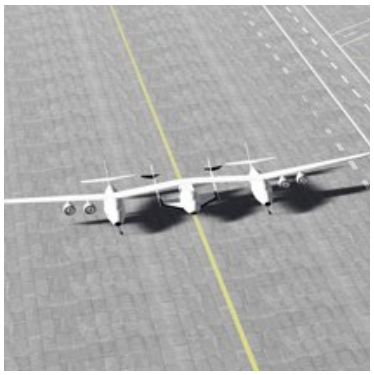
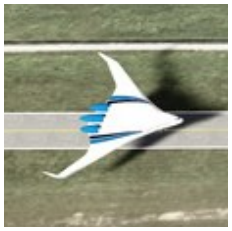
Federal Aviation Administration

Final Environmental Assessment, Finding of No Significant Impact, and Record of Decision for the Houston Spaceport, City of Houston, Harris County, Texas

June 2015





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Final Environmental Assessment for the Houston Spaceport, City of Houston, Harris County, Texas

AGENCY: Federal Aviation Administration (FAA), lead; National Aeronautics and Space Administration, cooperating agency.

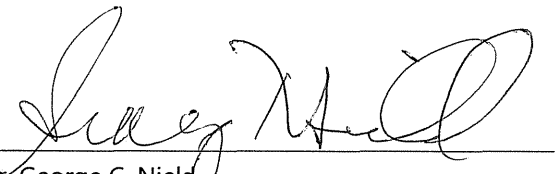
ABSTRACT: This Final Environmental Assessment (EA) addresses the potential environmental impacts of Houston Airport System's (HAS's) proposal to establish and operate a commercial space launch site at the Ellington Airport (EFD), in Houston, Texas and offer the site to prospective commercial space launch operators for the operation of horizontal take-off and horizontal landing Concept X and Concept Z reusable launch vehicles (RLVs). To operate a commercial space launch site, HAS must obtain a commercial space launch site operator license from the FAA. Under the Proposed Action addressed in this EA, the FAA would: (1) issue a launch site operator license to HAS for the operation of a commercial space launch site at EFD; (2) issue launch licenses to prospective commercial space launch operators that would allow them to conduct launches of horizontal take-off and horizontal landing Concept X and Concept Z RLVs from EFD, and (3) provide unconditional approval to the Airport Layout Plan (ALP) modifications that reflect the designation of a spaceport boundary and construction of planned spaceport facilities and infrastructure. Proposed launch operations would begin in 2015 and continue through 2019 in accordance with the terms of the launch site operator license. HAS proposes to provide RLV operators the ability to conduct up to 50 launches and landings (or 100 operations) per year, with approximately five percent of the operations expected to occur during night-time hours.

This EA evaluates the potential direct, indirect, and cumulative environmental effects that may result from the Proposed Action. The successful completion of the environmental review process does not guarantee that the FAA would issue a launch site operator license to HAS or launch licenses to RLV operators. Nor does completion of the NEPA process guarantee the FAA would provide unconditional ALP approval. The project must also meet all FAA safety, risk, and financial responsibility requirements per 14 Code of Federal Regulations (CFR) Part 400 and not affect adversely the safety, utility, or efficiency of the airport per 49 United States Code (U.S.C.) § 47107(a)(16).

CONTACT INFORMATION: To request a copy of the Final EA, please contact Mr. Daniel Czelusniak, Office of Commercial Space Transportation, Federal Aviation Administration, 800 Independence Avenue, SW, Suite 325, Washington, DC 20591; email Daniel.Czelusniak@faa.gov; or phone (202) 267-5924.

This environmental assessment becomes a federal document when evaluated, signed, and dated by the responsible FAA Official.

Issued in Washington DC on: June 22, 2015



Dr. George C. Nield
Associate Administrator for
Commercial Space Transportation

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DEPARTEMENT OF TRANSPORTATION

DATE: June 22, 2015

AGENCY: Federal Aviation Administration (FAA)

ACTION: Houston Spaceport, City of Houston, Harris County, Texas, Finding of No Significant Impact (FONSI) and Record of Decision (ROD)

SUMMARY: The FAA prepared the attached Final Environmental Assessment (EA) in accordance with the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] § 4321 et seq.), Council on Environmental Quality NEPA implementing regulations (40 Code of Federal [CFR] parts 1500 to 1508), FAA Order 1050.1E, Change 1, Environmental Impacts: Policies and Procedures, and FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions, to evaluate the potential environmental impacts of the Houston Airport System's (HAS) proposal to operate a commercial space launch site (referred to as the Houston Spaceport) at Ellington Airport (EFD) and offer the site to commercial space launch operators for the operation of horizontal take-off and horizontal landing reusable launch vehicles (RLVs). To operate a commercial space launch site, HAS must obtain a launch site operator license from the FAA.

After reviewing and analyzing currently available data and information on existing conditions and the potential impacts of the Proposed Action, the FAA has determined that the Proposed Action would not significantly impact the quality of the human environment. Therefore, preparation of an Environmental Impact Statement is not required, and the FAA is issuing this FONSI/ROD. The FAA made this determination in accordance with all applicable environmental laws. The Final EA is incorporated by reference in this FONSI/ROD.

FOR A COPY OF THE EA: Visit the following internet address: http://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/operator / or contact Daniel Czelusniak, Office of Commercial Space Transportation, Federal Aviation Administration, 800 Independence Ave., SW, Suite 325, Washington, DC 20591; e-mail Daniel.Czelusniak@faa.gov; or phone (202) 267-5924.

PURPOSE AND NEED: The purpose of the FAA action in connection with HAS's proposal is to fulfill the FAA's responsibilities under the Commercial Space Launch Act, 51 U.S.C. Subtitle V, Ch. 509 §§ 50901-50923, for oversight of commercial space launch activities, including issuing launch site operator licenses for the operation of commercial space launch sites, and launch licenses to operate reusable orbital and suborbital launch vehicles. The Proposed Action would be consistent with the objectives of the Commercial Space Launch Act.

The need for the FAA action of issuing a launch site operator license and launch licenses results from the statutory direction from Congress under the Commercial Space Launch Act to protect the public health and safety, safety of property, and national security and foreign policy interests of the U.S. and to encourage, facilitate, and promote commercial space launch and reentry activities by the private sector in order to strengthen and expand U.S. space transportation infrastructure.

Additionally, the purpose and need of the FAA action, in connection with HAS's request, is to ensure the proposed alterations at EFD do not adversely affect the safety, utility, or efficiency of EFD. Pursuant to 49

U.S.C. § 47107(a)(16), the FAA Administrator (under authority delegated from the Secretary of Transportation) must approve any revision or modification to an Airport Layout Plan (ALP) before the revision or modification takes effect. The Administrator's approval reflects a determination that the proposed alterations to the airport, reflected in the ALP revision or modification, do not adversely affect the safety, utility, or efficiency of the airport.

The purpose of HAS's proposal to establish a commercial space launch site at EFD is to help the City of Houston achieve its economic goals. Establishing a launch site at EFD would enable a HAS airport to serve as an alternative to a federal launch facility or other commercial launch sites for the operation of horizontally-launched and horizontally-landed Concept X and Z launch vehicles. HAS's need for the proposed commercial space launch site is to further the City's goals to grow economic activity within the City and support economic activity in the region. HAS's mission statement is to connect people, businesses, cultures, and economies of the world to Houston. The City of Houston Economic Development Division promotes diversifying the local economy and enhancing the region as a business and employment center. The City's strategy is to provide development areas that attract and accommodate the needs of new businesses.

PROPOSED ACTION: Under the Proposed Action addressed in this EA, the FAA would: (1) issue a launch site operator license to HAS for the operation of a commercial space launch site at EFD, (2) issue launch licenses to prospective operators that would allow them to conduct launches of horizontal take-off and horizontal landing RLVs from EFD, and (3) provide unconditional approval to the ALP modifications that reflect the designation of a spaceport boundary and existing and planned spaceport facilities and infrastructure. Under the modified ALP, the spaceport boundary would be coterminous with the airport property boundary.

ALTERNATIVES CONSIDERED: Alternatives analyzed in the Final EA include the Proposed Action and the No Action Alternative. Under the No Action Alternative, the FAA would not issue a launch site operator license to HAS and would not issue launch licenses to individual launch vehicle operators to operate at EFD. Also, there would be no need to update the EFD ALP, and thus there would be no FAA approval of a revised ALP. Existing operations would continue at EFD.

PUBLIC INVOLVEMENT: Agency consultation and coordination was conducted to obtain meaningful input regarding the Proposed Action and potential for environmental impacts. Additionally, the Draft EA was published for agency and public review and comment. See Appendix F of the Final EA for the agency and public involvement documentation, including public meeting materials, comments received, and FAA's responses to comments received on the Draft EA.

REGIONS OF INFLUENCE: This EA examines two Regions of Influence (ROIs) encompassing the areas potentially subject to impacts caused by construction and operations. The two ROIs are referred to as the "construction ROI" and "operation ROI." The construction ROI represents: (1) the area where ground disturbance could potentially occur during construction of the Proposed Action and (2) the environment immediately surrounding EFD. The construction ROI is defined by the U.S. Census block groups directly adjacent to EFD's property and encompasses approximately 19 square miles. The U.S. Census block groups were used to define the construction ROI in order to more accurately describe the population and economic characteristics of the area surrounding EFD which could experience construction-related effects.

For environmental considerations dealing with impacts from operations, an operation ROI was established. The operation ROI is based on the operational area associated with the Proposed Action, including EFD, the area below the RLV's flight path to the Gulf of Mexico, and the nominal sonic boom contour that could result from RLV reentry. The operation ROI encompasses approximately 7,000 square miles and includes portions of Harris, Brazoria, and Galveston Counties, with a majority of this ROI over the Gulf of Mexico. Figure 3-1 in the EA shows the construction and operation ROIs.

ENVIRONMENTAL IMPACTS AND AGENCY FINDINGS: The potential environmental impacts from the No Action Alternative and the Proposed Action were evaluated in the attached Final EA for each environmental impact category identified in FAA Order 1050.1E.

Chapter 3 of the Final EA describes the physical, natural, and human environment within the project ROIs. In addition, this chapter identifies those environmental impact categories that are not analyzed in detail, explaining why the Proposed Action would have no potential effect on those impact categories. Those categories are farmlands and wild and scenic rivers.

Chapter 4 of the Final EA provides evaluations of the potential environmental consequences of each alternative for each of the environmental impact categories analyzed in detail (including the construction-related impacts in each category) and documents the finding that no significant environmental impacts would result from the Proposed Action. In addition, Chapter 4 addresses the requirements of special purpose laws, regulations, and executive orders as set forth in Section 1.6 of the Final EA.

A summary of the documented findings for each impact category, including requisite findings with respect to relevant special purpose laws, regulations, and executive orders, follows:

- Air Quality, Final EA Section 4.1. Air pollutant emissions that would result from the Proposed Action would not result in exceedance of any National Ambient Air Quality Standard. Therefore, the FAA has determined there would be no significant air quality impacts.
- Climate, Final EA Section 4.2. When compared against the No Action Alternative, the Proposed Action's impacts on climate are negligible and therefore, the FAA has determined there would be no significant climate impacts.
- Coastal Resources, Final EA Section 4.3. Implementation of the Proposed Action would result in development entirely on EFD property and would result in no impacts to coastal zone resources. Therefore, the FAA has determined that there would be no significant impacts to coastal resources.
- Compatible Land Use, Final EA Section 4.4. A significant land use impact would occur if analysis shows that the Proposed Action would cause a significant noise impact. Based on noise analyses conducted with respect to rocket launch noise, including sonic booms, the FAA has determined the Proposed Action would result in no significant noise impacts and would not significantly impact land use compatibility.
- Department of Transportation Act, Section 4(f) Properties, Final EA Section 4.5. The FAA has determined that there would be no actual or constructive use of any Section 4(f) property within the region of influence of the Proposed Action and, therefore, no significant impacts.
- Fish, Wildlife, and Plants, Final EA Section 4.6. The FAA has determined the Proposed Action would not result in significant impacts to biological resources. In compliance with Section 7 of the ESA, the FAA has determined the Proposed Action would have "no effect" on federally listed species.

Similarly, the Proposed Action would not result in significant impacts on state-listed and non-listed species.

- Floodplains, Final EA Section 4.7. The Proposed Action would not involve development or construction activities within a floodplain, and the introduction of additional impervious surfaces would not have a significant adverse effect on the natural or beneficial values of nearby floodplains. Additionally, as there would be no floodplain encroachment, the project would be compliant with EO 11988, Floodplain Management. Therefore, the Proposed Action would not result in a significant adverse effect to floodplains.
- Hazardous Materials, Pollution Prevention, and Solid Waste, Final EA Section 4.8. Activities associated with the Proposed Action which would require the handling of hazardous materials, hazardous wastes, and solid wastes would be undertaken in accordance with all relevant federal, state, and local regulations pertaining to these substances. Therefore, the FAA has determined that the Proposed Action would result in no significant impacts in this category.
- Historical, Architectural, Archaeological, and Cultural Resources, Final EA Section 4.9 and Appendix D. In accordance with Section 106 of the National Historic Preservation Act and in consultation with the State Historic Preservation Officer (SHPO), the FAA has determined, and the SHPO has concurred, that the Proposed Action would result in no historic properties affected. Therefore, there would be no significant impacts in this category.
- Light Emissions and Visual Impacts, Final EA Section 4.10. The Proposed Action would have more light emissions and differ visually compared to the No Action Alternative. However, the additional infrastructure would not represent a visual impact compared to the No Action Alternative. The RLVs are anticipated to have similar lighting as aircraft currently operating at EFD during the nighttime hours. Therefore, there would be no significant impacts in this category.
- Natural Resources and Energy Supply, Final EA Section 4.11. The Proposed Action would not require the use of unusual materials or materials in short supply and would not measurably increase demand on local supplies of energy or natural resources. For these resources, implementation of the Proposed Action would not cause significant impacts with respect to natural resources or energy supplies.
- Noise, Final EA section 4.12. Based on noise analyses conducted with respect to rocket launch noise, including sonic booms, the FAA has determined the Proposed Action would result in no significant noise impacts.
- Secondary (Induced) Impacts, Final EA Section 4.13. Short-term construction-related employment of local contractors would occur as a result of the Proposed Action and is considered a positive impact. Flights associated with the Proposed Action would not cause significant air quality, noise, compatible land use, or socioeconomic impacts to the construction or operation ROIs. The Proposed Action would not increase other activities that could potentially add to direct or indirect impacts in these areas (e.g., increased vehicular emissions causing a significant air quality impact). Therefore, a significant secondary (induced) impact would not occur.
- Socioeconomic Impacts, Environmental Justice, and Children's Health and Safety Risks, Final EA Section 4.14. The FAA has determined the Proposed Action would result in no significant socioeconomic impacts. Since Proposed Action would not result in environmental impacts that would adversely affect any population, the FAA has determined there would be no disproportionately high or adverse impacts to children's environmental health and safety. Similarly,

and in accordance with Executive Order 12898, the FAA has determined there would be no disproportionately high or adverse impacts to low income or minority populations.

- Water Quality, Final EA Section 4.15. Implementation of the Proposed Action would result in temporary effects to water quality as contaminants could be discharged into groundwater resources during construction activities. However, implementation of water-related BMPs through construction permit conditions would prevent a significant impact to groundwater resources. In addition, the relatively low number of employees associated with the small development for spaceport operations would not result in a significant water use. Therefore, the Proposed Action's potential impact on potable water supplies or local wastewater treatment facilities would not be significant. The FAA has determined the Proposed Action would not result in significant impacts to water quality.
- Wetlands, Final EA Section 4.16. The Proposed Action would require seven acres of new impervious surface at EFD, none of which would be constructed within a wetland. Jet fueling operations would occur approximately 1,500 feet way from nearest isolated wetland. The FAA has determined the Proposed Action would not result in significant impacts to wetlands.

Please refer to Chapter 4 of the Final EA for a full discussion of the determination for each environmental impact category.

Chapter 5 of the Final EA provides an analysis of the potential cumulative impacts of the Proposed Action when added to other past, present, and reasonably foreseeable future actions. The FAA has determined that the Proposed Action would not result in significant cumulative impacts in any environmental impact category.

CONDITIONS AND MITIGATION: As prescribed by 40 CFR § 1505.3, the FAA shall take steps as appropriate to the action, through mechanisms such as the enforcement of licensing conditions, and shall monitor these as necessary to ensure that HAS implements measures with respect to mitigation and/or avoidance of impacts as set forth in Chapter 4 of the FEA under the various impact categories. These mitigation and avoidance measures include:

- Implementing best management during construction, including with regard to the unanticipated discovery of cultural resources.
- Handling hazardous materials, hazardous wastes, and solid wastes in accordance with all relevant federal, state, and local regulations pertaining to these substances.

DECISION CONSIDERATIONS: The FAA decision in this FONSI/ROD is based on a comparative examination of environmental impacts for each of the alternatives studied during the environmental review process. The EA discloses the potential environmental impacts for each of the alternatives and provides a full and fair discussion of those impacts. There would be no significant impacts, including no significant cumulative impacts, to the natural environment or surrounding population as a result of the Proposed Action.

The FAA believes the Proposed Action best fulfills the purpose and need identified in the Final EA. In contrast, the No Action Alternative fails to meet the purpose and need identified in the Final EA. The FAA has determined that the Proposed Action is a reasonable, feasible, practicable, and prudent alternative for a federal decision in light of the established goals and objectives. An FAA decision to take the required

actions and approvals is consistent with its statutory mission and policies supported by the findings and conclusions reflected in the environmental documentation and this FONSI/ROD.

After reviewing the EA and all its related materials, I have carefully considered the FAA's goals and objectives in relation to various aspects of the launch activities described in the EA, including the purpose and need to be met, the alternative means of achieving them, the environmental impacts of these alternatives, the mitigation necessary to preserve and enhance the environment, and the costs and benefits of achieving the stated purpose and need.

After careful and thorough consideration of the facts contained herein, I find the proposed Federal action is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(c) of NEPA. As a result, the FAA will not prepare an EIS for this action.

APPROVED: June 22, 2015

Dr. George C. Nield — Date
Associate Administrator for
Commercial Space Transportation

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DECISION AND ORDER

Houston Spaceport, City of Houston, Harris County, Texas

The FAA recognizes its responsibilities under NEPA, CEQ regulations, and its own directives. Recognizing these responsibilities, the FAA has carefully considered the objectives of the proposed Houston Spaceport in relation to aeronautical and environmental factors. Based upon the above analysis, the FAA has determined that the Proposed Action meets the purpose and need of the proposed project.

Having carefully considered the aviation and public safety and operational objectives of the project, as well as being properly advised as to the anticipated environmental impacts of the proposal, under the authority delegated by the Administrator of the FAA, we find that the project is reasonably supported.

Therefore, we direct that the following actions be taken under the authority of 51 U.S.C. §§ 50901 *et seq*. and 49 U.S.C. §§ 47101 *et seq*.):

1. Federal environmental approval for (1) the issuance of a launch site operator license to HAS for the operation of a commercial space launch site at EFD, and (2) issuance of launch licenses to prospective operators, subject to all applicable laws and regulations, that would allow them to conduct launches of horizontal take-off and horizontal landing RLVs from EFD. This environmental approval is subject to the environmental mitigation/avoidance measures identified in the above FONSI.

   This Decision does not in any way constitute a decision to grant a launch site operator license or launch licenses. Additional non-environmental statutory, regulatory, and administrative findings are needed to approve such licenses. This Decision represents only a determination that the environmental prerequisites of the Proposed Action have been met.

2. Unconditional approval to the ALP modifications that reflect the designation of a spaceport boundary and existing and planned spaceport facilities and infrastructure. Under the modified ALP, the spaceport boundary would be coterminous with the airport property boundary.

   This Decision and the issuance of a launch site operator license or launch licenses does not relieve HAS of its obligations under Title 49 U.S.C. Section 47107, et seq. which sets forth assurances to which an airport sponsor agrees as a condition of receiving Federal financial assistance. Similarly, HAS has obligations under the provisions of section 13(g) of the Surplus Property Act of 1944, as amended, 49 U.S.C. Section 47152.[1] In addition, HAS will continue to comply with the requirements of 14 CFR Part 139, Certification of Airports.

