. A transfer of operational control has occurred; or
    c. The operator has obtained alternative authorization under an individual TPDES permit or alternative TPDES general permit;
10. Maintain the following records for a period of 3 years:
    a. A copy of the SWPPP;
    b. All reports and actions required by this permit, including a copy of the construction site notice;
    c. All data used to complete the NOI, if an NOI is required for coverage under this general permit; and
    d. All records of submittal of forms submitted to the operator of any MS4 receiving the discharge and to the secondary operator of a large construction site, if applicable; and
11. NOI forms, NOT forms, NOC letters, and Construction Site Notices that require a signature must be signed according to 30 TAC § 305.44.

3.0 Site Information

3.1 Project Limits

The SpaceX Boca Chica Launch Site is located directly adjacent to the eastern terminus of State Highway 4 (Boca Chica Boulevard) and to Boca Chica State Park and Lower Rio Grande Valley National Wildlife Refuge lands. It is located immediately south of Brazos State Park, approximately 5 miles south of Port Isabel and South Padre Island, approximately 18 miles east of Brownsville, and approximately 3 miles north of the U.S./Mexico border on the Gulf Coast of Texas (Figure 3-1).

Project Latitude: 25°59’49.33”N

Project Longitude: -97°09’17.34”W

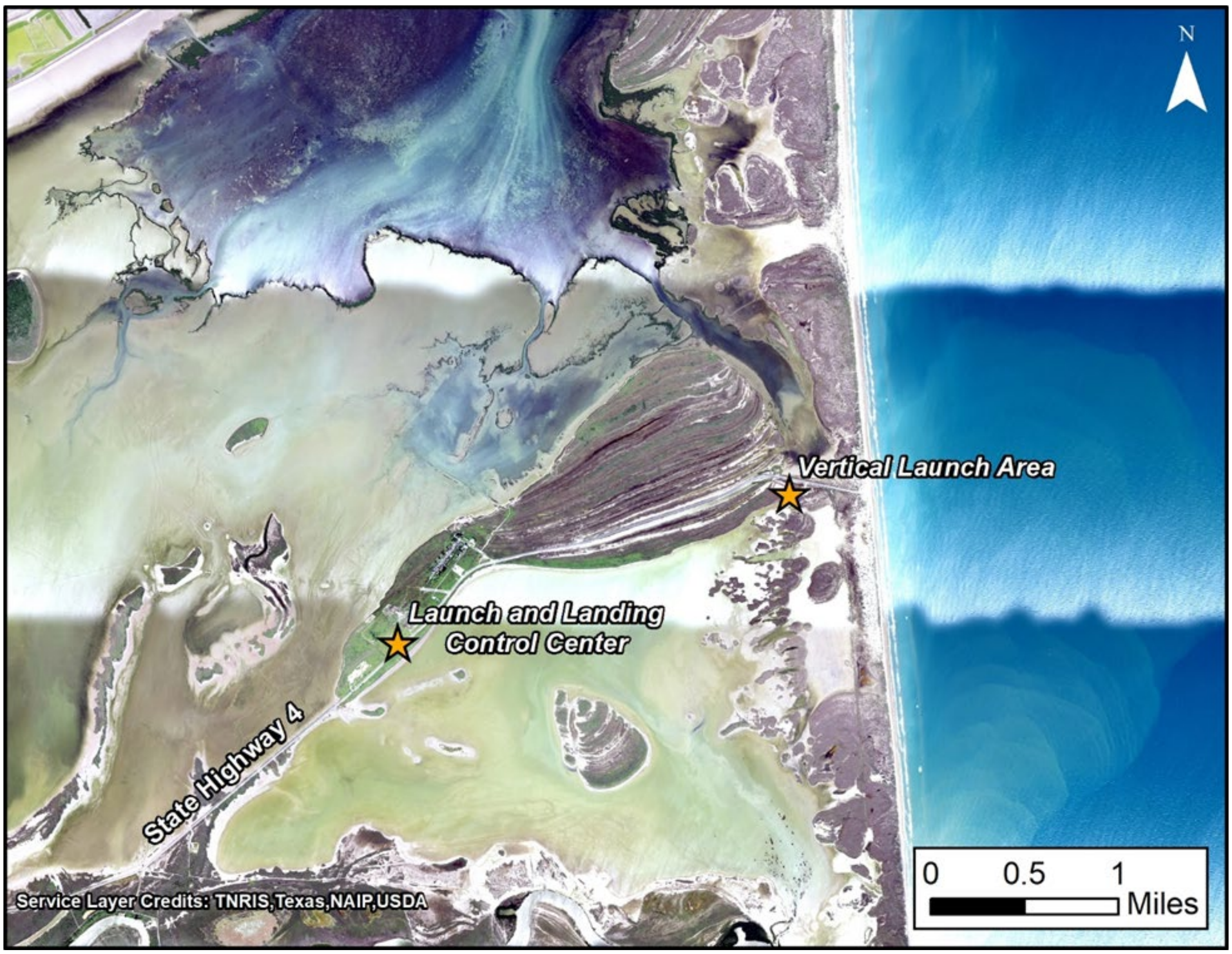


Figure 3-1 Location of the Vertical Launch Area and Launch and Landing Control Center

3.2 Site Preparation

Soil surcharging, layering of dirt on dirt, will be used to compact the lower layer of soil to allow for a more conducive foundation. Materials such as gravel or topsoil will be obtained from existing developed or previously used sources, not from undisturbed areas adjacent to the property. Sites will be cleared of vegetation and graded. Fill material will be clean and of such composition that will not adversely affect the biological, chemical or physical properties of adjacent water.

3.3 Project Description

SpaceX plans to construct facilities, structures, and utility connections in order to support the development of the new launch vehicle called the Starship/Super Heavy.

The SpaceX Boca Chica Launch Site consists of the vertical launch area (VLA), which includes two test pads, a landing pad, and launch pad. The vertical launch area is under construction, including addition of commodities and infrastructure. Further development of the vertical launch area would result in expansion of the site's footprint to SpaceX's property boundary, excluding the dune buffer zone, which is 1,000 feet from the mean high tide line. SpaceX is proposing additional construction at the VLA, including expanding the solar farm near the LLCC, adding infrastructure and facilities at the VLA, parking lots, a liquid natural gas pretreatment system, a liquefier, a payload processing facility, and trenching and pull-offs along SH 4. At the VLA, SpaceX is proposing to construct a redundant launch pad and commodities, a redundant landing pad, two integration towers, tank structural test stands, additional support buildings, and a power plant. SpaceX also plans to expand the solar farm, which will power both the production area and the pad.

3.3.1. Launch and Landing Control

The launch and landing control (LLC) is located near approximately 2 miles west of the vertical launch area and north of Boca Chica Boulevard (Figure 3-2). The two-story control center building, formally known as Stargate, is used for command and control of the launch vehicle, and ground systems during launch and test operations. The control center building consists primarily of several large rooms for control consoles, conference rooms, and support rooms. In addition, the facility houses office areas for site personnel.

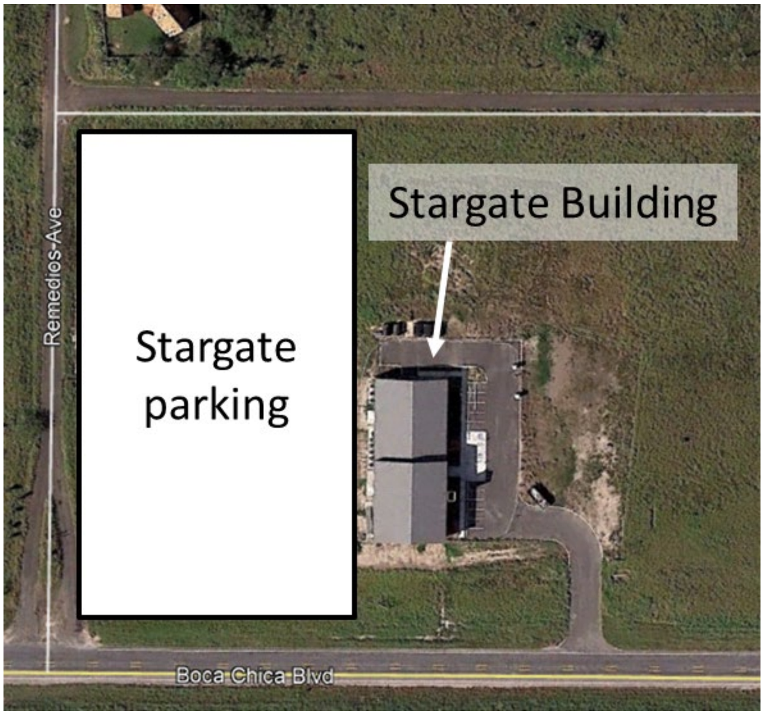


Figure 3-2 Launch and Landing Control

3.3.2. Solar Farm Area

The solar farm area is located west of the LLC, and is approximately 5.4 acres in size (Figure 3-3). The solar farm area consists of solar arrays and batteries for power storage. The solar farm area will be expanded to approximately 7 acres.

Figure 3-3 Proposed Footprint of the Expanded Solar Farm

Solar Array

The solar array encompasses approximately 2.5 acres, with each solar panel being approximately five feet tall. This area has been stabilized with vegetation.

Ground Tracking Station Antennas

SpaceX has two satellite dishes. Each satellite dish is approximately 41 feet tall, with approximately 900 square-foot pads. They are used to receive data from launch vehicles during flight and to communicate commands to the launch vehicles if needed. The antennas would be located on the north side of Parcel 2, in the middle of the property.

3.3.3. Vertical Launch Area

Infrastructure at the vertical launch area (Figure 3-4) includes:

- Orbital and suborbital launch pads
- Propellant handling storage areas
- Roads, parking areas, fencing, security, lighting, and utilities
- Landing Pad

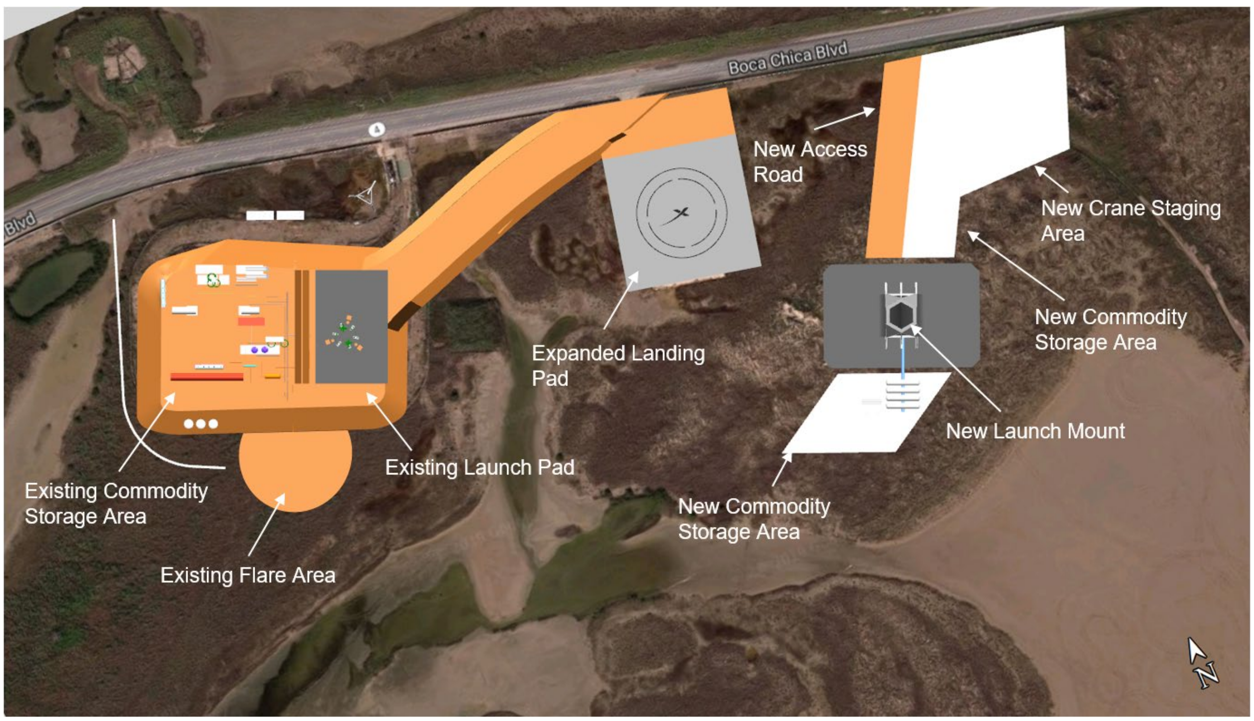


Figure 3-4 Layout of the Vertical Launch Area

3.3.4. Propellant Storage and Handling Areas

The propellant storage areas will include storage and handling equipment for the propellants and gases that fuel the launch vehicle. There are three primary areas: liquid oxygen (LOX) area, methane area, and nitrogen area. Each area will include storage tanks or vessels, including their supports and containment area where required; fluid pumps; gas vaporizers; and other components necessary to control flow to the launch vehicle. In addition, each area will include a concrete or asphalt parking area for delivery trucks for refill of the storage tanks.

3.3.5. Access Roads and Infrastructure

Roads and utilities will be required to provide access, power, and septic to the facilities within the launch area. Roads will be constructed of concrete or asphalt, depending on the planned use. The perimeter access road will be dirt/gravel. Throughout the area, there will be exterior lighting, security fences, and gates built. During launches, deluge water will be sprayed over the launch pad for cooling and sound and vibration suppression.

3.4 Sequence of Construction

Schedule for sequence of construction is TBD factoring in timelines and start date and other activity considerations.

3.5 Drainage Patterns and Receiving Waters

There are no surface waters (non-wetland surface waters) within the boundary or footprint of the manufacturing area, LLC, or the vertical launch area. The location of the launch site is within South Laguna Madre watershed, which is within the Bahia-Grande Brownsville Ship Channel watershed, a 363-square mile subwatershed to the Southwestern Texas Coastal Basin[1]. South Bay is an inland bay along the Gulf of Mexico located within the Laguna Madre hypersaline lagoon system and is the southernmost bay in Texas (TPWD 2012b). South Bay is separated from the Gulf of Mexico by Brazos Island. On the northern boundary of South Bay is an inlet where water flows freely from South Bay into the Brownsville Shipping Channel, which connects the Port of Brownsville to the Gulf of Mexico. On the southern end of South Bay, approximately 0.5 mile north of the vertical launch area, is Boca Chica Bay where Boca Chica State Park is located. Boca Chica Bay, located approximately 0.03 mile from the vertical launch area, is a subdelta of the Rio Grande.

The vertical launch area topology is essentially flat and low-lying. The pad elevations will be approximately 5-15 feet and slope all around, creating natural drainage away from the center of the pads. The control center and manufacturing area topology is similar to the launch area, generally flat. As with the vertical launch area, facilities in these areas will be built above ground level, creating natural drainage away from the facilities. Storm waters and other drainage will be diverted generally to the north of the area.

Runoff from both areas will not be to a MS4. South Bay water quality results were last posted in August 2018, and although they indicated the presence of fecal coliform, these levels were below EPA standards[1]. To the east of the vertical launch area is the Gulf of Mexico. Waters of the Gulf of Mexico have been deemed impaired waters by EPA. Causes of impairment include the presence of mercury in fish tissue (TCEQ 2011a). Water quality is regularly sampled at Boca Chica State Park Station #3, which is located near where State Highway 4 meets the Gulf of Mexico. The results of the last sampling event conducted in August 2018 indicated that Enterococcus bacteria were below maximum concentration in August 2018[2]. Enterococcus is the Federal standard for water quality at public salt water beaches.

[1] EPA. 2012. Designated Sole Source Aquifers in EPA Region VI.
[2] EPA. 2018. http://www.epa.gov/region6/water/swp/ssa/maps.htm.

The Rio Grande is located approximately 2 miles south of the launch site and is located outside of the watershed. Portions of the Rio Grande are designated a wild and scenic river. However, these portions are located over 400 miles away from the launch site. In addition, as per the Nationwide River Inventory (NRI), no rivers or river segments within Cameron County are currently listed.

3.6 Description of Vegetation

The uplands located within the vertical launch area are largely comprised of sporadically vegetated sand dunes in the eastern portion of the property and moderately to densely vegetated uplands in the western portion of the property. Additional upland islands are located in the unvegetated salt flats. The wetlands on-site are comprised of scrub shrub and emergent wetlands, both of which are categorized as high marsh areas, and unvegetated salt flats. Additionally, three small unvegetated depressional features were identified in the northwestern portion of the site. Upland vegetation is typified by Texas pricklypear (*Opuntia engelmannii*), honey mesquite (*Prosopis glandulosa*), little bluestem (*Schizachyrium scoparium*), gush bluestem (*Andropogon glomeratus*), giant reed (*Arundo donax*), cuman ragweed (*Ambrosia cumanensis*), and golden tickseed (*Coreopsis tinctoria*). Wetland vegetation is primarily comprised of saltgrass (*Distichlis spicata*), shoregrass (*Monanathocloe littoralis*), glasswort, shoreline seapurslane, sea ox-eye, and gulf cordgrass (*Spartina spartinae*). Other species observed include black mangrove and turtleweed. Vegetation in the sand dunes includes beach croton, sea purslane, and beach morning glory.

The LLC is comprised of upland vegetation dominated by little bluestem, honey mesquite, cuman ragweed, and yucca (*Yucca treculeana*).

3.7 Description of Soils

Based on the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) web soil survey (NRCS 2012a), the soils underlying the vertical launch area are comprised of Galveston fine sand, hummocky (90 percent Galveston); Mustang fine sand, saline (90 percent Mustang); Mustang fine sand (95 percent Mustang); and Coastal beach (100 percent). The Galveston fine sand is in the taxonomic class mixed, hyperthermic Typic Udipsamments. Mustang fine sand is in the taxonomic class siliceous, hyperthermic Typic Psammaquents. The LLC is underlain by Galveston fine sand, hummocky, which is classified as partially hydric soils. All of the soils on-site have very high wind erosion potential. Conversely, all of the soils on-site have very low water erosion potential (NRCS 2012a).

3.8 Non –Storm Water Discharges

The General Permit prohibits discharging anything other than storm water and authorized non-storm water discharges to Waters of the State or an MS4. Authorized non-storm water discharges include:

Offsite discharges are prohibited except as follows:

1) Discharges from firefighting activities and/or uncontaminated fire hydrant flushings.

2) Vehicle, external building, and pavement wash water where detergents and soaps are not used and where spills or leaks of toxic or hazardous materials have not occurred (unless all spilled material has been removed).
3) Uncontaminated water used to control dust.
4) Plain water originating from potable water sources.
5) Uncontaminated groundwater, spring water, or accumulated storm water.
6) Uncontaminated air conditioning condensate.
7) Lawn watering and similar irrigation drainage.

Non-storm water discharges are not anticipated during construction activities; however, BMPs have been identified in this SWPPP to control spills, leaks, and to prevent illicit connections and discharges during the project (see Section 4.0).

3.9 Threatened and Endangered Species

The Federal Aviation Administration (FAA) prepared a Biological Assessment (BA) in 2013 and based on the analysis presented in the BA, the FAA determined that the Proposed Action (construction and operations) *may affect, is likely to adversely affect* the piping plover and its critical habitat, red knot, northern aplomado falcon, Gulf Coast jaguarundi, ocelot, and Kemp's ridley, hawksbill, leatherback, loggerhead, and green sea turtles. The FAA has determined that the Proposed Action *may affect, is not likely to adversely affect* the West Indian manatee. In accordance with ESA Section 7, formal consultation was conducted between the USFWS and the FAA in 2013. Consultation with the USFWS was completed with their issuance of a Biological and Conference Opinion (BCO) on December 18, 2013. The BCO concurred with the findings of the BA analysis and concluded no jeopardy to any species and no adverse modification to designated piping plover critical habitat from construction and operations. Special conservation measures have been developed for the project and are presented in **Section 4.0**.

In 2017, the FAA re-initiated consultation with the USFWS on January 26, 2017 to assess potential effects on ESA-listed species as a result of installing a security fence and road at the launch area. After learning of SpaceX's proposed changes to the LLC site design, the FAA expanded the consultation with USFWS to include these changes. The FAA concluded no take of species beyond that issued in the BO was anticipated from SpaceX's proposed modifications to the LLC and launch area.

In 2021, the FAA prepared a Biological Assessment for the Programmatic Environmental Assessment for the Starship/Super Heavy launch vehicle program. The FAA the FAA determined that the Proposed Action (construction and operations) *may affect, is likely to adversely affect* the piping plover and its critical habitat, red knot, northern aplomado falcon, Gulf Coast jaguarundi, ocelot, and Kemp's ridley, hawksbill, leatherback, loggerhead, and green sea turtles. The FAA has determined that the Proposed Action *may affect, is not likely to adversely affect* the West Indian manatee and the Eastern black rail. Formal consultation with the USFWS is ongoing, and updates to special conservation measures will be reflected in future versions of this document.

3.10 Historical, Architectural, Archaeological, and Cultural Resources

Construction of the facilities would not physically impact any historic property listed or eligible for the National Register of Historic Places. No significant archaeological resources were found during the surveys of the vertical launch area, LLC, or solar farm area. The 2014 Section 106 Programmatic Agreement (PA) includes stipulations on the process for avoiding, minimizing, and mitigating adverse effects on historic properties. Section 106 consultation with applicable agencies is ongoing for the Starship/Super Heavy launch vehicle program; a new PA is currently under development.

3.11 Potential Pollution Sources

Potential sources of sediment to storm water runoff:

1) Clearing and grubbing operations
2) Grading and site excavation operations
3) Vehicle tracking
4) Topsoil stripping and stockpiling
5) Landscaping operations
6) Potential pollutants and sources, other than sediment, to storm water runoff
7) Combined Staging Area—small fueling activities, minor equipment maintenance, sanitary facilities, and hazardous waste storage
8) Materials Storage Area—general building materials, solvents, adhesives, paving materials, paints, aggregates, trash, etc.
9) Construction Activity—paving, curb/gutter installation, concrete pouring/mortar/stucco, and building construction
10) Concrete Washout Areas

Potential construction site pollutants include:

Material	Pollutants
Concrete	Limestone, sand
Asphalt	Petroleum
Glue, adhesives	Polymers, epoxies
Paints	Metal oxides, solvent, carbonate, arsenic
Wood preservatives	Solvent, petroleum distillates, arsenic, copper, chromium
Hydraulic oil/fluids	Mineral oil
Gasoline	Benzene, ethyl benzene, toluene, xylene, Methyl Tertiary Butyl Ether (MTBE)
Diesel fuel	Petroleum distillate, oil & grease, naphthalene, xylenes
Antifreeze/coolant	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)
Sanitary toilets	Bacteria, parasites, and viruses
Site trash	Plastic, paper

4.0 Best Management Practices

BMPs have been selected to control potential pollutants on-site. General timing or sequence for implementation of BMPs shall be as required and/or as directed/approved by the Engineer to provide adequate controls. BMPs are to reduce sediments from construction activities. [Sediment and Erosion Control Drawings are TBD and will be complete during final site design] The type of BMPs will be selected for good housekeeping, sediment control, storm water management, spill prevention and biological resources. Control measures must be properly installed and maintained according to the manufacturer's or designer's specifications.

In lieu of detaining for the 25-year storm, permanent storm water quality best management practices (BMPs) could be implemented to address concerns of sediment and pollutants in the runoff. While the process of detaining stormwater for a period of time would allow for the settlement of sediment and some particulates out of the stormwater before discharging into the bay, this could be achieved more efficiently with water quality BMPs (best management practices), designed to treat the "first flush" of stormwater before discharging into the bay. These BMPs can include Sedimentation/Filtration Ponds, Biofiltration Ponds, Extended Detention Basins, Wet Ponds, Retention/Irrigation Systems, Rain Gardens, Constructed Wetlands, Vegetative Filter Strips, Grassy Swales, Permeable Concrete, as well as engineered systems from various vendors. BMP selection and design will be dependent on site conditions and drainage patterns. Some of these BMPs may be used by themselves and some may be used in tandem with other BMPs

4.1 Good Housekeeping

Good housekeeping practices are the primary means by which construction-related pollutants will be controlled at this site. These practices include properly managing construction materials and wastes so they do not come into contact with storm waste. The following good housekeeping BMPs will be in place:

1) No solid materials shall be discharged to surface waters or buried on site. All solid non-hazardous waste material including disposable materials will be collected in containers or closed dumpsters. The collection containers will be emptied periodically and the collected material hauled to a landfill permitted by State and/or appropriate local municipality to accept the waste for disposal.
2) To ensure off-site vehicle tracking of sediments and the generation of dust is minimized, the paved areas adjacent to the entrances and exits will be cleaned to remove any excess mud, dirt, or other material tracked from the site. All trucks hauling materials from the construction site will be covered with a tarpaulin.
3) Construction material waste collection points will not be located in any wetland, water body or stream bed.
4) Concrete truck water discharges on the site will be prohibited or minimized. If allowed by the Engineer, they must be managed in a manner so as not to contaminate surface water. They must not be located in areas of concentrated flow.
5) Hazardous material spill/leak shall be prevented or minimized. At a minimum, this includes asphalt products, fuels, oils, lubricants, solvents, paints, acids, concrete

curing compounds, and chemical additives for soil stabilization. BMPs shall be implemented to the storage areas of these products.

6) Dumpsters will be equipped with lids (predator-proof) and kept closed at all times except when adding or removing trash.
7) Trash must be removed regularly to help prevent attracting predators or blowing debris into sensitive areas.
8) Dumpsters will be constructed and positioned in such a way as to reduce the risk of the dumpster tipping over.
9) Exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, and sanitary waste to precipitation will be minimized. These items will be stored under cover if possible.

4.2 Sediment Controls

Sediment controls are structural measures intended to complement and enhance the selected erosion control measures and reduce sediment discharges from active construction areas. Sediment controls are designed to intercept and settle out soil particles that have been detached and transported by the force of water. Sediment control BMPs include:

1) Install fiber rolls or silt fence along the site perimeter as shown on the erosion control drawings (no planting within piping plover critical habitat).
2) Vehicles, heavy equipment, and general construction traffic shall use the designated entrances/exits to prevent sediment tracking onto paved areas and to minimize ground disturbance. Limit construction traffic to the stabilized entrance/exits only.
3) Verification that silt fences are in proper condition prior to all rainfall events.

4.3 Erosion Controls

Erosion control, also referred to as soil stabilization, consists of source control measures that are designed to prevent soil particles from detaching and becoming transported in storm water runoff. Erosion control BMPs protect the soil surface by covering and/or binding soil particles and many have the secondary effect of increasing water infiltration. Erosion control BMPs include:

1) Schedule construction activities to reduce the amount of soil exposed at one time. Perform mass grading during the dry season.
2) SpaceX will provide effective soil cover for inactive areas and all finished slopes, open space, utility backfill, and completed lots
3) The amount of exposed soil will be minimized to the greatest extent practical during construction.
4) The disturbance of slopes and dunes will be avoided/minimized to the greatest extent practical.
5) Native topsoil at the site will be preserved, unless infeasible.
6) Soil compaction in post-construction pervious areas will be minimized.

4.4 Spill Prevention

The following are the management practices that will be used to reduce the risk of spills or other accidental exposure of materials and substances to storm water runoff.

1. All spills must be cleaned and disposed properly and reported to the Engineer. Please refer to Section 3.10 of the facility Spill Prevention, Control and Countermeasures (SPCC) Plan for detailed spill response instructions. Report any release at or above the reportable quantity during a 24-hour period to the National Response Center at 1-800-424-8802. An effort will be made to store only enough products required to do the job.
2. All materials stored onsite will be stored in a neat, orderly manner in their appropriate containers and if possible, under a roof or other enclosure.
3. Products will be kept in their original containers with the original manufacturer's label.
4. Substances will not be mixed with one another unless recommended by the manufacturer.
5. Whenever possible, all of a product will be used up before disposing of the container.
6. Manufacturer's recommendations for proper use and disposal will be followed.
7. Designated areas for equipment maintenance and repair (control of oil, grease and fuel spills).
8. Dumpsters will be equipped with lids (predator-proof) and kept closed at all times except when adding or removing trash.
9. Trash must be removed regularly to help prevent attracting predators or blowing debris into sensitive areas.
10. Dumpsters will be constructed and positioned in such a way as to reduce the risk of the dumpster tipping over.
11. Protected storage area for chemicals, paints, solvents, fertilizers and other potentially toxic materials.
12. Adequately maintained sanitary facilities.
13. Proper control of raw materials stored onsite (for example, sand, aggregate and cement used in the manufacture of concrete or stockpiles of topsoil).
14. Construction staging areas and vehicle maintenance areas shall be constructed in a manner to minimize the runoff of pollutants.

4.5 Biological Resources

The 2014 USFWS BCO specified non-discretionary Reasonable and Prudent Measures that are necessary to minimize impacts to listed species (i.e., amount or extent of incidental take) and critical habitat. The BCO also specified discretionary Conservation Recommendations that are intended to avoid or minimize adverse effects of a proposed action on listed species and critical habitat. The FAA commits to implementing the Reasonable and Prudent Measures and the Terms and Conditions outlined in the BCO to minimize potential impacts on ESA-listed species and critical habitat. The FAA is currently in consultation with USFWS, which will result in the development of updated Reasonable and Prudent Measures and Terms and Conditions, which will be incorporated in future updates of this document after the completion of consultation.

FAA/SpaceX has agreed on Reasonable and Prudent Measures to avoid and minimize impacts to the ocelot, jaguarundi, aplomado falcon, piping plover, red knot, and sea turtles. Of those measures, the following measures are relevant to storm water management:

1. Submit a detailed Storm water Monitoring Plan.
2. In conjunction with final design, an SWPPP will be prepared. The SWPPP will include BMPs for erosion and sedimentation controls, including techniques to diffuse and slow the velocity of stormwater to reduce potential impacts (e.g., soil loss and sedimentation) to water quality during construction. All construction activities with the potential of impacting water quality due to potential runoff from the site will be conducted in accordance with SWPPP requirements.
3. Uncontaminated rainwater will be allowed to drain or pumped out of containment structures only following visual inspection to determine the absence of evidence of a spill or leak of oil and/or visible seen on the surface of the water. If a spill has occurred within the last 48 hours preceding a rain event, Space X will conduct analytical sampling of the waters before releasing.
4. To the maximum extent practicable the following would be followed:
    a. The perimeter of all areas to be disturbed during construction or maintenance activities would be clearly demarcated using flagging or temporary construction fence, and no disturbance outside that perimeter would be authorized (in particular tidal flats and dunes). All access routes into and out of the proposed disturbance area would be flagged, and no construction travel outside those boundaries would be authorized. When available, areas already disturbed by past activities or those that would be used later in the construction period shall be used for staging, parking, and equipment storage.
    b. Roads would be designed and located where roadbed erosion into special-status species habitat is avoided or minimized and the potential for entrapment of surface flows within the roadbed due to grading would also be avoided or minimized.
    c. Drip pans underneath equipment, containment zones used when refueling vehicles or equipment, and other measures would be implemented.
    d. Non-hazardous waste materials, litter, and other discarded materials, such as construction waste, would be contained within secured containers until removed from the construction site. All trash containers would have secured closures to prevent animal foraging.
5. Prior to entry and exit into unpaved areas of the project, SpaceX would ensure heavy equipment would traverse over construction shaker or rumble plates or rock bed to remove any sediment and dirt and prevent importation of non-native plant species. The equipment would be inspected to ensure that hydraulic fittings are tight, hydraulic hoses are in good condition (and replaced if damaged), and there are no petroleum leaks.

6. SpaceX will designate an FCR that will be present during the beginning of the construction period to provide all construction personnel and SpaceX employees with an environmental worker-education briefing that will include, but not be limited to, the following:
    a. Information regarding federally and State-listed species with the potential to occur in the area, impacts that may occur, conservation measures being implemented, their responsibilities under the ESA, and avoidance and reporting procedures.
    b. Measures to prevent wildfires, including restricting smoking to areas clear of vegetation, ensuring no fires of any kind are ignited and equipping vehicles with spark arrestors and fire extinguishers.
    c. Requirements for safe handling and disposal of hazardous wastes will be implemented.

5.0 Inspection and Maintenance

5.1 Inspection

A qualified person or persons will be designated to perform required inspections. This person must be knowledgeable of the General Permit, familiar with the construction site, and knowledgeable of this SWPPP. The following inspections will be conducted:

1. Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system.
2. Erosion and sediment control measures identified in the plan will be observed to ensure that they are operating correctly.
3. Where discharge locations or points are accessible, they will be inspected to ascertain where erosion control measures are effective in preventing significant impacts to receiving waters.
4. Locations where vehicles enter or exit the disturbed areas of site will be inspected for evidence of offsite sediment tracking.
5. Inspections are intended to identify areas where the pollutant control measures at the site are ineffective and are allowing, or could potentially allow, pollutants to enter surface waters. Receiving water will be inspected to ascertain whether control measures are effective in preventing significant impacts. Locations where vehicles enter or exit the site will be inspected for evidence of offsite sediment tracking.

    a) The inspection will be conducted by the responsible person at least once every fourteen (14) calendar days and within twenty-four (24) hours of the end of a storm event of 0.5 inch or greater.

       As an alternative to the above described inspection schedule, the SWPPP may be developed to require that these inspections will occur at least once every seven (7) calendar days. If this alternative schedule is developed, the inspection must occur on a specifically defined day, regardless of whether or not there has been a rainfall event since the previous inspection.

    b) Based on the results of the inspection, if revisions to the SWPPP are needed they will be made no later than seven (7) calendar days following the inspection.

5.2 Maintenance

All erosion and sediment controls shall be maintained in good working order. If a repair is necessary, it shall be performed before the next anticipated storm event but no later than seven calendar days after the surrounding exposed ground has dried sufficiently to prevent further damage from equipment. If maintenance prior to the next anticipated storm event is impracticable, maintenance must be scheduled and accomplished as soon as practicable. Disturbed areas on which construction activities have ceased, temporarily or permanently, shall be stabilized within 14 calendar days unless they are scheduled to and do resume within 21 calendar days. The areas adjacent to creeks and drainage ways shall have priority followed by protecting storm sewer inlets.

Inspection and Maintenance forms are located in **Appendix C**.

6.0 Final Stabilization

When construction is complete, all construction materials and temporary BMPs will be removed from the site. Final stabilization will primarily consist of impervious concrete and asphalt and the planting of native plants.

Drainage on the LLC will remain essentially the same as before construction with storm water being conveyed off-site to the north. Final stabilization will be achieved prior to submitting the NOT. After the entire site is stabilized, any sediment that has accumulated will be removed and hauled off-site for disposal.

Storm Water Management for the facility would be assumed under the facility's Operation SWPPP.

7.0 Management Certification

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

Name and Title ____

Signature ____ Date ______________

DATE OF TEST (m/d/yr.)	OUTFALL NO. DIRECTLY OBSERVED DURING TEST	METHOD USED TO TEST OR EVALUATE DISCHARGE	DESCRIBE RESULTS FROM TEST FOR NON-STORM WATER DISCHARGE	IDENTIFY POTENTIAL SIGNIFICANT SOURCES	NAME OF PERSON WHO CONDUCTED THE TEST OR EVALUATION

CERTIFICATION	
I certify under penalty of law that the outfall(s) covered by this Storm Water Pollution Prevention Plan have been tested or evaluated for presence of non-storm water discharges, and that all non-storm water discharges from the outfall are limited to those identified in Section II.A.3 of the TPDES General Permit No. TXR150000.	
Signature	Date Signed

Appendix A – Notice of Intent

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
Texas Pollutant Discharge Elimination System
Stormwater Construction General Permit

The Notice of Intent (NOI) for the facility listed below was received on July 16, 2018. The intent to discharge stormwater associated with construction activity under the terms and conditions imposed by the Texas Pollutant Discharge Elimination System (TPDES) stormwater construction general permit TXR150000 is acknowledged. Your facility's TPDES construction stormwater general permit authorization number is:

TXR15962P

Coverage Effective: July 16, 2018

TCEQ's stormwater construction general permit requires certain stormwater pollution prevention and control measures, possible monitoring and reporting, and periodic inspections. Among the conditions and requirements of this permit, you must have prepared and implemented a stormwater pollution prevention plan (SWP3) that is tailored to your construction site. As a facility authorized to discharge under the stormwater construction general permit, all terms and conditions must be complied with to maintain coverage and avoid possible penalties.

Project/Site Information:
RN107697088
Spacex Texas Launch Site
1 Rocket Rd
Brownsville, TX 78521
Cameron County

Operator:
CN602867657
Space Exploration Technologies Corp.
1 Rocket Rd
Brownsville, TX 78521

This permit expires on March 05, 2023, unless otherwise amended. If you have any questions related to processing, you may contact the Stormwater Processing Center by email at swpermit@tceq.texas.gov or by telephone at (512) 239-3700. For technical issues, you may contact the stormwater technical staff by email at swgp@tceq.texas.gov or by telephone at (512) 239-4671. Also, you may obtain information on the TCEQ web site at http://www.tceq.texas.gov/goto/wq-dpa. A copy of this document should be kept with your SWP3.

Stephanie Bergeron Perdue

Issued Date: July 16, 2018

FOR THE COMMISSION

Appendix B – Construction Site Notice

LARGE CONSTRUCTION SITE NOTICE

FOR THE
Texas Commission on Environmental Quality (TCEQ)
Stormwater Program

TPDES GENERAL PERMIT TXR150000

"PRIMARY OPERATOR" NOTICE

This notice applies to construction sites operating under Part II.E.3. of the TPDES General Permit Number TXR150000 for discharges of stormwater runoff from construction sites equal to or greater than five acres, including the larger common plan of development. The information on this notice is required in Part III.D.2. of the general permit. Additional information regarding the TCEQ stormwater permit program may be found on the internet at:

https://www.tceq.texas.gov/permitting/stormwater/construction

Site-Specific TPDES Authorization Number:	TXR15962P
Operator Name:	Space Exploration Technologies
Contact Name and Phone Number:	Leonardo Alaniz , 956-443-4577
Project Description: *Physical address or description of the site's location, and estimated start date and projected end date, or date that disturbed soils will be stabilized.*	1 Rocket Road, Brownsville, Texas 78521 Cameron County, Start Jan 5, 2019, end Dec 31, 2022
Location of Stormwater Pollution Prevention Plan:	EHS Office, 52253 Boca Chica blvd (Hwy 4), Brownsville, TX 78521

Appendix C – Inspection and Maintenance Forms

<table>
<tr><th colspan="4">General Information</th></tr>
<tr><td>Date of Inspection</td><td></td><td>Start/End Time</td><td></td></tr>
<tr><td>Inspector’s Name(s)</td><td colspan="3"></td></tr>
<tr><td>Inspector’s Title(s)</td><td colspan="3"></td></tr>
<tr><td>Describe present phase of construction</td><td colspan="3"></td></tr>
<tr><td colspan="4">Type of Inspection:
❑ Regular ❑ Post-storm event</td></tr>
<tr><th colspan="4">Weather Information</th></tr>
<tr><td colspan="4">Has there been a storm event since the last inspection? ❑Yes ❑No</td></tr>
<tr><td colspan="4">Weather at time of this inspection?
❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds
❑ Other: Temperature:</td></tr>
<tr><td colspan="4">Are there any discharges at the time of inspection? ❑Yes ❑No
If yes, describe:</td></tr>
</table>

	Erosion and Sediment Control BMPs	Frequency	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are disturbed areas not actively being worked for a period exceeding 14 days in good condition (no weeds, pests) and properly vegetated?	Weekly and After Storms	❑Yes ❑No	❑Yes ❑No	
2	Are dust control trucks properly maintained, including the mobile pressure-type distributor?	Monthly	❑Yes ❑No	❑Yes ❑No	
3	Are silt fences adequately installed (perpendicular to direction of runoff) and maintained (sediment buildup less than 1/3 fence height?)	Weekly and After Storms	❑Yes ❑No	❑Yes ❑No	
4	Are hay bay dikes anchored and embedded properly?	Weekly and After Storms	❑Yes ❑No	❑Yes ❑No	
5	Are the filter rock dams functioning properly (sediments are not clogging the voids of crushed stone)?	Weekly and After Storms	❑Yes ❑No	❑Yes ❑No	

	Erosion and Sediment Control BMPs	Frequency	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
6	Are construction exits functioning properly (preventing sediment tracking offsite)?	Weekly and After Storms	❑Yes ❑No	❑Yes ❑No	
7	Are drainage ditches functioning properly (no ponding, no signs of erosion, no accumulating sediments)?	Weekly and After Storms	❑Yes ❑No	❑Yes ❑No	

	Other BMPs				
8	Are laydown areas free of debris and/or trash?	Weekly	❑Yes ❑No	❑Yes ❑No	
9	Are materials stored outside (construction material and equipment) free of oil?	Weekly	❑Yes ❑No	❑Yes ❑No	
10	Are materials positioned on wood cribbing blocks that are in good condition?	Weekly	❑Yes ❑No	❑Yes ❑No	
11	Are Safety Data Sheets up to date and stored in an accessible location?	Weekly	❑Yes ❑No	❑Yes ❑No	

12	Are construction materials (e.g., paints, thinners, etc.) properly labeled?	Weekly	❑Yes ❑No	❑Yes ❑No	
13	Are tanks and drums in good condition (properly labeled, free of corrosion, etc.)?	Weekly	❑Yes ❑No	❑Yes ❑No	
14	Are tank areas free of stressed vegetation?	Weekly	❑Yes ❑No	❑Yes ❑No	
15	Is there evidence of leaks and spills around tank areas?	Weekly	❑Yes ❑No	❑Yes ❑No	
16	Are emergency contact signs posted in tank loading areas?	Weekly	❑Yes ❑No	❑Yes ❑No	
17	Are spill response kits replenished?	Weekly	❑Yes ❑No	❑Yes ❑No	
18	Are containers placed within containment areas?	Weekly	❑Yes ❑No	❑Yes ❑No	
19	Are secondary containment areas free of leaks and spills?	Weekly	❑Yes ❑No	❑Yes ❑No	
20	Are containers in good condition (no corrosion or bulging)?	Weekly	❑Yes ❑No	❑Yes ❑No	

21	Is there evidence of concrete trucks being washed outside the designated area?	Weekly	❑Yes ❑No	❑Yes ❑No	
22	Are the non-hazardous waste dumpsters in good condition?	Weekly	❑Yes ❑No	❑Yes ❑No	
23	Is there evidence of waste mixing in the non-hazardous waste dumpsters?	Weekly	❑Yes ❑No	❑Yes ❑No	
24	Are the areas surrounding the dumpsters free of debris or trash?	Weekly	❑Yes ❑No	❑Yes ❑No	
25	Are the hazardous waste drums in the hazardous waste storage area (HWSA) in good condition?	Weekly	❑Yes ❑No	❑Yes ❑No	
26	Are the HWSA drums properly labeled? Is the contact information posted and current?	Weekly	❑Yes ❑No	❑Yes ❑No	
27	Is the contact information in the HWSA posted and current?	Weekly	❑Yes ❑No	❑Yes ❑No	

28	Does the HWSA have drums that have been stored for more than 180 days?	Weekly	❑Yes ❑No	❑Yes ❑No	
29	Is the client aware that drums are past due for disposal?	Weekly	❑Yes ❑No	❑Yes ❑No	
30	Is the secondary containment area free of leaks and spills?	Weekly	❑Yes ❑No	❑Yes ❑No	
31	Are the ditches adjacent to the blasting and painting operations free of paint chips, blast material and grit waste?	Weekly	❑Yes ❑No	❑Yes ❑No	
32	Are there full bags of spent water cutting grit at Machine Shop Accumulation Area	Weekly	❑Yes ❑No	❑Yes ❑No	
33	Is the storm water runoff tested prior to discharge?	Weekly	❑Yes ❑No	❑Yes ❑No	
34	Is the General Site Plan accurate?	Quarterly	❑Yes ❑No	❑Yes ❑No	

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

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

Print name and title:

____

Signature: ____

Date: _______________________

SpaceX Boca Chica Launch Site

Spill Prevention, Control, and Countermeasures (SPCC) Plan

Revision 10

December 2021

Contents

1.0 Introduction

This Spill Prevention, Control, and Countermeasures (SPCC) Plan is required by the U.S. Environmental Protection Agency (EPA) regulations contained in Title 40, Code of Federal Regulations, Part 112 (40 CFR 112) – Oil Pollution Prevention. A facility is subject to these regulations if the total aboveground storage capacity of oil and oil products exceeds 1,320 gallons; or if the underground storage capacity exceeds 42,000 gallons; and if, because of its location, the facility could reasonably be expected to discharge oil into navigable waters of the United States. Containers with a capacity of less than 55 gallons of oil or oil products are exempted from the requirements under the Oil Pollution Prevention regulations.

"Oil" is defined in 40 CFR 112.2 as "oil of any kind or in any form, including, but not limited to: fats, oils, or greases from animals, fish, or marine mammal origin; vegetable oils, including oils from seeds, nuts, fruits, or kernels; and, other oils and greases, including petroleum, fuel oil, sludge, synthetic oils, mineral oils, oil refuse, or oil mixed with wastes other than dredged spoil." This definition includes many transformer oils, hydraulic oils, and other oils.

This SPCC Plan is not required to be filed with the EPA, but a copy must be maintained on-site for review by the EPA. Should the facility discharge more than 1,000 gallons of oil in a single discharge, or discharge more than 42 gallons of oil in each of two discharges occurring within any 12-month period, the facility must submit the following information to the EPA Regional Administrator within 60 days:

- facility name and location;
- facility owner or operator names;
- facility maximum storage or handling capacity and normal daily oil throughput;
- an adequate description of the facility, including maps, flow diagrams, and topographical maps, as necessary;
- the cause(s) of the discharges, including a failure analysis of the system or subsystem where the failure occurred;
- the corrective actions and/or countermeasures taken (e.g., equipment repairs or replacement);
- any other prevention measures taken or contemplated to minimize the possibility of recurrence; and
- other reasonable information as request.

The EPA Regional Administrator will review this information and may require this facility to amend this SPCC Plan if it does not meet the regulations or if an amendment is necessary to prevent and contain oil discharges from the facility.

Certification

The Facility has a total aboveground oil storage capacity less than 10,000 gallons and has had no discharges and is considered to be a Qualified Facility by the EPA. According to the EPA, a Qualified Facility can prepare a self-certified Plan in lieu of a PE-certified Plan. If the total aboveground oil storage capacity increases above 10,000 gallons, this Plan will be certified be a Professional Engineer.

SpaceX hereby certifies this Plan is in accordance with all applicable requirements 40 CFR Part 112.

Plan Location and Review

1.1 Plan Location

In accordance with 40 CFR 112.3(e), a complete copy of this SPCC Plan is maintained at the facility in the control center building. The building is attended whenever the facility is operating, i.e., 7 days per week.

1.2 Plan Review

This SPCC Plan must be reviewed, updated, amended, and/or recertified under various circumstances, as follows:

1. A change(s) at the facility materially affects the potential of oil discharge.
2. Five years have elapsed since the plan was last reviewed.
3. Technical and non-technical amendments have been made to the plan.

Details regarding each of these circumstances, including the time frame for making such changes and the identification of those which require recertification are discussed below.

In accordance with 40 CFR §112.5(a), this plan is required to be updated and amended whenever a change occurs in the facility design, construction, operation, or maintenance that materially affects its potential for the discharge of oil. The plan shall be amended within six months of any such change. Examples of changes requiring plan amendment follow:

- The commissioning or decommissioning of containers
- The replacement, reconstruction, or movement of containers
- The reconstruction, replacement, or installation of piping systems
- Construction or demolition that might alter secondary containment structures
- Changes in products or services
- A revision in standard operating or maintenance procedures at the facility

Additionally, pursuant to 40 CFR §112.5(b), a review and evaluation of this SPCC Plan is conducted at least once every five years. As a result of this review and evaluation, SpaceX will amend the SPCC Plan within six months of the review to include more effective prevention and control technology if (1) such technology will significantly reduce the likelihood of a spill event from the facility, and (2) such technology has been field-proven at the time of review. The amendments shall be implemented as soon as possible, but no later than six months following preparation of the amended SPCC Plan.

1.3 Conformance with Applicable State and Local Requirements

40 CFR §112.7(a)(1): Include a discussion of your facility's conformance with the requirements listed in this part. *40 CFR §112.7(j): In addition to the minimal prevention standards listed under this section, include in your Plan a complete discussion of conformance with the applicable requirements and other effective discharge prevention and containment procedures listed in this part or any applicable more stringent State rules, regulations, and guidelines.*

The facility will comply with the requirements set forth in 40 CFR Part 112. An SPCC Plan Checklist identifying all applicable requirements under this Part and where the required information is located within the SPCC Plan is presented in Section 2.0, SPCC Cross Reference Table.

Management Approval

Space Exploration Technologies Corp. (SpaceX) is committed to the prevention of discharges of oil to navigable waters and the environment, and maintains the highest standards for spill prevention control and countermeasures through regular review, updating, and implementation of this SPCC Plan for the SpaceX facility. This SPCC Plan is fully approved by the management of SpaceX, and the necessary resources have been committed to fully implement the Plan as described herein.

Authorized Facility Representative: ______________________________

Title: ______________________________

Signature: ______________________________

2.0 SPCC Cross Reference Table

Provision	Plan Section	Section #	Page #
112.3(e)	Location of SPCC Plan	1.0	V
112.5	Plan Review	1.0	V
112.7(a)(1)	Conformance with Applicable State and Local	1.0	Vi
112.7	Management Approval	1.0	VII
112.7	Cross-Reference with SPCC Rule	2.0	8
112.7(a)(3)	General Facility Information	3.1/3.2/3.3	10
112.7(a)(3)(i)	Oil Storage	3.5	13
112.7(a)(3)(iii)	Secondary Containment and Spill Prevention Procedures	3.6	13
112.7(a)(3)(iv)	Spill Control Equipment	3.7	13
112.7(a)(3)(vi)	Emergency Contacts	3.9	14
112.7(a)(4)	Discharge Notification	3.10.1	15
112.7(a)(5)	Discharge Response	3.10.2	16
112.7(b)	Potential Discharge Volumes a and direction of flow	3.11	18
112.7(c)	Containment and Diversionary structures	3.11	19
112.7(d)	Practicability of Secondary Containment	3.11	20
112.7(e)	Inspections and Record Keeping	3.12	20
112.7(f)	Personnel, Training and Discharge Prevention Procedures	3.13	22
112.7(g)	Site Security	3.14	23
112.7(h)	Tank Truck Loading/Unloading	3.15	24
112.7(i)	Brittle Fracture Evaluation	3.15	24
112.7 (k)	Qualified Oil Filled Equipment	3.16	24
112.8(b)	Facility Drainage Controls	4.1	26
112.8(c)(1)	Construction	4.1.1	27
112.8(c)(3)	Drainage of Diked Areas	4.1.2	28
112.8(c)(4)	Corrosion Protection	4.1.2	28
112.8(c)(5)	Partially Buried and Bunkered Storage Tanks	4.1.3	28
112.8(c)(6)	Inspection	4.1.4	29
112.8(c)(7)	Heating Coils	4.1.5	29
112.8(c)(8)	Overfill Protection	4.1.5	30
112.8(c)(9)	Effluent Treatment	4.1.5	30
112.8(c)(10)	Visible Discharges	4.1.6	30
112.8(c)(11)	Mobile and Portable Containers	4.1.7	30
112.8(d)	Transfer Operations, Pumping and In-Plant Processes	4.1.7	30
112.20(e)	Certification of Substantial Harm Determination	Appendix C	

3.0 Site Specific Information

3.1 Facility Owner and Operator

Space Exploration Technologies
1 Rocket Rd, Brownsville, Texas
Cameron County

3.2 Facility Description

SpaceX owns and operates a private launch site on privately owned property at 1 Rocket Rd, in Cameron County, Texas. The facility consists of three operational areas, the vertical launch area, launch and landing control (LLC), and the solar farm (Appendix B).

Vertical Launch Area

Facility and infrastructure at the vertical launch area includes the following:

- Launch pads
- Test stands
- Landing pads
- Commodity storage and handling areas
- Workshop and office area
- Roads, parking areas, fencing, security, lighting, and utilities

The launch pad consists of a rectangular pervious compacted area and at height of approximately 15 ft and a footprint of approximately 34,000 ft^2. A smaller concrete structure, approximately 1,000 ft^2 is located on the launch pad and is used for the launch vehicle hop tests. An additional pad approximately 50,625 ft^2 to the east is landing operations.

Launch and Landing Control

The LLC is located immediately adjacent to Boca Chica Village, approximately 2 miles west of the proposed vertical launch area and north of Boca Chica Boulevard.

The two-story control center building, formally known as Stargate, is used for command and control of the launch vehicle, and ground systems during launch and test operations. The control center building consists primarily of several large rooms for control consoles, conference rooms, and support rooms. In addition, the facility houses office areas for site personnel.

Solar Farm Area

The solar farm area is located west of the LLC, and is approximately 5.4 acres in size. The solar farm area consists of solar arrays and batteries for power storage. The solar farm area will be expanded to approximately 7 acres.

3.3 Facility Operations

> *40 CFR §112.7(a)(3): Describe the physical layout of the facility and include a facility diagram, which must mark the location and contents of each container. The facility diagram must also include completely buried tanks that are otherwise exempted from the requirements of this part under §112.1(d)(4). The facility diagram must include transfer stations and connecting pipes.*

Launch and test activities start with transport of the vehicle from the command and control center to the vertical launch area. Once at the launch pad, pre-launch checkout and processing of the Launch Vehicle occurs. Pre-launch processing takes approximately 5 to 30 days to complete. Test activities can include system checkouts, propellant loading, static fires, and test hops. Test operations are closely monitored by the command team from the LLC, using a variety of instrumentation, remote control, and video.

SpaceX launch vehicles use liquid oxygen (LOX) and liquid methane (CH_4) for propellants.

To conduct a test operation, the CH_4 and LOX are pressure fed and also pumped from storage tanks to the launch vehicle tanks. High-pressure gaseous helium (He) from on-board storage tanks is used to pressure feed the LOX and CH_4 from the vehicle tanks to the engines. During the static fire and hops, both LOX and CH_4 are mostly consumed. After operations, any remaining propellants are pressure fed from the vehicle back to ground storage tanks and re-used, or are off-gassed from the vehicle. During the launch, deluge water may be sprayed over the launch pad for cooling and sound and vibration suppression.

Mapping and diagrams showing the physical layout of the facility are included in Appendix B.

3.4 Drainage Pathways and Distance to Navigable Waters

There are no surface waters (non-wetland surface waters) within the boundary or footprint of the LLC or the vertical launch area. The location of the vertical launch and LLC are within South Laguna Madre watershed, which is within the Bahia-Grande Brownsville Ship Channel watershed, a 363-square mile subwatershed to the Southwestern Texas Coastal Basin. South Bay is an inland bay along the Gulf of Mexico located within the Laguna Madre hypersaline lagoon system and is the southernmost bay in Texas. South Bay is separated from the Gulf of Mexico by Brazos Island. On the northern boundary of South Bay is an inlet where water flows freely from South Bay into the Brownsville Shipping Channel, which connects the Port of Brownsville to the Gulf of Mexico. On the southern end of South Bay, approximately 0.5 mile north of the proposed vertical launch area, is Boca Chica Bay where Boca Chica State Park is located. Boca Chica Bay, located approximately 0.03 mile from the vertical launch area, is a subdelta of the Rio Grande.

The vertical launch area topology is essentially flat and low-lying. Facilities were built above ground level by approximately 5-15 feet, creating natural drainage away from the facilities. Drainage flows to the north, and the State Highway 4 gutter carries the flow to the west. There are four culverts at the end of the highway gutter that outfall on the northwest of the pad, and two culverts that outfall to the south of the pad.

The LLC topology is similar to the vertical launch area, generally flat. As with the vertical launch area, facilities in the control center area are above ground level, creating natural drainage away from the facilities. Storm waters and other drainage flows away from the facilities and infiltrates through pervious areas or is collected in the swales of State Highway 4. There are no receiving bodies near this area.

Runoff from the both areas will not be to a Municipal Separate Storm Sewer System (MS4). Discharge from the vertical launch area will be into jurisdictional wetlands that contribute to the Rio Grande and un-vegetated salt flats associated with the Gulf of Mexico. SpaceX would manage surface water discharges from runoff during construction and operations according to the requirements of the Texas Pollutant Discharge Elimination System.

3.5 Oil Storage

40 CFR 112.7(a)3)(i) requires a discussion of the type of oil in each fixed container and its storage capacity. For mobile or portable containers, either provide the type of oil and storage capacity for each container or provide an estimate of the potential number of mobile or portable containers, the types of oil, and anticipated storage capacities.

Oil and oil products are not stored in containers unless the container material and construction are compatible with the material stored and the conditions of storage. Appendix A, Table 1 - Storage and Potential Spill Predictions shows the storage capacity, contents, and location of the oil storage containers at the facility.

3.6 Secondary Containment

3.6.1 Bulk Storage Containers

40 CFR §112.7(a)(3)(iii): Address discharge or drainage controls such as secondary containment around containers and other structures, equipment, and procedures for control of a discharge.

40 CFR §112.8(c)(2): Construct all bulk storage tank installations (except mobile refuelers) so that you provide a secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. You must ensure that diked areas are sufficiently impervious to contain discharged oil. Dikes, containment curbs, and pits are commonly employed for this purpose. You may also use an alternative system consisting of a drainage trench enclosure that must be arranged so that any discharge will terminate and be safely confined in a facility catchment basin or holding pond.

Table 1 (Appendix A) addresses the secondary containment provided for each bulk oil storage tank. In general, all of the bulk oil storage tanks, with the exception of several drums and the fuel tank on the diesel generator, are located outside in containment areas. All fuel/oil storage containment areas have sufficient capacity to contain the volume of the largest tank plus some rainfall input. See Section 3.10 for spill response procedures.

3.7 Spill Prevention Procedures

40 CFR §112.7(a)(3)(iii): Describe discharge or drainage controls such as secondary containment around containers and other structures, equipment, and procedures for the control of a discharge.

Please refer to Table 1 (Appendix A) for secondary containment and Section 3.12 for a description of required inspections. Section 3.10 addresses spill response procedures, and Section 3.8 addresses spill response and control equipment.

3.8 Spill Control Equipment

40 CFR §112.7(a)(3)(iv): Countermeasures for discharge discovery, response, and cleanup (both the facility's capability and those that might be required of a contractor).

Spill control equipment is available on site for use by facility, contractor, or emergency personnel. Table 3 (Appendix A) includes an inventory of spill control equipment for the facility which includes the equipment type, approximate quantity, and location.

40 CFR §112.7(a)(3)(v): Methods of disposal of recovered materials in accordance with applicable legal requirements.

All recovered material in liquid and solid form will be characterized for proper disposal and disposed of in accordance with applicable federal, state, and local regulations.