[1] Title 49 U.S.C. Section 47101, et. seq. provides for Federal airport financial assistance for the development of public-use airports under the Airport Improvement Program (AIP) established by the Airport and Airway Improvement Act of 1983, as amended. Upon acceptance of the AIP grant, the assurances become a binding contractual obligation between the airport sponsor and the Federal government. The sponsor of HAS bears sole responsibility for compliance with the assurances. HAS is also responsible for compliance with its obligations under the Surplus Property Act (49 U.S.C. Section 47152). These responsibilities continue after issuance of a launch site operator license or launch licenses.

Right of Appeal

This FONSI/ROD constitutes final order of the FAA Administrator and is subject to exclusive judicial review under 49 U.S.C. 46110 by the U.S. Circuit Court of Appeals for the District of Columbia or the U.S. Circuit Court of Appeals for the circuit in which the person contesting the decision resides or has its principal place of business. Any party having substantial interest in this order may apply for review of the decision by filling a petition for review in the appropriate United States Court of Appeals no later than 60 days after this order is issued in accordance with the provisions of 49 U.S.C. Section 46110. Any party seeking to stay implementation of the ROD must file an application with the FAA prior to seeking judicial relief as provided in Rule 18(a) of the Federal Rules of Appellate Procedure.

Issued on: June 22, 2015

Ignacio Flores
Manager, Airports Division
Southwest Region

Dr. George C. Nield
Associate Administrator for
Commercial Space Transportation

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A

AAIA	Airport and Airway Improvement Act
ABS	Acrylonitrile Butadiene Styrene
AC	Advisory Circular
ACHP	Advisory Council on Historic Preservation
AHPA	Archeological and Historic Preservation Act
AIRFA	American Indian Religious Freedom Act
ALP	Airport Layout Plan
APCP	Ammonium Perchlorate Composite Propellants
ASNA	Aviation Safety and Noise Abatement Act
ATC	Air Traffic Control
ATCT	Airport Traffic Control Tower
ATO	Air Traffic Organization
AZA	Airport Zoning Action

B

BMP	Best Management Practice

C

C	Federal Candidate Species for Listing
CAP	Criteria Air Pollutant
CBRA	Coastal Barrier Resources Act
CBRS	Coastal Barrier Resource Systems
CCA	Coastal Coordination Act
CEQ	Council on Environmental Quality

C Continued

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMP	Coastal Management Program
CNRA	Coastal Natural Resource Areas
CO	Carbon Monoxide
CWA	Clean Water Act
CZMP	Coastal Zone Management Program

D

dB	Decibel
dBA	A-weighted decibel
DHHS	Department of Health and Human Services
DL	Federally Delisted Species
DNL	Day Night Average Sound Level
DoD	Department of Defense
DOI	Department of the Interior

E

E	State Listed Endangered Species
EA	Environmental Assessment
Ec	Expected Casualty
EFD	Ellington Airport
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act

F

FAA	Federal Aviation Administration
FAA-ARP	FAA Office of Airports
FAR	Federal Aviation Regulations
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Floodplain Insurance Rate Map
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
FR	Federal Register
FTA	Federal Transit Administration
FWCA	Fish and Wildlife Coordination Act

G

GCP	General Construction Permit
GLO	General Land Office
GO	Generation Orbit

H

H_2O_2	Hydrogen Peroxide
HAS	Houston Airport System
H-GAC	Houston-Galveston Area Council
HGB	Houston-Galveston-Brazoria
HOU	William P. Hobby Airport
HTPB	Hydroxyl-terminated Polybutadiene

I

IAH	George Bush Intercontinental Airport
IBD	Inhabited Building Distance
IFR	Instrument Flight Rules

I Continued

ILD	Intraline Distance
INM	Integrated Nosie Model

L

lbs	Pounds
LE	Federally Listed Endangered Species
LOA	Letter of Agreement
LOX	Liquid Oxygen
LT	Federally Listed Threatened Species
LWCA	Land and Water Conservation Fund Act

M

MALSR	Medium Intensity Approach Lighting System with Runway Alignment Indicator Lights
MBTA	Migratory Bird Treaty Act
MOA	Memorandum of Agreement
MSGP	Multi-Sector General Permit
MSL	Mean Sea Level

N

N_2O	Nitrous Oxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NHD	National Hydrography Dataset
NHPA	National Historic Preservation Act
NL	Not Federally Listed Species

N Continued

NMFS	National Marine Fisheries Service
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOTAM	Notice to Airmen
NPL	National Priorities List
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NWI	National Wetlands Inventory

O

O_3	Ozone
OLA	Oxidizer Loading Area
OPA	Oil Pollution Act

P

Pb	Lead
PCB	Polychlorinated Biphenyl
PIC	Pilot-in-Command
PM	Particulate Matter
PTRD	Public Traffic Route Distance

R

R	Rare Species, but no Regulatory Listing Status
RCRA	Resource Conservation and Recovery Act
RLV	Reusable Launch Vehicle

R Continued

ROA	Runway Operating Area
ROD	Record of Decision
ROI	Region of Influence

S

SAGA	Sustainable Aviation Guidance Alliance
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Officer
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SOP	Standard Operating Procedure
SPCC	Spill Prevention Control and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan

T

T	State Listed Threatened Species
TAF	Terminal Area Forecast
TCEQ	Texas Commission on Environmental Quality
TCP	Traditional Cultural Properties
TFR	Temporary Flight Restriction
THC	Texas Historical Commission
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
TPDES	Texas Pollutant Discharge Elimination System
TPWD	Texas Parks and Wildlife Department

T Continued

TRACON	Terminal Radar Approach Control
TSCA	Toxic Substance Control Act
TX	Texas
TxANG	Texas Air National Guard
TxARNG	Texas Army National Guard

U

USACE	United State Army Corps of Engineers
U.S.C.	United States Code
USCG	United States Coast Guard
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service

V

VALE	Voluntary Airport Low Emission
VFR	Visual Flight Rules
VOC	Volatile Organic Compound

W

WSRA	Wild and Scenic Rivers Act

Z

ZHU ARTCC	Houston Air Route Traffic Control Center

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CHAPTER 1

INTRODUCTION

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As an introduction to this Environmental Assessment (EA) for a proposed commercial space launch site at Ellington Airport (EFD), this chapter provides background information about commercial space transportation, the role of the Federal Aviation Administration (FAA) in supporting commercial space flight, and the Houston Airport System (HAS) proposal to establish a commercial space launch site at EFD. In addition, this chapter describes the process that the FAA and HAS must follow in licensing, developing, and operating a commercial space launch site. The chapter concludes with the statement of purpose and need for the federal actions required as part of the National Environmental Policy Act (NEPA) process.

1.1 BACKGROUND

The space launch environment is evolving from medium- and heavy-lift orbital launches to the use of small commercial orbital and suborbital launches. The shift to smaller launches is largely due to the development of smaller satellites, an emerging suborbital space tourism market, and a national security environment demanding quick launch capability. Privatization, increased efficiency, and lower cost also contribute to the economic pressures driving a marketplace favoring the creation of commercial space launch sites.

The changing nature of space transportation is leading to the interest in small, responsive, commercially focused vehicles as low-cost solutions for private and government clients. An FAA launch site operator license would enable HAS to offer EFD as a site for commercial space launch vehicle operators to conduct horizontal take-off and horizontal landing of reusable launch vehicles (RLVs). This would help establish the State of Texas as a national and international node for commercial space transportation.

Private companies are interested in operating at non-federal launch sites because of the potential to be "bumped" by a higher priority federal launch at a federally controlled site. Title 10, Chapter 135 of the United States Code (U.S.C.), states it is the policy of the United States for the President to undertake actions appropriate to ensure, to the maximum extent practicable, that the United States has the capabilities necessary to launch and insert United States national security payloads into space whenever such payloads are needed (10 U.S.C. § 2273). Additionally, the 1997 Memorandum of Agreement (MOA) among the Department of Defense, FAA, and the National Aeronautics and Space Administration (NASA) on Federal Interaction with Launch Site Operators states that critical national security or civil sector mission requirements may take precedence over commercial use of federal launch property and launch services.

1.1.1 Houston Spaceport Proposal

HAS proposes to operate a commercial space launch site at EFD, also referred to as the Houston Spaceport, and offer the site to commercial space launch operators for the operation of horizontal take-off and horizontal landing RLVs. To operate a commercial space launch site, HAS must obtain a launch site operator license from the FAA. HAS is in the process of developing an application for a launch site operator license for the operation of a commercial space launch site at EFD. The process includes an update to the Airport Layout Plan (ALP).

Under the Proposed Action addressed in this EA, the FAA would: (1) issue a launch site operator license to HAS for the operation of a commercial space launch site at EFD, (2) issue launch licenses to prospective operators that would allow them to conduct launches of horizontal take-off and horizontal landing RLVs

from EFD, and (3) provide unconditional approval to the ALP modifications that reflect the designation of a spaceport boundary (i.e., Airport property boundary) and existing and planned spaceport facilities and infrastructure. As explained in Section 1.2, the Proposed Action is subject to environmental review under the National Environmental Policy Act (NEPA) of 1969 as amended (42 United States Code [U.S.C.] §4321, *et seq.*).

EFD is one of three airports HAS operates and is located in Harris County, in the southeastern portion of the City of Houston. EFD is approximately 20 miles southeast of the center of downtown Houston, 10 miles north of Galveston Bay, and 30 miles north of the Gulf of Mexico (see Figure 1-1). Major roadways around EFD include Interstate 45, the Sam Houston Tollway, and State Highway 3 (Old Galveston Road). Union Pacific Railroad tracks parallel Highway 3 along the southwest boundary of EFD. The proposed Houston Spaceport is approximately 8 miles southeast of William P. Hobby Airport (HOU).

1.1.1.1 Existing Facilities

EFD has approximately 2,600 acres of land. There are currently three active runways, eight active taxiways, and one active taxilane. Runway 17R-35L is 9,001 feet (ft) long by 150 ft wide. Runway 17L-35R, the shortest runway, is 4,609 ft long by 75 ft wide. Runway 4-22, the crosswind runway, is 8,001 ft long by 150 ft wide. The crosswind runway is not certified under Federal Aviation Regulations (FAR) Part 139 for commercial use.

EFD is classified by the FAA as a general aviation reliever airport and is currently certified for 14 CFR Part 139 operations. Under Part 139, the FAA issues airport operating certificates to airports that:

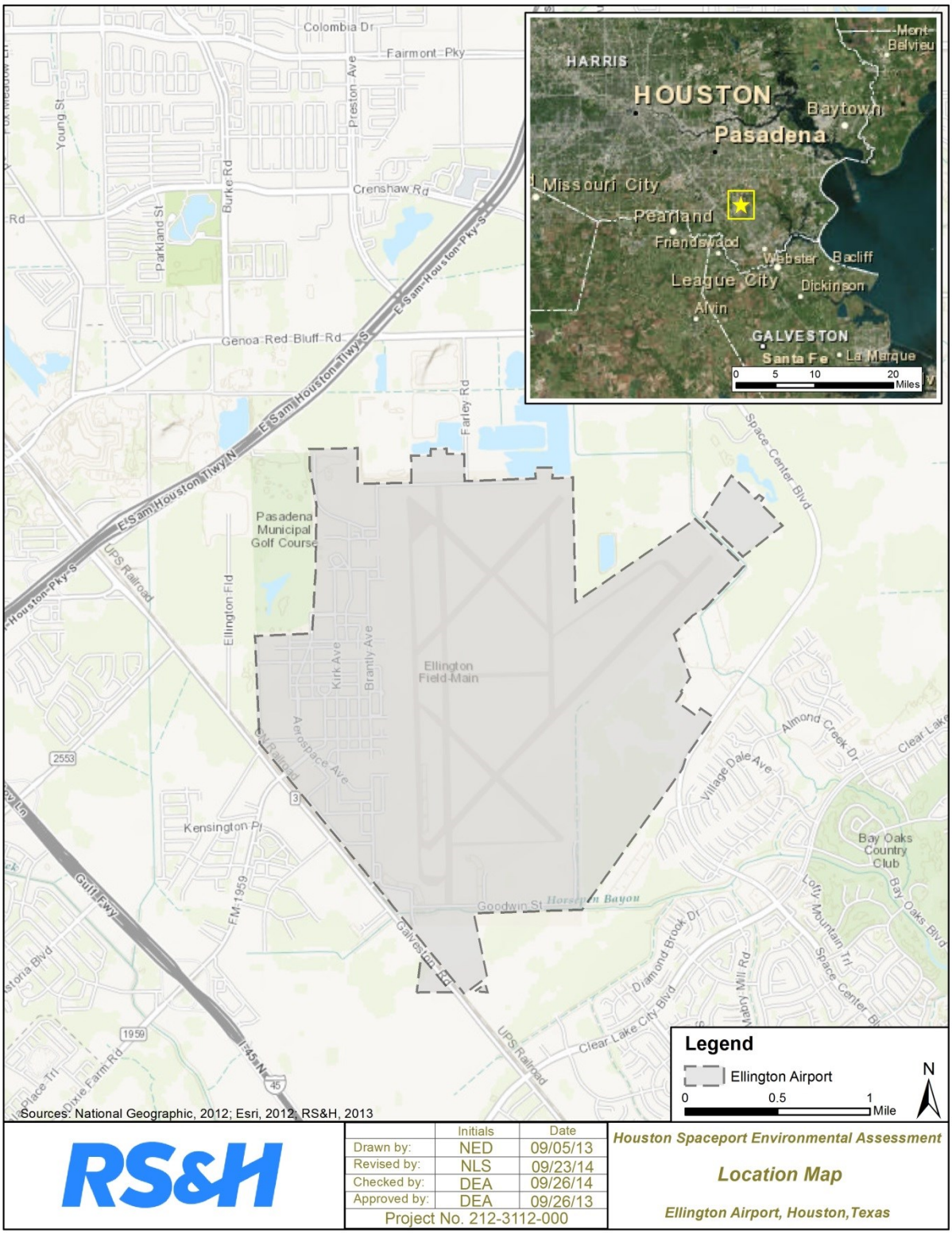
- serve scheduled and unscheduled air carrier aircraft with more than 30 seats;
- serve scheduled air carrier operations in aircraft with more than 9 seats but less than 31 seats; and
- the FAA Administrator requires a certificate of operations (FAA, 2013a).

There are also a series of service roads around the airfield currently used for airport maintenance and service operations. The primary uses of these roads include accessing navigational aid equipment, performing ground maintenance operations, performing perimeter fence inspections, and maintaining airfield security. The roads are approximately 10-12 ft wide and made of asphalt. There are also service roads along the east and west edges of the general aviation parking apron.

Current tenants at EFD include three military units, NASA, and a Fixed Base Operator. The three military tenants are the Texas Air National Guard (TxANG), the Texas Army National Guard (TxARNG), and the U.S. Coast Guard (USCG). These three tenants and NASA own land within EFD. They are not bound by any lease agreement and the City of Houston maintains a Joint Use Agreement with these tenants. There are also several unused buildings on EFD property, which could be repurposed for new tenants.

EFD currently supports a mix of aircraft operations. A yearly average total of 146,472 operations occurred at EFD between 2009 and 2013 (FAA, 2013b). Of the 146,472 operations, an average of 89,442 operations (61%) were performed by general aviation aircraft, and an average of 47,801 operations (33%) were conducted by the military (FAA, 2013b). Air taxis and air carriers conducted an average of 1,753 (1%) and 7,475 (5%) of the total operations, respectively (FAA, 2013b).

FIGURE 1-1
LOCATION MAP



There is a large amount of undeveloped land around the EFD airfield. The developable portion of the north airside area, approximately 50 acres, is primarily vacant. The western area of EFD has approximately 80 acres available for airside development and approximately 100 acres for non-airside development.[1] Development options include light industrial, corporate hangars, and most non-residential land uses. There are approximately 440 acres of EFD property in the southeast available for either airside or non-airside development.

1.1.1.2 Potential for Spaceport Development

A Spaceport Feasibility Study was completed in February 2012 for HAS (RS&H, 2012). The purpose of the study was to evaluate the potential for EFD to support spaceport operations in the Houston area. The decision to evaluate EFD was based on a number of factors, including:

- existing runway lengths;
- proximity to Johnson Space Center and other NASA training facilities;
- proximity to the Gulf of Mexico; and
- compatibility with existing aircraft operations.

The feasibility study identified the goals and objectives of a proposed spaceport. EFD was evaluated for compatibility with federal regulations in achieving those goals. The feasibility study included an infrastructure inventory and preliminary analysis based on various factors, including a preliminary environmental overview. The feasibility study concluded that EFD could support spaceport operations.

The proposed Houston Spaceport would commence operations in early 2015, and operations would continue through 2019, in accordance with the terms of the launch site operator license. HAS proposes to provide RLV operators the ability to conduct up to 50 launches and landings (or 100 operations) per year, which is substantially less than the 144,702 annual aircraft operations EFD currently experiences (FAA, 2013b). However, based on the current design and development of RLVs, approximately 35 launches and landings are anticipated in 2019. For a conservative analysis, this EA assesses up to 50 launches and landings in 2019, with approximately five percent of the operations expected to occur during night-time hours.

Two types of horizontal RLVs are being considered to operate at the Houston Spaceport: the Concept X RLV and the Concept Z RLV. The Concept X RLV would take off under conventional jet engine power and make either a powered or unpowered (glide) landing. The Concept Z RLV is a two-part vehicle, including a carrier vehicle and an attached RLV that would separate at an altitude approximately 40,000 ft above mean sea level (MSL). The Concept Z RLV would land gliding. Unlike vertical launch vehicles, the operation of these RLVs would be similar to the operation of commercial jet aircraft. These vehicles would use common fuels and oxidizers for propulsion such as conventional Jet-A fuel, liquid oxygen (LOX), and

[1] Airside development – Areas of land on airport property with the potential for future development and provides direct access to the airfield system (i.e., aprons, taxiways, runways).
Non-airside development – Areas of land on airport property with the potential for future development that do not provide access to the airfield system.

refined kerosene. The designation of vehicle safety areas and established operating procedures would help to ensure the safety of the uninvolved areas surrounding EFD.[2]

1.2 FAA ROLES

Upon approval of the Proposed Action, the FAA would be responsible for issuing licenses to operate a commercial space launch site at EFD and for the issuing of licenses for the operation of commercial space launch vehicles. Since HAS plans to develop facilities to accommodate RLVs at the Houston Spaceport, the FAA would also be responsible for approving changes to the EFD ALP showing these proposed facilities. The FAA's issuance these licenses and its approval of changes to an ALP are considered major federal actions under NEPA. Therefore, the FAA is responsible for analyzing the potential environmental impacts associated with each aspect of the Proposed Action. As these are connected actions, the potential environmental impacts of both the licensing and the ALP approval are analyzed in this EA. The FAA is the lead Federal agency and is preparing this EA in accordance with NEPA, Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), FAA Order 1050.1E, Change 1, Environmental Impacts: Policies and Procedures, and FAA Order 5050.4B, National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions.

The FAA licenses and regulates U.S. commercial space launch and reentry activity, as well as the operation of non-federal launch and reentry sites, as authorized by Executive Order (EO) 12465, *Commercial Expendable Launch Vehicle Activities*, and the Commercial Space Launch Act of 2011 (51 U.S.C. Subtitle V, ch. 509, §§ 50901-50923). The FAA's mission is to ensure public health and safety and the safety of property while protecting the national security and foreign policy interests of the U.S. during commercial launch and reentry operations. In addition, the FAA is directed to encourage, facilitate, and promote commercial space launches and reentries.

The FAA has the responsibility, under the Commercial Space Launch Act, to do the following:

- Promote economic growth and entrepreneurial activity through use of the space environment for peaceful purposes.
- Encourage the U.S. private sector to provide launch vehicles, reentry vehicles, and associated services by:
  - simplifying and expediting the issuance and transfer of commercial licenses, and
  - facilitating and encouraging the use of government-developed space technology.
- Ensure that the Secretary of Transportation provides oversight and coordinates the conduct of commercial launch and reentry operations, issue and transfer commercial licenses authorizing those operations, and protect the public health and safety, safety of property, and national security and foreign policy interests of the U.S.
- Facilitate the strengthening and expansion of the U.S. space transportation infrastructure, including the enhancement of U.S. launch sites and launch-site support facilities, and

[2] These would be operator dependent and would be included in the RLV operator license.

development of reentry sites, with federal, state, and private sector involvement, to support the full range of U.S. space-related activities.