3.9 Emergency Contacts

40 CFR §112.7(a)(3)(vi): Contact list and phone numbers for the facility response coordinator, National Response Center, cleanup contractors with whom you have an agreement for response, and all appropriate federal, state, and local agencies who must be contacted in case of a discharge as described in §112.1(b).

Reporting a spill to the proper facility personnel is of utmost importance so that further action/reporting can be initiated. In case of a fire, spill, or other emergency related to a potential release of oil or oil products, use existing radios and/or cell phones to contact the SPCC Coordinator (EHS Manager) or the designee.

For internal reporting, contact the SPCC Coordinator. If the SPCC Coordinator is not available, report the incident to one of the designees. The facility’s emergency contact list is provided in Table 2 (Appendix A).

After being notified, the SPCC Coordinator (or designee) will report the incident to the outside agencies if warranted. If a spill is reportable, the National Response Center and the Texas Commission on Environmental Quality (TCEQ) will be contacted immediately. The outside agency contact information is presented in Table 2 (Appendix A).

3.10 Spill Response Procedures

Procedures have been implemented to minimize the likelihood of spills and to respond quickly to spills, should they occur. This section presents the facility's emergency contact list, the spill response procedures to be followed during a spill event, and the descriptions of the types and locations of spill response equipment available at the facility for use during a spill event response.

The spill response procedures described herein serve to address spills of oil and oil-containing materials only. It is important to note that such spills may also be subject to additional local, state, and federal release reporting requirements under various regulations, which are beyond the scope of this plan. Such regulations include, but are not necessarily limited to, the Superfund Amendment and Reauthorization Act (SARA), Section 304; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and the Resource Conservation and Recovery Act (RCRA). Consequently, the SPCC Coordinator (EHS Manager) or his/her designee will be responsible for identifying any other applicable release reporting requirements, as well as any applicable cleanup requirements.

3.10.1 Notification and Reporting Procedures

40 CFR §112.7(a)(4): Unless you have submitted a response plan under §112.20, provide information and procedures in your Plan to enable a person reporting a discharge as described in §112.1(b) to relate information on the exact address or location and phone number of the facility; the date and time of the discharge, the type of material discharged; estimates of the total quantity discharged; estimates of the quantity discharged as described in §112.1(b); the source of the discharge; a description of affected media; the cause of the discharge; any damages or injuries caused by the discharge; actions being used to stop, remove, and mitigate the effects of the discharge; whether an evacuation may be needed; and, the names of individuals and/or organizations who have also been contacted.

In the event of an accident or chemical spill at the facility, the SPCC Coordinator or the designee will be contacted as soon as practicable after the incident has occurred. Notification of one representative of SpaceX is required; contact preference is in the order listed in Table 3 (Appendix A). If a spill to surface waters or off-site is imminent, the appropriate emergency agencies should be notified immediately of the potential threat.

External Reporting

If the spill is reportable, the SPCC Coordinator, or another responsible individual, will immediately notify the National Response Center and the TCEQ. If a spill of oil is conveyed off-site, the SPCC Coordinator or the duly authorized representative will notify the National Response Center and the TCEQ. This notification will be documented by the SPCC Coordinator. Information in the notification should follow the requirements described in the beginning of this subsection.

A follow-up written report will be submitted to EPA Region 6 Regional administrator within 60 days if the spill exceeds 1,000 gallons or occurs within 12 consecutive months of a previous reportable oil spill. The written report will contain, at a minimum, the information required by the Discharge Reporting Form in Appendix E. The completed form and verification of submittal must be maintained in the facility files along with the SPCC Plan.

The SPCC Coordinator will keep a log of activities during the spill event, including the quantity of oil spilled, recovered, and disposed, as well as other notable events that may occur during the spill and subsequent response activities. The SPCC Coordinator will prepare a chronological summary of the incident for the SPCC files.

Internal Reporting

If no report needs to be filed with an external agency, the SPCC Coordinator will complete a Discharge Reporting Form and evaluate the procedures included in the SPCC Plan to ensure that a similar event does not recur. Completed Discharge Reporting Forms will also be kept in Appendix E.

3.10.2 Spill Response, Containment, Cleanup

> *40 CFR §112.7(a)(5): Unless you have submitted a response plan under §112.20, organize portions of the Plan describing procedures you will use when a discharge occurs in a way that will make them readily usable in an emergency, and include appropriate supporting material as appendices.*

As the situation warrants, the response procedures (relating to spill discovery, containment, cleanup, and notification) described in this section will be followed.

3.10.3 Discovery of a Release

The person discovering a release of oil or oil product from a container, tank, or operating equipment should immediately initiate certain actions. If unable or unqualified (*e.g.*, has not received instruction in the proper use of spill kits, etc.) to perform these actions, the discoverer will seek assistance and notify the SPCC Coordinator (EHS Manager) or designee immediately.

1. **Ensure that no danger to human health exists first.** If there is an immediate threat to human life (*e.g.,* a fire in progress or fumes overcoming workers), initiate alarm signal and report the incident immediately to the supervisor and the SPCC Coordinator. An immediate alarm will be sounded to evacuate the building or area, and the fire department will be called. If the spill event warrants, it is advisable to request the assistance of the fire department or the fire department's hazardous materials response team in the initial response phase, especially when hazardous chemicals are involved. The SPCC Coordinator, the Site Manager, or the supervisor should be involved with the request for outside assistance.
2. **Extinguish sources of ignition, if possible.** Until the material is identified as nonflammable and noncombustible, potential sources of ignition in the area should be removed without endangering the safety of you and others. If the ignition

source is stationary (immobile), attempt to move spilled material away from ignition source if this can be accomplished safely.

3. **Attempt to stop the release at its source.** Simple procedures (turning valves, plugging leaks, etc.) may be attempted by the discoverer if there is no health hazard and there is a reasonable certainty of the origin of the leak. If the source of the release has not been found, if special protective equipment is necessary to approach the release area, or if assistance is required to stop the release, a team should be assembled and equipped to halt the discharge at its source or to guide and/or assist with the fire department's efforts. If a hazardous substance is known to have leaked, make appropriate notifications (see Step 4), and make sure to wear appropriate personal protective equipment (PPE) before approaching the spill area.
4. **Initiate spill notification and reporting procedures.** Report the incident as soon as possible to the SPCC Coordinator. The SPCC Coordinator or the Site Manager should be involved with notifications to outside agencies.

3.10.4 Release Containment Procedures

Releases of oil and oil-containing materials at the facility should be safely contained within secondary containment structures or otherwise diverted to prevent impacts to the waters of the United States if a release occurs. However, if material is released outside the containment areas, it is critical that the material be accurately identified and appropriate control measures be taken in the safest possible manner.

1. **Attempt to stop the release at the source.** A team should be assembled and equipped to halt the discharge at its source or to guide in the fire department's efforts if the source of the release has not yet been found, if special protective equipment is necessary to approach the release area, or if assistance is required to stop the release.
2. **Contain the material released into the environment.** Following proper safety procedures (consult applicable material safety data sheets [MSDSs] for material compatibility, safety, and environmental precautions), use absorbent material, and portable dikes or shovels and brooms to contain the spill.
3. **Continue the notification procedure.** Inform the SPCC Coordinator of the release (the SPCC Coordinator will perform other notifications as appropriate). Obtain assistance from outside contractors to clean up oil residues and/or hazardous substances, if necessary. The SPCC Coordinator or the Site Manager should be involved with requests for outside assistance.

3.10.5 Spill Cleanup Procedures

Appropriate PPE and cleanup procedures can be found on MSDSs. Care must be taken when cleaning up spills of oil and oil-containing materials. Spill cleanup activities will be conducted under the general supervision of the SPCC Coordinator, or a designee, who will designate facility personnel and equipment and authorize assistance as needed. Spill residues and other contaminated materials will be characterized (*i.e.*, as hazardous or nonhazardous waste) using MSDSs, testing, or other available information, and will be disposed of in accordance with applicable regulations. Spill response supplies or equipment depleted, consumed, damaged, or destroyed as a result of the spill or subsequent response activities will be replaced as soon as possible. The site's Storm Water Pollution Prevention Plan (SWPPP) also contains information about spill response and control. That plan is incorporated into the SPCC Plan by reference.

1. **Recover or clean up the material spilled.**
   Wherever possible, and appropriate, spilled material should be recovered and reused. Materials that cannot be reused must be declared a waste. Liquids absorbed by solid materials will be shoveled into open-top drums. When drums are filled after a cleanup, the drum lids will be secured and the drums will be appropriately labeled (or relabeled) identifying the substance(s) within. Always try to avoid commingling wastes. Combining non-compatible materials can cause potentially dangerous chemical and/or physical reactions or may limit disposal options. Compatibility information can be found on MSDSs.
2. **Clean up the spill area.**
   Surfaces contaminated by the release will be cleaned by the use of an appropriate cleaning material or water. Occasionally, porous materials (such as wood) may be contaminated with hazardous materials; such materials may require special handling and disposal.
3. **Decontaminate tools and equipment used in the cleanup.**
   Even if dedicated to cleanup efforts, tools and equipment that have been used must be decontaminated before replacing them in the spill control kit.

3.11 Potential Discharge Volumes and Direction of Flow

40 CFR §112.7(b): Where experience indicates a reasonable potential for equipment failure (such as loading or unloading equipment, tank overflow, rupture, or leakage or any other equipment known to be a source of a discharge), include a prediction of the direction, rate of flow, and total quantity of oil which could be discharged from the facility as a result of each type of major equipment failure.

***Note:** Types of failures to consider include tank (aboveground and underground) overflow, rupture or leakage, pipe failure, wastewater treatment plant failure, and spills during transfer operations at the rack and/or dock or tank truck parking area. The direction a spill would flow can be predicted by drainage patterns, the location of storm or sewer drains, and secondary containment; these predictions should be performed or verified by a Professional Engineer. The rate of flow will depend on the size and location of the failure and the equipment involved. The total quantity of oil that could be discharged from the facility should be based upon a worst-case situation and the time it would take to respond to a spill (e.g., shutting off a pump or closing a valve).*

Table 1 (Appendix A) presents the expected volume, discharge rate, general flow direction in the event of a release, and the provided secondary containment for different parts of the facility where oil or other hazardous fluids are stored, used, transferred, or handled. Secondary containment structures are essentially bathtubs made of impermeable materials such as concrete or plastic, located under and around storage tanks. In cases where tanks stand alone, there is a containment structure for each tank. Containment size depends on the amount stored – containment must be at least 110% of the largest tank in the containment area, so they are specific to each area and tank.

> *40 CFR §112.7(c): Provide appropriate containment and/or diversionary structures or equipment to prevent a discharge as described in §112.1(b), except as provided in paragraph (k) of this section for qualified oil-filled operational equipment. The entire containment system, including walls and floor, must be capable of containing oil and must be constructed so that discharge from a primary containment system, such as a tank or pipe, will not escape the containment system before cleanup occurs. At a minimum, you must use one of the following prevention systems or its equivalent:*
>
> *(1) For onshore facilities:*
>
> *(i) Dikes, berms, or retaining walls sufficiently impervious to contain oil*
> *(ii) Curbing*
> *(iii) Culverts, gutters, or other drainage systems*
> *(iv) Weirs, booms, or other barriers*
> *(v) Spill diversion ponds*
> *(vi) Retention ponds*
> *(vii) Sorbent material*

No railcar loading or unloading of oil takes place at the facility. All loading/unloading of oil is accomplished by drum or tank truck. When practical, secondary containment systems or structures will be available at the facility for loading/unloading operations. Fueling areas where large amounts or frequent fueling events are planned will include structures and/or equipment designed to contain any spills. An example of an area that might not have containment is a one-time transfer location that transfers a small amount of fluid, for example, refueling of a portable generator in a temporary location. In these situations, drip pans and other spill kit materials will be on site to handle any spilled materials. If secondary containment is not present, site geography is such that a spill or leak during loading/unloading would be retained in the immediate area on concrete or asphalt areas for immediate cleanup. Otherwise, a spill would flow towards the storm water retention ponds and would not result in a discharge of oil to waters of the United States. [Extent of asphalt, perimeter concrete curbing etc. is TBD].

3.11.1 Non-Qualified Oil-Filled Equipment Containment

40 CFR §112.7(c): Provide appropriate containment and/or diversionary structures or equipment to prevent a discharge as described in §112.1(b), except as provided in paragraph (k) of this section for qualified oil-filled operational equipment. The entire containment system, including walls and floor, must be capable of containing oil and must be constructed so that discharge from a primary containment system, such as a tank or pipe, will not escape the containment system before cleanup occurs. At a minimum, you must use one of the following prevention systems or its equivalent: *(1) For onshore facilities:* *(i) Dikes, berms, or retaining walls sufficiently impervious to contain oil* *(ii) Curbing* *(iii) Culverts, gutters, or other drainage systems* *(iv) Weirs, booms, or other barriers* *(v) Spill diversion ponds* *(vi) Retention ponds* *(vii) Sorbent material*

Table 1 (Appendix A) summarizes the spill prevention and control measures in-place to minimize the potential for equipment failure at tanks and drum storage. Oil-filled operational equipment is also presented in Table 1. The tank on the cart has a capacity of 55 gallons and is double-walled.

3.11.2 Exemptions to Secondary Containment/Diversionary Structures

40 CFR §112.7(d): Provided your Plan is certified by a licensed Professional Engineer under §112.3(d), or, in the case of a qualified facility that meets the criteria in §112.3(g), the relevant sections of your Plan are certified by a licensed Professional Engineer under §112.6(d), if you determine that the installation of any of the structures or pieces of equipment listed in paragraphs (c)[related to appropriate containment and diversionary equipment] and (h)(1)[related to loading rack secondary containment] of this section, and §§112.8(c)(2) [related to bulk storage secondary containment], 112.8(c)(11) [related to secondary containment for mobile storage], 112.9(c)(2) [related to onshore oil production facilities], 112.10(c) [related to onshore oil drilling and workover facilities], 112.12(c)(2) [related to animal fat, fish and vegetable oils] ,and 112.12(c)(11) [related to animal fat, fish and vegetable oils] to prevent a discharge as described in §112.1(b) from any onshore or offshore facility is not practicable, you must clearly explain in your Plan why such measures are not practicable; for bulk storage containers, conduct both periodic integrity testing of the containers and periodic integrity and leak testing of the valves and piping; and, unless you have submitted a response plan under §112.20, provide in your Plan the following: *1. An oil spill contingency plan following the provisions of part 109 of this chapter.* *2. A written commitment of manpower, equipment, and materials required to expeditiously control and remove any quantity of oil discharged that may be harmful.*

All methods of secondary containment proposed in this SPCC Plan have been deemed practicable; therefore, this requirement is not applicable.

3.12 Inspections/Record Keeping

40 CFR §112.7(e): Inspections, tests, and records. Conduct inspections and tests required by this part in accordance with written procedures that you or the certifying engineer develop for the facility. You must keep these written procedures and a record of the inspections and tests, signed by the appropriate supervisor or inspector, with the SPCC Plan for a period of three years. Records of inspections and tests kept under usual and customary business practices will suffice for purposes of this paragraph.

Inspections will be conducted to minimize the chances of oil spills and also to minimize the chances of spill control and countermeasure failure in the event of an oil spill. This subsection explains the scope and schedule of inspections conducted as part of the SPCC Plan. A facility inspection checklist is included in Appendix D.

Inspections at SpaceX will be performed by the SPCC Coordinator (EHS Manager) or a designee. The inspection records will be maintained as part of the facility's operations records for three years. Copies of the inspection records must be kept with a copy of the SPCC Plan or with the EHS Manager.

3.12.1 Detailed Inspections

The SPCC Coordinator (EHS Manager) or a designee will inspect for malfunctions, deterioration, operator errors, leaks, damage, discharge, or corrosion of SPCC-regulated valves, pumps, tanks, piping, oil handling storage and handling equipment, and spill prevention equipment. These items will be checked to minimize the possibility of spills of oil and hazardous substances. The inspections will be conducted not less than once per quarter and often enough to identify problems in time to correct them before a spill occurs.

Inspections will need to be conducted more often for some equipment and areas than for others. A list of equipment and areas where detailed inspections may be necessary, along with recommended inspection schedules, is given below. Copies of the facility inspection forms are included in Appendix D.

3.12.2 Inspection Schedule and Details

The areas and equipment identified below will be inspected on a **monthly** basis. The monthly inspections are to occur once per calendar month, and not within 15 days of the previous month's inspection.

1. Aboveground storage containers and oil-filled equipment will be examined visually by a competent person, an individual familiar with the inspection requirements of this Plan and trained in the inspection techniques required to identify potential release situations, to determine their condition and the need for maintenance. Such examination will include aboveground foundation and tank structural supports. The outside of the tanks will be checked/inspected for signs of deterioration; leaks from seams, rivets, bolts and gaskets; and accumulation of oil or hazardous substances inside

containment structures. More intensive inspections of the integrity of the tanks will be performed at least once per year.

2. Containment areas will be inspected for accumulation of oil or hazardous substances, to determine the source of any spills or leaks, and to ensure the integrity of containment structures.

Aboveground valves and piping will be examined on a scheduled, periodic basis (at least **once per quarter**) to determine the general condition of items such as supports, flange joints, expansion joints, valve stems and bodies, and drip pans. Periodic pressure or other nondestructive integrity testing may be warranted for piping where failure might lead to a spill event.

3.12.3 Inspection Records

Inspections will be documented and a written record of inspection, signed by an appropriate supervisor or the SPCC Coordinator (EHS Manager), will be made a part of the SPCC Plan. Inspections will be recorded on form located in Appendix D and will be maintained in the SPCC files for a minimum of three years.

3.13 Personnel Training

40 CFR §112.7(f): Personnel, training, and discharge prevention procedures. (1) At a minimum, train oil-handling personnel in the operation and maintenance of equipment to prevent discharges; discharge procedure protocols; applicable pollution control laws, rules, and regulations; general facility operations; and, the contents of the facility SPCC Plan. *40 CFR §112.7(f): (2) Designate a person at each applicable facility who is accountable for discharge prevention and who reports to facility management.* *40 CFR §112.7(f): (3) Schedule and conduct discharge prevention briefings for your oil-handling personnel at least once a year to make sure that they adequately understand the SPCC Plan for that facility. Such briefings must highlight and describe known discharges as described in §112.1(b) or failures, malfunctioning components, and any recently developed precautionary measures.*

In accordance with 40 CFR §112.7(f)(2), the SPCC Coordinator (EHS Manager) is designated as the person ultimately responsible for spill prevention at the facility. All SpaceX employees are, however, individually responsible for control of oil in the performance of their job functions. To this end, facility personnel who are reasonably expected to come into contact with or handle oil are required to receive initial spill prevention training as well as annual spill prevention briefings. The initial training will consist of in-house classroom and/or hands-on training, and will cover the following topics:

1. The operation and maintenance of equipment to prevent discharges
2. Discharge procedure protocols
3. Applicable pollution control laws, rules, and regulations
4. General facility operations
5. The contents of this plan

Annual spill prevention briefings are conducted for oil-handling personnel. This refresher training is done to make sure that oil-handling personnel have an adequate understanding of this plan. Any known discharges that occurred during the previous year will be discussed during these scheduled briefings. The discussion will include the mode of failure, the malfunctioning components, and the corrective actions taken. In addition, the training will include a discussion of any recently developed precautionary measures. Training records are maintained by the SPCC Coordinator (EHS Manager).

3.14 Site Security

> *40 CFR §112.7(g): Security (excluding oil production facilities). (1) Fully fence each facility handling, processing, or storing oil, and lock and/or guard entrance gates when the facility is not in production or is unattended.*

The perimeter of the facility is fenced and the front gate is manned by security personnel. Security personnel or SpaceX employees are present 24 hours a day, seven days a week. In addition, cameras are present on-site and are monitored by the control room.

> *40 CFR §112.7(g): (2) Ensure that the master flow and drain valves and any other valves permitting direct outward flow of the container's contents to the surface have adequate security measures so that they remain in the closed position when in non-operating or non-standby status.*

None of the oil storage containers at the facility have unsecured drain or other valves that could allow discharge to the surface. Facility access is controlled to ensure that unauthorized personnel cannot access oil storage containers.

> *40 CFR §112.7(g): (3) Lock the starter control on each oil pump in the "off" position and locate it at a site accessible only to authorized personnel when the pump is in a non-operating or non-standby status.*

The starter control on each oil pump is locked in the "off" position when the pump is in a non-operating or non-standby status. Site access is controlled at the front gate to ensure that unauthorized personnel cannot access oil transfer equipment.

> *40 CFR §112.7(g): (4) Securely cap or blank-flange the loading/unloading connections of oil pipelines or facility piping when not in service or when in standby service for an extended time. This security practice also applies to piping that is emptied of liquid content either by draining or by inert gas pressure.*

The loading/unloading connections at the bulk storage tanks are securely capped when not in use.

40 CFR §112.7(g): (5) Provide facility lighting commensurate with the type and location of the facility that will assist in the

(i) discovery of discharges occurring during hours of darkness, both by operating personnel, if present, and by nonoperating personnel (the general public, local police, etc.); and

(ii) prevention of discharges occurring through acts of vandalism.

Facility lighting is adequate for employee safety and spill detection during the hours of darkness. The facility is secured 24 hours per day, 365 days per year, making it unlikely that damage and/or discharge due to vandalism or sabotage will occur.

3.15 Tank Car and Truck Loading/Unloading Operations

40 CFR §112.7(h): Facility tank car and tank truck loading/unloading rack (excluding offshore facilities). (1) Where loading/unloading area drainage does not flow into a catchment basin or treatment facility designed to handle discharges, use a quick drainage system for tank car or tank truck loading and unloading areas. You must design containment systems to hold at least the maximum capacity of any single compartment of a tank car or tank truck loaded or unloaded at the facility.

40 CFR §112.7(h): (2) Provide an interlocked warning light or physical barrier system, warning signs, wheel chocks, or vehicle break interlock system in loading/unloading areas to prevent vehicles from departing before complete disconnection of flexible or fixed oil transfer lines.

40 CFR §112.7(h): (3) Prior to filling and departure of any tank car or tank truck, closely inspect for discharges the lowermost drain and all outlets of such vehicles, and if necessary, ensure that they are tightened, adjusted, or replaced to prevent liquid discharge while in transit

The site is not equipped with a loading/unloading rack as defined by the EPA for the purposes of the SPCC regulation. In order to prevent spills during tank truck loading/unloading operations, the facility requires all drivers to adhere to standard operating procedures when loading or unloading oil or fuel which include DOT regulations 49 CFR 177. Standard procedures include measures to prevent departure prior to hose disconnection and truck inspections to prevent spills in transit. In addition, SpaceX requires an employee to be present during all fuel loading/unloading operations.

40 CFR §112.7(i): If a field-constructed aboveground container undergoes a repair, alteration, reconstruction, or a change in service that might affect the risk of a discharge or failure due to brittle fracture or other catastrophe, or has discharged oil or failed due to brittle fracture failure or other catastrophe, evaluate the container for risk of discharge or failure due to brittle fracture or other catastrophe, and as necessary, take appropriate action.

The facility has no field-constructed aboveground tanks; therefore, this paragraph is not applicable.

3.16 Qualified Oil-filled Operational Equipment

40 CFR § 112.7(k) Qualified Oil-filled Operational Equipment. The owner or operator of a facility with oil-filled operational equipment that meets the qualification criteria in paragraph (k)(1) of this *sub- section may choose to implement for this qualified oil-filled operational equipment the alternate requirements as described in paragraph (k)(2) of this sub- section in lieu of general secondary containment required in paragraph (c) of this section.*

(1) Qualification Criteria—Reportable Discharge History: The owner or operator of a facility that has had no single discharge as described in § 112.1(b) from any oil-filled operational equipment exceeding 1,000 U.S. gallons or no two discharges as described in § 112.1(b) from any oil-filled operational equipment each exceeding 42 U.S. gallons within any twelve month period in the three years prior to the SPCC Plan certification date, or since becoming subject to this part if the facility has been in operation for less than three years (other than oil discharges as described in § 112.1(b) that are the result of natural disasters, acts of war or terrorism); and

(2) Alternative Requirements to General Secondary Containment. If secondary containment is not provided for qualified oil-filled operational equipment pursuant to paragraph (c) of this section, the owner or operator of a facility with qualified oil-filled operational equipment must:

(i) Establish and document the facility procedures for inspections or a monitoring program to detect equipment failure and/or a discharge; and

(ii) Unless you have submitted a response plan under § 112.20, provide in your Plan the following:

(A) An oil spill contingency plan following the provisions of part 109 of this chapter.

(B) A written commitment of manpower, equipment, and materials required to expeditiously control and remove any quantity of oil discharged that may be harmful.

The site does not have qualified oil-filled operational equipment; therefore, this paragraph does not apply.

4.0 Spill Prevention

4.1 Facility Drainage Controls

> *40 CFR §112.8(b)(1): The facility must restrain drainage from diked storage areas by valves to prevent discharge into the drainage system or facility effluent treatment system, except where facility systems are designed to control such discharge. You may empty diked areas by pumping or ejectors; however, you must manually activate these pumps or ejectors and must inspect the condition of the accumulation before starting, to ensure no oil will be discharged.*
>
> *40 CFR §112.8(b)(2): The facility must use valves of manual, open-and-closed design, for the drainage of diked areas. You must not use flapper-type drain valves to drain diked areas. If your facility drainage drains directly into a watercourse and not into an on-site wastewater treatment plant, you must inspect and may drain uncontaminated retained storm water.*

Secondary containment structures are equipped with manual open-and-closed type valves to prevent a discharge from entering the facility drainage system. Containment areas are inspected periodically to detect leaks, spills, and rainwater accumulation. The valves on the containment areas will remain closed at all times unless uncontaminated rainwater is being drained from the containment area. Drainage events are recorded in the log included in Appendix E to this SPCC Plan.

> *40 CFR §112.8(b)(3): The facility must design facility drainage systems from undiked areas with a potential for a discharge (such as where piping is located outside containment walls or where tank trucks discharges may occur outside the loading area) to flow into ponds, lagoons, or catchment basins designed to retain oil or return it to the facility. You must not locate catchment basins in areas subject to periodic flooding.*
>
> *40 CFR §112.8(b)(4): If facility drainage is not engineered as in paragraph (b)(3) of this section, equip the final discharge of ditches inside the facility with a diversion system that would, in the event of an uncontrolled discharge, retain oil in the facility.*

Drainage where spills outside of containment could occur will either flow along created channels leading to containment areas. Discharge offsite to low areas including tidal flats from the containment occurs after inspection.

> *40 CFR §112.8(b)(5): Where drainage waters are treated in more than one treatment unit and such treatment is continuous, and pump transfer is needed, provide two "lift" pumps and permanently install at least one of the pumps. Whatever techniques you use, you must engineer facility drainage systems to prevent a discharge as described in §112.1(b) in case there is an equipment failure or human error at the facility.*

This section is not applicable to this facility since there are no facility drainage treatment systems. In the event of a spill or contaminated rainwater, including a spill that leads to the retention pond, a contractor will clean up and dispose of the waste.

4.1.1 Tank System Operations

40 CFR §112.8(c)(1): Do not use a container for the storage of oil unless its material and construction are compatible with the material stored and the conditions of storage, such as pressure and temperature. *40 CFR §112.8(c)(8): Engineer or update each container installation in accordance with good engineering practice to avoid discharges. You must provide at least one of the following devices:* *(i) High liquid level alarms with an audible or visual signal at a constantly attended operation or surveillance station. In smaller facilities an audible air vent may suffice.* *(ii) High liquid level pump cutoff devices set to stop flow at a predetermined container content level.* *(iii) Direct audible or code signal communication between the container gauger and the pumping station.* *(iv) A fast response system for determining the liquid level of each bulk storage container such as digital computers, telepulse, or direct vision gauges. If you use this alternative, a person must be present to monitor gauges and the overall filling of bulk storage containers.* *(v) You must regularly test liquid level sensing devices to ensure proper operation.*

All oil storage containers in use at the facility are constructed of mild or stainless steel or aluminum and are fully compatible with their contents. Overfill protection for the gasoline and diesel fuel tanks, and the TVC cart are provided by direct vision gauges. SpaceX personnel communicate with the control center by telephone or headsets during all loading/unloading activities. Filling of the diesel generators is monitored by manually gauging the tank level prior to adding any material to the tanks. SpaceX requires the physical presence of facility personnel to monitor all container filling operations.

4.1.2 Drainage of Diked Areas

40 CFR §112.8(c)(3): Do not allow drainage of uncontaminated rainwater from the diked area into the storm drain or discharge of an effluent into an open watercourse, lake, or pond, bypassing the facility treatment system unless you: (i) normally keep the bypass valve sealed closed, (ii) inspect the retained rainwater to ensure that its presence will not cause a discharge described in §112.1(b), (iii) open the bypass valve and reseal it following drainage under responsible supervision, and (iv) keep adequate records of such events, for example, any records required under permits issued in accordance with §122.41(j)(2) and §122.41(m)(3).

Uncontaminated rainwater is allowed to drain from or is pumped out of containment structures only following visual inspection to determine the absence of evidence of a spill or leak of oil and/or a visible sheen on the surface of the water.

4.1.3 Additional Bulk Storage Preventative Measures for Buried Tanks

40 CFR §112.8(c)(4): Protect completely buried metallic storage tanks installed on or after January 10, 1974 from corrosion by coating or cathodic protection compatible with local soil conditions. You must regularly leak test such completely buried metallic storage tanks.

There are no buried tanks at the facility; therefore, this requirement is not applicable.

40 CFR §112.8(c)(5): Do not use partially buried or bunkered metallic tanks for the storage of oil, unless you protect the buried section of the tank from corrosion. You must protect partially buried and bunkered tanks from corrosion by coating or cathodic protection compatible with local soil conditions.

There are no partially buried or bunkered tanks at the facility; therefore, this requirement is not applicable.

4.1.4 Inspection/Integrity Testing

40 CFR §112.8(c)(6): Test each aboveground container for integrity on a regular schedule, and whenever you make material repairs. The frequency and type of testing must take into account container size and design (such as floating roof, skid mounted, elevated, or partially buried). You must combine visual inspection with another testing technique such as hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, or another system of nondestructive shell testing. You must keep comparison records and you must also inspect the container's supports and foundations. In addition, you must frequently inspect the outside of the container for signs of deterioration, discharges, or accumulation of oil inside diked areas. Records of inspections and tests kept under usual and customary business practices will suffice for purposes of this paragraph. ***Note**: Since electrical, operating, and manufacturing equipment are not bulk storage containers, this requirement is not applicable to those devices and equipment.*

The bulk storage containers listed in Table 1 are required to undergo integrity testing on a regular schedule and whenever material repairs are made, in accordance with good engineering practices as well as appropriate applicable industry standards.

The 55-gallon drums are only temporarily onsite (*i.e.*, disposed/returned to manufacturer when empty, etc.). Therefore, inspection of these bulk storage containers is limited to visual integrity inspections. To this end, all such containers are required to be elevated to visually detect leaks from all sides, including the bottom. Elevation of such containers shall be achieved through the use of rollers, wood pallets, drum racks, and/or spill containment pallets/tubs. Visual integrity inspections of portable containers will be performed as part of the monthly facility-wide inspections discussed in Section 3.12. Such inspections are to be performed by an inspector. Due to the number of such containers used and the temporary nature of their presence onsite, inspection records will be limited to exception reports which record when a leak is discovered. Additional information on inspections is included in Section 3.12 of this Plan.

The remaining bulk storage tanks will undergo visual inspections, as well as periodic integrity testing (*e.g.*, hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, etc.) in accordance with applicable industry standards, as follows:

- Visual Inspection: In accordance with Section 6.3.1 of American Petroleum Institute (API) Standard 653[1], the external condition of the tank shall be monitored by close visual inspection by a person knowledgeable of the storage facility operations, the tank, and the characteristics of the contents thereof. The minimum frequency of such inspections shall be monthly.
- Additional Periodic Integrity Testing: Periodic testing shall be performed in accordance with applicable industry standards, as identified by a qualified tank inspector (*e.g.*, SP001-03 Certified Tank Inspectors, etc.). At the time of preparation of this plan, such standards include, but are not necessarily limited to API 653 and/or Steel Tank Institute (STI) SP001-03[2].

Facility personnel will examine the aboveground valves and pipelines on a regular basis. Facility personnel will also assess the general condition of flange joints, expansion joints, catch pans, pipeline supports, and valve locks in accordance with the inspection requirements in Section 3.12.

4.1.5 Heating Coil

40 CFR §112.8(c)(7): Control leakage through defective internal heating coils by monitoring the steam return and exhaust lines for contamination from internal heating coils that discharge into an open watercourse, or pass the steam return or exhaust lines through a settling tank, skimmer, or other separation or retention system.

The facility does not operate oil storage tanks with internal heating coils. This requirement is not applicable.

40 CFR §112.8(c)(9): Observe effluent treatment facilities frequently enough to detect possible system upsets that could cause a discharge as described in §112.1.

This section is not applicable to the facility since there are no effluent treatment facilities.

4.1.6 Visible Discharges

40 CFR §112.8(c)(10): Promptly correct visible discharges which result in a loss of oil from the container, including but not limited to seams, gaskets, piping, pumps, valves, rivets, and bolts. You must promptly remove accumulations of oil in diked areas.

Visual discharges from oil storage tanks, process equipment, transfer areas, and containers will be reported to the SPCC Coordinator (EHS Manager), who will be responsible for addressing any deficiencies. If the SPCC Coordinator (EHS Manager) is not available, the release will be

[1] *Tank Inspection, Repair, Alteration, and Reconstruction*, API Standard 653, 3rd ed., December 2001.
[2] *Standard for Inspection of Aboveground Tanks*, STI SP001-03, 3rd edition, Steel Tank Institute: July 2005.

reported to the alternate. Any release of oil will be cleaned up immediately, with the resulting clean-up material and product disposed in accordance with the applicable federal, state, and local regulations.

4.1.7 Mobile Oil Storage

40 CFR §112.8(c)(11): Position or locate mobile or portable oil storage containers to prevent a discharge as described in §112.1(b). Except for mobile refuelers, you must furnish a secondary means of containment, such as a dike or catchment basin, sufficient to contain the capacity of the largest single compartment or container with sufficient freeboard to contain precipitation.

The site uses 55-gallon drums, which are considered mobile or portable oil storage containers. Drums are located in concrete secondary containment areas or inside buildings on containment pallets. Oil-containing drums are not staged outside without containment.

40 CFR §112.8(d): Facility transfer operations, pumping, and facility process. (1) Provide buried piping that is installed or replaced on or after August 16, 2002, with a protective wrapping and coating. You must also cathodically protect such buried piping installations or otherwise satisfy the corrosion protection standards for piping in part 280 of this chapter or a state program approved under part 281 of this chapter. If a section of buried line is exposed for any reason, you must carefully inspect it for deterioration. If you find corrosion damage, you must undertake additional examination and corrective action as indicated by the magnitude of the damage.

There is no buried oil piping at the facility.

40 CFR §112.8(d): (2) Cap or blank-flange the terminal connection at the transfer point and mark it as to origin when piping is not in service or is in standby service for an extended time.

The terminal connections at the facility are blank-flanged when not in use. All truck transfer operations are accomplished with flexible hoses and governed by the procedures in Section 3.15 above.

40 CFR §112.8(d): (3) Properly design pipe supports to minimize abrasion and corrosion and allow for expansion and contraction.

The piping systems operated at the facility are designed with proper pipe supports to minimize abrasion and corrosion and allow for expansion and contraction.

40 CFR §112.8(d): (4) Regularly inspect aboveground valves, piping, and appurtenances. During the inspection you must assess the general condition of items, such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces. You must also conduct integrity and leak testing of buried piping at the time of installation, modification, construction, relocation, or replacement.

Facility personnel are responsible for regular inspections of valves, piping, and appurtenances in accordance with the maintenance schedule and the SPCC inspection requirements. Additional details regarding the SPCC inspection requirements are provided in Section 3.12.

40 CFR §112.8(d): (5) Warn vehicles entering the facility to be sure that no vehicle will endanger aboveground piping or other oil transfer operations.

Vehicles entering the facility are required to check in at the guard shack. Oil transfer operations are not conducted in the way of normal vehicle access routes.

Appendix A:-Tables

Table 1
Facility Storage and Potential Spill

NO.	TANK I.D./LOCATION	VOLUME (gallons)	CONTENTS	TYPE OF FAILURE	DISCHARGE VOLUME (gallons)	RATE (gal/hr)	DIRECTION OF FLOW	SPCC Measures in Place
Bulk Storage Containers								
1	040-450	1000	Diesel Fuel	Rupture; Leakage	1000	1000	East	Steel Containment
2	1050-348	1000	Dyed Diesel Fuel	Rupture; Leakage	1000	1000	East	Steel Containment
3	TIDEPORT	1000	Dyed Diesel Fuel	Rupture; Leakage	1000	1000	East	Steel Containment
4	1000-68	1000	Gasoline	Rupture; Leakage	1000	1000	East	Steel Containment
5	1040-441	1000	Dyed Diesel	Rupture; Leakage	1,000	1,000	East	Steel Containment
6	1080-407	1000	Dyed Diesel	Rupture; Leakage	1,000	1,000	East	Steel Containment
Drums/DOT Containers								
7	Used Oil Drums / Awaiting Shipment	400	Used Oil	Rupture; Leakage	55	Up to 55	Retained Inside Building	Inside building with containment pallets
Oil-Filled Equipment								
8	Solar Farm Backup Generator	800	Dyed Diesel	Rupture; Leakage	800	800	North	Containment double-walled tank
9	Vertical Launch Area Launch Pad Backup Generators	800	Dyed Diesel	Rupture; Leakage	800	800	North	Containment double-walled tank
Totals		**7200 gallons**						

Table 2: Emergency Response Contacts

CONTACT NAME/AGENCY	ADDRESS	TELEPHONE NUMBERS
SPCC Coordinator, Leo Alaniz EHS Manager	1 Rocket Rd	(956) 443-4577
SPCC Coordinator Alternate, Sam Patel, Site Director	1 Rocket Rd	(904) 451-0747
National Response Center (NRC)	NRC c/o U.S. Coast Guard (G-OPF) Room 2611 2100 2nd Street SW Washington, D.C. 20593-0001	800-414-8802
State Emergency Response Center (SERC)	TCEQ	800-832-8224
TCEQ Region 15	1804 W Jefferson Ave Harlingen TX 78550-5247	956 425-6010
Local fire department	Brownsville -911	(956)-546-3195
Clean-up Contractor	CRRC	(956) 564-0138
For Spills that extend outside the Fenceline, SpaceX Safety should contact these agencies:		
South Texas Refuges Complex Office		(956) 784-7500
Lower Rio Grande Valley National Wildlife Refuge	3325 Green Jay Rd Alamo, TX 78516	(956) 784-7520
U.S. Fish and Wildlife Service Spill Response	Corpus Christi Ecological Services Office	(361) 994-9005
Texas General Land Office Environmental Emergency Hot Line		800-832-8224

Table 3
Spill Control Equipment and Inspection Form

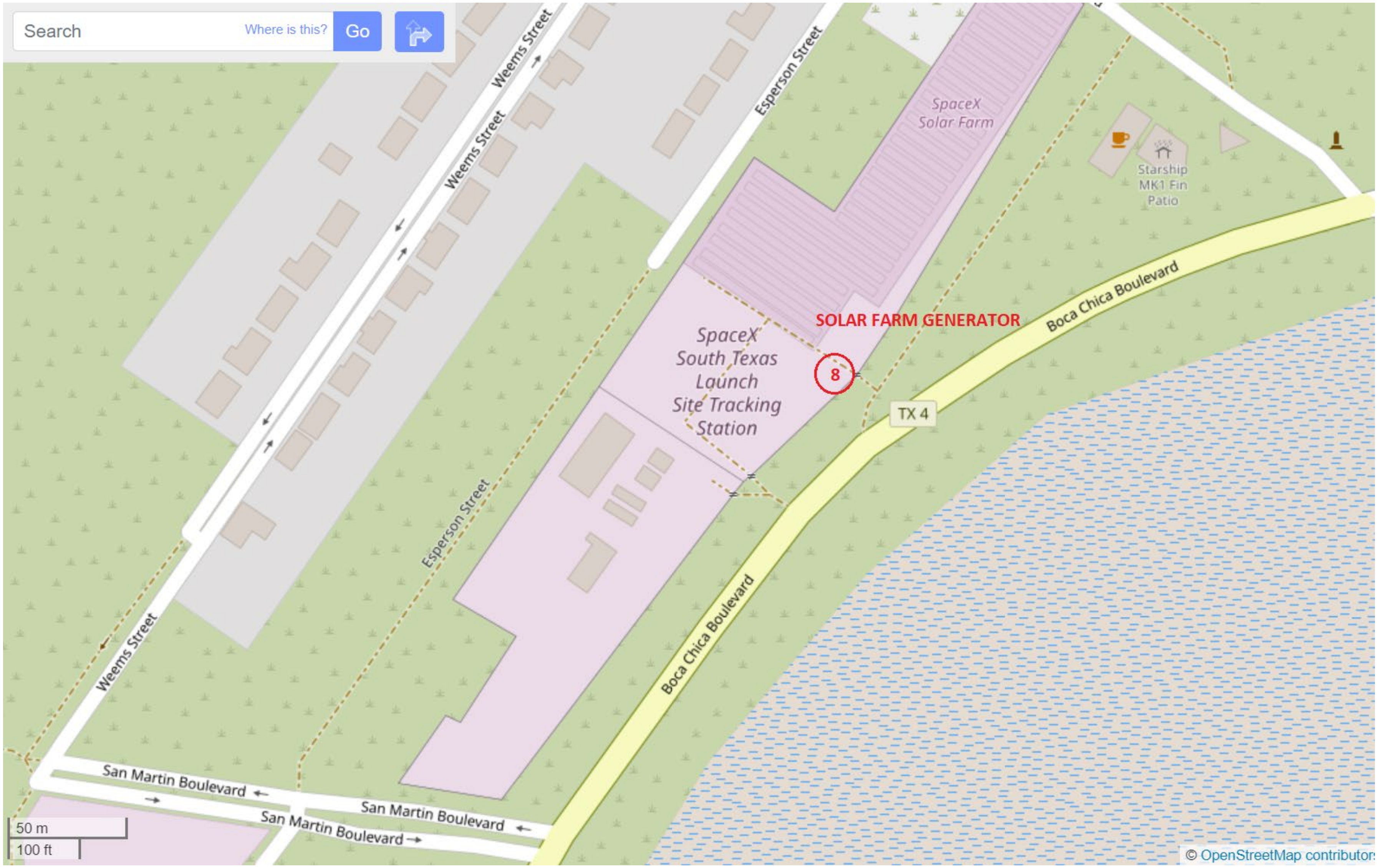
Inspector ____

Date ____

LOCATION	MATERIALS DESCRIPTION	AMOUNT REQUIRED IN STOCK	CHECK	AMOUNT REQUIRED RESTOCKED	CHECK
Pad Area	1-65 gallon & 1-30 gallon	2 full kits			
Generator Facility	1-65 gallon & 1-30 gallon	2 full kits			
Control Center	1-65 gal. 1-65 gal. 1-30 gal.	3 full kits			

[Quantities and Contents TBD]

Appendix B: Facility Mapping



Solar Farm Back-up Diesel Generator

Launch Complex Back-up Generator

Appendix C: Certification of the Applicability of the Substantial Harm Criteria Checklist

Certification of the Applicability of the Substantial Harm Criteria Checklist

Facility name: Space Exploration Technologies, Inc.

Facility address: I Rocket Rd, Brownsville, TX

1. Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons?

   Yes ___ No X

2. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank plus sufficient freeboard to allow for precipitation within any aboveground oil storage tank area?

   Yes ___ No X

3. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C-III to this appendix or a comparable formula[3]) such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments? For further description of fish and wildlife and sensitive environments, see Appendices I, II, and III to DOC/NOAA's "Guidance for Facility and Vessel Response Plans: Fish and Wildlife and Sensitive Environments" (see Appendix E to this part, section 13, for availability) and the applicable Area Contingency Plan.

   Yes ___ No X

4. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and is the facility located at a distance (as calculated using the appropriate formula in Attachment C-III to this appendix or a comparable formula[1]) such that a discharge from the facility would shut down a public drinking water intake[4]?

   Yes ___ No X

[3] If a comparable formula is used documentation of the reliability and analytical soundness of the comparable formula must be attached to this form.

[4] For the purposes of 40 CFR part 112, public drinking water intakes are analogous to public water systems as described at 40 CFR §143.2(c).

5. Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and has the facility experienced a reportable oil discharge in an amount greater than or equal to 10,000 gallons within the last 5 years?

   Yes ___ No _X_

Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document, and that based on my inquiry of those individuals responsible for obtaining this information, I believe that the submitted information is true, accurate, and complete.

Signature: ______________________________

Name (please type or print): ______________________________

Title: ______________________________

Date: ______________________________

Appendix D: Facility Inspection Reports

Monthly Facility Inspection Report and Checklist

Date: ________________________ Time: ________________________ Inspector: ________________________ Inspector's signature: ________________	**X** = Satisfactory **NA** = Not applicable **R** = Repair or adjustment repair **C** = See comments under Remarks/Recommendations

Drainage:

___ No noticeable oil sheen on runoff
___ Containment area drainage valves closed and locked
___ No visible oil sheen in the containment areas
___ No standing water in containment areas

ASTs:

___ Tank surface checked for signs of leakage
___ Tank condition and coating good (no rusting, corrosion, or pitting)
___ Bolts, rivets, or seams not damaged
___ Tank supports not damaged or deteriorated
___ Level gauges and alarms working properly
___ Vents not obstructed
___ Valves, flanges, and gaskets free of leaks
___ Containment walls intact
___ Presence of water/contamination in the containment area

Drums and Containers:

___ Surface checked for signs of leakage
___ Condition good (no rusting, corrosion, or pitting)
___ Drums elevated and no evidence of leaks from bottom
___ Covers secured/fill openings not obstructed
___ Containment areas intact
___ Drums located in or on containment
___ Presence of water/contamination in the containment area
___ No leaks at valves, flanges, or other fittings, if applicable

Pipelines:

___ No signs of corrosion damage to pipelines or supports
___ No leaks at valves, flanges, or other fittings

Truck Loading/Unloading Area:

___ No standing water in loading/unloading area
___ Warning signs posted
___ No leaks in hoses
___ Connections capped and blank-flanged, where applicable
___ Fill line one-way valve is operating properly and is securely in the closed position when not in use

Security & Spill Kits:

___ Fence and gates intact
___ Locks on gates
___ Spill kits are present in designated locations and contents are maintained
___ Lighting working properly

Include Remarks/Recommendations on Back of Page

Appendix E: Discharge Reporting Form

Drainage Discharge Report Form

Containment area:
Operator's name:
Date and time water discharge from the containment area started:
Date and time water discharge from the containment area stopped: Approximate volume ________________ discharged to ____________________________
Appearance of water prior to pumping or discharging: Color Sheen Odor Foam   NOTE: Only unimpacted, visually clean water will be discharged to the environment. Water impacted by oil products will be contained and properly disposed as oily wastewater.
Signature of operator:

Appendix F: Training Records

[TBD]

Access Restriction Notification Plan

Revised: December 9, 2021

Action/Activity	Description	Start Time[1]	Duration
Provide forecast of planned closures	Provide forecast of planned closures 1-2 weeks in advance of the closure on the County's website and/or send via email to the agency distribution list.	T- 7-14 days	-
Alert agencies of closure dates and times	Notify Agency Partners of approved closure dates (typically 24-48 hours prior to the closure). Public notice of Cameron County order to temporarily close Boca Chica Beach is provided via email and on the Cameron County website[2]. Updates provided as changes occur to the planned closure date.	At receipt of closure approval from Cameron County	-
Road closure signage	TXDOT updates the changeable message sign advertising the roadway closure.	T- 3 days	Through release of closure
Notices to mariners and airmen	Verify NOTAM's and NOTMAR's have been properly issued.	T- 3 day	-
Road closure alert	Alert TxDOT Brownsville Maintenance Office, Local Emergency Services, and Agency Partners of closure.	T- 2 days	-
Establish Soft Checkpoint	Begin notification of launch and secure times to all people passing the checkpoint.	T-1 hrs	-
Lock down Soft Checkpoint	Restrict access to all but property owners and authorized personnel.	NET T- 1 hrs	Through Launch
Notification of Start of Road Closure	Text message notification sent to text distribution list; email notification sent to Agency Partners and Local Emergency Services.	At start of road closure	-
Establish Hard Checkpoint	Restrict access to all but authorized personnel.	At Pad Clear	Through Launch
Notification of end of closure	Text message notification sent to text distribution list; email notification sent to Agency Partners and Local Emergency Services.	Road opening	-
Notification of revocation of closure	Notify Agency Partners, Local Emergency Services, and Cameron County of cancellation of planned closure via email. Cancellation of closure also included on the Cameron County website also updated to show cancellation of closure. Notify Local Law Enforcement.	At cancellation of closure	-

Notes: hrs = hours; min = minutes; TXDOT= Texas Department of Transportation; NOTAM = Notice to Airmen; NOTMAR = Notice to Mariners; NET = no earlier than.

[1]Start Time may be adjusted as appropriate to the operation. The approximate times provided refer to the number of hours before engine ignition. For example, T-12 hrs means 12 hours prior to engine ignition.
[2] Cameron County website page for SpaceX road and beach closures is found at https://www.cameroncounty.us/spacex/

Anomaly Response Plan for Boca Chica Launch Site

Revised: April 20, 2022

Table of Contents

Introduction

SpaceX operates at the Boca Chica launch site in Cameron County, TX. In 2019, SpaceX developed the Starship technology, a reusable suborbital launch vehicle. SpaceX is currently testing Starship and Super Heavy prototypes at the launch site. This involves static fire engine tests and a series of suborbital launches at the vertical launch area (VLA) from just a few inches above ground level (AGL) to up to 30 kilometers (18 miles) AGL. SpaceX is also proposing to conduct static fire engine tests and suborbital and orbital launches of the Starship/Super Heavy launch vehicle.

This Anomaly Response Plan outlines the security and safety steps SpaceX will implement in the event of an anomaly or mishap during space flight operations.

Stakeholders

Below is a list of primary SpaceX personnel and government agencies that may be engaged during launch activities and following any anomaly or mishap. Points of contact are summarized in Table 1.

1. SpaceX
    a. Flight Control I: team has responsibility to ensure activities proceed in a disciplined, safe manner as well as direct immediate emergency and safing actions following a mishap
    b. Security
    c. Environmental Health & Safety (EHS)
    d. Operations Support Coordinator (OSC)
2. Federal Aviation Administration (FAA)
3. Cameron County Sheriff's Office (CCSO)
4. U.S. Customs and Border Protection (CBP)
5. U.S. Coast Guard (USCG)
6. U.S. Fish & Wildlife (USFWS)
7. Texas Department of Transportation (TxDOT)
8. Texas Department of Public Safety (DPS)
9. Texas Parks and Wildlife Department (TPWD)
10. Brownsville Navigation District (BND)
11. US Army Corp of Engineers (USACE)
12. Texas Historical Commission (THC)
13. National Park Service (NPS)
14. Texas General Land Office (TGLO)

I. Closure and Clearing Operations

Tanks tests, wet dress rehearsals, static fire engine tests, and launches (suborbital and orbital) would require restricting public access in the vicinity of the launch pad and securing land and water areas as part of public safety requirements. The areas on land that would be closed to public access is referred to as the closure area (Figure 1). The closure area includes an area of Boca Chica Beach, ranging from the Brownsville Shipping Channel south to the U.S./Mexico border. The Brownsville Shipping Channel would be temporarily restricted during orbital launches and some suborbital launches, but not restricted during tank tests, wet dress rehearsals, or static fire engine tests. SpaceX would coordinate these closures in accordance with the SpaceX Security Plan.

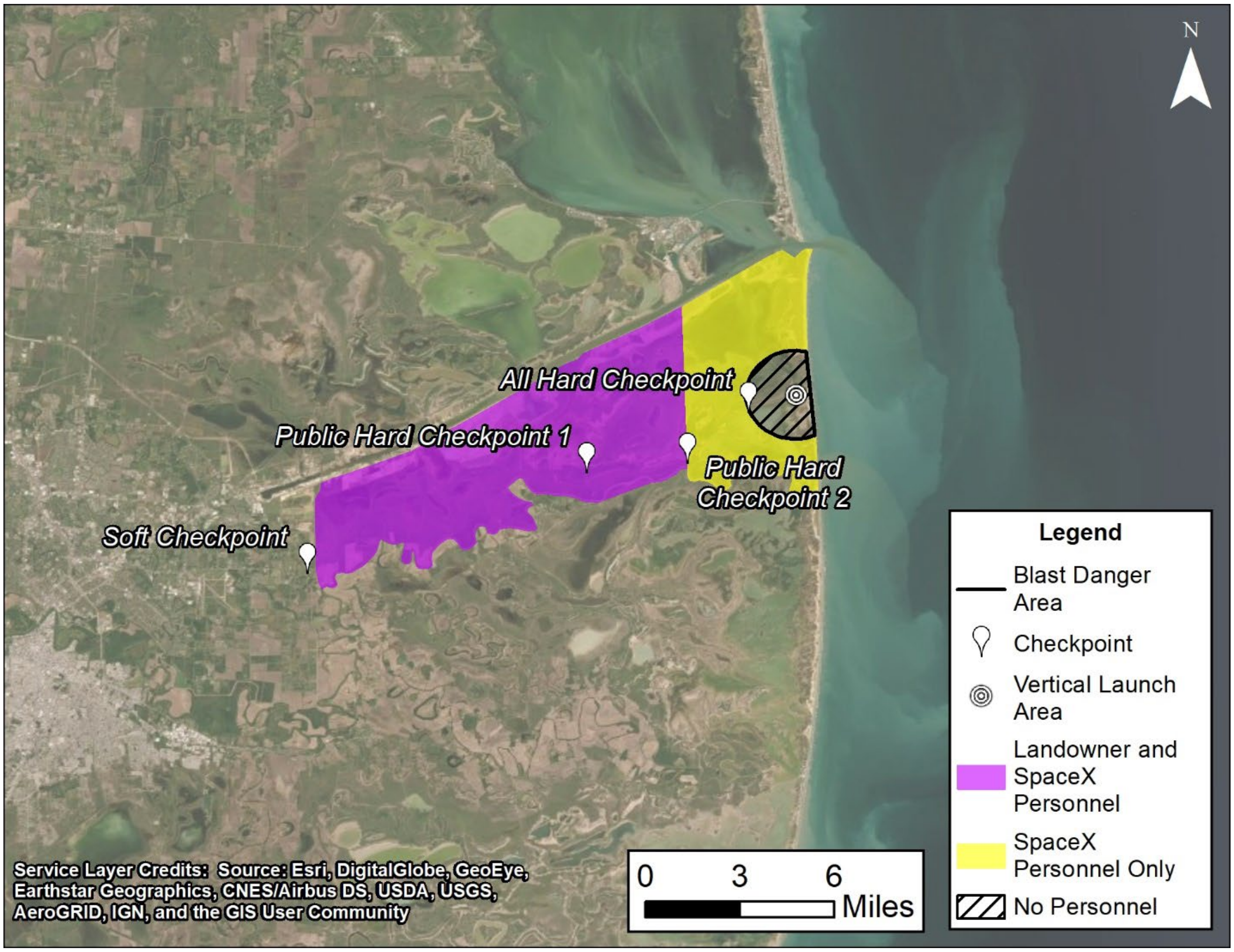


Figure 1 Locations of Hard and Soft Checkpoints

Range Coordination

The Range Team will consist of SpaceX Security and other local, state, and federal partners with responsibility to clear areas for public safety.

The Red Team is responsible for the ensuring the vehicle is safe upon conclusion of the launch activity or at the discretion of Flight Control I. The Red Team will consist of qualified, trained SpaceX employees in hazardous material and species identification. The team will be designated by Flight Control I on launch day. Red Team entry through the Hard Checkpoint will be coordinated through the Range.

The OSC will be designated by Flight Control I. The OSC reports to Flight Control I regarding the status of clearing activities and any other safety or security concerns leading up to and during spaceflight activities. For example, in the event of a medical incident, emergency medical services will be activated through the Range. All SpaceX activities and external stakeholder activities occurring in the safety zone will be communicated to the OSC in real time.

In the event of an incursion into the pad or other related facility, the countdown will be paused and a SpaceX Security Officer will respond. In the event of a Launch Incident, Launch Accident, or Mishap, SpaceX security will maintain all checkpoints until deemed safe to return to the pad. If an unauthorized person needs to be removed from the launch safety area, SpaceX will work with local law enforcement in handling the operation.

II. Anomalies

A Starship/Super Heavy test operation or launch could fail (referred to as an anomaly or mishap). An anomaly on the launch pad could cause a fire on the launch pad and/or an explosion that spreads debris. While anomalies are not licensed activities, as part of evaluating a launch license or permit application, the FAA evaluates SpaceX's debris analysis to ensure the hazard area is of sufficient size to ensure public safety.

The SN11 anomaly, which occurred during landing operations at the VLA, created the largest debris field to-date, and although debris spread outside the launch pad, it was contained to a 700-acre area adjacent to the launch pad, specifically, Boca Chica State Park and Brazos Island State Park. Therefore, the FAA expects debris from an anomaly at the VLA during launch or landing operations to be contained to this 700-acre area of potential affect (APE) (Debris APE). An anomaly on the launch pad during testing operations is expected to be contained to a smaller APE, either because the test does not involve explosive commodities, or because it is static (i.e., no impact from velocity of the vehicle).

In the event of an anomaly, SpaceX will evaluate the level of response based on the situation and notify the appropriate emergency personnel and land-managing agencies. Immediately following an anomaly, SpaceX may be required to continue to restrict public access in the vicinity of the VLA to address any impacts and ensure public safety. SpaceX will request an extension of the access restriction from Cameron County. The access restriction will be released when the area is deemed safe for the public by SpaceX and Cameron County. This determination by SpaceX and Cameron County would be made with input provided by public land-managing agencies (i.e., TPWD, TGLO, and USFWS).

SpaceX estimates up to 300 hours of access restrictions per year could be needed to address things such as ensuring public safety and debris removal on public land. The anomaly hours go beyond the 500 nominal operational closure hours. The hour count for nominal operations will stop when the launch operation is complete and the area is deemed safe for SpaceX or emergency personnel to enter. The anomaly-response hour count will start at that point to address debris removal and last until the area is deemed safe for the public and the access restriction is released.

Mishaps on Land

Following an anomaly or mishap, immediate action will be taken to safe the vehicle or system to stop or limit damage. Key operators will be directed to stay on console from the control room to preserve all data and observations, including freezing console configurations and collecting logs, test procedures, maintenance, and training record. The state of the vehicle and the pad will be announced.

If immediate danger to personnel or public exists (including fire that may spread outside of fence line), the EHS lead will be notified and they will handle Immediate Emergency Response as defined here:

- Initiate evacuation to safe areas
- Take count of evacuated personnel and identify missing personnel
- Begin first aid of injured personnel
- Designate and dispatch SpaceX EHS manager to pad emergency response units and establish communication back to OSC

During emergency actions, the Hazardous Materials Emergency Response Plan is initiated. The plan ensures public safety and provides notification to the public. Flight Control I will initiate or delegate responsibilities in the reporting chain.