1.2.1 FAA Licenses, Permits, and Approvals

A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator for each launch point, launch vehicle type, and weight class identified in the license application and upon which the licensing determination is based. Issuance of a license to operate a launch site 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 (14 CFR §420.41). A launch site operator license remains in effect for five 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 (14 CFR §420.43).

The FAA issues separate licenses for operation of launch vehicles. Therefore, prospective vehicle operators (e.g., Rocket Crafters) would need to obtain individual launch licenses from the FAA before launching from EFD.

The FAA issues launch licenses for the operation of RLVs (14 CFR Part 431). A launch license for a RLV is valid for a two-year renewable term and authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters, including launch sites and trajectories, transporting specified classes of payloads to any reentry site or other location designated in the license. A licensee can renew its license by submitting an application to the FAA at least 90 days before the license expires. An RLV mission-specific license authorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for the mission to a reentry site or other location approved for the mission. A RLV mission-specific license expires upon completion of all activities authorized by the license or the expiration date stated in the reentry license, whichever occurs first.

The following describes the launch licenses that could be obtained by operators:

- RLV Mission Operator License – "[A]uthorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters" (14 CFR § 431.3(b)).
- RLV Mission-Specific License – "[A]uthorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for the mission to a reentry site or other location approved for the mission" (14 CFR §431.3(a)).

1.2.2 Airport Layout Plan

The Airport and Airway Improvement Act of 1982 directs the Secretary of Transportation to maintain a plan (i.e., an ALP) for developing public use airports (49 U.S.C. Chapter 471). An ALP is an FAA-approved plan that depicts both existing facilities and planned development for an airport and is required by statute to be up-to-date [49 U.S.C. § 47107(a)(16)]. The ALP must depict the following:

- boundaries and proposed additions to all areas owned or controlled by the sponsor for airport purposes;
- location and nature of existing and proposed airport facilities and structures; and

- location on the airport of existing and proposed non-aviation areas and improvements.

Therefore, the improvements, as part of the Houston Spaceport, are required to be shown on the EFD ALP (FAA, 2013c). Under the Proposed Action, the EFD ALP modifications reflect the following actions (see Chapter 2 for further details):

- designation of the spaceport boundary;
- construction of a hangar/processing facility;
- construction of a connector taxiway;
- designation of an oxidizer loading area:
- construction of an oxidizer storage tank pad;
- construction of a RP-1 truck parking area;
- construction of a vehicle parking area;
- construction of an access road;
- construction of FAA-approved fencing; and
- construction of a storm water treatment pond.

In approving changes to an ALP, the FAA Office of Airports reviews proposed development to:

- assess operational factors affecting the safe and efficient control of air traffic;
- establish conformance with FAA airport design criteria, federal regulations, and federal grant agreements (CFR Parts 77, 139, 150, 152, 157, and 169);
- review and approve construction plans and specification; and
- review and approve an amended Airport Certification Manual (Part 139).

As part of the ALP review process, the Office of Airports initiates coordination of airspace studies with the FAA Air Traffic Organization (ATO); circulates the ALP to other FAA offices and divisions for review and comment; and coordinates with the airport sponsor to resolve outstanding issues. Following the resolution of any outstanding issues, the Office of Airports may conditionally approve the ALP pending completion of NEPA review. The FAA Southwest Region/Texas Airports Development Office has approval authority for the updates to the EFD ALP.

A federal action for this EA is to provide unconditional approval to the ALP modifications that reflect the designation of a spaceport boundary and existing and planned spaceport facilities and infrastructure, as listed above and further described in Chapter 2 of this EA.

1.2.3 Letter of Agreement

As part of the launch site operator license application process, HAS will have to negotiate and enter into a Letter of Agreement (LOA) with all relevant Air Traffic Control facilities to accommodate the flight parameters of the RLVs. Coordination with the FAA Office of Air Traffic would result in the identification of a flight corridor such that a Temporary Flight Restriction (TFR) would be put into place in the RLV operating area when flights occur. The RLV operating area would be defined in cooperation with the FAA

Office of Commercial Space Transportation, the FAA ATO, affected military air traffic control agencies, and airspace users such as airlines, private pilots, and off-shore helicopter transportation routes (i.e., the transportation of oil rig personnel).

1.3 NEPA PROCESS

The purpose of a NEPA analysis is to ensure full disclosure and consideration of environmental information in federal agency decision-making. NEPA also serves as a way to inform the public of potential impacts of, and alternatives to, a proposed federal action before decisions are made and actions are taken. As noted above, FAA licensing and ALP approval are federal actions requiring NEPA review and approval. In the NEPA process, the FAA must analyze the potential environmental impacts associated with the issuance of licenses (including the LOA, construction of spaceport development, and RLV operations) and ALP approval. The FAA is the lead federal agency for this NEPA process.

The FAA invited NASA to participate in this NEPA process as a Cooperating Agency.[3] NASA agreed to participate as a Cooperating Agency and provided technical review and input for this EA.

This EA is being conducted in accordance with the following regulations and orders:

- Council on Environmental Quality (CEQ) *Regulations for Implementing the Procedural Provisions of NEPA* (40 CFR Parts 1500-1508),
- FAA Order 1050.1E, *Change 1, Environmental Impacts: Policies and Procedures*, and
- FAA Order 5050.4B, *NEPA Implementing Instructions for Airport Actions*.

This EA evaluates the potential direct, indirect, and cumulative environmental effects that may result from the Proposed Action described in Chapter 2. The successful completion of the environmental review process does not guarantee that the FAA would issue a launch site operator license to HAS or launch licenses to RLV operators. The project must also meet all FAA safety, risk, and financial responsibility requirements per 14 CFR Part 400 and not affect adversely the safety, utility, or efficiency of the airport per 49 USC § 47107(a)(16).

1.4 PURPOSE AND NEED

The purpose and need provides the foundation for identifying reasonable alternatives to a Proposed Action. According to FAA Order 1050.1E, Change 1, Paragraph 405(c), the purpose and need identifies the problem facing the proponent (i.e., the "need" for the action), the proposed solution to the problem (i.e., the "purpose" of the action), and the proposed timeframe for implementing the action.

1.4.1 FAA's Purpose and Need

The need for the FAA action of issuing a launch site operator license and launch licenses results from the statutory direction from Congress under the Commercial Space Launch Act to protect the public health and safety, safety of property, and national security and foreign policy interests of the U.S. and to

[3] A Cooperating Agency is an agency that has jurisdiction by law or special expertise regarding any environmental impact resulting from a proposed action or reasonable alternative.

encourage, facilitate, and promote commercial space launch and reentry activities by the private sector in order to strengthen and expand U.S. space transportation infrastructure.

The purpose of the FAA action in connection with HAS's proposal is to fulfill the FAA's responsibilities under the Commercial Space Launch Act, 51 U.S.C. Subtitle V, Ch. 509 §§ 50901-50923, for oversight of commercial space launch activities, including issuing launch site operator licenses for the operation of commercial space launch sites, and launch licenses to operate reusable orbital and suborbital launch vehicles. The Proposed Action would be consistent with the objectives of the Commercial Space Launch Act.

Additionally, the purpose and need of the FAA action, in connection with HAS's request, is to ensure the proposed alterations at EFD do not adversely affect the safety, utility, or efficiency of EFD. Pursuant to 49 U.S.C. § 47107(a)(16), the FAA Administrator (under authority delegated from the Secretary of Transportation) must approve any revision or modification to an ALP before the revision or modification takes effect. The Administrator's approval reflects a determination that the proposed alterations to the airport, reflected in the ALP revision or modification, do not adversely affect the safety, utility, or efficiency of the airport.

1.4.2 Houston Airport System's Purpose and Need

HAS's need for the proposed commercial space launch site is to further the City's goals to grow economic activity within the City and support economic activity in the region. HAS's mission statement is to connect people, businesses, cultures, and economies of the world to Houston. The City of Houston Economic Development Division promotes diversifying the local economy and enhancing the region as a business and employment center. The City's strategy is to provide development areas that attract and accommodate the needs of new businesses. To be successful as a commercial space launch site, the area should have characteristics that would accommodate horizontal take-off and horizontal landing RLVs at a HAS airport. These characteristics include:

- location within the Houston Airspace System;
- location in an area with a comparatively low population density;
- a runway with minimum length of 8,000 ft;[4]
- a minimum of 45,000 square ft of hangar space;[5] and
- extensive airspace separation distances from other aircraft operating in the Houston area airspace.

The purpose of HAS's proposal to establish a commercial space launch site at EFD is to help the City achieve its economic goals. Establishing a launch site at EFD would enable a HAS airport to serve as an alternative to a federal launch facility or other commercial launch sites for the operation of horizontally-launched and horizontally-landed Concept X and Z launch vehicles. HAS proposes that launch operations would begin in 2015 and continue through 2019.

[4] Length was determined as a result of recent communications with RLV operators.

[5] Area was determined as a result of recent communications with RLV operators.

1.5 AGENCY AND PUBLIC INVOLVEMENT

Agency consultation and coordination was conducted to obtain meaningful input regarding the Proposed Action and potential for environmental impacts. Additionally, the Draft EA was published for agency and public review and comment. See Appendix F for the agency and public involvement documentation, including public meeting materials, comments received, and FAA's responses to comments received on the Draft EA.

1.5.1 Early Notification Letters

An early notification letter was distributed to various federal, state, and local agencies on October 11, 2013 announcing HAS's Proposed Action to obtain a launch site operator license. The early notification letter was initiated to:

- provide information about the Proposed Action;
- obtain feedback from the federal, state, and local agencies;
- inform those agencies who may be interested and potentially affected; and
- provide the opportunity for early comments.

See Appendix A-1 for the early notification letter and list of agencies contacted. Over 100 various federal, state, and local agencies, federally recognized Native American Tribes, and EFD tenants have been contacted regarding the preparation of this EA. During the early agency consultation process, the following agencies and tenants provided comments:

- NASA
- USCG
- National Park Service (NPS)
- United States Fish and Wildlife Service (USFWS)
- Federal Emergency Management Agency (FEMA)
- Texas Historical Commission (THC)
- TxANG
- Texas Commission on Environmental Quality (TCEQ)
- Texas Parks and Wildlife
- Harris County Public Health and Environmental Services
- Flying Tigers (EFD tenant)

See Appendix A-2 for response letters received from agencies.

1.5.2 Draft EA Notification and Distribution

In accordance with NEPA, CEQ Regulations, FAA Order 1050.1E, Change 1, and FAA Order 5050.4B, the FAA initiated a public review and comment period for the Draft EA. Interested parties were invited to submit comments on the Draft EA on or before January 31, 2015. An electronic version of the Draft EA was

available on the FAA website[6] and HAS website[7]. Appendix F includes a list of parties, including intergovernmental agencies that received copies of the Draft EA and/or notification of its availability.

1.5.3 Open House Public Meeting for the Draft EA

The FAA held an open house public meeting on the evening of January 22, 2015 at Space Center Houston. The purpose of the open house was to provide interested parties (e.g., public, stakeholders, etc.) the opportunity to ask questions about and provide comments regarding the Draft EA. Representatives from the FAA, HAS, and HAS's consultant team were available to discuss the project. Sixty-seven individuals attended the open house.

See Appendix F for the agency and public involvement documentation.

1.6 OTHER ENVIRONMENTAL REQUIREMENTS

In addition to NEPA, this EA addresses the following relevant special purpose laws, regulations, and EOs, including:

- Endangered Species Act of 1973 (threatened or endangered species and critical habitat)
- EO 11988 (floodplains)
- EO 11990 (wetlands)
- Title 36 CFR Part 800 (historic properties)
- U.S. Department of Transportation (USDOT) Act Section 4(f) (recreation areas and historic sites)

Other laws, regulations, permits, and licenses may be applicable to the proposed construction, operation, and maintenance of facilities and infrastructure of a commercial space launch site at EFD. Additional environmental requirements may include the following:

- City of Houston Building Permit;
- TCEQ General Construction Permit (GCP) TXR150000;
- Texas Pollutant Discharge Elimination System (TPDES) Permit; and
- National Pollutant Discharge Elimination System (NPDES) Permit.

[6] http://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_progress/
[7] http://www.fly2houston.com/0/3922259/0/83280D83283/

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CHAPTER 2

PROPOSED ACTION AND ALTERNATIVES

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This chapter describes the Proposed Action's development and operational characteristics and the consideration and evaluation of reasonable alternatives to the Proposed Action.

2.1 PROPOSED ACTION

HAS proposes to operate a commercial launch site at EFD in Harris County, Texas and offer the site to commercial space launch operators for the operation of horizontal take-off and horizontal landing RLVs. To be successful as a commercial space launch site, the area must meet the technical and operational requirements to accommodate horizontal take-off and horizontal landing RLVs. These requirements include: location within the HAS; location in an area of comparatively low population density in order to comply with 14 CFR Part 420; a runway with minimum length of 8,000 ft; a minimum of 45,000 square ft of hangar space; and extensive airspace separation distances from other aircraft operating in the Houston area airspace. HAS proposes to provide RLV operators the ability to begin launch operations in 2015 and continue through 2019.

To operate a commercial space launch site, HAS must obtain a launch site operator license from the FAA. Under the Proposed Action addressed in this EA, the FAA would: (1) issue a launch site operator license to HAS for the operation of a commercial space launch site at EFD, (2) issue launch licenses to prospective operators that would allow them to conduct launches of horizontal take-off and horizontal landing RLVs from EFD, and (3) provide unconditional approval to the ALP modifications that reflect the designation of a spaceport boundary and existing and planned spaceport facilities and infrastructure. Under the modified ALP, the spaceport boundary would be coterminous with the airport property boundary.

As noted in Section 1.2.3, as part of the launch site operator license application process, HAS will have to negotiate and enter into an LOA with all relevant Air Traffic Control facilities to accommodate the flight parameters of the RLVs. In order to accommodate the potential operations, airspace around Houston was examined by representatives from Houston Air Route Traffic Control Center (ZHU ARTCC), I90 Terminal Radar Approach Control (I90 TRACON), FAA ATO Central Service Center, HAS, and the FAA early in the spaceport licensing process. The Proposed Action includes a draft route and procedures to allow for RLVs to safely operate in and out of the Houston Spaceport without adversely affecting urban areas, existing airspace conditions, or the neighboring public-use airports. This information is described within a draft LOA, as required by 14 CFR Part 420.31(b). A final LOA would be negotiated by an actual operator during the application process for a launch license, using the precise flight parameters of the subject vehicle. These procedures would be fully developed prior to RLV operations occurring in and out of EFD. The draft LOA calls for Air Traffic Control to issue a Notice to Airmen (NOTAM) defining the affected airspace and to issue a TFR for the affected area. A NOTAM provides notice of unanticipated or temporary changes to components of, or hazards in, the National Airspace System (FAA Order JO 7930.2M, Air Traffic Organization Policy).

Coordination with the FAA Office of Air Traffic would result in the identification of a flight corridor such that a TFR would be put into place in the RLV operating area when flights occur. The extent of the TFR will be determined in cooperation with the vehicle operator when the final LOA is negotiated. The RLV operating area would be defined in cooperation with the FAA Office of Commercial Space Transportation,

the FAA ATO, affected military air traffic control agencies, and airspace users such as airlines, private pilots, and off-shore helicopter transportation routes (i.e., the transportation of oil rig personnel).

The FAA would not 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. Advance notice via NOTAMs would assist general aviation pilots in scheduling around any temporary disruption of flight activity at EFD. Launches would be infrequent (less than 1 percent of the total operations occurring at EFD), of short duration, and scheduled well in advance to minimize interruption of airport operations.

For the above reasons, environmental impacts from the temporary closure of airspace and the issuance of NOTAMs and TFRs under the Proposed Action are not anticipated and thus are not addressed further in the EA (see Appendix B, Airspace and Airports, for further information). Moreover, in accordance with FAA Order 1050.1E, Chapter 3 (Advisory and Emergency Actions and Categorical Exclusions), the issuance of NOTAMs is categorically excluded from NEPA review absent extraordinary circumstances.

The following sections describe the operational characteristics of the concept RLVs proposed to operate at EFD and physical development proposed at EFD to accommodate those operations.

2.1.1 Horizontal Take-off and Landing Vehicles

Design parameters have been established for concept RLVs considered in this EA. Figure 2-1 shows examples of RLVs and Table 2-1 summarizes the parameters of the Concept X and Z RLVs. This information is based on publicly available information from various RLV operators. The purpose of establishing these characteristics, or parameters, is to conservatively assess the potential impacts of RLV operations at EFD. This information does not necessarily reflect the exact RLV that would operate at the Houston Spaceport. Instead, it defines the scope (or bounds) of the analysis, such that if a prospective operator's RLV parameters fall within the parameters in this EA, the environmental consequences of launching would fall within this EA's scope. Based on the *Houston Spaceport Economics and Business Study* (XArc, 2013), the HAS anticipates the proposed RLVs to operate from the Houston Spaceport include the parameters described within Table 2-1. However, if the operator's RLV parameters fall outside the parameters in this EA, the FAA would re-evaluate the potential impacts and potentially prepare additional NEPA analysis (FAA Order 1050.1E, Paragraph 411).

Propellant types and quantities are RLV dependent. Fuels that could be used include rocket propellant-1 (RP-1), Jet-A fuel, hydroxyl-terminated polybutadiene (HTPB), acrylonitrile butadiene styrene (ABS), nylon, and ammonium perchlorate composite propellants (APCP). Oxidizers include LOX, nitrous oxide (N_2O), and hydrogen peroxide (N_2O_2).

FIGURE 2-1
EXAMPLES OF CONCEPT VEHICLES

Concept X Vehicle Examples

Concept Z Vehicle Examples

Reusable Launch Vehicle	Takeoff Power Source	Power Source to Reach Sub-orbital Altitude[1]	Power Source to Land at Spaceport
Concept X	Aircraft engine	Rocket engine	Aircraft engine/glide
Concept Z	Aircraft engine[2]	Rocket engine	Glide, no power[3]

Notes:
1 - Occurring at approximately > 40,000 feet mean sea level
2 - Launch vehicle carried via larger aircraft to designated launch area
3 - Carrier vehicle would land under conventional jet aircraft engine power.

RS&H

	Initials	Date
Drawn by:	NED	09/30/14
Revised by:	NED	09/30/14
Checked by:	DEA	09/30/14
Approved by:	DEA	09/30/14
Project No. 212-3112-000		

Houston Spaceport Environmental Assessment
Examples of Concept X and Z Vehicles
Ellington Airport, Houston,Texas

TABLE 2-1
DESIGN CONCEPT RLV CHARACTERISTICS

Characteristics	Design Concept X RLV	Design Concept Z RLV
Typical Maximum Takeoff Thrust	30,000 lbs	27,600 lbs
Wingspan	30 ft	Carrier Vehicle – 140 ft Space Vehicle – 60 ft
Typical Maximum Takeoff Weight	45,000 lbs	120,000 lbs
Common Propellants Combinations	Jet-A / ABS / N_2O Jet-A / RP-1 / LOX	Jet-A / APCP Jet-A / HTPB / N_2O Jet-A / Nylon / N_2O Jet-A / RP-1 / LOX

Source: RS&H, 2014

2.1.1.1 Concept X RLV

The Concept X RLV is a dual-propulsion RLV, similar to a current airplane. The RLV takes off from a runway using jet power and flies to a specified location and altitude (approximately 40,000 ft to 55,000 ft MSL) before igniting its rocket engine(s) to complete its flight profile. Upon completion of its mission, the Concept X RLV returns for a horizontal landing by either restarting its jet engines or by gliding. The Concept X RLV is anticipated to be capable of providing suborbital flights for passengers and/or scientific payloads. Concept X RLVs can also serve as a reusable first stage for small satellite delivery to low earth orbit.

2.1.1.2 Concept Z RLV

The Concept Z launch vehicle is a two-part space vehicle consisting of a reusable carrier aircraft and a reusable or an expendable space vehicle. The carrier aircraft is powered by jet engines and designed and/or modified to carry the space vehicle to a safe location and high altitude (approximately 40,000 ft MSL), where the two components detach and the rocket engine of the space vehicle is ignited. The carrier aircraft flies back to the Spaceport and lands under jet engine power. The space vehicle, which can be either suborbital or orbital, completes its mission and either returns for a horizontal landing by gliding or is expended.