Notifications and Points of Contact following an anomaly

Points of contact are summarized in Table 1.

- If necessary, notify Cameron County Emergency Management, Emergency Manager, Tom Hushen (Cell: (956)-454-5887, Desk: (956)-547-7000)) and coordinate response.
- If necessary, notify Brownsville Fire, Fire Chief, Jarrett Sheldon (Cell: (956)-337-3917, Desk: (956)-546-3195) and coordinate response.
- US Coast Guard, Sector / Air Station Corpus Christi Command Center ((361)-939-0450) to report any affect to safety of the waterway and the last known vehicle position.
- Contact U.S. Fish and Wildlife, Chris Perez, (24hr Dispatch: (956)-784-7520, Cell: 956-475-1372 Desk: (956)-784-7553) and coordinate response. The USFWS point of contact will coordinate with TPWD, THC, and NPS.
- Contact Texas General Land Office, Rene Garcia: Desk (361)-886-1606, Cell: (361)-960-9863 and coordinate response.
- Contact SpaceX Security and coordinate response (Cell: (206)-225-6151) Radio ST-A or Security
- Contact TxDOT, Area Engineer, Andres Espinoza (Cell: (956)-357-0290, Desk: (956)-399-5102) to coordinate maintaining road closures.
- Contact Border Patrol, Supervisory Agent, Pete Caballero ((956)-498-8362) and coordinate response.
- Texas Parks and Wildlife Dept., Chris Dowdy ((254)-784-9066) and coordinate response.
- Notify the Cameron County Judge and if necessary, coordinate extension of beach closures.
- Notify Cameron County Commissioner Pct.1 ((956)-459-4020).
- Check in with Cameron County Emergency Management, Emergency Manager, Tom Hushen (Cell: (956)-454-5887 Desk: (956)-547-7000)).
- Check in with Cameron County Fire Marshal, Juan Martinez (Cell: (956)-708-5110, Desk: (956)-547-7000)).
- Notify Texas Historical Commission
    - Justin Kockritz Desk: 512 936 7403
    - Bill Irwin Desk: 936-878-2214 ext. 237
    - Ellen Busch Desk: 512.936.1520

Reentry to the Pad

The launch pad and vehicle operators in the LLCC will coordinate together to determine when the area is safe for the Red Team (SpaceX staff) to enter. The Red Team will act on the direction of Flight Control I. Flight Control I or delegate will work with the Red Team to identify and safe any hazardous debris in accordance with the Hazardous Materials Emergency Response Plan and the regulatory agencies. Flight Control I or delegate will determine a plan for communicating safety state of pad to SpaceX personnel and regulatory agencies, including road and beach closure releases.

Cleanup of Debris

A limited number of Red Team (typically four) will enter debris field first. They will survey the area, photograph the site, and locate hazardous components. Hazardous components may include the battery, the flight termination system, debris with stored energy, including components with valves and pressurizes systems.

Following the initial evaluation of the area, SpaceX will coordinate with TPWD, THC, NPS, TGLO, and USFWS prior to any attempt of cleanup, in order to minimize damage to the refuge lands and sensitive historic, biological, and geological resources. The method of debris cleanup will be assessed on a case-by-case basis and will be approved by TPWD, USFWS and TGLO. Conditions that would be assessed include location and size of the debris, weather, condition of the soil, number of support staff, etc.

Cleanup of debris on State Highway 4 will be the first priority, followed by Refuge or TPWD lands, and then SpaceX property. SpaceX will consult with TPWD and USFWS prior to any activity that may impact sensitive wildlife habitat and refuge lands during cleanup. SpaceX will enter on foot as much as possible and coordinate the use of vehicles with applicable landowners or land-managing agencies to minimize impacts. SpaceX will perform an initial assessment of the debris to geotag and pick up debris by hand and carry out on foot. If SpaceX cannot remove debris by hand, SpaceX will coordinate the use of equipment or vehicles with applicable landowners or public land-managing agencies. SpaceX will not use motorized vehicles on the tidal flats and will stay within established paths. Once removal is complete, restoration and monitoring efforts with respect to disturbed areas such as lomas and tidal flats, will be coordinated with TPWD, TGLO, and USFWS.

In the case an animal is killed or injured, the EHS lead will contact USFWS and TPWD. If the killed or injured animal is a protected species, the EHS lead will coordinate with the SpaceX Environmental Specialists to report the take to the FAA, and the FAA will lead agency coordination on the incident.

SpaceX will continue sending closure notifications to the regulatory and public land-managing agencies as plans finalize (typically 24–48 hours prior to the closure). The agencies will continue to receive updates immediately when the closures go into place and when the closures end, as well as cancellations of requested closures. SpaceX personnel at the LLCC will send these notifications to ensure the most up-to-date information is distributed. Notices will also be sent in real time status and updates on closures through a text message alert service. Subscribers can text “BEACH” TO 1-877-591-2152 to receive updates.

In the event that a historic property is damaged, the EHS lead will coordinate with the SpaceX Environmental Specialists to report the damage to the FAA. SpaceX will retain a qualified professional archaeologist or architectural historian to document the damage in a report, which will be provided to the Texas Historical Commission. SpaceX will coordinate with THC and other relevant agencies to determine a reasonable course of action. This action could include hiring a qualified professional to make recommendations for repairs to the historic property or other appropriate mitigation identified in consultation with THC. Any proposed measures to repair historic properties will be subject to the review process described in the Stipulation III of the Programmatic Agreement between the FAA, THC, SpaceX, USFWS, TPWD and NPS. Historic properties in the vicinity of the launch pad include the 1846 Cypress Pilings, the 1865 Palmetto Pilings, and the 1936 Palmetto Pilings Centennial Marker, which are eligible for listing on the National Register of Historic Places.

In the event of unanticipated discoveries of human remains and/or other cultural resources during debris clean up, SpaceX will adhere to the procedures of the SpaceX Unanticipated Discoveries Plan.

Any restoration required from after the removal of debris would be coordinated with USWFS and TPWD.

Crash in the Ocean

If the vehicle enters the ocean after an accident, mishap or incident, the response depends on the depth of the ocean at the crash site. Impact at a depth of 300 feet or less greatly increases the likelihood of recovery of physical debris. Key operators will be directed to stay on console and preserve all data and observations, including freezing console configurations and collecting logs, test procedures, maintenance, and training record.

In the case a protected animal is killed or injured, the EHS lead will contact the SpaceX Environmental Specialists who will report the incident to the FAA for agency coordination, as appropriate.

Notifications and Points of Contact

SpaceX will coordinate with the USCG and FAA Air Traffic Control and FAA Office of Commercial Space Transportation (AST) regarding any hazardous airspace and maritime area closures for potential recovery efforts. If the impact location is in near shore waters, SpaceX will request assistance from the USCG to secure the impact location. SpaceX will allocate personnel to assist emergency response units in safing the area and locating missing personnel, if needed.

- US Coast Guard, Sector- Air Station Corpus Christi Command Center (361)-939-0450
- Any local governments near the impact site will be notified to ensure public safety. The Local Incident Manager (usually fire or police department) would take lead. Contact information will depend on location of mishap.

Debris on Foreign Land

If an anomaly occurs while the vehicle instantaneous impact point is over foreign land, there is a risk of a hazard to public safety due to falling debris. Key operators will be directed to stay on console to preserve all data and observations, including freezing console configurations and collecting logs, test procedures, maintenance, and training record. OSC will perform Section 8 State Vector Transmittal to Range Safety steps. SpaceX will take immediate action to safe the vehicle or system or contain the event to prevent or limit damage. Cleanup with debris

Notifications and Points of Contact

If it is suspected that debris may have fallen on foreign land, SpaceX will contact the US State Department Operations Center Senior Watch Officer at 202-647-1512. SpaceX will provide the latitude and longitude of the predicted impact location, and ask to notify the affected country through diplomatic channels, and provide the SpaceX point of contact information for any subsequent debris recovery or aid requests from the local government. The U.S. State Department will then lead in international coordination; SpaceX will provide assistance to the State Department upon request.

Notification to the FAA

In the event of an anomaly, the method of FAA notification will be based on the following criteria:

If the launch accident, launch incident, or mishap resulted in a fatality or serious injury OR a launch accident that causes greater than $25,000 to property not associated with the flight that is not located at the launch site or designated recovery area and an unplanned event occurring during the flight of a launch vehicle resulting in the impact of a launch vehicle, its payload or any component thereof outside the designated impact limit lines, immediate contact must be made with the FAA Washington Operations Center: ((202) 267-3333). Report completion to FAA/AST Safety Officer on console and StarshipRegulatory@spacex.com.

If the mishap did not result in a fatality or serious injury nor $25,000 damage to property not associated with the flight, the FAA Washington Operations Center: ((202) 267-3333) OR the Associate Administrator, Commercial Space Transportation ((202) 267- 7793) must be notified as soon as practical and no later than 24 hours. Report completion to StarshipRegulatory@spacex.com.

If the launch accident, launch incident, or mishap resulted in a fatality or serious injury, prepare an FAA/AST Mishap Report Worksheet with the data in the SpaceX Boca Chica Launch Site Emergency Response and Mishap Investigation Plan Appendix 2-- FAA Mishap Report Worksheet of the Contingency Plan. See 'References' section above for link to Plan. Send Worksheet to the FAA/AST Safety Officer or Duty Officer, whichever is available on console and/or send to StarshipRegulatory@spacex.com.

Table 1 Points of Contact

Departments/Agencies	Contact	Contact Information	Responsibility
SpaceX Environmental Health & Safety (EHS)	Leo Alaniz	(956) 708-2118	Coordinate response
SpaceX Environmental Specialists	Katy Groom Kelsey Condell Elyse Procopio	(904) 434-2215 (321) 205-5856 (321) 243-8434	Report take of listed species or damage to historic resources
SpaceX Cultural Resources Specialist	Julisa Meléndez, SEARCH Project Manager	(814) 232-0910	Coordinate in the event of damage to a historic resource or debris outside of the APE
SpaceX Flight Control I	Ty Huntington	(561) 236-0083	Coordinate response
SpaceX Hazardous Materials Response	Leo Alaniz	(956) 708-2118	Coordinate response to hazardous materials
SpaceX Red Team	Leo Alaniz	(956) 708-2118	Coordinate response
SpaceX Security		Cell: (206) 225-6151 Radio: ST-A or Security	Coordinate security response
Brownsville Fire Dept.	Jarrett Sheldon, Fire Chief	Cell: (956)-337-3917 Desk: (956)-546-3195	Coordinate response
Brownsville Navigation District (BND) Port Harbormaster	Michael Davis	956.592.3975	Inform the Port Harbormaster of any continued hazards, changes to length of access restrictions
Cameron County Emergency Manager	Tom Husehen, Emergency Manager	Cell: (956)-454-5887 Desk: (956)-547-7000	Coordinate response
Cameron County Fire Marshal	Juan Martinez	Cell: (956) 708-5110 Desk: (956) 547-7000	Notify in event of an anomaly
Cameron County Judge	Eddie Trevino Jr.	(956) 544-0830	Coordinate extension of beach access restriction
Cameron County Commissioner Pct.1		(956) 459-4020	Notify in event of an anomaly
Cameron County Sheriff's Office (CCSO)	Silverio Cisneros	(956) 266-3840	Coordinate extension of access restriction
Federal Aviation Administration (FAA)	Stacey Zee	(202) 981-1437	Incident coordination
National Park Service (NPS)	Rolando Garza	(956) 466-5490	Coordinate response
US Army Corp of Engineers (USACE)	Jayson Hudson	(409) 766-3108	Coordinate if needed regarding Waters of the US
U.S. Coast Guard (USCG)	Sector/Air Station Corpus Christi Command Center	(361) 939-0450	Report any effect to safety of the waterway and the last known vehicle position
U.S. Customs and Border Protection (CBP)	Pete Caballero Supervisory Agent	(956) 498-8362	Coordinate response
U.S. State Department	Operations Center Senior Watch Officer	(202) 647-1512	Lead for international coordination

U.S. Fish and Wildlife (USFWS)	Chris Perez	24h dispatch: 956-784-7520 Cell: 956-475-1372 Desk: (956) 784-7553	Coordinate response with TPWD, THC and NPS
Texas Dept. of Transportation (TxDOT)	Andres Espinoza Area Engineer	Cell: (956) 357-0290 Desk: (956) 399-5102	Coordinate Maintaining Road Closures
Texas Department of Public Safety (DPS)	Lt. Scholick	(956) 330-1180	Coordinate response
Texas General Land Office (TGLO)	Rene Garcia	Cell: (361)960-9863 Desk: (361) 886-1606	Coordinate response
Texas Historical Commission (THC)	Bill Irwin	Desk: 936-878-2214 ext. 237	Coordinate regarding historic resources and closures
	Justin Kockritz	Desk: 512 936 7403	
	Ellen Busch	Desk: 51.936.1520	
Texas Parks and Wildlife (TPWD)	Chris Dowdy	Cell: (254) 784-9066	Coordinate response

Boca Chica Launch Site
Security Plan

Date: April 20, 2022
Version: 4.8 - EA

Introduction

The SpaceX Security Team provides security to the Boca Chica Launch Site during routine operations and in support of vehicle operations. The Boca Chica Launch Site is a dynamic environment that incorporates multiple layers of security with a significant emphasis on interagency coordination and cooperation. SpaceX will follow this plan to ensure that there are not any unauthorized persons, vessels, trains, aircraft, or other vehicles within the safety clear zones. The plan includes conducting "safety sweeps" by security personnel as needed for each launch, as well as roadblocks, surveillance activities, and other security checkpoints as appropriate. Safety sweeps will utilize various methods, as appropriate that may include, but are not limited to: video surveillance; motion detection; and human patrol assets.

Stakeholders

Below is a list of primary SpaceX stakeholders and external agencies that may be engaged during Boca Chica launch activities.

1. SpaceX
    a. Flight Control
    b. Security
    c. Environmental Health & Safety (EHS)
    d. Operations Support Coordinator (OSC)
    e. Red Team
2. Federal Aviation Administration (FAA)
3. Cameron County Sheriff's Office (CCSO)
4. U.S. Customs and Border Protection (CBP)
5. U.S. Coast Guard
6. U.S. Fish & Wildlife Service
7. Texas Department of Transportation
8. Texas Department of Public Safety
9. Texas Parks and Wildlife
10. Brownsville Navigation District
11. Texas Historical Commission

Clearing Operations

Safety clear zones will be established for each launch and test, when necessary, to contain the adverse effects of launch and test operations involving a hazard. The purpose of these zones is to protect public health and safety and the safety of property. The zones are sized to prevent a launch anomaly from harming those outside the safety clear zones, including SpaceX's, state, and federal property, and they typically extend downrange along the flight trajectory for a certain distance.

This temporary access restriction and clearing plan describes the procedures for land and water access restriction areas that will restrict public access on the day of launch operations along State Highway 4, on Boca Chica Beach, and offshore.

Tank tests, wet dress rehearsals, static fire engine tests, and launches (suborbital and orbital) will require restricting public access in the vicinity of the Vertical Launch Area (VLA) and securing land and water as part of public safety requirements. The areas on land that will be closed to the public access are referred to as the access restriction area. The access restriction area includes an area of Boca

Chica Beach, ranging from the Brownsville Shipping Channel south to the U.S./Mexico border.

A total of 500 hours of nominal access restrictions per year will be required for FAA-licensed activities. SpaceX will use reasonable efforts to avoid performing launch operations on weekends to the extent orbital mechanics and/or other operational issues do not conflict with or otherwise prevent such efforts. In addition, SpaceX would avoid performing launch operations on the following holidays: Memorial Day, Labor Day, July 4th, Martin Luther King Day, Presidents' Day, Texas Independence Day, Cesar Chavez Day, Emancipation Day in Texas (also referred to as Juneteenth), Veteran's Day, Good Friday, Easter, Father's Day, Mother's Day, Thanksgiving Day, Christmas Eve, Christmas Day, New Year's Eve and New Year's Day ("Holidays").

If an agency needs access to an area within a planned access restriction, the agency is encouraged to contact SpaceX directly to find the best opportunity to access the area and avoid any conflict in operations.

Pad

As necessary, SpaceX's Flight Control, EHS lead, and Security lead will conduct pad clearing operations.This team will clear the pad and its supporting structures to ensure that there are no personnel on site. Once the pad is clear, the gate will be locked.

Maritime

The Brownsville Ship Channel to the north of the launch site separates the area from Port Isabel and South Padre Island. The channel is approximately 7 km north of the launch site. This is not a populated area; there are no permanent residences or commercial structures in the area between the launch site and the channel. The Rio Grande River is located about 4 km to the south of the launch site. As necessary, to inform the maritime public of potential hazards associated with testing and launches on the waterways, the U.S. Coast Guard (USCG) will issue any of the following: a Local Notice to Mariners, a Broadcast Notice to Mariners, and/or Marine Safety Information Bulletins. SpaceX will provide information to the USCG for either of the Local Notice to Mariners and/or the Marine Safety Information Bulletins. Additionally, for flight operations, Cameron County Sheriff's Office (CCSO) will control access to the South Bay.

Boca Chica State Park Beach

As necessary, CCSO will close Boca Chica State Park Beach and assist SpaceX Security in clearing the beach from Highway 4 south to the Rio Grande river and north to the marine channel. The CCSO will also close the beach access points. U.S. Customs and Border Protection (CBP) may assist the county in clearing the beach and communicating the results to the SpaceX OSC.

Boca Chica Village

Boca Chica Village (the Village) is the nearest population center to the launch site, just over 1.24 miles west ofthe launch location. Boca Chica Village consists of private homes, SpaceX housing, and is near the SpaceX production and manufacturing areas.

<u>Overpressure Mitigation</u>

As necessary, to mitigate the risk of injury to the Village residents due to overpressure, Cameron County will exercise its authority to protect the public and direct residents to go outside their properties. Cameron County will provide warnings to residents by distributing a written notice in English and Spanish to residents in the Village. Cameron County will alert residents when the launch operation giving rise to the overpressure risk is imminent by sounding a police siren in the Village.

Evacuating Boca Chica Village

As necessary, CCSO will aid in evacuation of the Village to the fullest extent of their authority in accordance with the applicable law. That operation should take place approximately T-6 hours prior to the planned space flight activity, and in coordination with other clearing procedures. Activity in the Village will be monitored until the clear has been verified, and then continually throughout the duration of the window.

Checkpoint Operations

As necessary, SpaceX will operate Hard and Soft Checkpoints to limit access to the launch site and ensure the integrity of permissioned access.

- A soft checkpoint located at the intersection of Oklahoma Avenue and SH 4, just east of Brownsville. Government personnel, SpaceX personnel, emergency personnel, and anyone with property beyond this soft checkpoint could pass, but the general public will be denied access.
- The second checkpoint (referred to as “public hard checkpoint 1”) will be located at the intersection of Massey Way and SH 4. Only SpaceX personnel, government personnel, emergency personnel involved in SpaceX operations, and anyone with property beyond this checkpoint will be able to pass this checkpoint.
- The third checkpoint (referred to as “public hard checkpoint 2”) will be located at the intersection of SH 4 and Richardson Avenue. Only SpaceX personnel and FAA launch support personnel will be able to pass this checkpoint.
- The final checkpoint (referred to as “all hard checkpoint”) will be located just west of the LLCC. No one will be able to pass this checkpoint

CCSO and SpaceX Security will establish these checkpoints.CCSO will exercise its authority to limit access. CBP may participate in these operations at its discretion. When the Soft Checkpoint is in effect for flight, access will be restricted to SpaceX essential personnel, landowners who reside past the checkpoint and outside of the flight caution area, and CCSO Hard Checkpoint support. SpaceX will provide credentials for persons who will pass through the Soft Checkpoint. No members of the public will enter the safety clear zone during launch operations.

Range Coordination

As necessary, SpaceX will establish a safety clear zone during pre-flight, launch and post-flight operations to protect public health and safety and the safety of property during Starship operations. SpaceX will ensure the integrity of the safety clear zone with Hard and Soft Checkpoints as defined in this plan.

The Range team will consist of SpaceX Security and other local, state, and federal partners with responsibility to clear areas for public safety. Range stakeholders will report clear activities, concerns, and incident response to the OSC. Range coordination activities will begin when the Soft Checkpoint is established and conclude when all checkpoint operations close. SpaceX, along with Refuge employees if permitted, will ensure bollards and cable barrier secure and gaps are closed to reduce public vehicle traffic onto TPWD/USFWS property upon direction from TPWD and/or USFWS. SpaceX will coordinate closely with the Service’s Federal Wildlife Officer, through the Refuge Dispatch at (956) 784-7520. The Officer will be in charge of maintaining security throughout the neighboring National Wildlife Refuge, including land leased to Service.

Emergency Response Support

In the event of a Launch Incident, Launch Accident, or Mishap, SpaceX security, in close coordination with CCSO, will maintain all checkpoints until deemed safe to return inside the safety clear areas. As necessary, SpaceX may request first responders be available to help mitigate brush fires outside of the clear areas or respond to medical emergencies. In general, first responders will remain outside of the debris field until the Red Team sweeps the debris field to safe the area.

DRAFT
SpaceX Boca Chica Launch Site Lighting Management Plan

April 20, 2022

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Figures

1.0 Introduction

1.1 Overview

This Lighting Management Plan (Plan) describes the exterior lighting for the Space Exploration Technologies Corp. (SpaceX) Boca Chica Launch Site, located near Brownsville, TX (Figure 1-1). This Plan also provides site-specific guidelines for the installation and operation of night lighting.

Figure 1. Location of the Vertical Launch Area and Launch and Landing Control

1.2 Site Description

The Boca Chica Launch Site consists of three areas, the Vertical Launch Area (VLA), the solar farm, and the Launch and Landing Control (LLCC). The LLCC includes one building known as Stargate. Adjacent to the LLCC is the SpaceX private manufacturing and production area.[1] The solar farm consists of an

[1] The manufacturing and production area supports SpaceX operations that are outside of the Federal Aviation Administration's (FAA's) jurisdiction; accordingly, activity in this area is outside the scope of the FAA's environmental review process and subsequent special purpose law consultations.

approximately 2.5-acre area roughly 1.7 miles west of the VLA. The VLA is approximately 16.5 acres and includes:

- One test pad, one redundant test pad, a launch pad and a landing pad.
- Propellant storage and handling areas.
- Roads, parking areas, fencing, security, lighting, and utilities.

2.0 Lighting Design

The lighting design objective is to minimize, or where possible, eliminate site lighting seen from the beach, vegetated dunes, and from the Palmito Ranch Battlefield National Historic Landmark (NHL). To accomplish this, lighting will primarily consist of directional lights, oriented downward, and where possible, away from the beach. Exterior lights used expressly for safety or security purposes are limited to the minimum number and configuration required to achieve their functional roles. Up lighting and side lighting will only be used in the event that a safety or mission critical operational need arises – use will be temporary. Extendible pole lights will be reduced to as minimal a height as operationally allowed.

Independent research has shown that different types of lighting affect sea turtle orientation to varying degrees. Low-pressure sodium (LPS) lighting has historically been a best practice, having the least impact with nearly monochromatic amber lighting of 589-590 nanometers. Mitigation of existing high intensity discharge (HID) exterior lighting, consisting of white light, which contains the greatest percentage of blue and green wavelengths is ongoing. Lighting with a more yellow appearance, such as high pressure sodium (HPS) contains a smaller percentage of light at the blue and green end of the visible light spectrum, and can still cause disorientations.

The most effective method of reducing incidental take relating to lighting disorientations is to eliminate light sources. A total elimination of exterior lighting at Starbase is not possible due to safety, security and mission critical operational requirements. SpaceX will perform its internal best management practices to reduce lighting.

Low pressure sodium or amber LED lighting will be used as operational constraints allow. To minimize ground reflection, flat or non-reflective coatings will be used where possible. Details of lighting design in each area of the launch site are identified below. When possible (e.g., when safety or security is not compromised), timers and/or motion sensors will be used to limit lighting. The Occupational Safety and Health Administration (OSHA) requires the workplace to be illuminated when workers are present. This also includes access ways. When workers are present at the VLA or the LLC, task lighting will be used to illuminate the work areas. These lights will be directed downward, where possible, to minimize visibility from the beach, vegetated dunes, and NHL. When workers are not present, the task lighting will be turned off. On-site security is required to prevent unauthorized access to information, including information protected by International Traffic in Arms Regulations (ITAR) or SpaceX or customer-owned information. Security processes that mitigate these threats include restricting access to facilities to authorized personnel only and ensuring network systems are secure. In addition to protecting information, it is important for employee and public safety to prevent accidental or deliberate theft, vandalism, or other damage to the facility, equipment, and to personnel. Security ensures no one is harmed by test activities or daily operational activities. To protect the VLA, SpaceX security limits access to site grounds using perimeter fences, monitoring equipment, and security patrols. SpaceX security works closely with local law enforcement personnel in protecting the facilities and handling any emergent issues. Lighting is required to monitor the perimeter fence lines, entrances, and exits. This lighting will be on during all nighttime hours to ensure security.

The proposed approach to lighting design is included throughout the facility descriptions presented in this Plan.

2.1 Operational Guidelines

Launch or pre-launch operations may occur at night, during which lighting will be required on the pad deck areas. SpaceX would conduct construction activities during normal working hours to the greatest extent possible; however, due to late arrival of construction supplies, launch critical work, or other unexpected events, there may continue to be construction during nighttime hours. Additionally, primary roads, parking areas, building entrance lighting, and the primary gated entrance to each area could be illuminated during nighttime hours. In some cases, some site lighting may be motion controlled or be able to be adjusted to security needs.

Should there be the need for additional, local temporary exterior lighting to support construction activities or emergencies, the following requirements will be adhered to:

- Whenever possible, lights will be placed in such a way that they do not shine directly towards the beach or vegetated dunes or unnecessarily illuminate large objects visible from the Palmito Ranch Battlefield, or the beach or vegetated dunes (during the sea turtle nesting season). Additionally, up-lighting will be minimized to the maximum extent possible.
- Lighting will be extinguished upon completion of work in an illuminated area.
- The size, type, and number of exterior lights will be minimized and will be restricted to low pressure sodium, when practicable, during turtle nesting season.
- Fixtures will be shielded or screened whenever practical.
- A qualified biologist will conduct lighting inspections before nesting season and biweekly during the nesting-hatching season (March 15th to October 1st).

2.2 Compliance Verification

SpaceX will have responsibility for ensuring compliance of these procedures by site personnel, including all contractors and subcontractors. The following monitoring and enforcement actions will be taken, and the persons responsible for the misuse of lights will be notified.

- All SpaceX personnel and contractors will be receive training regarding sea turtles and the importance of minimizing light impacts to the beach, the vegetated dunes, and the NHL.
- SpaceX site management will issue annual notices to all complex personnel prior to sea turtle nesting season (March 15 to October 1) for continued awareness.
- To comply with the terms and conditions of the BO, SpaceX will perform a lighting inspection on the beach in front of the VLA. The inspection will include the number, type, and locations of lights visible from the beach. A set of daytime and nighttime lighting inspections will be done before nesting season. If lighting at the VLA, Stargate, or the solar area changes, this Plan will be updated and additional light monitoring will be completed to reduce or eliminate light seen from the beach.
    - SpaceX will conduct evening inspections between 9:00 PM and 5:00 AM biweekly during sea turtle nesting season.

- Data from lighting monitoring and unannounced inspections, as well as any compliance issues and remedies, will be summarized in the annual Monitoring Report.
- SpaceX will address deviations with the Service on a timely manner to implement corrective actions.

2.3 Parking and Roadway Lighting

Parking and roadway lighting consists of lighting used for parking areas, roadways, and driveways to provide lighting for driving and transit between facilities.

2.4 Egress Lighting

Egress lighting is present in facilities to provide illumination of walkways used in the exit of employees during low-visibility hours.

2.5 Facility Operations Task Lighting

Facility Operations Task Lighting is utilized for mission critical operations in support of launch. Lighting may consist of Pad Deck visibility lighting and commodity farm visibility lighting. Operational tasks shall be coordinated with the SpaceX Site Director or designee to determine the appropriate lighting needed per operation.

2.6 Security Lighting

Security Lighting consists of constant illumination at guard shacks, vehicle spotlights used during launch operations, and perimeter fencing lighting.