2.1.1.3 Pre-Flight Activities

This section describes general pre-flight activities associated with either the Concept X or Concept Z flights. A ground crew would perform and supervise all pre-flight, flight, and landing operations and would be trained with the operating protocols for the specific RLV.

Preplanning - RLV operators would be required to notify HAS before a planned launch at EFD and the HAS would coordinate all operations with the control tower chief. Designated HAS personnel would notify the launch operator of other activities at EFD, resolve potential conflicts for use, and notify other appropriate airspace scheduling agencies. Flights would be rehearsed with all flight and ground support crews before each flight, and rehearsals would be repeated with various failure scenarios and irregular performance to ensure crew readiness.

Propellant Loading - Aircraft on the ground at EFD would experience minimal interruptions during RLV propellant loading operations, as described below for each concept RLV.

- Concept X RLV: The Concept X RLV would roll out of its hangar and receive Jet-A fuel to top off the fuel tanks. At this point, there would be no oxidizer on board. Therefore, other aircraft operating on the ground at EFD would be required to maintain only a 50-foot distance from the RLV, similar to conventional aircraft operating practices.

  When fueling is complete, the vehicle would taxi or be tugged to the RP-1 fueling area (which could be as close as 25 feet away), and RP-1 fuel would be loaded. At this point, other aircraft would still be required to maintain a 50-foot distance from the RLV.

  The RLV would taxi north from Runway 4-22 to Taxiway G, and then to Taxiway B in order to access the oxidizer loading area (OLA). Refer to Section 2.1.2.1 for the location of the OLA. The Concept X RLV would meet the LOX tanker truck and any required portable filtering and pumping equipment at this location. This would require all other aircraft to maintain a safe distance from the RLV. While the LOX tanker truck is in transit to and from the RLV, it would be required to maintain a 100-foot distance from all aircraft. The LOX truck and portable equipment would return to storage. Runway 4-22 would remain open and operational during this time. In the event of inclement weather, the RLV would be de-fueled and removed from the runway, and the launch would be cancelled.

- Concept Z RLV: The Concept Z RLV would follow similar operational procedures as Concept X, except this vehicle would roll out of its hangar with the HTPB solid fuel installed. The vehicle would receive Jet-A fuel in the ramp area to top off the fuel tanks. Also, instead of LOX being added, this vehicle could require the loading of N_2O at the OLA.

Passenger Loading - After the oxidizer and safety checks are complete, passengers are loaded on to the RLV. Procedures for passenger loading include:

- arrival/departure of any necessary vehicle ingress/egress aids (stairs, ladders);
- docking/undocking of ingress/egress aids to vehicle;
- arrival/departure of the passenger-carrying vehicle;
- loading of passengers;
- securing of passenger cabin;
- final vehicle pre-flight checks; and
- presentation of passenger safety and emergency procedures.

RLV Runway Operating Area - The RLV Runway Operating Area (ROA)[8] would meet all FAA safety, risk, and financial responsibility requirements per 14 CFR Part 400 and not adversely affect the safety, utility, or

[8] Term referring to the runway identified as the recommended runway for RLV operations.

efficiency of EFD per 49 USC § 47107(a)(16). The bounds of the RLV ROA are generally contained within the EFD property line, with the exception of areas just beyond the south end of the runway. The RLV ROA is only active immediately prior to an RLV takeoff and until such time as the vehicle departs the runway. Procedures to occur in the RLV ROA include:

- final RLV pre-flight checklist;
- air traffic control communications; and
- RLV takeoff.

2.1.1.4 RLV Flight Profile

Once the RLV is loaded with oxidizer and passengers (if applicable) at the OLA and the equipment and personnel have safely left the area, the RLV would taxi or be towed to the north end of Runway 17R-35L for immediate departure. Runway 17R-35L would be reserved for RLV departure in the same manner as other aircraft departing or arriving at EFD. Both the Concept X and Z RLVs would fly from EFD to existing Special Use Airspace[9] over the Gulf of Mexico. The proposed RLV would depart EFD to the south and complete all launch operations in the Offshore Warning Areas (W-147D and W-147C) located in the Gulf of Mexico (see Figure 2-2).[10]

In general, the flight begins in the Class D airspace of EFD.[11] Upon exiting EFD Class D airspace, the RLV would fly through two layers of Class B Airspace.[12] The RLV would continue south for approximately 18 miles. The RLV would then bank approximately 16 degrees to the southeast and would continue through Alert Area A-381 Airspace Gulf within Class A airspace. The flight profile of the Concept X and Z RLVs are described in further detail in the following paragraphs. Appendix B provides more information regarding the airspace and airports.

- Concept X RLV Flight Profile - The Concept X RLV would take-off to the south under turbojet power. The vehicle would fly to a designated launch area over the Gulf of Mexico, approximately 20 miles away from land. Rocket ignition would occur at approximately 60 miles offshore at approximately 40,000 ft MSL with a vertical orientation. The rocket engines would shut off at 150,000 ft MSL at a maximum speed of Mach 3.5. The RLV would reach an apogee above 62 miles.

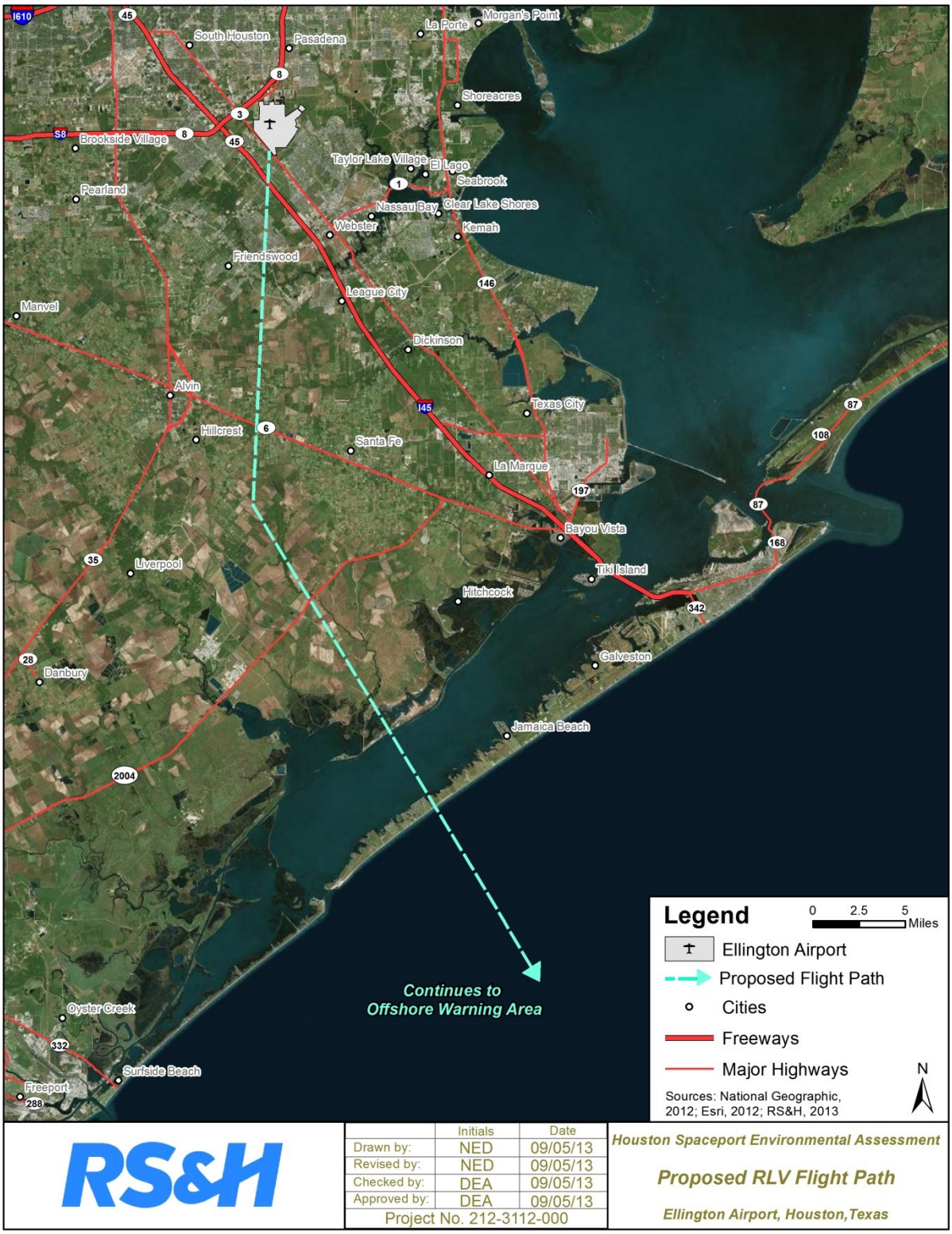
[9] Special use airspace consists of airspace of defined dimensions identified by an area on the surface of the Earth wherein activities must be confined because of their nature, or wherein limitations are imposed upon aircraft operations that are not a part of those activities, or both.

[10] A warning area is airspace of defined dimensions, (extending from 3 nautical miles outward from the coast of the United States), designated to contain activity that may be hazardous to nonparticipating aircraft.

[11] Class D airspace starts at ground level and extends out for approximately four nautical miles from the center of EFD up to an elevation of 2,000 feet above ground level.

[12] The Class B airspace is associated with HOU, located approximately 15 and 20 nautical miles from the center of HOU and at an elevation of 2,000 feet MSL to 10,000 feet MSL and 4,000 feet MSL to 10,000 feet MSL, respectively.

FIGURE 2-2
PROPOSED RLV FLIGHT PATH



The reentry and descent phase would be powered (turbofan) or unpowered (gliding) with the pilot in command of the vehicle requesting authorization from EFD's airport traffic control tower (ATCT) for a horizontal landing. A sonic boom generated by the Concept X RLV would occur during ascent and descent (or reentry). The sonic boom generated during the RLV's supersonic portion of the ascent would not impact the Earth's surface due to the steep ascending flight path angle. The sonic boom generated during the supersonic portion of the RLV's reentry would occur at around 80,000 ft over the Gulf of Mexico, approximately 30 miles from the Texas shoreline (see Section 4.12 for further details). Total flight time is estimated to be less than one hour.[13]

- Concept Z RLV Flight Profile - The Concept Z carrier vehicle and attached space vehicle would take-off to the south and fly to a designated launch site over the Gulf of Mexico, approximately 20 miles away from land. The carrier vehicle and attached space vehicle would ascend to an altitude of approximately 40,000 ft MSL. At this stage, the carrier vehicle would release the attached space vehicle. Once released, the space vehicle would free fall for a few seconds prior to ignition of its rocket engine, approximately 60 miles offshore.

  Following ignition of the rocket engine, the space vehicle would climb at supersonic speed (in excess of 768 miles per hour) until propellants are consumed at or around 150,000 ft MSL. The rocket engine would shut off and the space vehicle would coast to an apogee of at least 360,000 ft MSL. Like the Concept X RLV, a sonic boom would be generated during ascent and reentry. The ascent boom would not impact the Earth's surface, and the reentry boom would occur at around 80.000 ft over the Gulf of Mexico, approximately 30 miles from the Texas shoreline. The RLV would descend from the point of reentry and glide, with no propellant combustion, to a horizontal landing at EFD.

  The carrier vehicle, remaining in flight after the release of the RLV at approximately 50,000 ft MSL, would follow the RLV back to EFD. The carrier vehicle would then make a powered landing at EFD. The total flight time is estimated to be less than one hour.[14]

Following a successful suborbital flight, the RLV would return to EFD's Class D airspace under jet power or as a glider and be handed off to the EFD ATCT like any other aircraft. An RLV returning as a glider would utilize the HI-TACAN Runway 35L arrival.[15] Once the RLV lands, the use of Runway 17R-35L would be temporarily suspended until the RLV is removed from the runway. Non-aircraft operations such as towing equipment, and other required support equipment, would be permitted on all other taxiways and aprons not occupied by the RLV. Once the RLV is removed from the runway, EFD would resume normal operations.

The time between the RLV's initial contact with the Ellington ATCT on its return and the termination of the RLV's flight on its designated ramp area would depend on how quickly spaceport or RLV operator

[13] The flight time is ultimately operator dependent.
[14] The flight time is ultimately operator dependent.
[15] A Categorical Exclusion was completed for this approach path and, therefore, was not included in the analysis for this EA.

personnel would be able to reach the RLV with the required towing equipment. The time the RLV lands and is towed back to its designated ramp area is estimated to be approximately ten minutes, but is ultimately RLV operator dependent. As this time would be minimal, impacts to normal operations at EFD would be insignificant.

Contingency Landing Locations - Since the concept RLVs would return to EFD either under jet power or gliding, potential contingency sites are considered in the event that the RLV is unable to return to EFD. According to the 2012 Feasibility Study, there are two general aviation airports between a possible ignition point in the Gulf of Mexico and EFD. These airports are Scholes International Airport in Galveston, TX and Brazoria County Airport in Angleton/Lake Jackson, TX. The feasibility of using these airports is dependent on runway length and the requirements of the RLV operator. Should additional runway lengths be needed at either of these two airports by the RLV operator, a runway extension would be considered as part of the NEPA action for the vehicle licensing proposal, separate from this launch site operator license.

Potential Launch Failures - For each mission, HAS would establish areas to ensure public safety according to regulations in 14 CFR Part 431. FAA regulations as defined in 14 CFR Parts 417, 420, and 431 all require safety to the general public as their primary consideration in granting a license. In addition, as part of the licensing process and as part of maintaining safety of air traffic, the FAA would require HAS to establish agreements with ZHU ARTCC, I90 TRACON, and the 147th Reconnaissance Wing to coordinate the use of the required airspace.

In terms of potential effects for a nominal trajectory, the flight path does not include flights over highly populated areas. In the unlikely event of a launch failure, the debris impacts would be expected to be contained within a FAA approved hazard area. Nominal spaceport operations would not be expected to significantly impact operations at nearby airports because the flight path would be carefully coordinated to avoid the airspace of publicly owned airports in the area. Impacts to nearby airports expected as a result of spaceport operations would be those related to an RLV emergency landing. If an emergency landing were required, Air Traffic Control (ATC) would assist the RLV pilot to safely land the vehicle.

Normal operations would only be interrupted if the RLV pilot-in-command (PIC) declared an emergency and required assistance. If the PIC chose to land the RLV at a location other than EFD as a result of a distress situation, the RLV would be maneuvered to land at an airport of the PIC's choice and in coordination with Houston ATC. Upon landing, the RLV would likely be disabled and remain on the runway until assistance could be rendered. After landing, all other aircraft would be required to maintain a safe distance from the RLV because the vehicle might not have expended all its fuel.

Spaceport operations at EFD would only impact aircraft operations at nearby airports in the unlikely event of an emergency landing. As noted earlier, only licensed RLVs would be permitted to operate from the Houston Spaceport, reducing the likelihood that an emergency landing would be required.

2.1.1.5 Post-Flight Activities

For nominal launches, all of the oxidizer would be consumed during the RLV powered flight. For aborted flights, the oxidizer would be released and evaporate before landing, while the fuel would remain onboard and would be returned to the ground by the RLV. For a nominal launch, no hazardous post-flight ground operations would be required to return the RLV to safe conditions. In the event the oxidizer is not completely consumed or released, the RLV would be moved to an area with an established safety clear zone (i.e., OLA), and the remaining oxidizer and fuel would be removed in accordance with safety procedures developed for the Houston Spaceport. After safety checks of the RLV are completed, post-flight activities would also include:

- transporting the RLV from the runway to the hangar/processing facility (either by ground service equipment or under power);
- passenger and pilot deplaning; and
- post-flight checkouts and inspections.

2.1.1.6 Proposed Launch Operations

HAS proposes to provide RLV operators the ability conduct up to 50 launches per year at the Houston Spaceport (see Table 2-2) during the study years for this EA. Based on the *Houston Spaceport Economics and Business Study* (XArc, 2013), launches are anticipated to reach 35 launches per year during the timeframe of the license (2015-2019). However, for a conservative analysis, this EA assesses up to 50 launches in each year of the license. Approximately five percent of these launches could occur during nighttime hours.

TABLE 2-2
ESTIMATED NUMBER OF LAUNCHES PER YEAR

RLV Vehicle	2015	2016	2017	2018	2019
Concept X	25	25	25	25	25
Concept Z	25	25	25	25	25
Total	50	50	50	50	50

Note: For analysis purposes only. The number of launches per year is operator dependent and would be further assessed within a launch site operator license application. If the application included launches outside the scope of this EA, a supplemental EA would be prepared.
Source: RS&H, 2014.

In order to help ensure the safety of the RLV operations, routine jet engine testing would occur at EFD. For this EA, it is estimated that up to 15 RLV engine tests would be conducted per year.

2.1.1.7 Personnel

Depending on the vehicle operator and types of operations, an operator may employ 10 to 40 people. This could include mechanics and ground crew, air crew staff, trainers, office staff, and flight controllers. The estimated number of employees is subject to change based on the number and type of operations.

2.1.2 Construction of Spaceport Development

Figure 2-3 shows the proposed facilities associated with the Proposed Action. Design and construction of the proposed hangar/processing facility would be to store, maintain, and operate multiple types of concept RLVs. This facility would be comparable to existing EFD hangars and office facilities, and would be constructed in 2015 (upon FAA approval of a Houston Spaceport launch site operator license application, including a decision on the Final EA and an FAA approved ALP, as described previously in Section 1.2).

The proposed Houston Spaceport development projects pursuant to this license are reflected on an updated ALP subject to FAA Airports Division approval. Should EFD need additional spaceport facilities beyond the Proposed Action described in the following subsections, further environmental reviews would be completed accordingly.

2.1.2.1 Landside Development

As shown in Figure 2-3, relatively minor physical development would be required to support spaceport activity. This section describes the proposed landside development associated with the Proposed Action.

Hangar/Processing Facility and Apron - The Proposed Action includes the construction of an initial hangar/processing facility and apron area. According to the updated ALP, the dimensions of the hangar/processing facility are 200 ft x 230 ft. The hangar/processing facility would be constructed adjacent to a new 220 ft x 500 ft concrete apron area. The proposed location of the initial hangar/processing facility is southeast of Runway 4-22 within the HAS hay program area.[16]

Other landside development associated with the Proposed Action at EFD includes the following:

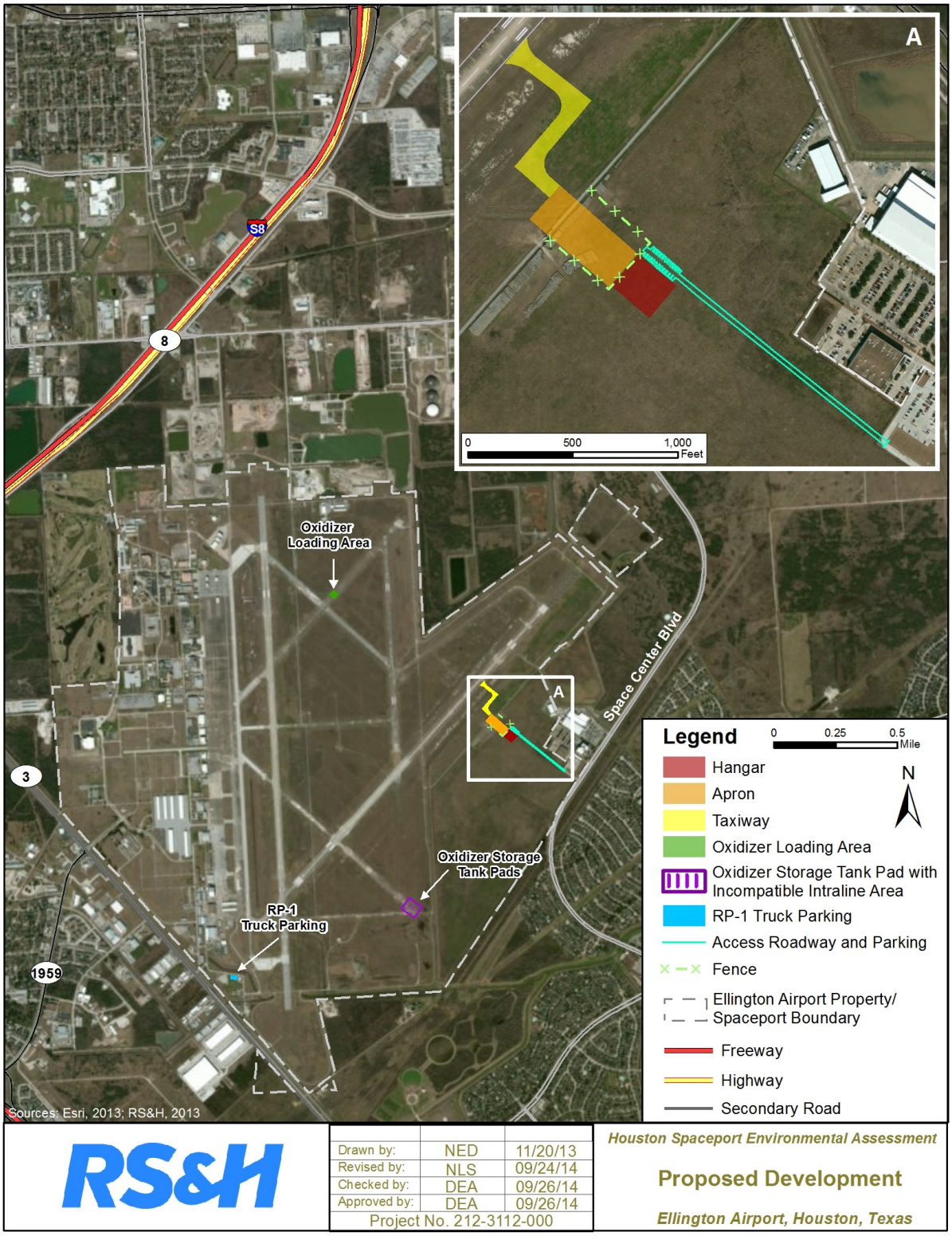
- construction of a 200 ft x 70 ft vehicle parking area (approximately 30-35 parking spots);
- construction of 1,270 ft of access road;
- construction of 1,065 ft of FAA-approved fencing; and
- construction of a storm water treatment pond (e.g., FAA compliant pond(s) to collect rainfall runoff from new impervious surfaces associated with the Proposed Action).