3.0 Area Inventories

3.1 Key to Lighting Maps

Key

- (red) FSP Pro Series Sparta Sports Light Gen1 White LED 850W Spotlight
- (blue) OLWX1 White LED Wall Luminaire 40W
- (pink) DSXW1 White LED Full Cut-Off Wall Light 40W
- (green) LOVUS ST60-039 Solar Light 60W

3.2 Locations and Lighting Maps

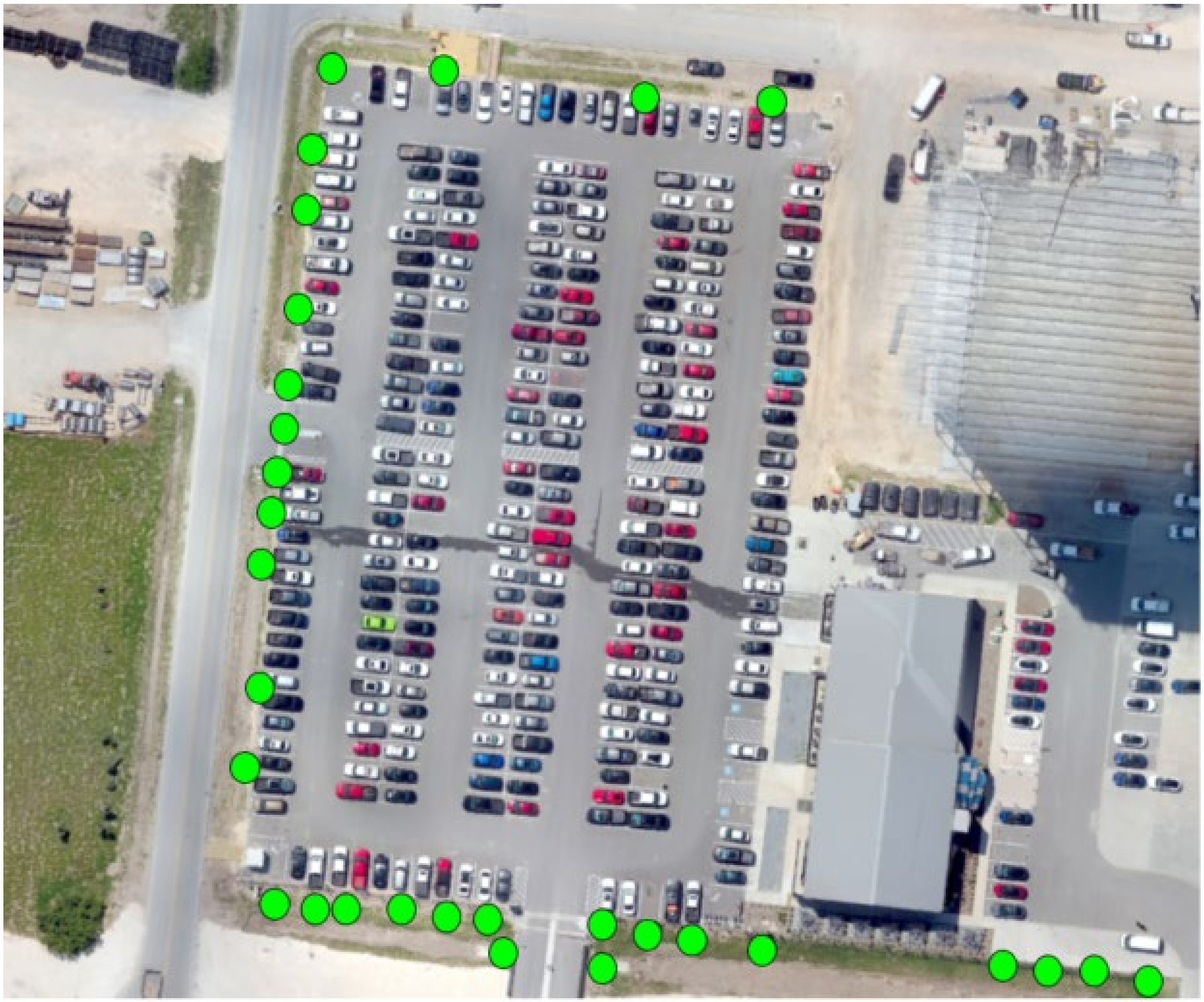
3.2.1 Launch and Landing Control

The LLCC consists of Stargate and the adjacent parking lot. Lighting at the Stargate building consists of two white LED shielded spotlights mounted about 10 feet high, controlled by photocell, and operating dusk to dawn. Additional lighting at the Stargate building consists of 21 white LED full cut-off wall mounted lights (OLWX1) mounted about 10 feet high, controlled by photocell, and operating dusk to dawn.

Figure 2 Lighting at Launch and Landing Control

The parking lot at the LLCC includes 30 downward facing solar LED streetlight fixtures to provide low lighting. These lights are controlled by photocell, mounted about 8 feet high, and operate from dusk until dawn. These lights are sensor activated, when not activated they are very dim, and become brighter with motion activation.

Figure 3 Lighting and Launch and Landing Control Parking Lot



LOVUS 600LM
Solar LED Street Light- Motion Sensor and Light Control

3.2.2 Solar Farm

The solar farm consists of solar arrays and batteries for power storage. Lighting at the solar farm area consists of eight white LED (DSXW1) full cut-off wall lights, mounted about 10 feet high, controlled by photocell, operating from dusk to dawn.

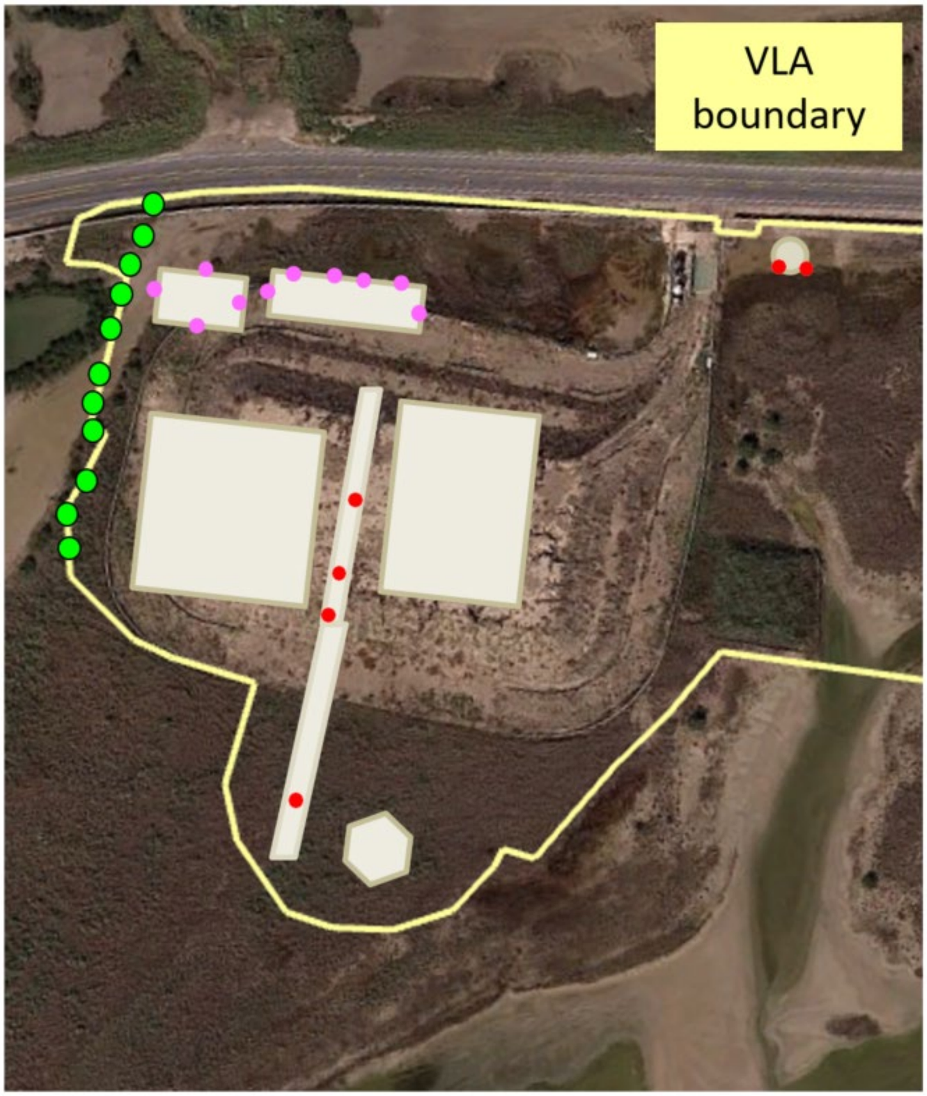
Figure 4 Lighting at the Solar Farm

3.2.3 Vertical Launch Area

The VLA consists of the landing pad, the suborbital area, and the orbital area. There is no lighting at the landing pad. Lighting at the suborbital area includes 10 white LED (DSXW1) full cut-off wall lights, mounted about 10 feet high, controlled by photocell, operating from dusk to dawn. There are also four white shielded LED spotlights mounted about 30 feet high on the suborbital berm, controlled by photocell, and operating dusk to dawn.

Along the western edge of the suborbital area, there are 11 downward facing solar LED streetlight fixtures to provide low lighting. These lights are controlled by photocell, mounted about 8 feet high, and operate from dusk until dawn. These lights are sensor activated, when not activated they are very dim, and become brighter with motion activation.

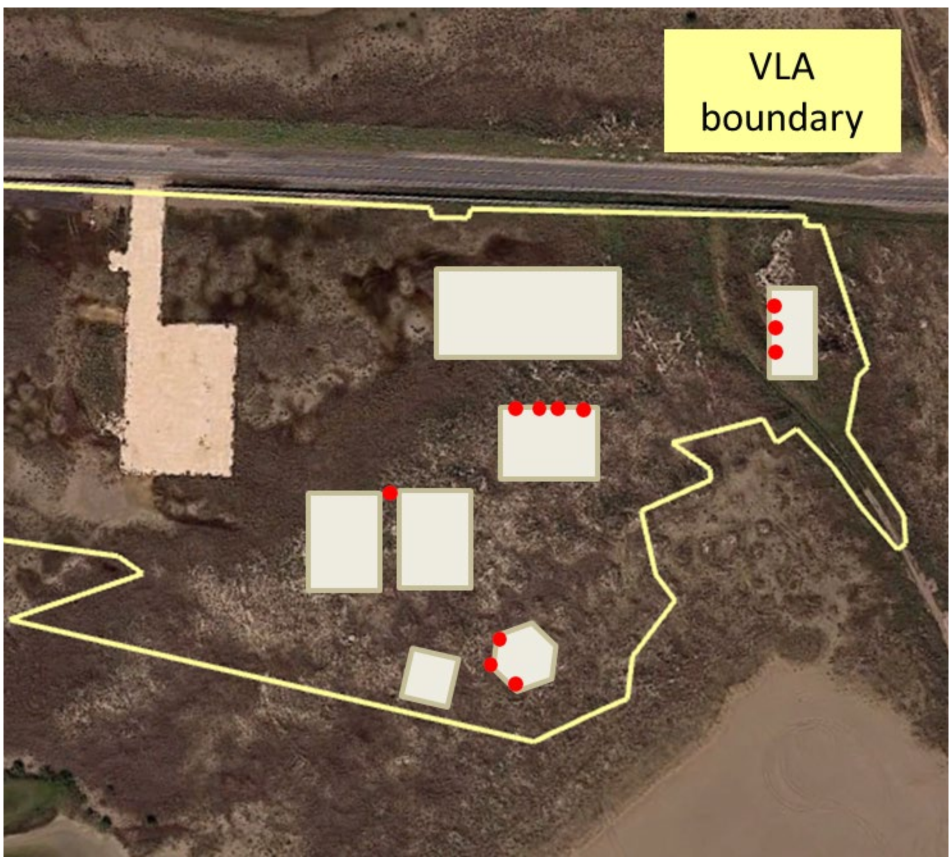
Figure 5 Lighting at the Vertical Launch Area Suborbital Area



LOVUS 600LM
Solar LED Street
Light- Motion
Sensor and Light
Control

Lighting at the orbital pad consists of 11 white LED shielded spotlights mounted between 10- 50 feet high, controlled by photocell, and operating dusk to dawn.

Figure 6 Lighting at the Vertical Launch Area Orbital Area



4.0 Lighting Matrix and Cut Sheets

Launch and Landing Control

Fixture ID	Symbol	Location	Lamp Type	Shield?	Power	Housing Style	Mount Height	Hours of Operation	Control Method
FSP	● (red)	Parking	White LED	Y	850W	spotlight	10'	Dusk to Dawn	Photocell
OLWX1	● (blue)	Building Exterior	White LED	N	40W	Full Cut-Off Wall Light	10’	Dusk to Dawn	Photocell
Solar	● (green)	Parking	White LED	N	60W	Street Light	8’	Dusk to Dawn	Motion Activated

Solar Farm

Fixture ID	Symbol	Location	Lamp Type	Shield?	Power	Housing Style	Mount Height	Hours of Operation	Control Method
DSXW1	● (pink)	Building Exterior	White LED	N	40W	Full Cut-Off Wall Light	10'	Dusk to Dawn	Photocell

Suborbital Area of Vertical Launch Area

Fixture ID	Symbol	Location	Lamp Type	Shield?	Power	Housing Style	Mount Height	Hours of Operation	Control Method
DSXW1	● (pink)	Building Exterior	White LED	N	40W	Full Cut-Off Wall Light	10'	Dusk to Dawn	Photocell
FSP	● (red)	Berm and Starhopper	White LED	Y	850W	Spotlight	20’-30’	Dusk to Dawn	Photocell
Solar	● (green)	Western fence line	White LED	N	60W	Street Light	8’	Dusk to Dawn	Motion Activated

Orbital Area of Vertical Launch Area

Fixture ID	Symbol	Location	Lamp Type	Shield?	Power	Housing Style	Mount Height	Hours of Operation	Control Method
FSP	●	Top of columns, bunkers, and seavans	White LED	Y	850W	Spotlight	10'-50'	Dusk to Dawn	Photocell

SpaceX Boca Chica Launch Site Biological Monitoring Plan

April 22, 2022
Revised: May 10, 2022

Contents

1.0 Introduction

NOTE: This Biological Monitoring Plan is a preliminary plan. It is to be used as a guide in the development of an approved complete survey plan once FAA and SpaceX have contracted with a qualified independent contractor to perform the avian and vegetation plan. The contractor must be experienced in developing monitoring surveys and observation and identification of piping plovers and red knots as well as other shorebirds, northern aplomado falcons, and vegetative changes of their habitat.

SpaceX will be responsible for conducting avian monitoring for sensitive shorebird species and vegetation monitoring in association with the U.S. Fish and Wildlife Service (USFWS) and as stipulated in the April 22, 2022 Final Biological and Conference Opinion (BCO) and the Federal Aviation Administration's (FAA) 2022 Programmatic Environmental Assessment (PEA). SpaceX's Boca Chica Launch Site is located on SpaceX-owned land in Cameron County, Texas, near the cities of Brownsville and South Padre Island. Figure 1 shows the location of the Boca Chica Launch Site.

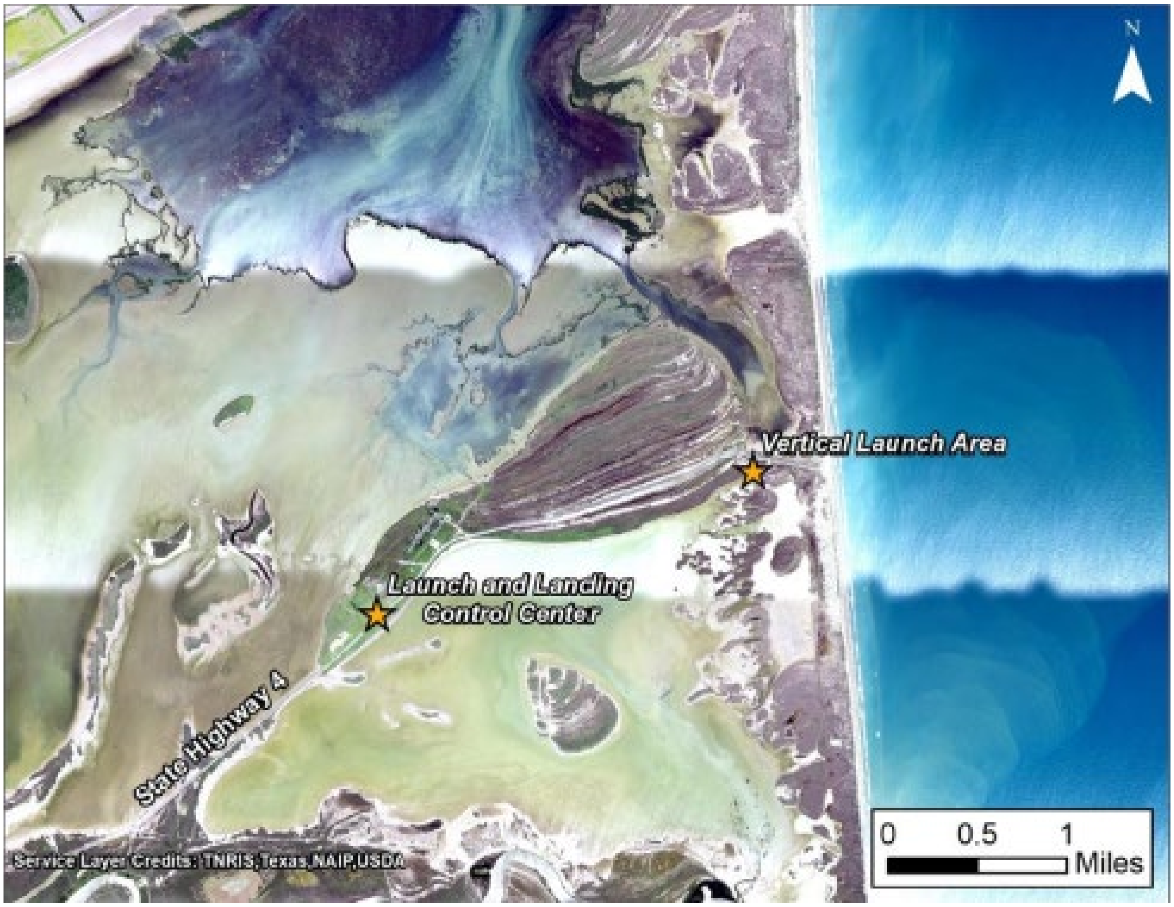


Figure 1 Location of the SpaceX Launch and Landing Control Center and Vertical Launch Area

After the stipulated monitoring timeframe described in the April 22, 2022 BCO, or when SpaceX applies for a renewal or extension of their launch license or permit, the Service, the FAA, and SpaceX will evaluate the need to modify, adapt, or discontinue the monitoring.

2.0 Avian Monitoring Plan

SpaceX will be responsible for conducting avian monitoring for sensitive shorebird species in association with USFWS and as stipulated in the April 22, 2022 BCO and the 2022 PEA.

Avian monitoring surveys will target the following imperiled species: Wilson's Plover (*Charadrius wilsonia*), Snowy Plover (*Charadrius alexandrinus*), Piping Plover (*Charadrius melodus*) Red Knot (*Calidris canutus*), and northern aplomado falcons (*Falco femoralis septentrionalis*). In addition, all other avian species observed during avian monitoring surveys will be noted and a list of species recorded in the area will be provided to the Service annually.

Monitoring for the aplomado falcon will adhere to the Interim Survey Methodology for the Northern Aplomado Falcon (*Falco femoralis septentrionalis) in Desert Grasslands* (USFWS 2003).

Black rails were not expected to occur on the VLA or LLCC, however, there have been detections of black rail in Cameron County.

2.1 Construction and Seasonal Monitoring

Construction and post-construction seasonal monitoring for listed species (piping plover, red knot, and northern aplomado falcon) will continue to be conducted by qualified biologists on accessible U.S. soil within a three-mile radius of the construction area. Findings will be included in the Biological Monitoring Annual Report.

Surveys will be conducted by traveling along established transects (routes) in different habitats in the impact area, hereafter referred to as Boca Chica, Las Palomas, South Bay and Beach Routes (Figure 2). The impact area and survey routes are consistent with the area and routes that have been surveyed since 2015, and will allow for interannual comparisons. These transects were established to provide surveyors with an unobstructed view of significant portions of the impact area, meet particular habitat requirements of each species, provide habitat heterogeneity within the impact area, and allow access during flooding.

Survey Methodology

The Boca Chica Route includes several yucca stands, which will be traversed on foot to increase the likelihood of detecting northern aplomado falcons. Las Palomas and South Bay routes may be surveyed by all-terrain-vehicles (ATV) and on foot, given the large areas and the inaccessibility of the area via trucks. The Beach route may be traveled by truck traveling at speeds less than 12 mph. Care will be taken to avoid damaging the algal flats, such as staying on upland, vegetated areas as much as possible, only traversing unpaved during dry conditions and limiting ATV use to existing paths and roads. Figure 2 illustrates the five study routes.

Wilson's plovers, horned larks, and common nighthawks are among the species expected to nest along the low sparse vegetation at the upper edge of the flats. Care should be taken as to not destroy nests and effectively eliminate these species from the surveyed areas. Nesting seasons encompass March - August.

The Boca Chica Route on the map does not have points identified as the other two do. Identifying or even detecting birds at a distance is difficult. It may be necessary to consider having a driver and an observer partnering up.

Figure 2 Construction Monitoring Area and Routes

Timing and Abiotic Variables

Surveys will be initiated within an hour after local sunrise, using the US Naval Observatory Sunrise charts for the Boca Chica locality and the current year (http://aa.usno.navy.mil/data/docs/RS_OneYear.php) and will be completed by 1300 h.

Direction of traveled routes will be alternated between successive surveys to avoid biasing certain areas of routes covered to certain times of the day. The Beach Route will be surveyed during a weekday to avoid tourists and traffic.

Climate and tidal information will be obtained from the National Oceanographic and Atmospheric Administration weather station located at Port Isabel, TX, located 10 km northwest of the launch site (http://www.cbi.tamucc.edu/data/018). For the inland routes (South Bay, Boca Chica, Las Palomas) presence or absence of standing water will be noted.

Data Collection

Upon each encounter of a target species, the number of individuals will be counted, their general behavior (resting, perching, feeding, flying, copulating, displaying, etc.) noted and all legs examined to determine presence/absence of bands, and when possible, unique band numbers or unique color band combinations. When possible, images will be taken of banded birds to serve as photographic vouchers. Positive band identifications will be entered into the website http://www.bandedbirds.org, in order to determine history and movements of individuals and to contribute important data to the database. During nesting season, care will be taken to avoid disturbing or harming nests. Prior to approaching a point during nesting season, monitors will carefully look for incubating birds, and upon approach will carefully watch for birds flushing from a nest. In the event a bird appears to flush from a nest, care must be taken to identify the eggs (which can be well camouflaged) or avoid the potential nest altogether.

Time of initial observation, approximate distance of group or individual from the surveyor and waypoints will be noted. For raptors found perching on trees, waypoints would be taken and species identified (if logistically possible); care will be taken to not approach any active nest sites within 100 m. For the Las Palomas and South Bay Routes, surveyors will stop at each observation point (see Figure 2), turn off the ATV and spend 10 minutes listening and scanning the sky for northern aplomado falcons and for potential perch sites in the area. If a given observation point had an obstructed view of the landscape, the surveyor will move within a radius of 100 m in order to obtain a clear view. Because northern aplomado falcons do not build their own nests, any other large raptor stick nests will also be recorded. Data on large stick nests potentially used by northern aplomado falcons are relevant for determining habitat suitability. The western terminus of the Las Palomas route contains a northern aplomado falcon nest structure, which will be checked during each survey, particularly during nesting season (generally March through August). Once data are recorded, the surveyor team will move directly to the next observation point to avoid double-counting. On the Beach Route, whether the birds were observed foraging along the tidal edge or in the dead seaweed piles or sand dunes will also be noted.

Reporting

A Biological Monitoring Annual Report will be submitted to the FAA and USFWS prior to March 1st of each subsequent year. The report will present abundance estimates for the surveyed species within the study area based on the sampled locations in an effort to document long-term trends and regional movements, if possible, of each monitored species. Depending on the nature of the reported changes, SpaceX will coordinate with the Service to implement remediation measures as needed. Any take of listed species will be reported immediately to the Service by SpaceX. SpaceX will contact the appropriate federal agencies in accordance with the

Terms and Conditions of the 2022 Biological Opinion and with the SpaceX Anomaly Response Plan.

2.2 Launch Monitoring

Pre- (no more than one week prior) and post- (up to one day after) launch monitoring of the five imperiled species (piping plover, red knot, Wilson's plover, snowy plover, and northern aplomado falcon) will be conducted within a one-mile radius of the VLA. These surveys will use the same routes as the Construction and Seasonal Monitoring, however these surveys will be focused to a one-mile radius from the launch pad (Figure 3). In order to try to capture a more accurate assemblage, pre-launch monitoring will only take place if no engine ignition activities have taken place for at least 2 weeks. The pre-launch monitoring will be conducted prior to pre-launch static fire engine tests.

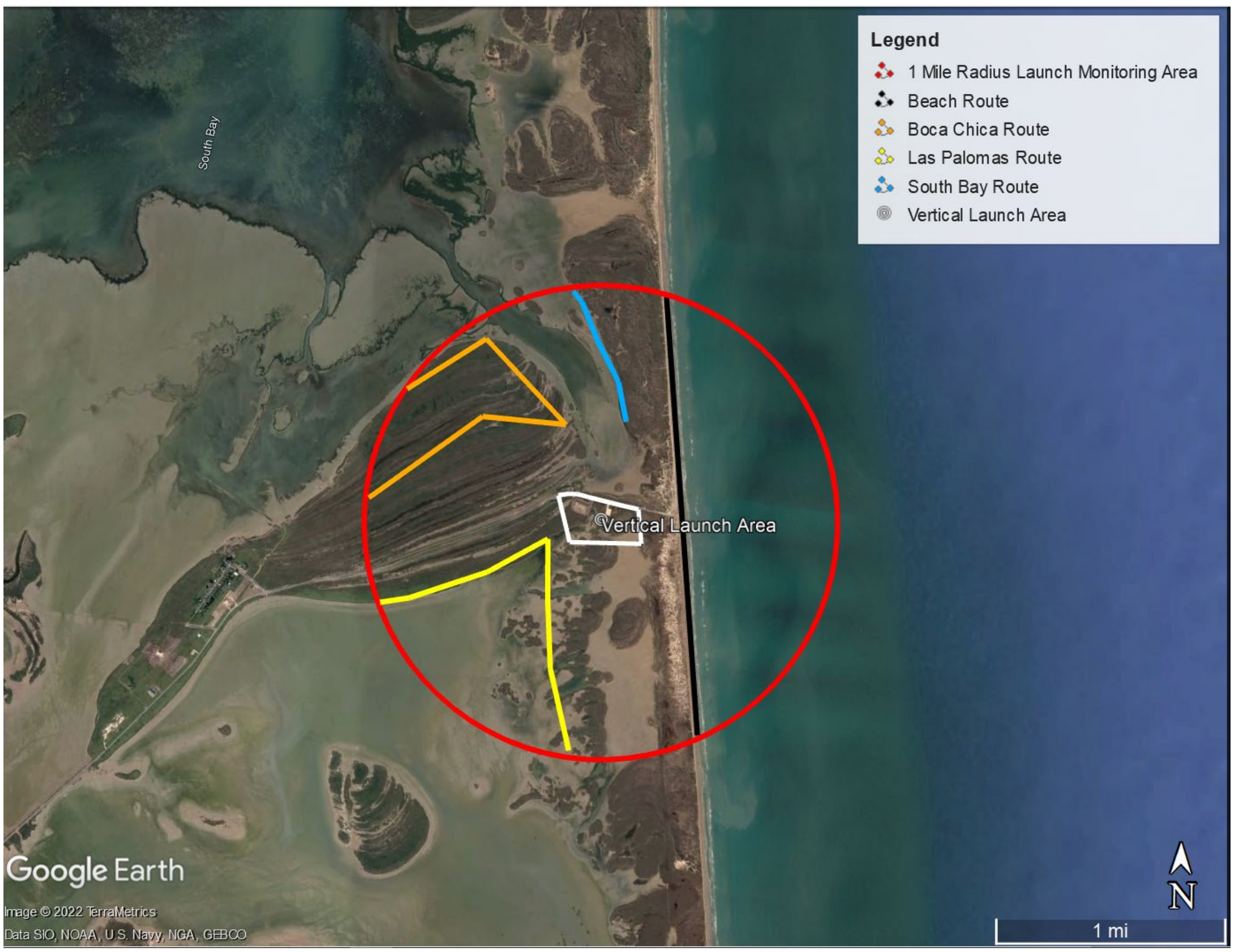


Figure 3 Launch Monitoring Area (1 mile radius)

Survey Methodology

Survey methodology will be the same as for construction and seasonal monitoring, but limited within the 1-mile survey area. The Boca Chica Route includes several yucca stands, which will be traversed on foot to increase the likelihood of detecting northern aplomado falcons. Las Palomas and South Bay routes may be surveyed by all-terrain-vehicles (ATV) and on foot, given the large areas and the inaccessibility of the area via trucks. The Beach route may be traveled by truck traveling at speeds less than 12 mph. Care will be taken to avoid damaging the algal flats, such as staying on upland, vegetated areas as much as possible, only traversing unpaved during dry conditions and limiting ATV use to existing paths and roads.

Timing and Abiotic Variables

Surveys will be initiated within an hour after local sunrise, using the US Naval Observatory Sunrise charts for the Boca Chica locality and the current year (http://aa.usno.navy.mil/data/docs/RS_OneYear.php) and will be completed by 1300 h.

Direction of traveled routes will be alternated between successive surveys to avoid biasing certain areas of routes covered to certain times of the day. The Beach Route will be surveyed during a weekday to avoid tourists and traffic.

Climate and tidal information will be obtained from the National Oceanographic and Atmospheric Administration weather station located at Port Isabel, TX, located 10 km northwest of the launch site (http://www.cbi.tamucc.edu/data/018). For the inland routes (South Bay, Boca Chica, Las Palomas) presence or absence of standing water will be noted.

Data Collection

Upon each encounter of a target species, the number of individuals will be counted, their general behavior (resting, perching, feeding, flying, copulating, displaying) noted and all legs examined to determine presence/absence of bands, and when possible, unique band numbers or unique color band combinations. When possible, images will be taken of banded birds to serve as voucher specimens. Positive band identifications will be entered into the website http://www.bandedbirds.org, in order to determine history and movements of individuals and to contribute important data to the database. Prior to approaching a point during nesting season, monitors will carefully look for incubating birds, and upon approach will carefully watch for birds flushing from a nest. In the event a bird appears to flush from a nest, care must be taken not to step on or run over the eggs (which can be well camouflaged) and to avoid the potential nest altogether.