Propellant Storage - Fuels needed to support the types of RLVs that would operate at EFD could include RP-1, Jet-A fuel, HTPB, ABS, nylon and APCP. Oxidizers include LOX, N_2O, and H_2O_2. Table 2-3 shows the maximum quantities of fuel and oxidizer that could be stored on-site at one time for RLV operations under the Proposed Action.

Propellants, except Jet-A fuel, HTPB, APCP, and nylon/ABS, would be stored offsite and delivered to EFD by tanker truck. Due to the inert nature of solid fuel, it is reasonable to assume that as many as ten hybrid rocket motor casings containing solid fuel (ABS or HTPB) could be stored in the same processing hangar as the RLV. Jet-A fuel would be stored in existing infrastructure and supplied according to existing Standard Operating Procedures (SOPs) at EFD.

[16] Since 2006, HAS has managed an area within the southeast portion of EFD property for farming activities (e.g., tilling, seeding, cutting, baling, etc.) in order to produce Coastal Hay and Tifton 85 Bermuda grass.

FIGURE 2-3
PROPOSED DEVELOPMENT



Other oxidizers not currently used at EFD would be brought in by tanker trucks, park at the oxidizer storage area for safety, and would be transferred to the RLV during loading/unloading for flights at the OLA. These oxidizers are similar in composition and management requirements to the Jet-A fuel currently used at EFD.

TABLE 2-3
MAXIMUM QUANTITIES OF FUEL/OXIDIZER STORED ON-SITE FOR THE PROPOSED ACTION

Oxidizers/Propellants	Maximum Quantity *(1,000s of lbs)*
LOX	171
N_2O	121
RP-1	68
Jet-A/a/	952
HTPB (solid, inert)	150
Nylon/ ABS (solid, inert)	150
APCP	60

/a/ This is EFD's current storage capacity. This is not the quantity of Jet-A fuel that would be used for RLV operations.
Source: RS&H, 2014

The proposed location of the oxidizer storage area is south of Runway 4-22 for the temporary storage of trucks transporting oxidizer. This places the oxidizer outside of all aviation operating areas. Four 75 ft x 75 ft concrete pads are proposed in order for the safe temporary storage of the oxidizer.

Oxidizer Loading Area - The proposed OLA would consist of a 150 ft x 150 ft concrete pad to be located along Taxiway B in between Runway 17R-35L and Runway 17L-35R. This area is the currently designated "Hot Pad" used by the TxANG at EFD for sensitive tasks (e.g., ordinance loading/unloading).

Oxidizer loading operations are more hazardous than the aviation fuel loading operations for the following reasons:

- The RLV already contains aviation fuel, therefore adding an oxidizer is considered a hazard.
- A common oxidizer, LOX, is cryogenic and requires unique handling and equipment.
- N_2O is stored at high pressure at room temperature and requires special loading equipment.

2.1.2.2 Airside Development

Airside development includes those aspects of development associated with the runway and taxiway system. As described in Section 1.1.1.1, EFD has an 8,000 ft and 9,000 ft runway. Runway 17R-35L can accommodate the departure and return of the Rocket Crafters' Sidereus and Generation Orbit RLV concept vehicles. As shown in Figure 2-3, the Proposed Action would include:

- construction of 1,000 linear ft of taxiway from the apron area to the airfield system;
- pavement repair to Taxiway D southeast of Runway 4-22; and
- construction of 220 ft of roadway to access the oxidizer storage area.

A new 1,000-ft taxiway would accommodate the movement of the RLV from the apron to the airfield and subsequently to the oxidizer loading area. Based on the current performance characteristics of Virgin Galactic's Spaceship Two/White Knight Two, the airport's current runway lengths would not accommodate this Concept Z vehicle. HAS would need to add approximately 2,000 ft of runway length at EFD to accommodate the operation of this RLV. However, additional runway length at the airport is not being proposed at this time, and thus is not part of the Proposed Action in this EA. The operation of Spaceship Two/WhiteKnight Two at the Houston Spaceport is for conservative environmental analysis purposes only.

2.2 ALTERNATIVES CONSIDERED

NEPA, the CEQ Regulations, and FAA Orders 1050.1E and 5050.4B require an analysis of alternatives that could satisfy the purpose and need for proposed activities. This serves as a basis for comparison of alternatives and may prompt selection of an alternative that has fewer environmental effects. The following alternatives were considered.

2.2.1 No Action Alternative

NEPA requires agencies to consider a "no action" alternative in their NEPA analyses and to compare the effects of not taking action with the effects of the action alternative(s). Thus, the No Action Alternative serves as a baseline to compare the impacts of the Proposed Action. Under the No Action Alternative, the FAA would not issue a launch site operator license to HAS, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Also, there would be no need to update the EFD ALP, and thus there would be no FAA approval of a revised ALP. Existing operations would continue at EFD.

The No Action Alternative would not satisfy the purpose and need for the Proposed Action because it would not allow for operation of a commercial space launch site and would not satisfy the HAS's need to diversify the local economy and enhance the region as a business and employment center.

2.2.2 Alternatives Considered and Not Carried Forward For Further Analysis

This section describes other alternatives considered and eliminated from further environmental analysis. FAA Order 1050.1E, Change 1, paragraph 506.e states that alternatives "…must be reasonable, feasible, and achieve the project's purpose." Potential alternatives that would not meet these criteria are eliminated from further consideration.

To satisfy the need of HAS's proposal (see Section 1.4), a commercial space launch site must meet the following criteria ("Screening Criteria") to accommodate horizontal take-off and horizontal landing of RLVs in the Houston area:

- a location within the Houston airport system;
- a location in an area of comparatively low population density in order to comply with 14 CFR Part 420;
- a runway with minimum length of 8,000 ft;
- a minimum of 45,000 square ft of hangar space; and
- extensive airspace separation distances from other aircraft operating in the Houston area airspace.

Based upon the Screening Criteria, alternative sites were examined by HAS. This section describes alternative sites considered by HAS, which for the reasons provided in the following subsections, were found to be infeasible. These alternative sites were not carried forward for further analysis in the EA.

2.2.2.1 Alternative 1: Other Airports

Alternative 1 would entail the development and subsequent operation of the same infrastructure associated with the Proposed Action (e.g., hangar, apron, unloading area, access roads, and storm water treatment) located at a different airport or facility.

As described in Section 1.4 of this EA, the purpose of HAS's proposal to establish a commercial space launch site is to help the City achieve its economic goals. Establishing a launch site would enable a HAS airport to serve as an alternative to a federal launch facility or another commercial launch site for the operation of horizontally-launched and horizontally-landed Concept X and Z RLVs. As the commercial launch site operator, HAS must meet FAA regulations, specifically, *License to Operate a Launch Site – Control Access*, requiring a licensee to control public access (14 CFR § 420.53).

HAS manages and operates two other airports: George Bush Intercontinental Airport (IAH) and William P. Hobby Airport (HOU). While there are about 28 public use airports in the Houston Metropolitan Area, HAS does not have the authority to manage or conduct operations at these other airports, nor would HAS acquire another regional airport solely for the purpose of providing a commercial space launch site, as this would not be economically feasible. The range of potentially reasonable alternative airports is therefore limited to those currently under HAS management.

Source: Google, 2013.

IAH - IAH is located approximately 23 miles north of downtown Houston, near the Sam Houston Tollway. In 2012, IAH ranked 5th among U.S. airports in terms of aircraft activity. IAH encompasses more than 11,000 acres of property with five passenger terminals accommodating 20 passenger airlines, and 20 million passengers in 2012.

The IAH airfield accommodated over 517,000 annual aircraft operations in 2012; nearly 1,400 on an annual average day. The airfield at IAH (see photo left) includes five runways as described below:

- 15L-33R – 12,000 ft by 150 ft,
- 9-27 – 10,000 ft by 150 ft,
- 8R-26L – 9,400 ft by 150 ft,
- 15R-33L – 10,000 ft by 150 ft, and
- 8L-26R – 9,000 ft by 150 ft.

HOU - HOU, the second busiest commercial airport in the Houston area, is located in the City of Houston, about seven miles south of downtown, in Harris County. Major roadways close to HOU include Interstate 45 to the west, Interstate 610 to the north, and Beltway 8 to the south. HOU is by far the smallest of the HAS airports with an area of approximately 1,500 acres. Currently, HOU has one terminal with 25 gates which accommodated approximately five million passengers in 2012.


Source: Google, 2013.

HOU accommodated nearly 200,000 aircraft operations in 2012. HOU has four runways: two air carrier runways (12L-30R and 12R-30L), and two runways (4-22 and 17-35) used primarily by general aviation aircraft (see photo right). The dimensions of these runways are as follows:

- 4-22 – 7,602 ft by 150 ft,
- 12R-30L – 7,602 ft by 150 ft,
- 12L-30R – 5,148 ft by 100 ft, and
- 17-35 – 6,000 ft by 150 ft.

Evaluation of Other Airports - The following paragraphs describe the ability and/or inability of IAH and HOU to satisfy the need of HAS's proposal based on the Screening Criteria.

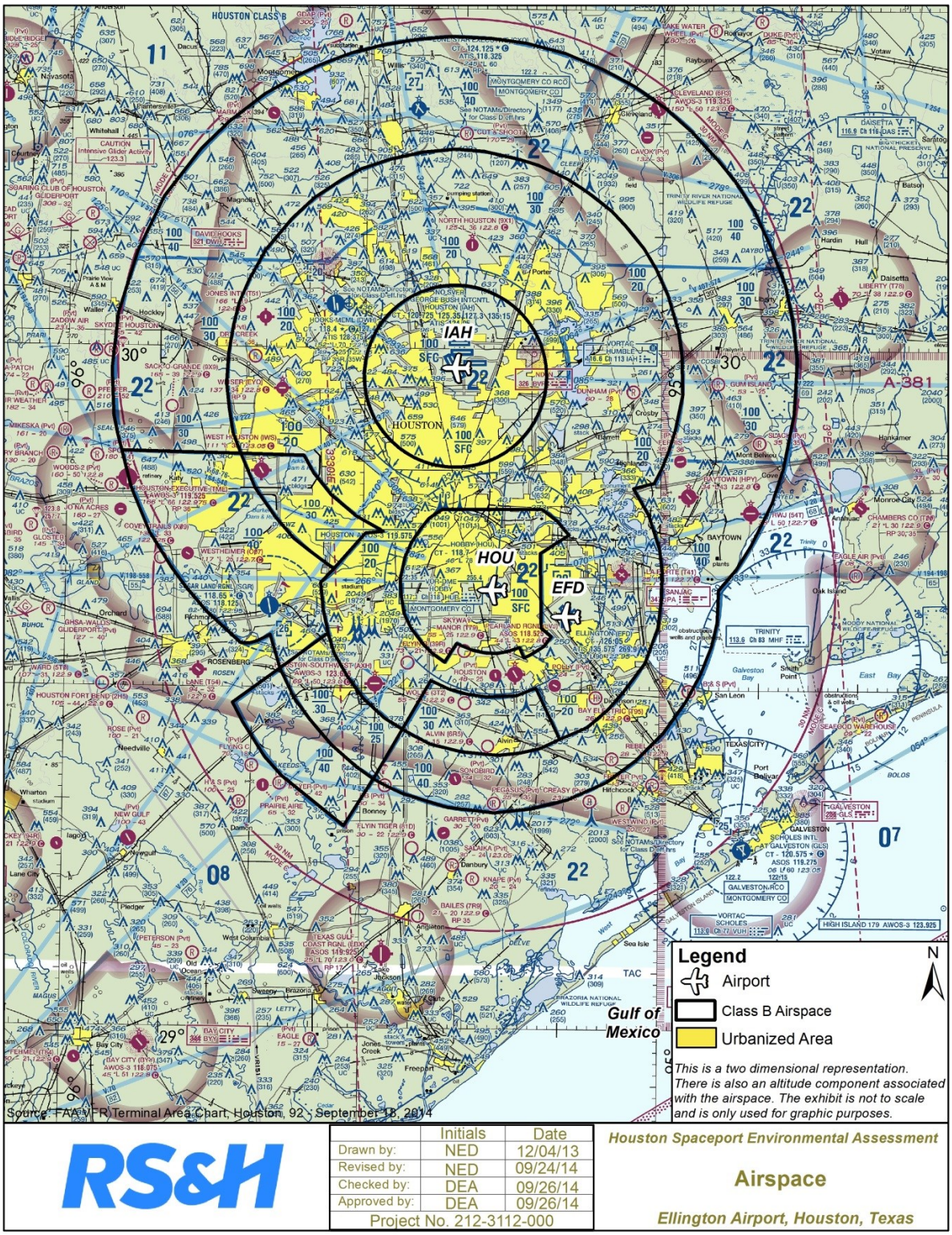
- *A location within the Houston airport system*: Both airports are owned and operated by HAS, thereby meeting the criteria of being located within the Houston airport system.

- *A location in an area of comparatively low population density in order to comply with 14 CFR Part 420*: Figure 2-4 shows that, compared to EFD, RLVs operating out of either IAH or HOU would need to travel farther and transit over more populated areas to reach the Gulf of Mexico and the Warning Areas. Flight paths from either airport do not meet the criteria of being located in an area of comparatively low population density.

- *A runway with a minimum length of 8,000 ft*: The four runways at IAH are over 8,000 ft long. Therefore, they have sufficient length to meet this criteria. None of the runways at HOU are 8,000 ft or longer. Therefore, HOU would not meet the minimum runway length criteria.

- *A minimum of 45,000 square ft of hangar space*: Both airports would be able to accommodate the development associated with the Proposed Action in some manner (e.g., reuse of an old hangar, removal of existing airport development). IAH and HOU would meet the minimum developable space criteria.

FIGURE 2-4
HOUSTON AREA CLASS B AIRSPACE

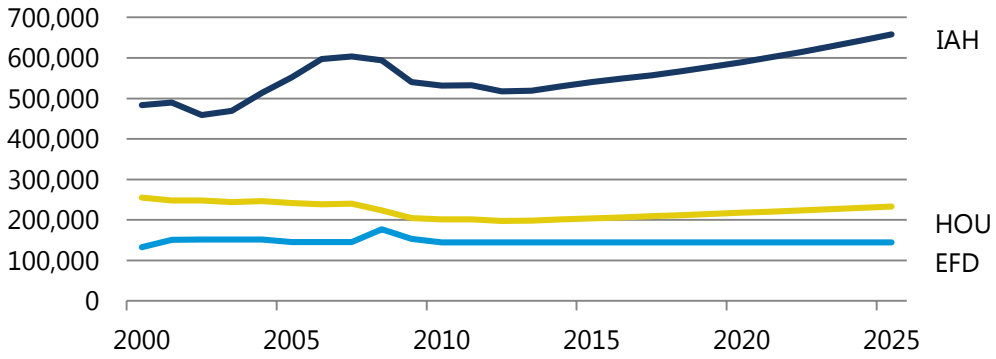


» *Extensive airspace separation distances from other aircraft operating in the Houston area airspace*: Figure 2-4 shows the FAA's Terminal Area Chart for Houston, which is centered on the Class B Airspace surrounding IAH and HOU. Class B Airspace is controlled airspace surrounding the nation's busiest airports and is designed to contain all of the published instrument approaches once an aircraft enters the airspace. An FAA ATC clearance is required to operate in Class B Airspace. IAH and HOU are the focal points of most published instrument approaches in the Houston airspace and, consequently, operating a commercial launch facility at either IAH or HOU significantly would disrupt airport operations and regional air traffic more than at EFD.

An RLV flight requires extensive separation distances from other aircraft, effecting Houston airspace. The operation of an RLV at IAH or HOU would include a detailed flight procedure that would shift a significant number of IAH and HOU aircraft operations within the airspace and substantially increase ATC coordination managed by I90 TRACON and ZHU ARTCC. Prior to a scheduled RLV operation, airspace coordination among the I90 TRACON, ZHU ARTCC, and ATCT would begin to clear the airspace from IAH or HOU to a Warning Area over the Gulf of Mexico. This would require the re-routing a significant number of aircraft operations arriving and departing IAH or HOU to allow for a cleared flight path for the operation of the RLV. The re-routing of aircraft could significantly disrupt and/or congest the Houston area airspace, reducing the potential safety of aircraft passengers and crew. In addition, RLV flights from IAH would also entail longer transit times to the Gulf of Mexico and the Warning Area in which they would operate, much of it over urbanized areas. Therefore, a RLV flight departing from IAH or HOU would be significantly more difficult to coordinate and implement for arriving and departing air carrier operations when compared to the Proposed Action at EFD.

Additionally, as shown in Figure 2-5, IAH had approximately 517,000 operations in 2012, of which approximately 288,000 were air carrier operations. The 2013 FAA Terminal Area Forecast (TAF) shows HOU having approximately 198,000 total operations and approximately 109,500 air carrier operations in 2013. These two air carrier airports alone account for approximately 714,000 total annual operations within the Houston area airspace. By comparison, in 2013, EFD had approximately 144,702 total operations and 1,852 air carrier operations.

FIGURE 2-5
HAS AIRPORTS' TOTAL OPERATIONS BY YEAR



Source: FAA TAF, 2013

While IAH and HOU meet some of the criteria to satisfy the need of HAS's proposal, neither airport is located in an area of comparatively low population density nor provide extensive airspace separation distances from other aircraft operating in the Houston area airspace. For these reasons, neither IAH nor HOU would be a reasonable alternative to the Proposed Action. Therefore, Alternative 1 is not carried forward for further environmental analysis.

2.2.2.2 Alternative 2: Other On-Airport Alternatives at EFD

Early planning coordination among FAA, HAS, HAS contractors, and EFD tenants (e.g., TxANG, NASA, etc.) addressed the potential for locating the spaceport landside improvements (hangar/processing facility, propellant storage, and OLA) at other on-Airport locations at EFD. The current west side of the airport is fully developed. Based on the current airfield configuration and the associated safety areas (runway safety areas, taxiway safety areas, runway protection zones, building restriction lines, etc.), the northern, southern, and eastern portions of the on-Airport property would not accommodate the proposed hangar/processing facility and apron. Therefore, the southeast location for the hangar/processing facility and apron as set forth in the Proposed Action (Figure 2-3) is the only feasible location. Other on-Airport locations for the landside improvements were precluded from further analysis.

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CHAPTER 3

AFFECTED ENVIRONMENT

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This chapter describes the physical, natural, and human environment within the project regions of influence (ROIs) (see Figure 3-1).[17] This information establishes a baseline for use in determining potential impacts of the Proposed Action and the No Action Alternative, as described in Chapter 2.

As described in Section 1.1.1, EFD is located in Harris County, in the southeastern portion of the City of Houston. EFD is approximately 20 miles southeast of the center of downtown Houston, 10 miles north of Galveston Bay, and 30 miles north of the Gulf of Mexico. Major roadways around EFD include Interstate 45, the Sam Houston Tollway, State Highway 3 (Old Galveston Road), and a freight rail line. EFD is approximately eight miles southeast of HOU and encompasses approximately 2,600 acres of land. At the time of this analysis, there are three active runways, eight active taxiways, and one active taxilane. Runway 17R-35L is 9,001 feet long by 150 feet wide. Runway 17L-35R is 4,609 feet long by 75 feet wide. Runway 4-22 is 8,001 feet long by 150 feet wide. Refer to Section 1.1.1 for more details regarding EFD characteristics.

This EA examines two ROIs encompassing the areas potentially subject to impacts caused by construction and operation of the Proposed Action. The ROIs encompass areas adequate to address potential impacts as required by FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*.

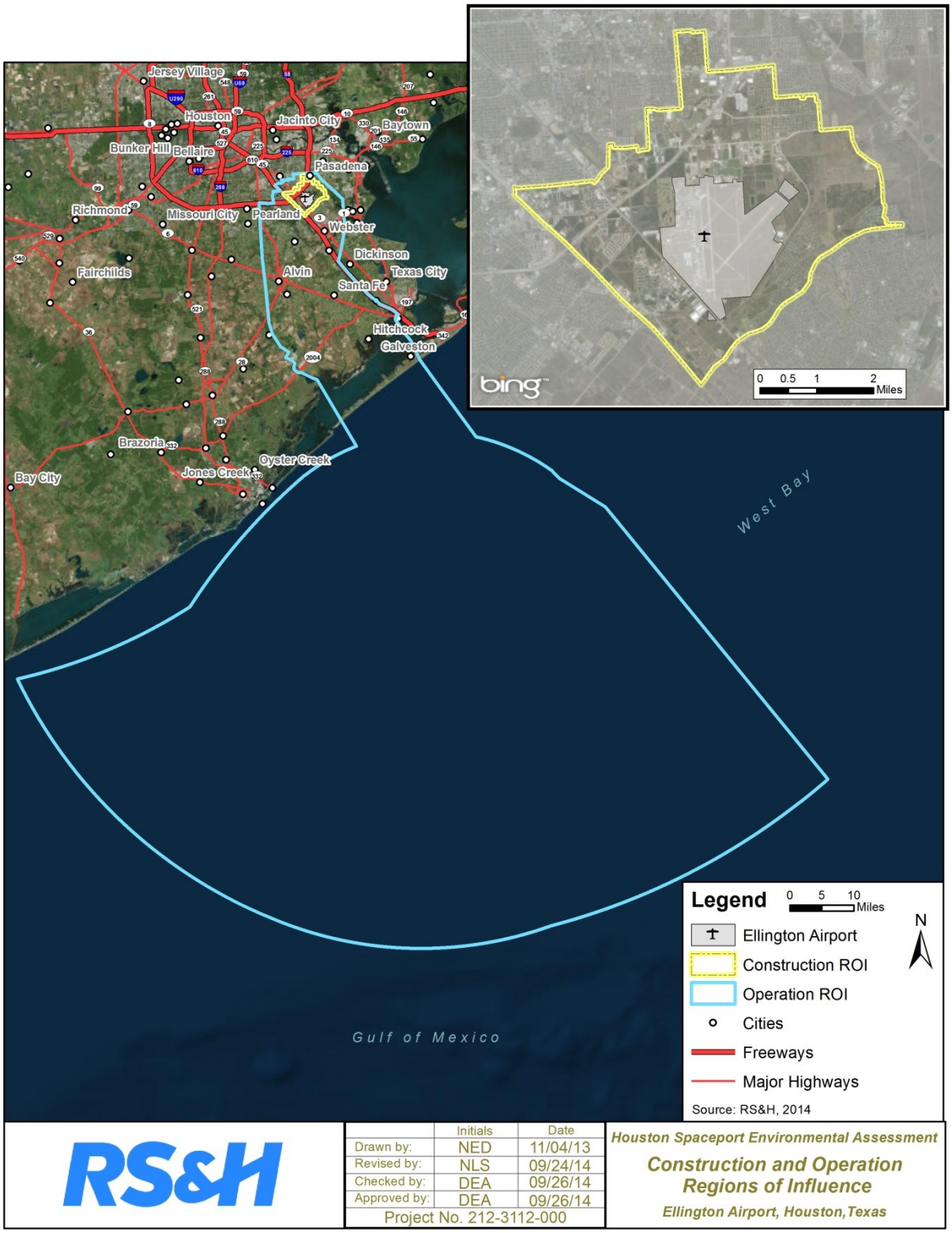
The construction ROI represents: (1) the area where ground disturbance could potentially occur during construction of the Proposed Action and (2) the environment immediately surrounding EFD. The construction ROI is defined by the U.S. Census block groups directly adjacent to EFD's property and encompasses approximately 19 square miles. The U.S. Census block groups were used to define the construction ROI for purposes of this EA in order to more accurately describe the population and economic characteristics of the area surrounding EFD which could experience construction-related effects of the Proposed Action. For environmental considerations dealing with impacts from operation of the Proposed Action, an operation ROI was established. The operation ROI is based on the operational area of the Proposed Action, including EFD, the area below the RLVs flight path to the Gulf of Mexico, and the nominal sonic boom contour that could result from RLV reentry. The operation ROI encompasses approximately 7,000 square miles and includes portions of Harris, Brazoria, and Galveston counties, with a majority of this ROI over the Gulf of Mexico. Figure 3-1 shows the construction and operation ROIs.

FAA Order 1050.1E, Change 1 requires an evaluation of impacts for specific environmental categories. This chapter describes in detail the existing conditions for the following categories:

- Air Quality (Section 3.1)
- Climate (Section 3.2)
- Coastal Resources (Section 3.3)

[17] The physical environment refers to the geographic overview, climate, water resources, floodplains, soils, and air quality. The natural environment refers to biotic communities, threatened and endangered species, and wetlands. The human environment refers to land use and local governments, Section 4(f) properties, historical and archaeological resources, airport noise, demographics, social groups, and socioeconomics.

FIGURE 3-1
CONSTRUCTION AND OPERATION REGIONS OF INFLUENCE



- Compatible Land Use (Section 3.4)
- USDOT Act, Section 4(f) Properties (Section 3.5)
- Fish, Wildlife, and Plants (Section 3.6)
- Floodplains (Section 3.7)
- Hazardous Materials, Pollution Prevention, and Solid Waste (Section 3.8)
- Historical, Architectural, Archaeological, and Cultural Resources (Section 3.9)
- Light Emissions and Visual Resources (Section 3.10)
- Natural Resources and Energy Supply (Section 3.11)
- Noise (Section 3.12)
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks (Section 3.13)
- Water Quality (Section 3.14)
- Wetlands (Section 3.15)

This EA does not analyze potential impacts to the following environmental categories:

- Farmlands - There are no prime or unique farmlands, or farmlands of statewide or local importance, as defined by the Farmland Protection Policy Act (FPPA), within the construction ROI. Although some soil types within the construction ROI are generally considered prime farmland (e.g., Bernard clay loam, Bernard-Edna complex, Lake Charles clay), the entire construction ROI is recognized by the U.S. Census Bureau as an urbanized area. Under Section 523(10)(B) of the FPPA, land identified as urbanized areas on Census Bureau maps are not subject to the provisions of the FPPA (USDA, 2012). Additionally, EFD was established in 1917 by the U.S. Military and converted to urban land use prior to the establishment of the FPPA. Section 658.2(c)(1) of the FPPA, enacted on August 4, 1984, states the act does not apply if the acquisition of land or easements for the project occurred prior to that date.
- Wild and Scenic Rivers - There are no wild and scenic rivers as designated by the Wild and Scenic Rivers Act located within the ROIs. The closest Wild and Scenic River segment to EFD is the Saline Bayou Wild and Scenic River, approximately 250 miles northeast of EFD.

Chapter 4 discusses secondary (induced) impacts, also listed in FAA Order 1050.1E, Change 1, as an impact category.

3.1 AIR QUALITY

This section summarizes details on the current (2013) and historical attainment status with respect to the National Ambient Air Quality Standards (NAAQS), as well as recently recorded air monitoring data for the area surrounding the proposed Houston Spaceport at EFD. This section also discusses greenhouse gases.

3.1.1 Air Quality Status

The U.S. Environmental Protection Agency (USEPA) sets NAAQS in order to protect the public health and environmental welfare. The USEPA has identified the following six criteria air pollutants for which NAAQS

are applicable: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2). EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels (USEPA, 2012).

Geographic areas found to be in violation of one or more NAAQS are classified as nonattainment areas. Nonattainment designations are generally based on the degree of nonattainment (e.g., serious, severe, moderate, marginal) which dictates the deadline (i.e., the attainment year) by which the area must be brought back into attainment of a NAAQS. States with nonattainment areas must develop a State Implementation Plan (SIP) demonstrating how the area will be brought back into attainment of the NAAQS within designated timeframes. Areas where concentrations of the criteria pollutants are below (i.e., within) the NAAQS are classified as attainment areas. Lastly, areas with prior nonattainment status that have since transitioned to attainment are known as maintenance areas.

The 2013 attainment/nonattainment designations for the area surrounding EFD (i.e., Harris County) are listed on Table 3-1. The area is in marginal nonattainment of the EPA's 2008 NAAQS for O_3. The area is also still considered to be in severe nonattainment for the 1997 O_3 NAAQS. EPA proposed to revoke the 1997 NAAQS in June 2013 (78 FR 34178) but until this action is published as a final rule in the FR, both the severe and marginal designations apply in Harris County.

TABLE 3-1
ATTAINMENT DESIGNATIONS

Pollutant	Designation
Carbon monoxide (CO)	Attainment
Lead (Pb)	Attainment
Nitrogen dioxide (NO_2)	Attainment
Ozone (O_3), 1-Hour[a]	Severe-17
Ozone (O_3), 8-Hour (1997)[b]	Severe-15
Ozone (O_3), 8-Hour (2008)	Marginal
Particulate Matter (coarse or PM_{10})	Attainment
Particulate Matter (fine or $PM_{2.5}$)	Attainment
Sulfur dioxide (SO_2)	Attainment

[a] Standard revoked.

[b] Standard anticipated to be revoked.

Source: US Environmental Protection Agency Green Book Nonattainment Areas (http://www.epa.gov/airquality/greenbk/), 2013.

As required by the USEPA, the TCEQ (with local assistance from the City of Houston Health Department and other entities) has established and maintains a permanent network of air quality monitoring stations throughout the state. These monitors record concentrations of pollutants in the ambient (i.e., outdoor) air to gauge compliance with the NAAQS. Table 3-2 summarizes air quality monitoring data collected at the Houston Deer Park #2 monitoring station, the closest station to the construction ROI (approximately three miles northeast of the construction ROI) for the period of 2011 to 2013. For ease of reference, the applicable NAAQS for each monitored pollutant is included in the table. As shown in Table 3-2, violations

of the 8-hour O_3 NAAQS were registered at the Houston Deer Park #2 monitoring station during this timeframe.

TABLE 3-2
AIR MONITORING DATA IN THE EFD AREA (2011 – 2013)

Site Name and Address (Direction from EFD)	Pollutant	Averaging Period	NAAQS	Year				Exceeds NAAQS
				2011	2012	2013	Average[1]	
Houston Deer Park #2 4514 1/2 Durant St. (3.5 miles NE)	CO	8-hour[2]	9 ppm	1.0	.09	1.3	NA	No
		1-hour[2]	35 ppm	1.5	1.2	1.8	NA	No
	NO_2	1-hour[3]	100 ppb	40.3	36.8	37.6	38.2	No
		Annual[4]	53 ppb	15.7	16.6	15.9	NA	No
	O_3	8-hour[5]	0.075 ppm	0.083	0.085	0.069	0.079	Yes
	Pb	Rolling 3 month[6]	0.15 µg/m^3	0.02	<0.01	<0.01	NA	No
	$PM_{2.5}$	Annual[7]	12 µg/m^3	8.5	10.1	9.0	9.2	No
		24-hour[3]	35 µg/m^3	21.3	22.1	28.0	23.8	No
	PM_{10}	24-hour[8]	150 µg/m^3	41	47	49	46	No
	SO_2	1-hour[9]	75 ppb	26.6	22.7	9.3	18.2	No
		3-hour[2]	0.5 ppm	0.017	0.015	0.007	NA	No

Notes: NA = not applicable, ppb = parts per billion ppm = parts per million, µg/m^3 = micrograms per cubic meter.
[1] Three-year average only reported if applicable to NAAQS evaluation.
[2] Not to be exceeded more than once per year.
[3] 98th Percentile of 1-hour daily maximum concentrations, averaged over 3 years.
[4] Annual mean.
[5] Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years.
[6] Not to be exceeded.
[7] Annual mean, averaged over 3 years.
[8] Not to be exceeded more than once per year on average over 3 years.
[9] 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
Source: USEPA AIRData – Monitor Data Queries 2014; and USEPA Air Quality System – Detailed AQS Data, 2013.

Per the General Conformity Rule codified at 40 CFR Part 51, federally obligated actions occurring in nonattainment or maintenance areas are required to demonstrate conformity with any existing SIP designed to remedy violations of the NAAQS or prevent future violations. The primary way to accomplish this is to compare annual emissions associated with a federal action against *de minimis* thresholds for pollutants of concern as specified in the General Conformity Rule. This process is called a General Conformity Applicability Test. If a project-related construction- or operational-related emissions exceed *de minimis* thresholds during any year, a formal General Conformity Determination must be prepared. If not, the project is said to conform to any applicable SIP.

As previously stated, the Houston area is considered nonattainment for both the currently enforceable 1997 and 2008 8-hour O_3 NAAQS. The area is also technically designated nonattainment of the now historical 1-hour O_3 standard. After revoking the 1-hour O_3 standard, the USEPA ruled that most areas, including Harris County, were no longer subject to the 1-hour standard as of 2005. Nonetheless, the anti-backsliding provisions of the CAA may subject the area to certain federal requirements for nonattainment and maintenance areas.[18]

The 2009 Houston-Galveston-Brazoria (HGB) Eight-Hour Ozone Nonattainment Area Reasonable Further Progress State Implementation Plan Revision (Rule Log 2006-030-SIP-NR), adopted by the TCEQ on May 23, 2007 and approved by the USEPA in April of 2009 (74 FR 18298) is the O_3 SIP for the Houston area. Since then, TCEQ has prepared and adopted the HGB Reasonable Further Progress State Implementation Plan for the 1997 Eight-Hour Ozone Standard (Rule Log 2009-018-SIP-NR) and the HGB Attainment Demonstration SIP Revision for the 1997 Eight-Hour Ozone Standard (Rule Log No. 2009-017-SIP-NR). The USEPA has recently proposed to approve these SIP revisions (78 FR 55029, 78 FR 55037) and once approved they will become the applicable SIPs for the Proposed Action at EFD.

Therefore, the most stringent of the O_3 *de minimis* thresholds applicable to the Houston area (i.e., the severe nonattainment area designation under the 1997 8-hour standard) correspond to 25 tons per year of nitrogen oxides (NO_x) or volatile organic compounds (VOC), both of which are considered precursors to ground level O_3 formation. Accordingly, a General Conformity Applicability Test outlined at 40 CFR §93.153(b) has been prepared, the results of which are discussed in Section 4.1.2.2, whereby operational and construction CAP emissions associated with the Proposed Action occurring below the local atmospheric mixing height (i.e., below 3,038 feet for the Houston Area) are compared to these thresholds.[19]

3.2 CLIMATE

Research has shown there is a direct correlation between fuel combustion and greenhouse gas (GHG) emissions. In terms of U.S. contributions, the U.S. Government Accountability Office reports that "domestic aviation contributes about three percent of total CO_2 emissions, according to EPA data," compared with other industrial sources, including the remainder of the transportation sector (20%) and power generation (41%) (GAO, 2009). The International Civil Aviation Organization (ICAO) estimates that GHG emissions from aircraft account for roughly three percent of all anthropogenic GHG emissions globally (Melrose, 2010). Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global climate (USEPA, 2009).

The scientific community is continuing efforts to better understand the impact of aviation emissions on the global atmosphere. The FAA is leading and participating in a number of initiatives intended to clarify

[18] Codified under 40 CFR 51.905, the anti-backsliding provisions of the CAA prevent the rescission of measures or requirements applicable to areas in which a NAAQS is revoked or relaxed by the EPA, such that select requirements continue to apply to an area after revocation or relaxation of the NAAQS in question (i.e., the 1-hour O3 NAAQS), if the requirements were applied in the area based on the area's prior designation.

[19] The local mixing height is defined as the vertical extent in the troposphere above which emitted pollutants do not mix downward to ground level.

the role that commercial aviation plays in GHG emissions and climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g., National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, U.S. EPA, and U.S. Department of Energy), has developed the Aviation Climate Change Research Initiative in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions. FAA also funds the Partnership for Air Transportation Noise & Emissions Reduction Center of Excellence research initiative to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. Similar research topics are being examined at the international level by the ICAO (Maurice & Lee, 2007).

3.3 COASTAL RESOURCES

The State of Texas has a Coastal Management Program (CMP), which ensures the long-term environmental and economic health of the Texas coast through management of the state's coastal natural resource areas. The Texas CMP was finalized in 1997 and accepted into the Coastal Zone Management Program (CZMP) by the National Oceanic and Atmospheric Administration (NOAA), following the passing of the Coastal Coordination Act (CCA) in 1991. The CCA set the boundaries of the Texas coastal zone to include all or part of 18 coastal counties and more than eight million acres of land and water. EFD is in Harris County, which partially lies within the Texas Coastal Zone Boundary (CZB). Due to the County's location within the coastal zone, the impact of the State's CMP is important to the future of Harris County and surrounding counties. Figure 3-2 depicts EFD's location within the coastal zone boundary.

The Texas CMP is managed by the Texas Land Commissioner within the Texas General Land Office (GLO). In accordance with the Texas Administrative Code, §501.1, the purpose of the CMP is to "make more effective and efficient use of public funds and to more effectively and efficiently manage coastal natural resource areas and the activities that may affect them."

There is a Texas Coastal Preserve within the operation ROI, approximately six miles east of EFD. There are no Coastal Barrier Resource Systems (CBRSs) within the construction or operation ROIs. There is an otherwise protected area, Unit TX-05P, in the operation ROI. This resource is approximately 28 miles away from the construction ROI (USFWS, 2013).

3.4 COMPATIBLE LAND USE

Land use and zoning is the right and responsibility of local or state governments, not federal agencies. The City of Houston has not enacted conventional zoning. Rather, the City of Houston implements airport compatible land use regulations in the Code of Ordinances, Chapter 9, Article VI (Ordinance No. 2008-1052) (City of Houston, 2008a). This article establishes airport land use areas that extend one and one-half miles from either side of a runway center line and five miles from each runway end.

Article VI also establishes three land use tiers, shown in Figure 3-3. These tiers have certain restrictions created to protect each HAS airport from the encroachment of sensitive land uses. Article VI's definition of sensitive land uses includes childcare facilities, nursing homes, assisted living centers, boarding houses, schools, hospitals, or medical facilities (City of Houston, 2008b). Article VI also institutes rules for issuing land use permits allowing compatible developments within each tier.