Time of initial observation, approximate distance of group or individual from the surveyor and waypoints will be noted. For raptors found perching on trees, waypoints would be taken and species identified (if logistically possible); care will be taken to not approach any nest sites within 100 m. For the Las Palomas and South Bay Routes, surveyors will stop at each observation point (see Figure 2), turn off the ATV and spend 10 minutes listening and scanning the sky for northern aplomado falcons and for potential perch sites in the area. If a given observation point had an obstructed view of the landscape, the surveyor will move within a radius of 100 m in order to obtain a clear view. Because northern aplomado falcons do not build their own nests, any other large raptor stick nests will also be recorded. Data on large stick nests potentially used by northern aplomado falcons are relevant for determining habitat suitability. The western terminus of the Las Palomas route contains a northern aplomado falcon nest structure, which will be checked during each survey, particularly during nesting season (generally March through August). Once data are recorded, the surveyor team will move directly to the next observation point to avoid double-counting. On the Beach Route, whether the birds were observed foraging along the tidal edge or in the dead seaweed piles or sand dunes will also be noted.

Reporting

Pre- and post-launch survey data will be reported to USFWS within two weeks of survey completion. Data will also be summarized in the Biological Monitoring Annual Report provided to the FAA and USFWS. Depending on the nature of the reported changes, SpaceX will coordinate with the Service to implement remediation measures as needed. Any take of listed species will be reported immediately to the Service by SpaceX.

3.0 Vegetation Monitoring Plan

Vegetation monitoring will be implemented to document changes in designated and proposed critical habitat impacted by the Proposed Action. Intensive vegetation monitoring will consist of surveys of vegetation plots based upon the previously established sampling grid. Extensive vegetation monitoring will use multispectral satellite imagery within a three-mile radius of the launch site, which has been ongoing since 2015, and will provide comparisons of extensive-scale vegetation changes.

3.1 Intensive Vegetation Monitoring

The original grid created in 2015 consisted of 107 points, each separated by 100 feet, plus 6 vegetation creep plots (113 plots total in 2015). Sampling areas encompassed low-lying, unvegetated mudflats, a transition zone comprised of halophytic vegetation, and short hind dunes (Figure 4). In 2016, an additional 6 study plots were established in order to supplement the original grid where researchers felt there were gaps in coverage. In total, 119 plots have been surveyed since 2019 and will continue to be monitored.

Figure 4 depicts the zones that have been intensively monitored since 2015. The orange ‘Take’ area depicts the 8.66-acre area for which USFWS issued take in 2013, and the yellow ‘Monitoring’ denotes the additional 23.51-acres designated by USFWS for supplemental monitoring in 2013. ‘Bare’, ‘Transition’, and ‘Dune’ refer to the three main types of habitat surveyed. ‘Creep’ refers to plots placed at the edge of vegetation zone transitions between mudflats and halophytic salt flats for the sake of tracking encroachment or “creep” into mudflats. Although SpaceX is no longer proposing a deluge system that could produce water vapor, this monitoring will continue to take place in order to monitor for changes in vegetation surrounding the launchpad that may result from SpaceX’s activities.

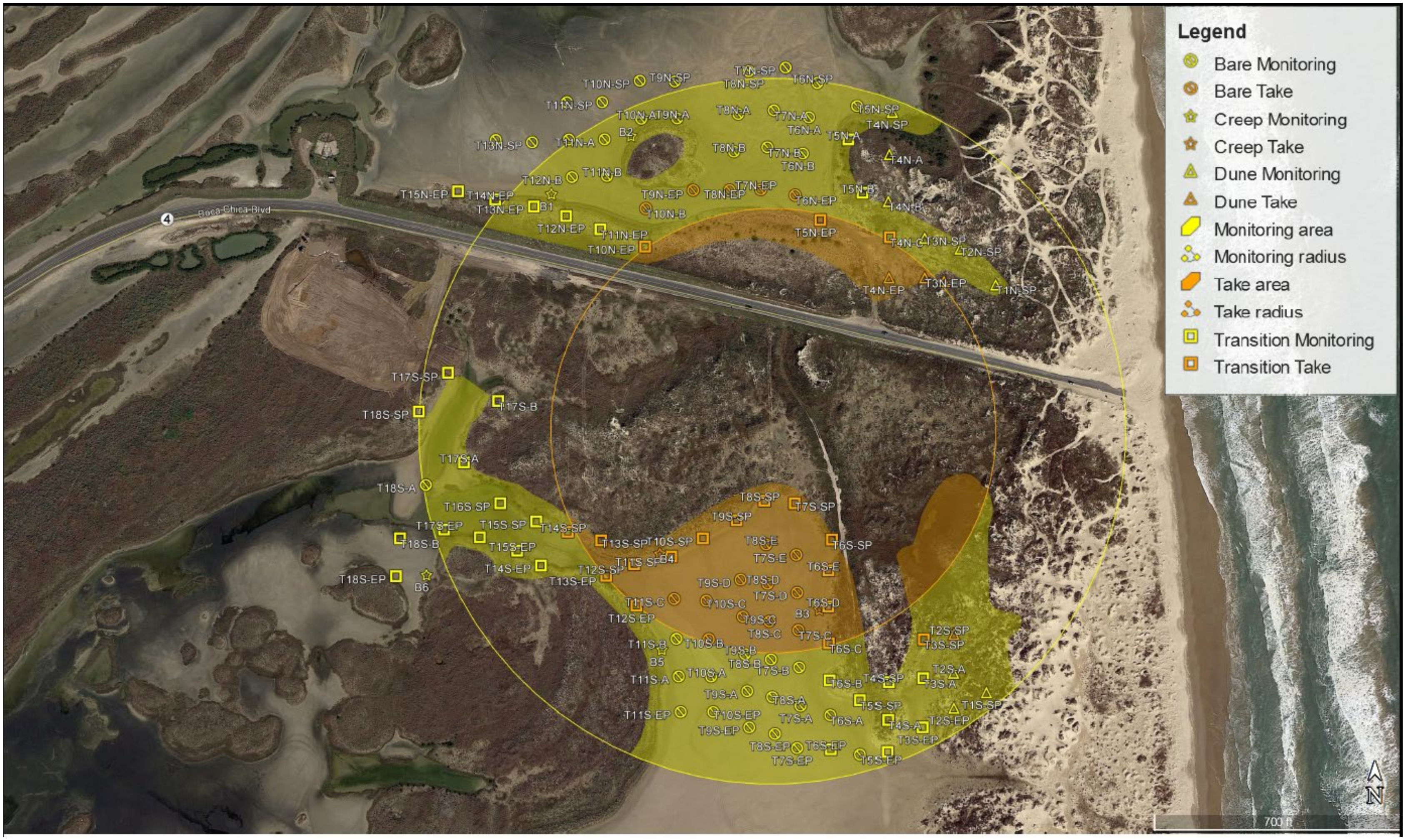


Figure 4 Intensive Vegetation Monitoring Study Area and Sampling Points

Survey Methodology

Surveys will take place in the fall (September to November). Plant cover by species and the percentage of bare ground at each sampling point will be visually estimated within a 1 square meter area. Plant species will be identified to the lowest taxonomic level possible. The maximum height attained by the tallest species in each plot will also be measured, as well as the estimated average overall vegetation canopy height. Five photographs will be taken at each sampling point (including bare mudflats), including four photographs taken in each cardinal direction and one photograph of the 1 square meter survey plot. The survey photographs will be carefully reviewed to visually evaluate the differences between imagery across time to ensure consistency between revisits. The surveys will also include consideration of any large shrubs or shrub layer vegetation greater than 1.4 meter tall (e.g., mangrove, huisache, etc.) that occur within a 2-m radius of each sampling point. Nesting birds will be avoided; if an active nest is encountered, a 50 meter (164 feet) buffer from the nest will be maintained.

3.2 Extensive Vegetation Monitoring Through Remote Sensing

Extensive vegetation monitoring makes use of multispectral satellite imagery to detect largescale changes within a circular study area with a 3 mile radius centered at the SpaceX Vertical Launch Area in Boca Chica, Texas. The study area is approximately 16 square miles excluding the Gulf of Mexico to the East, and the Rio Grande River and Mexico to the South, and is largely contained within the Lower Rio Grande National Wildlife Refuge. Major habitats include dune, marsh, coastal prairie, tidal flats, and coastal lagoon habitat.

The first launch from the SpaceX Boca Chica facility occurred on April 5, 2019. Imagery for each year will be compared to the prior reporting cycle and also will be compared to February 14, 2014, the initial reporting cycle. Imagery will be evaluated to determine changes in vegetation based on the Normalized Difference Vegetation Index (NDVI). The NDVI transforms multispectral multispectral data into a single image band with values ranging from -1 to +1 where values < 0 represent surfaces that contain no chlorophyll while values > 0 increase with increasing chlorophyll. In particular, the 446 acres of directly impacted designated piping plover and proposed red knot critical habitat will be evaluated for changes in vegetation (direct impact area shown in blue in Figure 5). In addition, the area surrounding the Launch and Landing Control Center will be evaluated for changes to the mudflats. The Launch and Landing Control Center is shown in Figure 5.

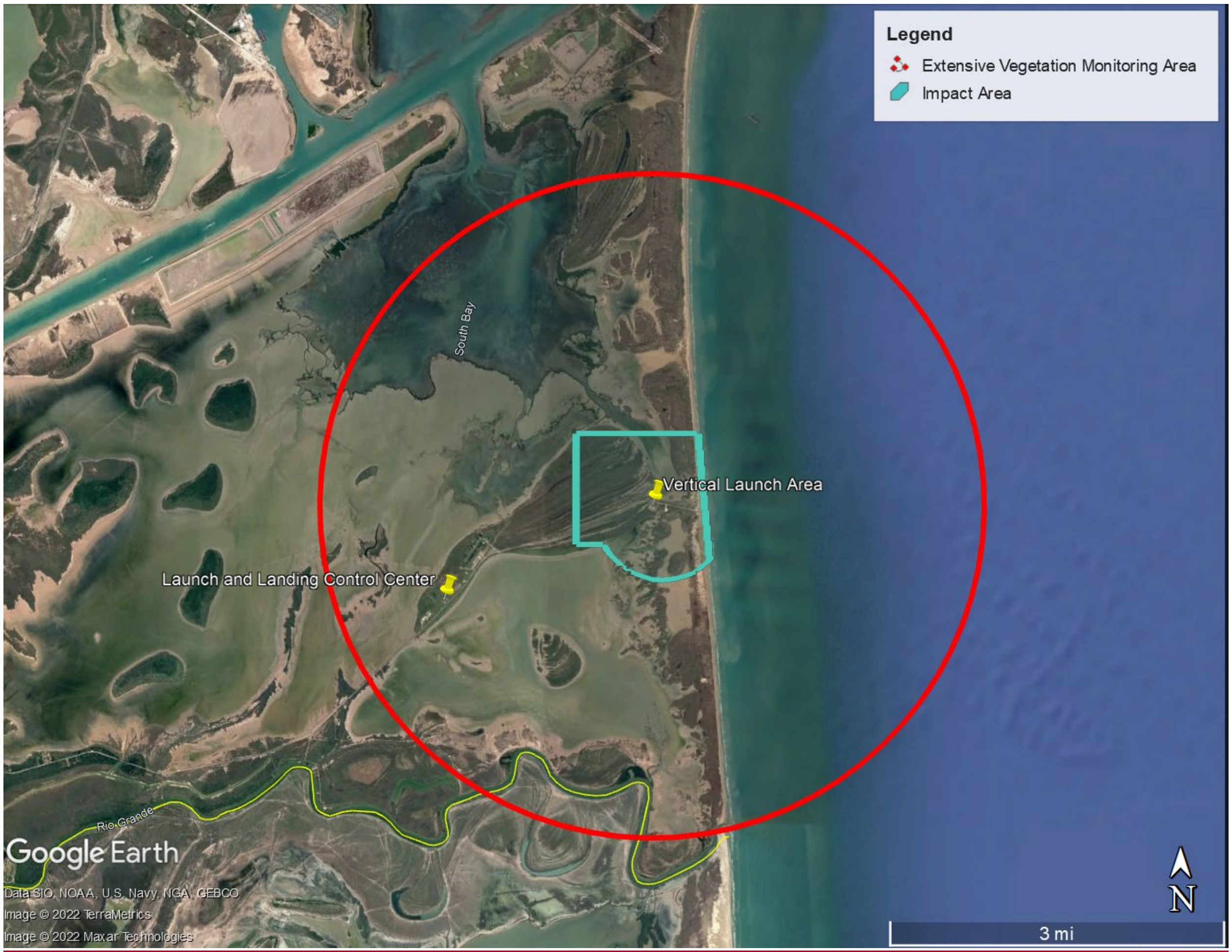


Figure 5 Remote Sensing Study Area

3.3 Reporting

The results of the intensive and extensive vegetation monitoring will be submitted to the FAA and USFWS in the Biological Monitoring Annual Report prior to March 1st of each subsequent year. This monitoring and reporting mechanism will ensure that vegetation and any potential induced changes are accurately tracked and reported.

If the monitoring report shows evidence that SpaceX operations are resulting in induced vegetation changes, then SpaceX will present the findings to the USFWS in the annual report. Depending on the nature of the reported changes, SpaceX will coordinate with USFWS to implement remediation measures as needed.

4.0 Sea Turtle Monitoring Plan

Five species of sea turtles are found in U.S. waters and nest on U.S. beaches: leatherback, hawksbill, loggerhead, green and Kemp's ridley. All are known to nest in Texas. The leatherback and hawksbill rarely nest in Texas but offshore waters are important feeding, resting, and migratory corridors.

SpaceX will be responsible for conducting monitoring for turtles in association with USFWS as stipulated in the April 22, 2022 Final BO and the 2022 PEA. Sea Turtle Inc. (STI) is authorized to perform nesting patrols and have partnered with SpaceX to conduct sea turtle monitoring since 2015. STI is a nonprofit 501(c)(3) organization that rescues, rehabilitates, and releases injured sea turtles. SpaceX plans to continue partnering with STI to conduct sea turtle monitoring.

4.1 Contractor Qualifications

Sea Turtle, Inc. currently performs sea turtle patrols along beaches in South Texas, including Boca Chica Beach. During non-nesting season (September to mid-March), STI conducts weekly beach surveys. During sea turtle nesting season (March to August), STI conducts daily beach surveys in the early morning through the late afternoon. STI is responsible for monitoring the lowermost approximately 50 miles of US coastline, from the Mansfield channel to the mouth of the Rio Grande River. The area monitored and patrolled by Sea Turtle Inc includes the beach on Boca Chica, from the mouth of the Rio Grande river at the US/Mexico border to the jetty pass at Brazos channel, (indicated by the pink line in Figure 6).

Surveys will be conducted by an approved Service section 10(a)(1)(A) scientific permit (Endangered Species Permit) holder that has gone through the appropriate training to be a certified sea turtle patroller. Certification training can be arranged with the Sea Turtle Coordinator located at PAIS.

The current USFWS permit holder for Sea Turtle Inc. (Dr. Amy Bonka) is a Kemp's ridley expert, with over 10 years of sea turtle experience. Dr Bonka's research has been focused on sea turtles, specifically the Kemp's ridley and she holds a USFWS Native Threatened and Endangered Species Recovery permit (ESA Section 10(A)1(a) permit) for work with sea turtles in Texas, as well as Texas Parks and Wildlife Department Scientific, Educational Display, and Rehabilitation permits. Sea Turtle Inc. is the primary USFWS permitted sea turtle rehabilitation facility for the South Padre Island/Boca Chica areas. Currently, annual state training is required for all nesting and stranding sea turtle work. Staff and volunteers at STI attend state nesting season training annually. Sea Turtle Inc staff provides additional training on nesting protocols specific to South Padre Island and Boca Chica beaches.

4.2 Survey Methodology

The study area is Boca Chica Beach, consisting of the beach from the southern U.S. border to the Brownsville Ship Channel jetties, shown below in Figure 6.

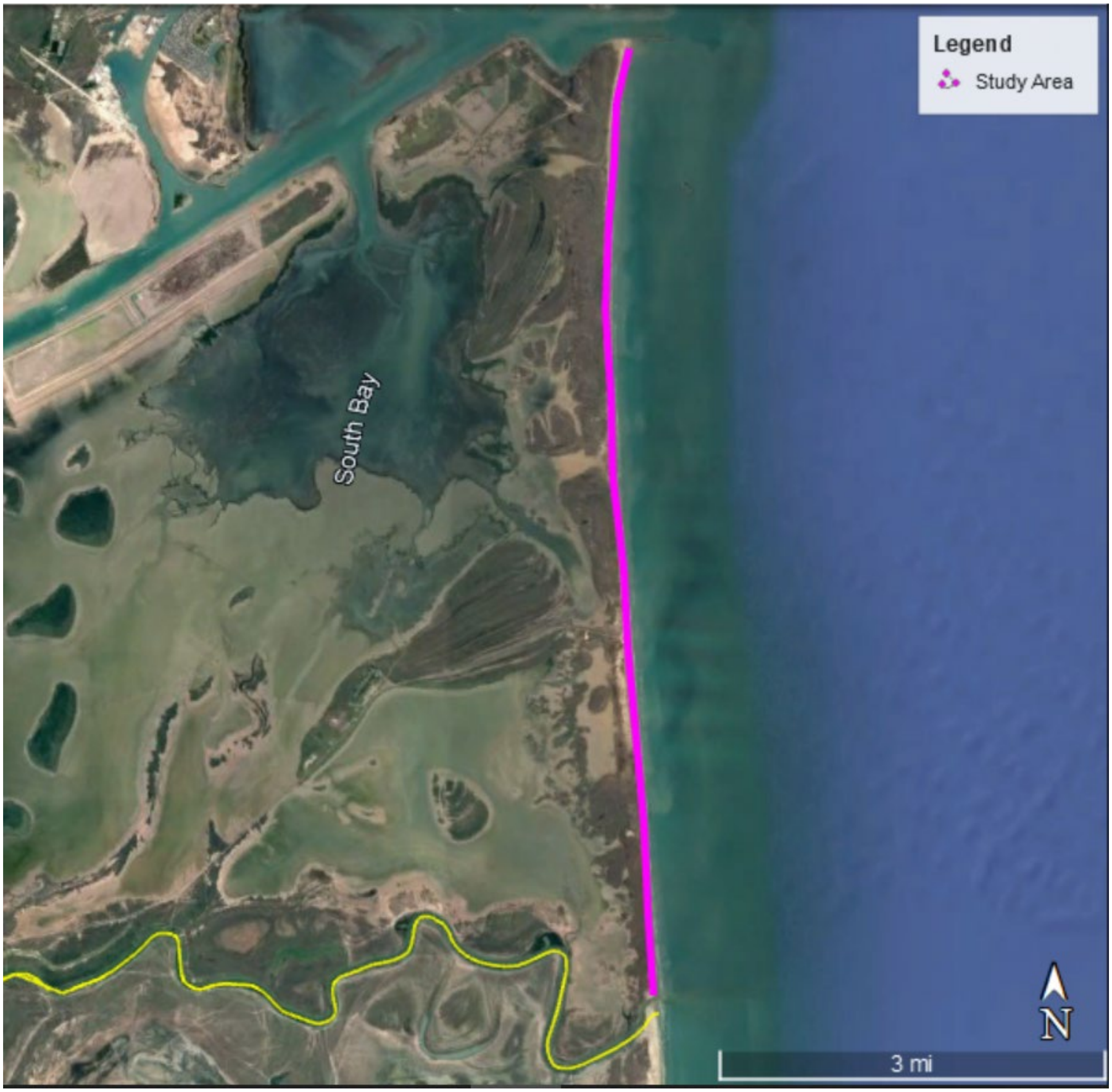


Figure 6. Sea Turtle Monitoring Study Area

Sea turtle crawl track and nest searches will be conducted during the monitoring surveys. When a sea turtle crawl track is found on the beach, monitoring staff will determine whether the crawl resulted in a nest. The GPS location and date of the crawl will be recorded in a Monitoring Field Record. If individuals are located during the surveys, species information, GPS location and date will be recorded in the Monitoring Field Record. STI collects all eggs encountered and transports them to their facility to be incubated and released after hatching. If a turtle, or turtle nest are discovered prior to road closure and security sweeps, SpaceX will coordinate with STI to ensure all eggs are removed prior to launch activities. STI will be given sufficient time to complete removal of all eggs or sea turtles.

When dead or stranded sea turtles are encountered, Sea Turtle Inc. utilizes a standard methodology for handling sea turtles. STI completes a stranding report for any turtle activity (live or dead), which documents the circumstances surrounding the death or injury. Information collected includes but is not limited to species, GPS location, cause of stranding, measurements of the individual, identifiers (eg. pit tags) and disposition (released, taken to Sea Turtle Inc. for rehabilitation). For deceased turtles encountered by STI, STI will record the above information on the individual and the probable cause of death. This report is submitted by STI to the Sea Turtle Stranding and Salvage Network (STSSN, NOAA) and the USFWS. STI shares summary information with SpaceX annually for the Biological Monitoring Annual Report.

In the event that SpaceX or STI activities on behalf of SpaceX result in the direct take (killing, harming, or maiming) of a sea turtle, hatchling, and/or eggs, the person(s) responsible for monitoring sea turtles shall notify SpaceX, the Service's Coastal Ecological Services Field Office (361/533-6765) and PAIS Sea Turtle Coordinator (361/949-8173, extension 226). If SpaceX staff encounter an injured or dead sea turtle, they will report the incident to the Sea Turtle Inc. 24/7 emergency number (956-761-4511) or Dr. Amy Bonka directly. The staff will describe the state of the turtle and the circumstances around the injury, take photographs of the turtle and the injuries, and provide them to Sea Turtle Inc. SpaceX would coordinate with STI and follow their directions for transferring the turtle to the STI facility for treatment and/or processing.

4.3 Monitoring Reporting and Notification Requirements

The results of each year's sea turtle monitoring efforts will be summarized in the Sea Turtle monitoring section of the Biological Monitoring Annual Report that will be submitted by SpaceX to the FAA and USFWS prior to March 1st of each year. The report will summarize all monitoring activities outlined in this plan. These annual reports will also document SpaceX's compliance with sea turtle conservation measures.

The Sea Turtle Monitoring section of the Biological Monitoring Annual Report will include the following:

- Summary of the patrol effort for the year
- Summary of the number of turtles and/or nests found that year by species
- A summary of any documented take, if any, by species.

Sea Turtle Inc shares their nesting and patrol data regarding activity on Boca Chica with SpaceX for SpaceX's Biological Monitoring Annual Report. This data is also provided by Sea Turtle Inc. to the USFWS for Sea Turtle Inc.'s annual report. Depending on the nature of the reported changes, SpaceX will coordinate with the Service to implement remediation measures as needed.

5.0 Literature Cited

United States Fish and Wildlife Service. 2003. Interim Survey Methodology for the Northern Aplomado Falcon (*Falco femoralis septentrionalis*) in Desert Grasslands. May.

Placeholder for Biological Opinion

Placeholder for PEA

November 7, 2013

Dr. Steve Davis
Space Exploration Technologies (SpaceX)
1030 15th Street NW Suite 220E
Washington, DC, 20005-1503

Mr. Juan Bosquez Jr., P.E.
San Benito Area Engineer
Texas Department of Transportation
P.O. Box 1041
San Benito, TX 78586

RE: SpaceX Roadway Closure Traffic Control Plan

Dear Mr. Bosquez:

Space Exploration Technologies Corp. (SpaceX) has proposed to construct and operate a private launch site in order to accommodate up to 12 (twelve) launches per year. The proposed private launch site will be located at the eastern terminus of State Highway (SH) 4 off the Gulf of Mexico and is needed to provide SpaceX with an exclusive launch facility that would allow the company to meet tight launch windows.

To support these launches, Space X would like to request from the Texas Department of Transportation (TxDOT) a "Revolving" Letter approval for the closure of SH 4 during launch and other hazardous operations. The approval shall have the following stipulations.

1. The "Revolving" Letter approval would be valid for a span of 1 (one) year; however, it would automatically renew annually unless revoked in writing by TxDOT, with a 60 day notice of termination.
2. SpaceX shall only close SH 4 for launch and other hazardous operations as determined by SpaceX in consultation, when necessary, with Cameron County and the Texas General Land Office.
3. The SH 4 roadway closure shall be in accordance to the attached Traffic Control plan, the Texas Manual on Uniform Traffic Control Devices, and all pertinent TxDOT Standards.
    a. A Hard Checkpoint will be provided as shown in the Traffic Control Plan. The Hard Checkpoint will be a "no pass" area determined by the hazard area. No one without SpaceX clearance would be permitted to pass by this hard checkpoint during launch and other hazardous operations.
    b. A Soft Checkpoint will be provided as shown in the Traffic Control Plan. The Soft Checkpoint will be the area where Government personnel, SpaceX personnel, emergency personnel, and anyone with property

    beyond this soft checkpoint could be granted admittance, but the general public would be denied access.

    c. These checkpoints shall be consistent with the findings in the Environmental Impact Statement.

4. SpaceX shall alert the TxDOT Brownsville Maintenance Office of all roadway closures at least 48 hours in advance.
5. A changeable message sign advising the traveling public of the roadway closure shall be set up 7 days in advance of any closures unless special approval is provided by TxDOT for shorter notice times.
6. Roadway closures will typically be for 6 hours with some instances lasting up to 15 hours maximum.
7. During all road closures, SpaceX, at its own expense, shall provide a private traffic management company or the local law enforcement agents to enforce the roadway closure.

If you have any questions or need additional information, please feel free to contact me. I look forward to hearing from you.

Sincerely,

Steve Davis
Director of Advanced Projects

Enclosure

Texas Department of Transportation
125 EAST 11TH STREET | AUSTIN, TEXAS 78701-2483 | (512) 463-8700 | WWW.TXDOT.GOV
1350 E. HIGHWAY 77 | P.O. BOX 1041 | SAN BENITO, TEXAS 78586 | (956)399-5102

December 9, 2013

Pete Sepulveda, Jr.
County Administrator
Cameron County
1100 E. Monroe, Suite 256
Brownsville, Texas 78520

RE: SpaceX Roadway Closure Traffic Control Plan

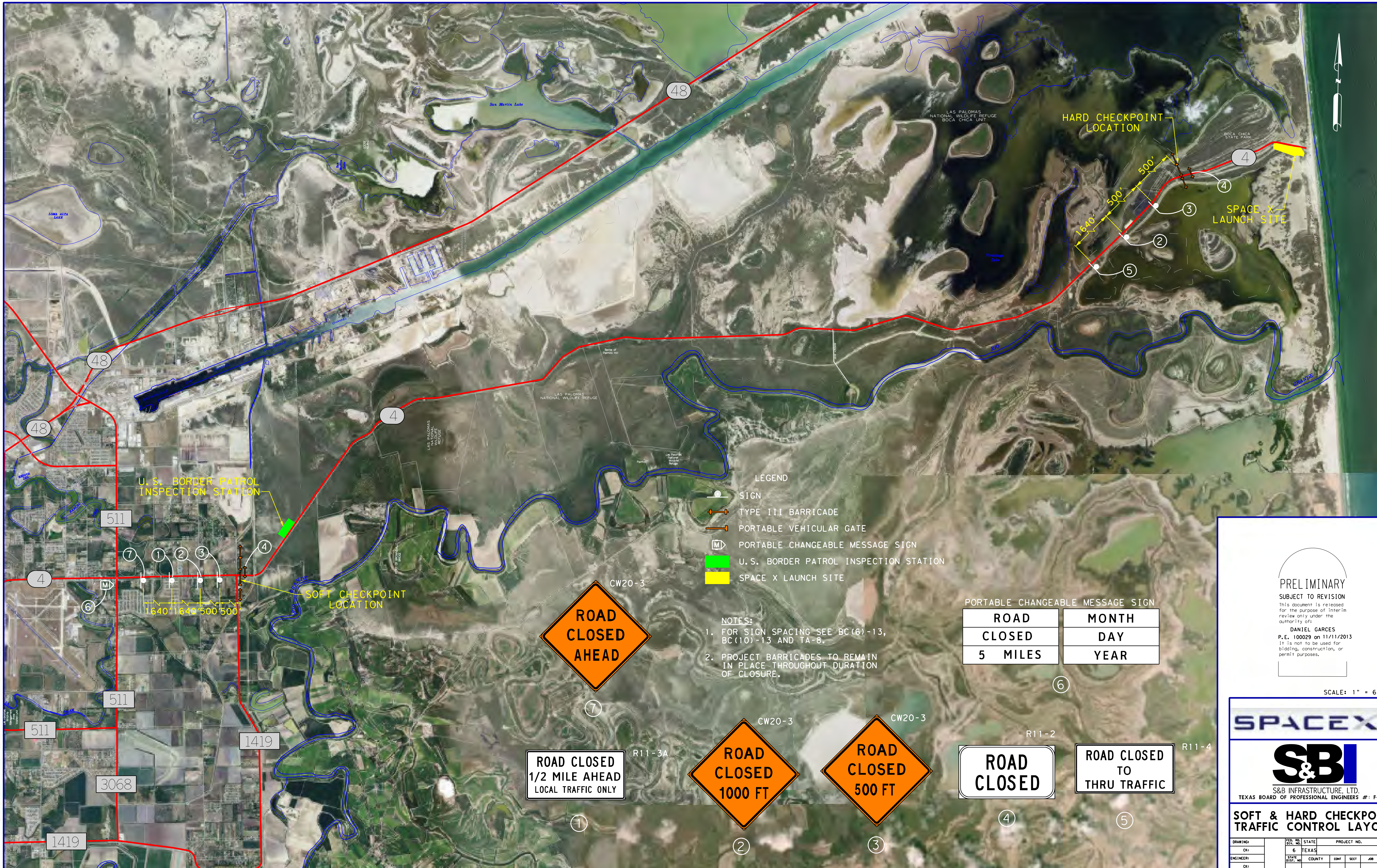
Dear Mr. Sepulveda,

This letter serves notification that the traffic control plan submitted by Space Exploration Technologies (Space X) on November 20, 2013 for review has been approved. This approval will allow Cameron County to perform road closures on SH 4 as per the submitted traffic control plan and standards. The Texas Department of Transportation will reserve the right to request changes to the traffic control plan as necessary to ensure the safety of the traveling public.