FIGURE 3-2
COASTAL BOUNDARY

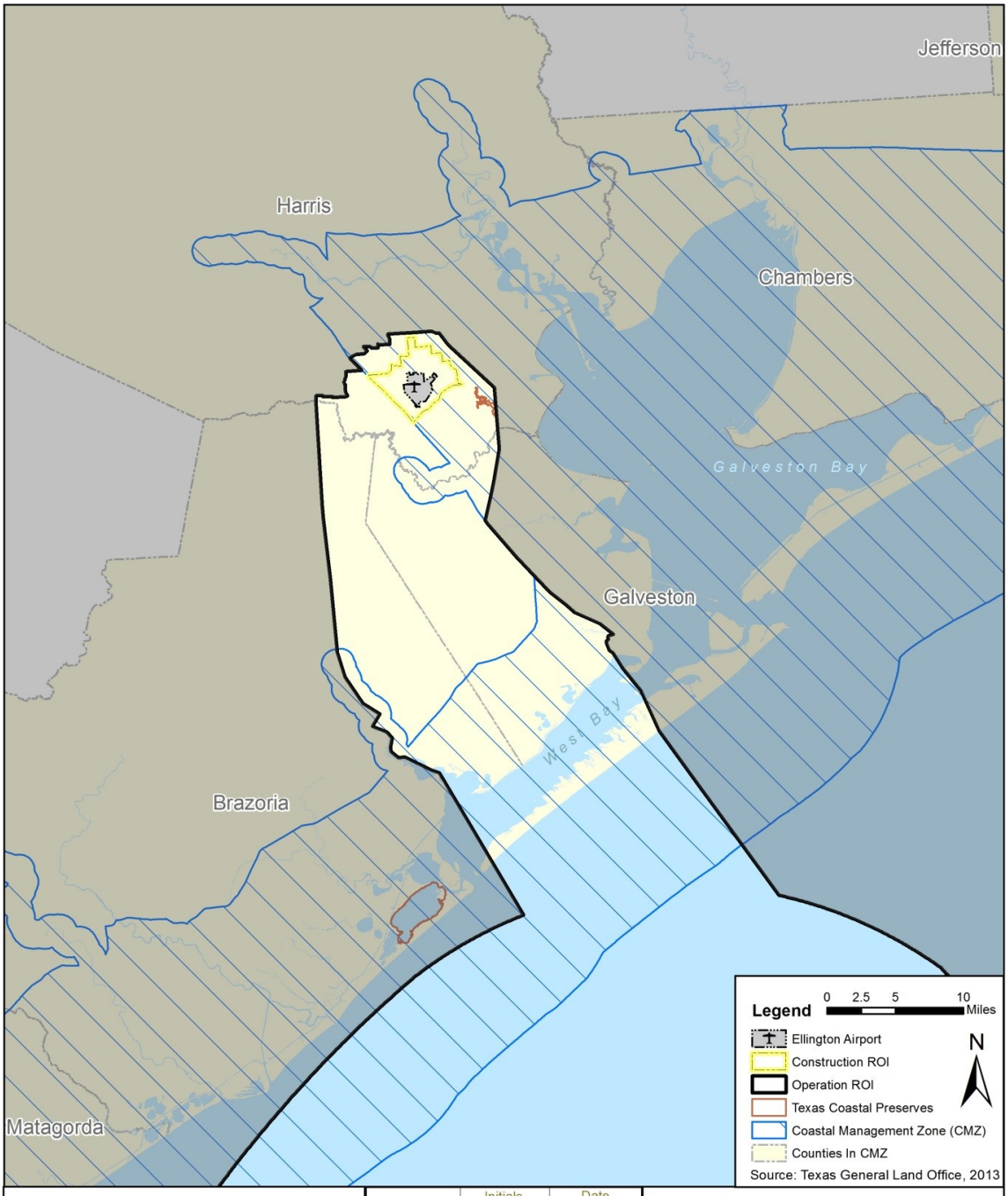
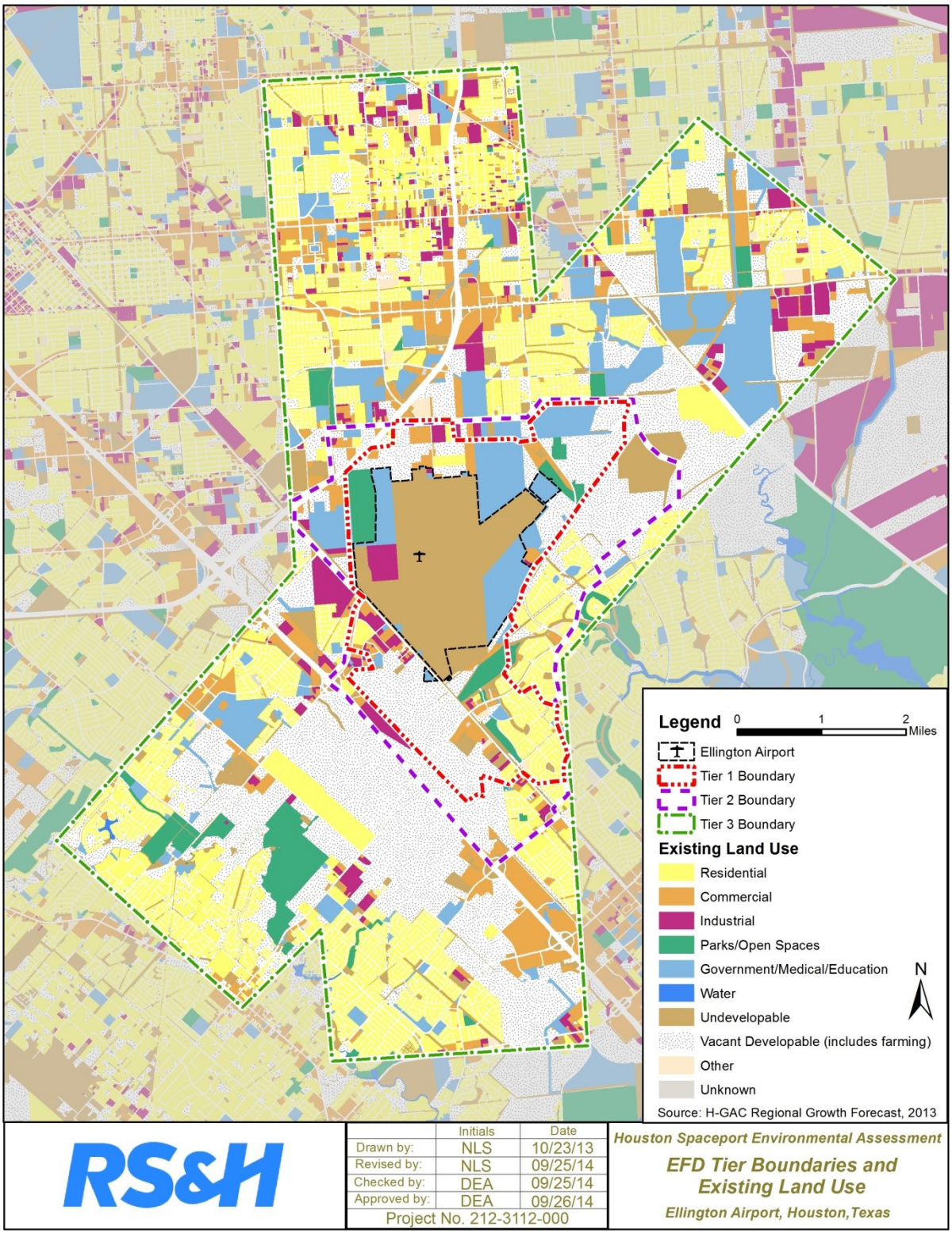


FIGURE 3-3
EXISTING LAND USE



The Tier 1 and 2 boundaries follow the average day-night sound level (DNL) 65 A-weighted decibel (dBA) and DNL 60 dBA noise contours, respectively. Tier 3 is an overlay of the Texas Local Government Code Section 241, Airport Zoning Act (AZA). AZA establishes a "controlled compatible land use area" around EFD. The HAS land use compatibility matrix outlines the compatibility of various land uses within each tier (see Table 3-3).

TABLE 3-3
HAS LAND USE COMPATIBILITY MATRIX

Land Uses	Tier 1/a/	Tier 2	Tier 3
Residential Dwellings (Single Family or Multi family)			
A. Enlargement of existing single family structures	/	✓	✓
B. Renovation of existing single family structures	✓	✓	✓
C. Replacement of existing single family structures after casualty/b/	/	✓	✓
D. Enlargement, renovation, or replacement of existing multi-family structures	/	/	✓
E. New Multi-family development	x	/	✓
F. New mobile home parks or subdivisions	x	x	✓
G. New single family construction, including demolition, in existing developed residential areas	/	/	✓
H. New construction in undeveloped or non-residential areas	x	/	✓
Sensitive and Public Assembly Use (e.g., hospitals, nursing homes, K 12 schools)			
A. Enlargement or renovation of existing structures	/	/	✓
B. New Construction	/	/	✓
Lodging			
A. Enlargement or renovation of existing structures	/	/	✓
B. New Construction	/	/	✓
Commercial and Employment Uses (e.g., retain, restaurants, offices)			
A. Enlargement or renovation of existing structures	✓	✓	✓
B. New Construction	✓	✓	✓

Notes: /a/ Must meet certain notification requirements
/b/ "Casualty" means destruction by accidental or natural causes.
✓ Compatible
/ Conditionally Compatible **-** Compatible only with sound insulation measures. Subject to conditions including sound insulation and execution of avigation easement. For enlargement, conditions will apply if the enlargement of the structure is more than 51% of the appraised value of the livable area.
x Not Compatible

Source: HAS, 2011

The operation ROI covers portions of Harris, Brazoria, and Galveston counties. These counties are part of the Houston-Galveston Area Council (H-GAC). Nearly all types of H-GAC designated land uses occur within the operation ROI. A general field survey of the project ROIs was conducted in August 2013. The land uses observed during the field survey support the H-GAC land use classifications and the applicability of these land use classifications for this EA.

3.4.1 Existing Land Use

The northern portion of the operation ROI consists mostly of residential land uses. There are commercial, industrial, parks/open spaces, and vacant developable (including farming) land uses scattered throughout this area. The northeastern portion of the operation ROI has a greater presence of industrial, parks/open spaces, and vacant developable (including farming) land uses.

The majority of the central portion of the operation ROI consists of vacant developable (including farming) land uses. The residential land uses in this area are primarily along Highway 6. Similarly, the commercial and industrial land uses occur mostly along Highway 6 and Highway 35. Amoco Chemical Company is located in this portion of the ROI, along Farm to Market (FM) Road 2004. The central portion of the operation ROI also has a number of land uses classified as undevelopable.

The southern portion of the operation ROI is primarily vacant developable (including farming) and parks/open spaces land uses. There are also large tracts of industrial and undevelopable land uses. Residential areas are mostly toward the southwest and along the Gulf of Mexico, although there are residential land uses scattered throughout the area. Similarly, there are commercial land uses in the southwestern area and along the Gulf of Mexico.

The areas within the construction ROI contain government/medical/educational, commercial, industrial, and vacant developable (includes farming) land uses. There are residential land uses approximately one-half mile east and west of EFD. There is a large area of vacant developable (including farming) land south and northeast of EFD. This area corresponds closely with the present and future DNL 65 dBA contours of EFB and the Tier 1 Boundary. New residential development, within the Clear Lake community, is currently taking place southeast of EFD. There are also new industrial parks being developed. The Southeast Water Purification Plant is expanding, located north of EFD.

Wildlife is managed at EFD to reduce the risk of wildlife hazards to aircraft operations. However, there are several existing wildlife hazards near EFD. The industrial and commercial area directly north of EFD has multiple open water ponds and water retention facilities. Standing Stone Solstice Circle, a public park, is located south of EFD and has a small pond. There are also wetlands directly east of EFD. These open water ponds, water retention facilities, and wetlands could attract wildlife and create potential wildlife hazards.

Landfills may also create wildlife hazards. Three closed landfills are located near EFD. These are to the north and northwest, with the closest closed landfill approximately one-half mile north of EFD. The closest active landfill to EFD is an H-GAC designated Type IV landfill labeled #1708, approximately two miles northwest of EFD. This type of landfill allows for the disposal of brush, construction and demolition waste and/or rubbish free of putrescible, and household wastes. The landfill is covered weekly (H-GAC, 2013).

3.5 DEPARTMENT OF TRANSPORTATION, SECTION 4(F) PROPERTIES

Section 4(f) properties are publicly owned lands including public parks, recreation areas, wildlife and waterfowl refuges, or publicly or privately owned historic sites of National, State, and/or local importance. The term historic sites includes prehistoric and historic districts, sites, buildings, structures, or objects listed in, or eligible for listing in, the NRHP. Section 4(f) properties are protected under Section 4(f) of the

USDOT Act, codified and renumbered as 49 U.S.C. §303(c). In accordance with § 4(f), the FAA will not approve any program or project that requires the use of any Section 4(f) property determined by the officials having jurisdiction thereof, unless no feasible and prudent alternative exists to the use of such land and such program, and the project includes all possible planning to minimize harm resulting from the use.

Figure 3-4 shows publicly owned parks within the construction ROI. The closest parks to EFD are the Standing Stone Solstice Circle, Pasadena Municipal Golf Course, and Holly Bay Court Park. There are no wildlife refuges, waterfowl refuges, or historic sites within the construction ROI.

According to H-GAC, there are 146 public parks within the operation ROI (see Table 3-4).[20] The Brazoria National Wildlife Refuge is also within the operation ROI (Houston Wildlife Refuges, 2014). There are no waterfowl refuges within the operation ROI. Additionally, there are four NRHP-listed resources within the operation ROI (see Section 3.9).

3.6 FISH, WILDLIFE, AND PLANTS

Relevant federal laws, regulations, and EO[21] that protect biotic communities include the following:

- Airport and Airways Development Act, Section 47106(c)(B);
- Endangered Species Act (ESA) (16 U.S.C. §1531-1544);
- Related Essential Fish Habitat Requirements of the Magnuson-Stevens Act, as amended by Sustainable Fisheries Act [16 U.S.C. § 1855 (b)(2)];
- Fish and Wildlife Conservation Act of 1980 (16 U.S.C. § 661, *et. seq.*);
- EO 13112, Invasive Species (64 FR 6183);
- Migratory Bird Treaty Act (MBTA) (16 U.S.C. § 703-712); and
- Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federally Landscaped Grounds (60 FR 40837).

The following regulations implement the federal acts that protect biotic communities:[22]

- 50 CFR Part 402 provides instructions on federal agency consultation with the USFWS. This also provides instructions on preparing biological assessments to determine project-related effects on federally-listed endangered and threatened species. 50 CFR 600.920 requires federal agencies approving or funding federal actions which may affect essential fish habitat to consult with the National Marine Fisheries Service (NMFS).
- 50 CFR Parts 10 and 10.13 discusses the taking and protection of the listed migratory birds.

[20] Country clubs and homeowner association parks are not included in this list as they are not public facilities (membership is required).

[21] Due to the number of federal laws and EOs applicable to the Proposed Action, this section presents only the legal citations or references for those requirements in lieu of summarizing their requirements. See FAA Order 1050.1E, Appendix A for more information.

[22] Note there are no regulations implementing the FWCA. Section 662 of the Act requires federal agencies to coordinate with USFWS when an action would affect a waterway.

FIGURE 3-4
PARKS WITHIN THE CONSTRUCTION ROI

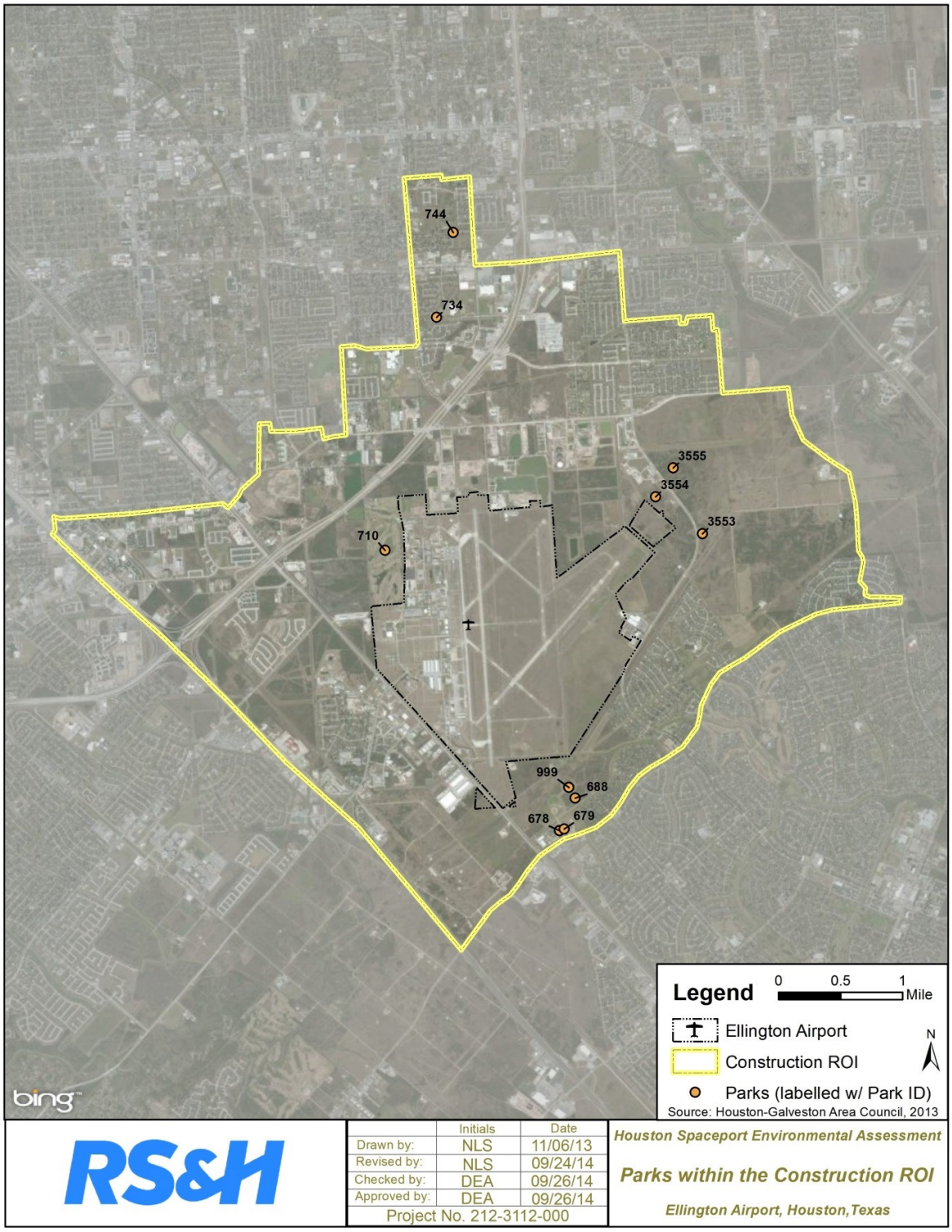


TABLE 3-4
PUBLIC PARKS WITHIN THE OPERATION ROI

Park ID	Name	Park Type
446	Galveston Island State Park	Regional Park
447	Lafittes Harbor Acres	Community Park
448	Trimble & Lindsey Acres	Neighborhood Park
449	Galveston Country Club	Golf Course
454	Audobon Society Bird Preserve	Nature Conservancy/ Reserves/Wetlands
460	San Bernard	Nature Conservancy/ Reserves/Wetlands
461	Mahan Park	Urban Park
462	Carbide Park	Urban Park
465	Jack Brooks Park	Regional Park
466	Westlawn	Mini Park
467	Unknown	Mini Park
472	Runge Park	Sports Fields
473	Santa Fe Trails	Mini Park
474	Castle Estates	Mini Park
481	Bob Briscoe Park	Recreational Sports Facility
487	Hillcrest Golf Club	Golf Course
490	Pearson Park	Recreational Sports Facility
496	Morgan Park	Recreational Sports Facility
502	City Of Alvin Ball Park	Sports Fields
504	Unknown	Recreational Sports Facility
508	Prairie Dog Park	Mini Park
509	Alvin Park	Mini Park
511	Unknown	Neighborhood Park
512	Alvin Park	Mini Park
513	Unknown	Mini Park
515	Alvin Park	Mini Park
516	Newman Park	Mini Park
517	Chaparral Recreation Association	Golf Course
520	Bay Colony Pointe	Mini Park
521	Bay Colony Recreation Center	Recreational Sports Facility
532	Big League Dreams	Sports Fields
534	River Oaks At Friendswood	Golf Course
535	Sequoia Gold Magnolia Creek	Golf Course
536	Magnolia Creek Recreation Center	Recreational Sports Facility
539	Westover Park	Mini Park
540	Westover Park	Mini Park
542	Unknown	Golf Course
543	Brittany Lakes	Mini Park
545	Brittany Lakes	Mini Park