Sincerely,

Toribio Garza, P.E.
Pharr District Engineer
Texas Department of Transportation

Cc: Dr. Steve Davis
San Benito Area Office



PRELIMINARY

SUBJECT TO REVISION

This document is released for the purpose of interim review only under the authority of:

DANIEL GARCES

P.E. 100029 on 11/11/2013

It is not to be used for bidding, construction, or permit purposes.

SCALE: 1" = 6,000'

SPACEX

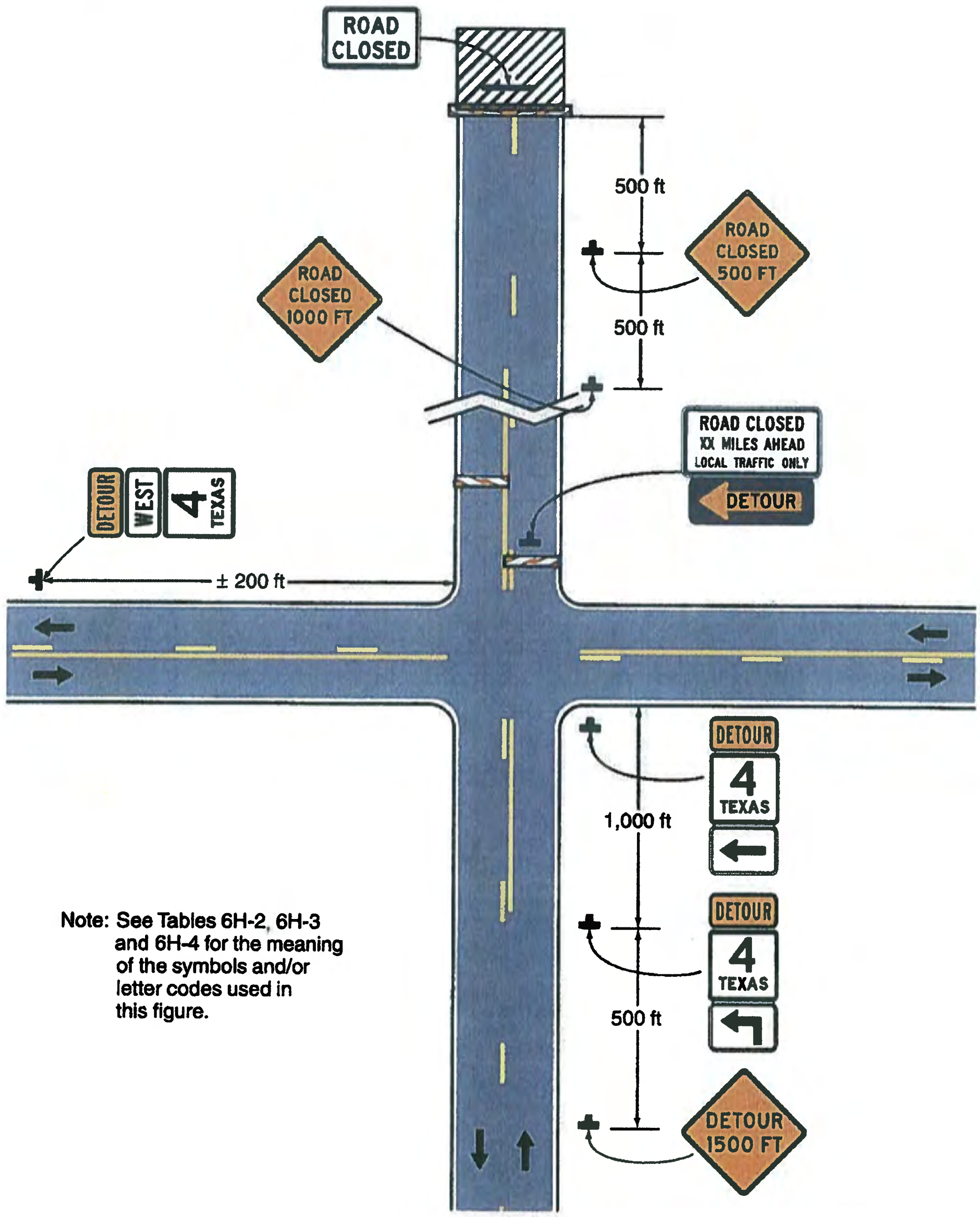
S&B INFRASTRUCTURE, LTD.

TEXAS BOARD OF PROFESSIONAL ENGINEERS #: F-1582

SOFT & HARD CHECKPOINT TRAFFIC CONTROL LAYOUT

DRAWING:		FED. RD. DIV. NO.	STATE	PROJECT NO.				HIGHWAY NO.
CK:		6	TEXAS					
ENGINEER:		STATE DIST. NO	COUNTY		CONT	SECT	JOB	SHEET NO.
CK:		PHR	CAMERON					
REVIEW:								
CK:								

Figure 6H-8. Road Closure with an Off-Site Detour (TA-8)



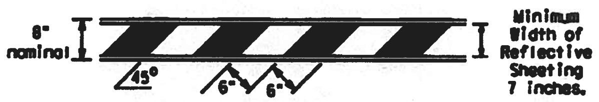
Note: See Tables 6H-2, 6H-3 and 6H-4 for the meaning of the symbols and/or letter codes used in this figure.

Typical Application 8

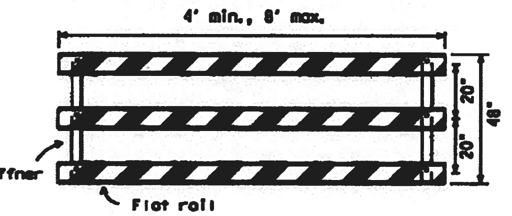
TYPE 3 BARRICADES

1. Refer to the Compliant Work Zone Traffic Control Devices List (CWZTCD) for details of the Type 3 Barricades and a list of all materials used in the construction of Type 3 Baricades.
2. Type 3 Barricades shall be used at each end of construction projects closed to all traffic.
3. Barricades extending across a roadway should have stripes that slope downward in the direction toward which traffic must turn in detouring. When both right and left turns are provided, the chevron striping may slope downward in both directions from the center of the barricade. Where no turns are provided at a closed road striping should slope downward in both directions toward the center of roadway.
4. Striping of rails, for the right side of the roadway, should slope downward to the left. For the left side of the roadway, striping should slope downward to the right.
5. Identification markings may be shown only on the back of the barricade rails. The maximum height of letters and/or company logos used for identification shall be 1".
6. Barricades shall not be placed parallel to traffic unless an adequate clear zone is provided.
7. Warning lights shall NOT be installed on barricades.
8. Where barricades require the use of weights to keep from turning over, the use of sandbags with dry, cohesionless sand is recommended. The sandbags will be tied shut to keep the sand from spilling and to maintain a constant weight. Sand bags shall not be stacked in a manner that covers any portion of a barricade rails reflective sheeting. Rock, concrete, iron, steel or other solid objects will NOT be permitted. Sandbags should weigh a minimum of 35 lbs and a maximum of 50 lbs. Sandbags shall be made of a durable material that tears upon vehicular impact. Rubber (such as tire inner tubes) shall not be used for sandbags. Sandbags shall only be placed along or upon the base supports of the device and shall not be suspended above ground level or hung with rope, wire, chains or other fasteners.
9. Sheeting for barricades shall be retroreflective Type A conforming to Departmental Material Specfication DMS-8300 unless otherwise noted.

Barricades shall NOT be used as a sign support.

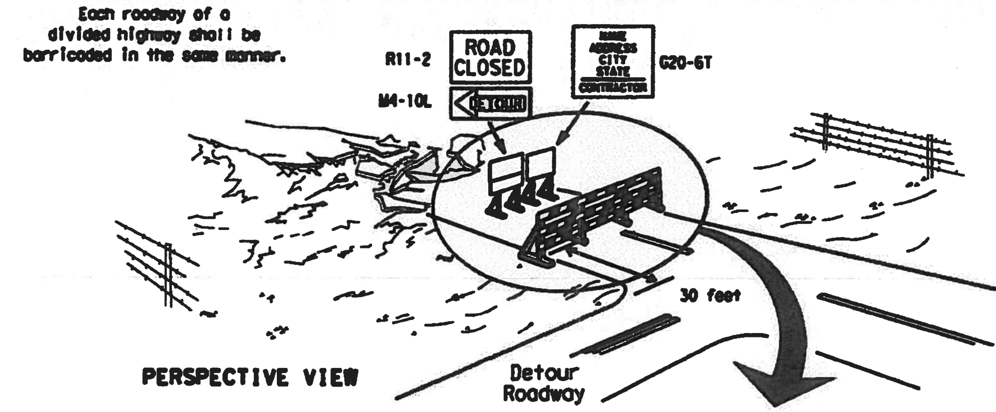


TYPICAL STRIPING DETAIL FOR BARRICADE RAIL



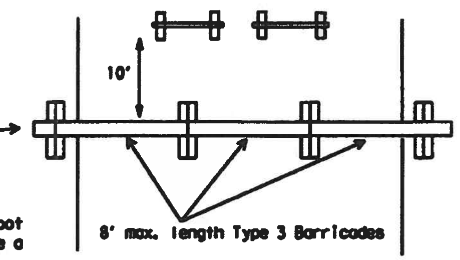
Stiffner may be inside or outside of support, but no more than 2 stiffeners shall be allowed on one barricade.

TYPICAL PANEL DETAIL FOR SKID OR POST TYPE BARRICADES



PERSPECTIVE VIEW

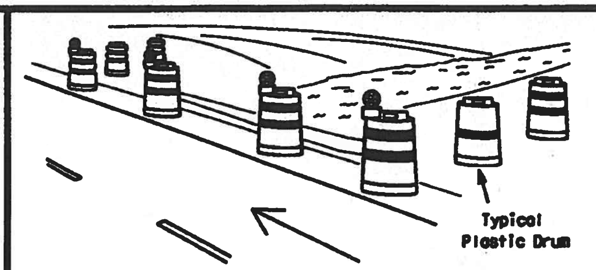
The three rails on Type 3 barricades shall be reflectorized orange and reflective white stripes on one side facing one-way traffic and both sides for two-way traffic.
Barricade striping should slant downward in the direction of detour.



PLAN VIEW

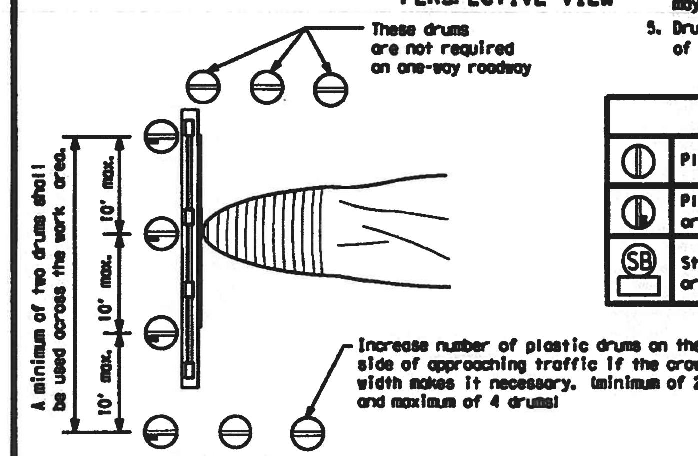
1. Signs should be mounted on independent supports at a 7 foot mounting height in center of roadway. The signs should be a minimum of 10 feet behind Type 3 Barricades.
2. Advance signing shall be as specified elsewhere in the plans.

TYPE 3 BARRICADE (POST AND SKID) TYPICAL APPLICATION



PERSPECTIVE VIEW

1. Where positive redirectional capability is provided, drums may be omitted.
2. Plastic construction fencing may be used with drums for safety as required in the plans.
3. Vertical Panels on flexible support may be substituted for drums when the shoulder width is less than 4 feet.
4. When the shoulder width is greater than 12 feet, steady-burn lights may be omitted if drums are used.
5. Drums must extend the length of the culvert widening.

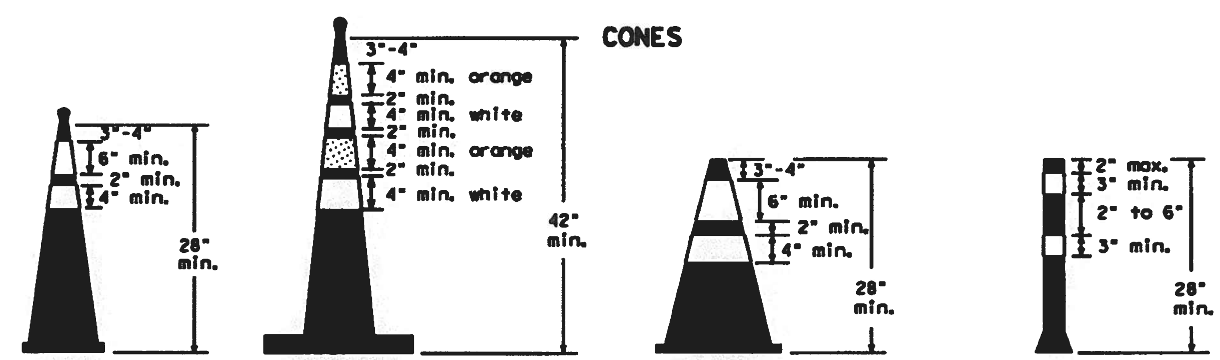


PLAN VIEW

LEGEND	
(symbol)	Plastic drum
(symbol)	Plastic drum with steady burn light or yellow warning reflector
SB	Steady burn warning light or yellow warning reflector

CULVERT WIDENING OR OTHER ISOLATED WORK WITHIN THE PROJECT LIMITS

CONES



Two-Piece cones

One-Piece cones

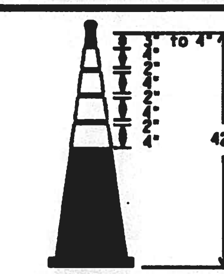
Tubular Marker

28" Cones shall have a minimum weight of 9 1/2 lbs.

42" 2-piece cones shall have a minimum weight of 30 lbs. including base.

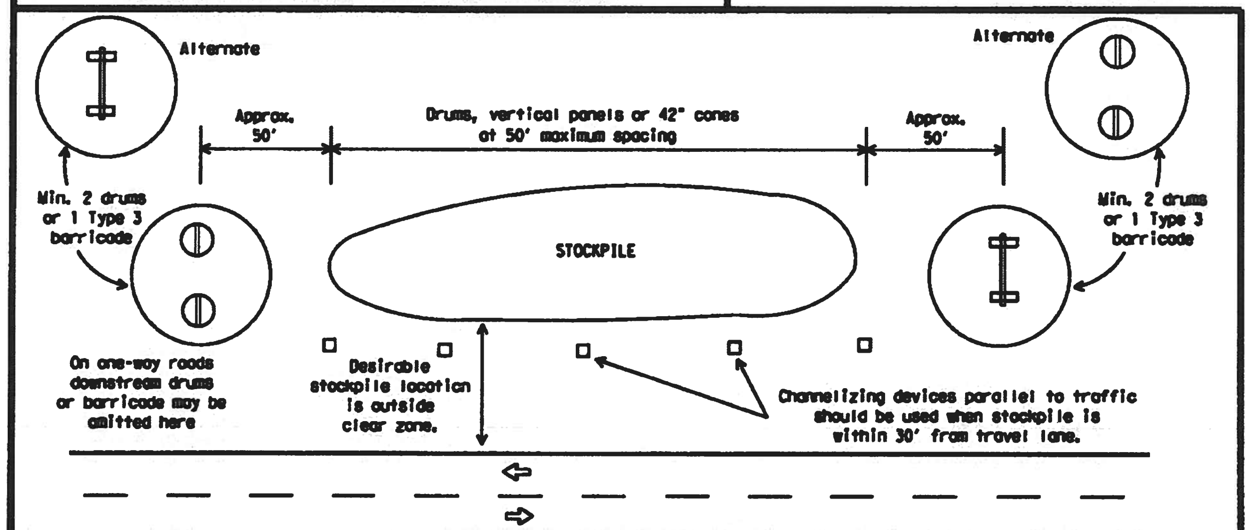
1. Traffic cones and tubular markers shall be predominantly orange, and meet the height and weight requirements shown above.
2. One-piece cones have the body and base of the cone molded in one consolidated unit. Two-piece cones have a cone shaped body and a separate rubber base, or ballast, that is added to keep the device upright and in place.
3. Two-piece cones may have a handle or loop extending up to 8" above the minimum height shown, in order to aid in retrieving the device.
4. Cones or tubular markers used at night shall have white or white and orange reflective bands as shown above. The reflective bands shall have a smooth, sealed outer surface and meet the requirements of Departmental Material Specification DMS-8300 Type A.
5. 28" cones and tubular markers are generally suitable for short duration and short-term stationary work as defined on BC(4). These should not be used for intermediate-term or long-term stationary work unless personnel is on-site to maintain them in their proper upright position.
6. 42" two-piece cones, vertical panels or drums are suitable for all work zone durations.
7. Cones or tubular markers used on each project should be of the same size and shape.

THIS DEVICE SHALL NOT BE USED ON PROJECTS LET AFTER MARCH 2014.



EDGELINE CHANNELIZER

1. This device is intended only for use in place of a vertical panel to channelize traffic by indicating the edge of the travel lane. It is not intended to be used in transitions or tapers.
2. This device shall not be used to separate lanes of traffic (opposing or otherwise) or warn of objects.
3. This device is based on a 42 inch, two-piece cone with an alternate striping pattern: four 4 inch retroreflective bands, with an approximate 2 inch gap between bands. The color of the band should correspond to the color of the edgeline (yellow for left edgeline, white for right edgeline) for which the device is substituted or for which it supplements. The reflectorized bands shall be retroreflective Type A conforming to Departmental Material Specification DMS-8300, unless otherwise noted.
4. The base must weigh a minimum of 30 lbs.



TRAFFIC CONTROL FOR MATERIAL STOCKPILES

SHEET 10 OF 12

Texas Department of Transportation — Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION CHANNELIZING DEVICES

BC(10)-13

FILE:	bc-13.dgn	DN: TxDOT	CK: TxDOT	DW: TxDOT	CK: TxDOT
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REVISIONS 9-07 7-13		DIST	COUNTY		SHEET NO.

104

DATE:
FILE:

WHEN NOT IN USE, REMOVE THE PCMS FROM THE RIGHT-OF-WAY OR PLACE THE PCMS BEHIND BARRIER OR GUARDRAIL WITH SIGN PANEL TURNED PARALLEL TO TRAFFIC

PORTABLE CHANGEABLE MESSAGE SIGNS

1. The Engineer/Inspector shall approve all messages used on portable changeable message signs (PCMS).
2. Messages on PCMS should contain no more than 8 words (about four to eight characters per word), not including simple words such as "TO," "FOR," "AT," etc.
3. Messages should consist of a single phase, or two phases that alternate. Three-phase messages are not allowed. Each phase of the message should convey a single thought, and must be understood by itself.
4. Use the word "EXIT" to refer to an exit ramp on a freeway; i.e., "EXIT CLOSED." Do not use the term "RAMP."
5. Always use the route or interstate designation (IH, US, SH, FM) along with the number when referring to a roadway.
6. When in use the bottom of a stationary PCMS message panel should be a minimum 7 feet above the roadway, where possible.
7. The message term "WEEKEND" should be used only if the work is to start on Saturday morning and end by Sunday evening at midnight. Actual days and hours of work should be displayed on the PCMS if work is to begin on Friday evening and/or continue into Monday morning.
8. The Engineer/Inspector may select one of two options which are available for displaying a two-phase message on a PCMS. Each phase may be displayed for either four seconds each or for three seconds each.
9. Do not "flash" messages or words included in a message. The message should be steady burn or continuous while displayed.
10. Do not present redundant information on a two-phase message; i.e., keeping two lines of the message the same and changing the third line.
11. Do not use the word "Danger" in message.
12. Do not display the message "LANES SHIFT LEFT" or "LANES SHIFT RIGHT" on a PCMS. Drivers do not understand the message.
13. Do not display messages that scroll horizontally or vertically across the face of the sign.
14. The following table lists abbreviated words and two-word phrases that are acceptable for use on a PCMS. Both words in a phrase must be displayed together. Words or phrases not on this list should not be abbreviated, unless shown in the TMUTCD.
15. PCMS character height should be at least 18 inches for trailer mounted units. They should be visible from at least 1/2 (.5) mile and the text should be legible from at least 600 feet at night and 800 feet in daylight. Truck mounted units must have a character height of 10 inches and must be legible from at least 400 feet.
16. Each line of text should be centered on the message board rather than left or right justified.
17. If disabled, the PCMS should default to an illegible display that will not alarm motorists and will only be used to alert workers that the PCMS has malfunctioned. A pattern such as a series of horizontal solid bars is appropriate.

WORD OR PHRASE	ABBREVIATION	WORD OR PHRASE	ABBREVIATION
Access Road	ACCS RD	Major	MAJ
Alternate	ALT	Miles	MI
Avenue	AVE	Miles Per Hour	MPH
Best Route	BEST RTE	Minor	MNR
Boulevard	BLVD	Monday	MON
Bridge	BRDG	Normal	NORM
Cannot	CANT	North	N
Center	CTR	Northbound	(route) N
Construction Ahead	CONST AHD	Parking	PKING
CROSSING	XING	Road	RD
Detour Route	DETOUR RTE	Right Lane	RT LN
Do Not	DONT	Saturday	SAT
East	E	Service Road	SERV RD
Eastbound	(route) E	Shoulder	SHLDR
Emergency	EMER	Slippery	SLIP
Emergency Vehicle	EMER VEH	South	S
Entrance, Enter	ENT	Southbound	(route) S
Express Lane	EXP LN	Speed	SPD
Expressway	EXPWY	Street	ST
XXXX Feet	XXXX FT	Sunday	SUN
Fog Ahead	FOG AHD	Telephone	PHONE
Freeway	FRWY, FWY	Temporary	TEMP
Freeway Blocked	FWY BLKD	Thursday	THURS
Friday	FRI	To Downtown	TO DWNTN
Hazardous Driving	HAZ DRIVING	Traffic	TRAF
Hazardous Material	HAZMAT	Travelers	TRVLRS
High-Occupancy Vehicle	HOV	Tuesday	TUES
Highway	HWY	Time Minutes	TIME MIN
Hour (s)	HR, HRS	Upper Level	UPR LEVEL
Information	INFO	Vehicles (s)	VEH, VEHS
It Is	ITS	Warning	WARN
Junction	JCT	Wednesday	WED
Left	LFT	Weight Limit	WT LIMIT
Left Lane	LFT LN	West	W
Lane Closed	LN CLOSED	Westbound	(route) W
Lower Level	LWR LEVEL	Wet Pavement	WET PVMT
Maintenance	MAINT	Will Not	WONT

Roadway designation = IH-number, US-number, SH-number, FM-number

RECOMMENDED PHASES AND FORMATS FOR PCMS MESSAGES DURING ROADWORK ACTIVITIES

(The Engineer may approve other messages not specifically covered here.)

Phase 1: Condition Lists

Road/Lane/Ramp Closure List

FREEWAY CLOSED X MILE	FRONTAGE ROAD CLOSED
ROAD CLOSED AT SH XXX	SHOULDER CLOSED XXX FT
ROAD CLSD AT FM XXXX	RIGHT LN CLOSED XXX FT
RIGHT X LANES CLOSED	RIGHT X LANES OPEN
CENTER LANE CLOSED	DAYTIME LANE CLOSURES
NIGHT LANE CLOSURES	I-XX SOUTH EXIT CLOSED
VARIOUS LANES CLOSED	EXIT XXX CLOSED X MILE
EXIT CLOSED	RIGHT LN TO BE CLOSED
MALL DRIVEWAY CLOSED	X LANES CLOSED TUE - FRI
XXXXXXXX BLVD CLOSED	

Other Condition List

ROADWORK XXX FT	ROAD REPAIRS XXXX FT
FLAGGER XXXX FT	LANE NARROWS XXXX FT
RIGHT LN NARROWS XXXX FT	TWO-WAY TRAFFIC XX MILE
MERGING TRAFFIC XXXX FT	CONST TRAFFIC XXX FT
LOOSE GRAVEL XXXX FT	UNEVEN LANES XXXX FT
DETOUR X MILE	ROUGH ROAD XXXX FT
ROADWORK PAST SH XXXX	ROADWORK NEXT FRI-SUN
BUMP XXXX FT	US XXX EXIT X MILES
TRAFFIC SIGNAL XXXX FT	LANES SHIFT *

* LANES SHIFT in Phase 1 must be used with STAY IN LANE in Phase 2.

Phase 2: Possible Component Lists

Action to Take/Effect on Travel List

MERGE RIGHT	FORM X LINES RIGHT
DETOUR NEXT X EXITS	USE XXXXX RD EXIT
USE EXIT XXX	USE EXIT I-XX NORTH
STAY ON US XXX SOUTH	USE I-XX E TO I-XX N
TRUCKS USE US XXX N	WATCH FOR TRUCKS
WATCH FOR TRUCKS	EXPECT DELAYS
EXPECT DELAYS	PREPARE TO STOP
REDUCE SPEED XXX FT	END SHOULDER USE
USE OTHER ROUTES	WATCH FOR WORKERS
STAY IN LANE *	

Location List

AT FM XXXX
BEFORE RAILROAD CROSSING
NEXT X MILES
PAST US XXX EXIT
XXXXXXX TO XXXXXXX
US XXX TO FM XXXX

Warning List

SPEED LIMIT XX MPH
MAXIMUM SPEED XX MPH
MINIMUM SPEED XX MPH
ADVISORY SPEED XX MPH
RIGHT LANE EXIT
USE CAUTION
DRIVE SAFELY
DRIVE WITH CARE

** Advance Notice List

TUE-FRI XX AM- X PM
APR XX- XX X PM-X AM
BEGINS MONDAY
BEGINS MAY XX
MAY X-X XX PM - XX AM
NEXT FRI-SUN
XX AM TO XX PM
NEXT TUE AUG XX
TONIGHT XX PM- XX AM

** See Application Guidelines Note 6.

APPLICATION GUIDELINES

1. Only 1 or 2 phases are to be used on a PCMS.
2. The 1st phase (or both) should be selected from the "Road/Lane/Ramp Closure List" and the "Other Condition List".
3. A 2nd phase can be selected from the "Action to Take/Effect on Travel, Location, General Warning, or Advance Notice Phase Lists".
4. A Location Phase is necessary only if a distance or location is not included in the first phase selected.
5. If two PCMS are used in sequence, they must be separated by a minimum of 1000 ft. Each PCMS shall be limted to two phases, and should be understandable by themselves.
6. For advance notice, when the current date is within seven days of the actual work date, calendar days should be replaced with days of the week. Advance notification should typically be for no more than one week prior to the work.

WORDING ALTERNATIVES

1. The words RIGHT, LEFT and ALL can be interchanged as appropriate.
2. Roadway designations IH, US, SH, FM and LP can be interchanged as appropriate.
3. EAST, WEST, NORTH and SOUTH (or abbreviations E, W, N and S) can be interchanged as appropriate.
4. Highway names and numbers replaced as appropriate.
5. ROAD, HIGHWAY and FREEWAY can be interchanged as needed.
6. AHEAD may be used instead of distances if necessary.
7. FT and MI, MILE and MILES interchanged as appropriate.
8. AT, BEFORE and PAST interchanged as needed.
9. Distances or AHEAD can be eliminated from the message if a location phase is used.

PCMS SIGNS WITHIN THE R.O.W. SHALL BE BEHIND GUARDRAIL OR CONCRETE BARRIER OR SHALL HAVE A MINIMUM OF FOUR (4) PLASTIC DRUMS PLACED PERPENDICULAR TO TRAFFIC ON THE UPSTREAM SIDE OF THE PCMS, WHEN EXPOSED TO ONE DIRECTION OF TRAFFIC. WHEN EXPOSED TO TWO WAY TRAFFIC, THE FOUR DRUMS SHOULD BE PLACED WITH ONE DRUM AT EACH OF THE FOUR CORNERS OF THE UNIT.

FULL MATRIX PCMS SIGNS

1. When Full Matrix PCMS signs are used, the character height and legibility/visibility requirements shall be maintained as listed in Note 15 under "PORTABLE CHANGEABLE MESSAGE SIGNS" above.
2. When symbol signs, such as the "Flagger Symbol"(CW20-7) are represented graphically on the Full Matrix PCMS sign and, with the approval of the Engineer, it shall maintain the legibility/visibility requirement listed above.
3. When symbol signs are represented graphically on the Full Matrix PCMS, they shall only supplement the use of the static sign represented, and shall not substitute for, or replace that sign.
4. A full matrix PCMS may be used to simulate a flashing arrow board provided it meets the visibility, flash rate and dimming requirements on BC(7), for the same size arrow.

Texas Department of Transportation

Traffic Operations Division Standard

BARRICADE AND CONSTRUCTION PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

BC(6)-13

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