TABLE 3-4 CONTINUED
PARKS WITHIN THE OPERATION ROI

Park ID	Name	Park Type
546	Westover Park	Recreational Sports Facility
547	Unknown	Community Park
550	Rustic Oaks	Mini Park
551	Unknown	Mini Park
552	Unknown	Recreational Sports Facility
553	Rustic Oaks	Mini Park
554	Rustic Oaks	Mini Park
557	Unknown	Sports Fields
559	Claremont Park	Mini Park
560	The Landing	Recreational Sports Facility
561	Villages Of Oak Creek Colony	Community Park
565	Claremont Park	Mini Park
567	Unknown	Urban Park
568	Braskora Gardens	Neighborhood Park
572	Greenridge	Mini Park
573	Magnolia Estates	Neighborhood Park
575	Park On Clear Creek	Urban Park
577	Creekside Estates	Neighborhood Park
582	Boraska Gardens	Urban Park
584	Challenger 7 Memorial Park	Regional Park
587	Unknown	Recreational Sports Facility
588	Unknown	Recreational Sports Facility
589	Butler Oaks	Mini Park
591	City Park	Community Park
592	Walter Hall Park	Urban Park
594	Forest Bend Park	Community Park
596	Stevenson Park	Recreational Sports Facility
597	Unknown	Neighborhood Park
599	Unknown	Nature Conservancy/ Reserves/Wetlands
603	The Park On Egret Bay	Mini Park
606	Bayou Brae Civic Club	Recreational Sports Facility
607	Heritage Park	Recreational Sports Facility
608	Renwick Park	Sports Fields
610	Unknown	Regional Park
612	Unknown	Neighborhood Park
613	Unknown	School Park
615	Pearson Park	Mini Park
617	Nassau Bay Peninsula Wildlife Park	Urban Park
618	Unknown	Mini Park

TABLE 3-4 CONTINUED
PARKS WITHIN THE OPERATION ROI

Park ID	Name	Park Type
624	1776 Park	Neighborhood Park
625	City Of Webster	Community Park
627	Independence Park	Athletic Facility
631	Egret Bay Villas	Mini Park
633	Green Acres	Mini Park
634	Aaron Pasternak Memorial Park	Mini Park
639	Randolph Park	Urban Park
640	Howard L Ward Park	Neighborhood Park
641	Woodcreek	Mini Park
647	Portofino Village	Mini Park
650	Timber Creek	Golf Course
651	Hyde Park	Mini Park
652	Clear Lake Park	Recreational Sports Facility
653	Clear Lake Park	Neighborhood Park
654	Unknown	Urban Park
655	Golfcrest Country Club	Golf Course
657	Sterling Knoll Park	Mini Park
658	Zychlinski Park	Mini Park
659	Clear Lake Golf Club	Golf Course
662	Williams Park	Recreational Sports Facility
671	Unknown	Sports Fields
673	Armand Bayou Park	Regional Park
677	Sagemeadow Park	Mini Park
678	Rodriguez (Sylvan) Park	Mini Park
679	Rodriguez (Sylvan) Park	Mini Park
684	Unknown	School Park
688	Rodriguez (Sylvan) Park	Regional Park
689	Unknown	Mini Park
690	Kirkwood South Park	Recreational Sports Facility
691	Twin Creek Woods	Mini Park
697	Sagemont Park	Community Park
698	Oasis Garden At Bay Area Park	Recreational Sports Facility
699	Jones Park	Recreational Sports Facility
701	Roy D. Kipper Mease Park	Regional Park
705	Blackhawk Park	Urban Park
706	Beverly Hills Park	Recreational Sports Facility
710	Pasadena Ellington Golf Club	Golf Course
715	Gulf Palms Park	Community Park
726	Unknown	Recreational Sports Facility

TABLE 3-4 CONTINUED
PARKS WITHIN THE OPERATION ROI

Park		
726	Unknown	Recreational Sports Facility
731	Wilson Memorial Park	Community Park
734	Fairmont Estates	Neighborhood Park
740	Fairmont Park	Recreational Sports Facility
744	Parkgate North	Mini Park
1452	Southbelt Hike And Bike Trail	Parks/Flood Control/Retention
1478	El Franco Lee Park	Regional Park
1692	Clear Creek Crossing	Mini Park
1693	Bay Colony Parkside Community Park	Mini Park
1694	Bay Colony Parkside Community Park	Neighborhood Park
1695	Leisure Lakes Community Park	Mini Park
1703	Centennial Park	Urban Park
1704	Friendswood Sports Park	Sports Fields
1705	Polly Ranch	Community Park
1757	Holly Bay Court Park	Urban Park
1776	Burke/Crenshaw Park	Urban Park
2067	Unknown	Neighborhood Park
2177	Dixie Farm Road Park	Urban Park
2178	Oxnard Park	Community Park
2184	Heritage Park Hike And Bike Trail	Parks/Flood Control/Retention
2221	Kingspoint Dog Park	Community Park
3232	Westover Park	Neighborhood Park
3234	Unknown	Regional Park
3553	Unknown	Nature Conservancy/ Reserves/Wetlands
3554	Unknown	Nature Conservancy/ Reserves/Wetlands
3555	Unknown	Nature Conservancy/ Reserves/Wetlands
3626	Unknown	Library
3629	Unknown	Library
3630	Alvin Branch Library	Library
3634	Unknown	Library

Source: HGAC Parks Score Viewer, http://arcgis02.h-gac.com/park_score/index.html, accessed May 2014.

EFD is located in the Upper Coastal Prairie Grasslands of the Gulf Prairies and Marshes of Texas's biogeographic area. Most of the Coastal Prairie has been converted to row crops or tame pasture. Overgrazing and fire suppression have also led to the increase of native and introduced woody species. These include the Chinese tallow tree (*Sapium sabiferum*), Huisache (*Acacia farnesiana*), Macartney rose (*Rosa bracteata*), and Honey mesquite (*Prosopis glandulosa*).

Table 3-5 shows the federally listed threatened and endangered species for the counties intersecting the operation ROI (Brazoria, Galveston, and Harris). Table 3-6 shows the state status for the species found in the counties intersecting the operation ROI. As noted in the U.S. Fish and Wildlife Service (USFWS) letter in response to an early coordination letter (see Appendix A), freshwater mussels are candidates for listing under the ESA and may occur in various regions throughout Texas. Texas Parks and Wildlife lists the Texas fawnsfoot (*Truncilla macrodon*) as occurring in Brazoria County. A small area of designated critical habitat for the piping plover (*Charadrius melodus*) exists in the operation ROI at the southwestern end of Galveston Island. This area is located over 30 miles from EFD.

The majority of the area within the construction ROI is either previously disturbed or paved. In 2001, the giant sharpstem umbrella-sedge (*Cyperus cephalanthus*) was observed two miles northeast of EFD. In 1984, the Texas windmill-grass (*Chloris texensis*) was observed two miles southwest of EFD. Both plant species are listed as species of concern in Texas (HAS, 2013b).

In many areas of the EFD property, native plants have been replaced with cultivated turf and ornamental shrubs. Most unpaved areas are cleared and maintained regularly. As described in the June 2013 Ellington Airport Self-Service Fueling Facility EA, no threatened or endangered species, species or habitat of concern, or critical habitat are currently known to exist within the EFD property (HAS, 2013b). According to the HAS 2004 Comprehensive Master Plan for EFD, suitable habitat for the federal and state endangered Texas prairie dawn (*Hymenoxys texana*) is common in undeveloped portions of EFD environs, particularly to the east of EFD (HAS, 2004a). HAS currently mows and maintains this area for hay production. The state endangered Houston Toad (*Bufo houstonensis*) was observed at EFD until 1973. According to the USFWS, it is likely the Houston toad is no longer in Harris County (USFWS, 2011).

The MBTA and EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, provide protection to all migratory birds (including their eggs, active nests, and bird parts) within the United States. Texas is part of the Central Flyway as defined by the USFWS. Species included on MBTA may utilize the Central Flyway. Bald eagles are also known to occur in Harris and Brazoria counties. According to Texas Parks and Wildlife, the bald eagle's nesting range includes Harris and Brazoria counties (TPW, 2013). There are colonial waterbird rookeries present in the operation ROI. The closest rookery to the construction ROI is approximately 24.5 miles south in West Bay. Figure 3-5 shows the colonial waterbird rookeries and designated critical habitat for the piping plover within the operation ROI. Fourteen bird strikes were reported at EFD in 2012 (FAA, 2013d).

TABLE 3-5
FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES
IN BRAZORIA, GALVESTON, AND HARRIS COUNTIES

Common Name	Scientific Name	Federal Status[/a/]	County(ies) Where Listed
Birds			
Attwater's Greater Prairie-Chicken	*Tympanuchus cupido attwateri*	E	Galveston
Brown Pelican	*Pelecanus occidentalis*	DM	Brazoria, Galveston
Eskimo curlew	*Numenius borealis*	E	Galveston
Piping Plover	*Charadrius melodus*	E,T	Brazoria, Galveston
Whooping Crane	Grus americana	E, EXPN	Harris, Galveston
Mammals			
West Indian Manatee	*Trichechus manatus*	E	Brazoria, Galveston
Reptiles			
Green Sea Turtle	*Chelonia mydas*	E,T	Brazoria, Galveston
Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	Brazoria, Galveston
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	Brazoria, Galveston
Leatherback Sea Turtle	*Dermochelys coriacea*	E	Brazoria, Galveston
Loggerhead Sea Turtle	*Caretta caretta*	T	Brazoria, Galveston
Plants			
Texas Prairie Dawn	*Hymenoxys texana*	E	Harris

[/a/]Status: E – Endangered, T -Threatened; DM - Recovered, Delisted and Being Monitored; EXPN – Experimental Essential Population

Source: U.S. Fish and Wildlife Service, County by County Species List, http://www.fws.gov/southwest/es/ES_Lists_Main.cfm, accessed May 2014.

TABLE 3-6
TEXAS PARKS AND WILDLIFE DEPARTMENT'S LISTED SPECIES
IN BRAZORIA, GALVESTON, AND HARRIS COUNTIES

Common Name	Scientific Name	State Status[/a/]	County(ies)
Birds			
American Peregrine Falcon	*Falco peregrinus anatum*	T	Harris, Brazoria, Galveston
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	R	Harris, Brazoria, Galveston
Attwater's Greater Prairie-Chicken	*Tympanuchus cupido attwateri*	E	Galveston
Bald Eagle	*Haliaeetus leucocephalus*	T	Harris, Brazoria, Galveston
Black Rail	*Laterallus jamaicensis*	R	Harris, Brazoria, Galveston
Brown Pelican	*Pelecanus occidentalis*	R	Harris, Brazoria, Galveston
Eskimo Curlew	*Numenius borealis*	E	Brazoria, Galveston
Henslow's Sparrow	*Ammodramus henslowii*	R	Harris, Brazoria, Galveston
Mountain Plover	*Charadrius montanus*	R	Harris, Galveston
Peregrine Falcon	*Falco peregrinus*	T	Harris, Brazoria, Galveston
Piping Plover	*Charadrius melodus*	T	Brazoria, Galveston

TABLE 3-6 CONTINUED
TEXAS PARKS AND WILDLIFE DEPARTMENT'S LISTED SPECIES
IN BRAZORIA, GALVESTON, AND HARRIS COUNTIES

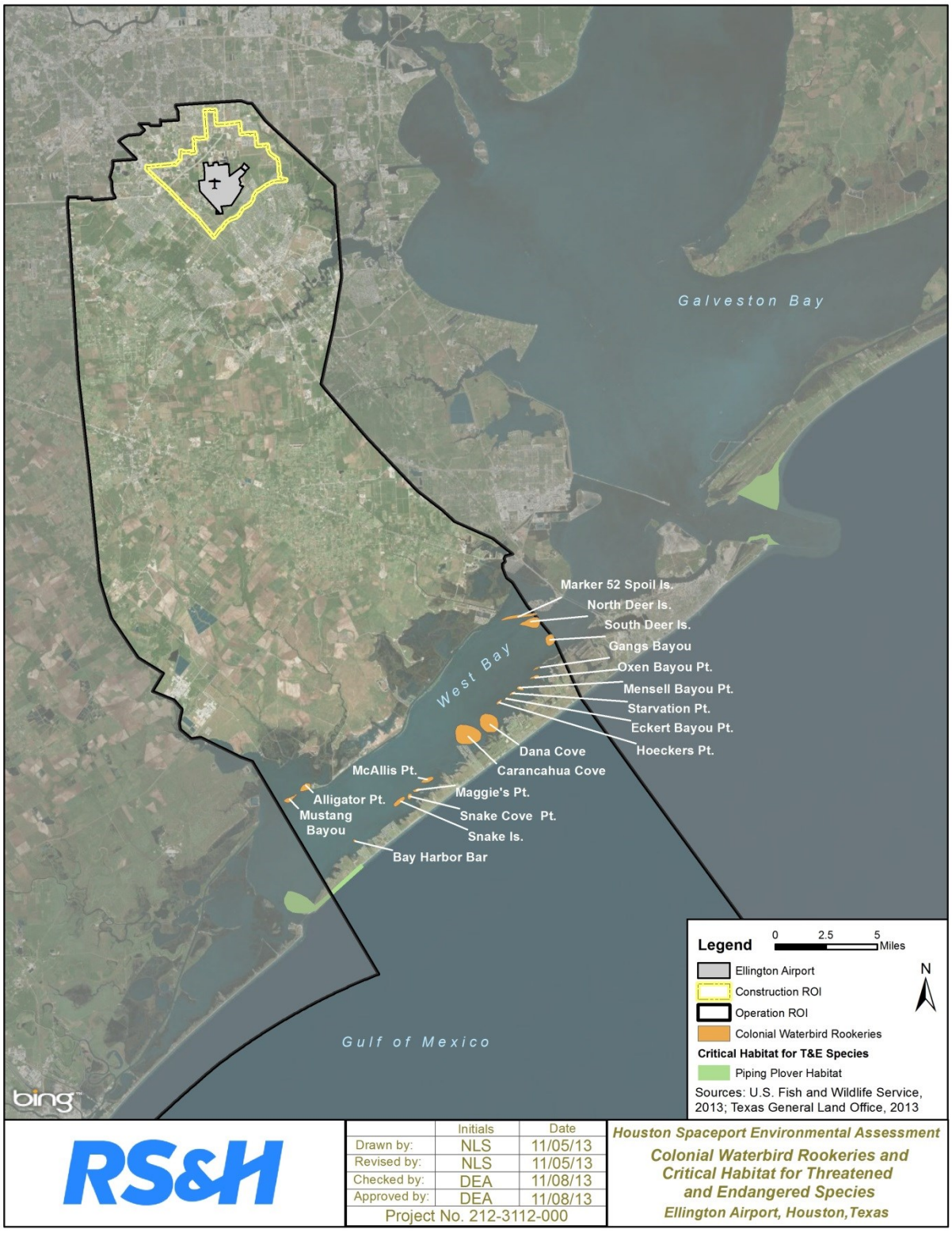
Common Name	Scientific Name	State Status[a]	County(ies)
Birds Continued			
Red-cockaded Woodpecker	*Picoides borealis*	E	Harris
Reddish Egret	*Egretta rufescens*	T	Galveston
Snowy Plover	*Charadrius alexandrinus*	R	Harris, Brazoria, Galveston
Sooty Tern	*Sterna fuscata*	T	Brazoria
Southeastern Snowy Plover	*Charadrius alexandrinus tenuirostris*	R	Harris, Brazoria, Galveston
Sprague's Pipit	*Anthus spragueii*	R	Harris, Galveston
Western Snowy Plover	*Charadrius alexandrinus nivosus*	R	Brazoria,
White-faced Ibis	*Plegadis chihi*	T	Harris, Galveston
White-tailed Hawk	*Buteo albicaudatus*	T	Harris, Galveston
Whooping Crane	*Grus americana*	E	Harris, Galveston
Wood Stork	*Mycteria americana*	T	Harris, Galveston
Mammals			
Jaguarundi	*Herpailurus yaguarondi*	E	Brazoria
Louisiana Black Bear	*Ursus americanus luteolus*	T	Harris, Galveston
Plains Spotted Skunk	*Spilogale putorius interrupta*	R	Harris, Galveston
Ocelot	*Leopardus pardalis*	E	Brazoria
Rafinesque's Big-eared Bat	*Corynorhinus rafinesquii*	T	Harris
Red wolf	*Canis rufus*	E	Harris, Brazoria, Galveston
Southeastern Myotis Bat	*Myotis austroriparius*	R	Harris
West Indian Manatee	*Trichechus manatus*	E	Brazoria, Galveston
Fishes			
American Eel	*Anguilla rostrata*	R	Galveston
Creek Chubsucker	*Erimyzon oblongus*	T	Harris
Sharpnose Shiner	*Notropis oxyrhynchus*	R	Brazoria
Smalltooth Sawfish	*Pristis pectinata*	E	Harris, Galveston
Mollusks			
Little Spectaclecase	*Villosa lienosa*	R	Harris
Louisiana Pigtoe	*Pleurobema riddellii*	T	Harris
False Spike Mussel	*Quadrula mitchelli*	T	Brazoria
Sandbank Pocketbook	*Lampsilis satura*	T	Harris
Smooth Pimpleback	*Quadrula houstonensis*	T	Brazoria
Texas Fawnsfoot	*Truncilla macrodon*	T	Brazoria
Texas Pigtoe	*Fusconaia askewi*	T	Harris
Wabash Pigtoe	*Fusconaia flava*		Harris
Amphibians			
Houston Toad	*Anaxyrus houstonensis*	E	Harris

TABLE 3-6 CONTINUED
TEXAS PARKS AND WILDLIFE DEPARTMENT'S LISTED SPECIES
IN BRAZORIA, GALVESTON, AND HARRIS COUNTIES

Common Name	Scientific Name	State Status[/a/]	County(ies)
Reptiles			
Alligator Snapping Turtle	*Macrochelys temminckii*	T	Harris, Brazoria, Galveston
Atlantic Hawksbill Sea Turtle	*Eretmochelys imbricata*	E	Brazoria, Galveston
Green Sea Turtle	*Chelonia mydas*	T	Harris, Brazoria, Galveston
Gulf Saltmarsh Snake	*Nerodia clarkii*	R	Harris, Brazoria, Galveston
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	E	Harris, Brazoria, Galveston
Leatherback Sea Turtle	*Dermochelys coriacea*	E	Harris, Brazoria, Galveston
Loggerhead Sea Turtle	*Caretta caretta*	T	Harris, Brazoria, Galveston
Texas Diamondback Terrapin	*Malaclemys terrapin littoralis*	R	Brazoria, Galveston
Texas Horned Lizard	*Phrynosoma cornutum*	T	Brazoria, Galveston
Smooth Green Snake	*Liochlorophis vernalis*	T	Harris
Timber/Canebrake Rattlesnake	*Crotalus horridus*	T	Harris, Brazoria, Galveston
Plants			
Coastal Gay-feather	*Liatris bracteata*	R	Harris, Brazoria, Galveston
Correll's False Dragon-head	*Physostegia correllii*	R	Galveston
Florida Ladies-tresses	*Spiranthes brevilabris var. floridana*	R	Harris
Giant Sharpstem Umbrella-sedge	*Cyperus cephalanthus*	R	Harris, Brazoria,
Grand Prairie Evening Primrose	*Oenothera pilosella ssp sessilis*	R	Galveston
Houston Daisy	*Rayjacksonia aurea*	R	Harris, Galveston
Neglected Coneflower	*Echinacea paradoxa var. neglecta*	R	Harris
Panicled Indigobush	*Amorpha paniculata*	R	Harris
Texas Ladies'-tresses	*Spiranthes brevilabris var. brevilabris*	R	Harris, Galveston
Plants Continued			
Texas Meadow-rue	*Thalictrum texanum*	R	Harris, Brazoria,
Texas Prairie Dawn	*Hymenoxys texana*	E	Harris
Texas Windmill-grass	*Chloris texensis*	R	Harris, Brazoria, Galveston
Threeflower Broomweed	*Thurovia triflora*	R	Harris, Brazoria, Galveston

[/a/]Status: LE, LT - Federally Listed Endangered/Threatened; C - Federal Candidate for Listing; DL - Federally Delisted; NL - Not Federally Listed; E, T - State Listed Endangered/Threatened; R - Rare, but no regulatory listing status.
Source: Texas Parks and Wildlife Department, Wildlife Division, Diversity and Habitat Assessment Programs. County Lists of Texas' Special Species. Harris, Brazoria and Galveston Counties, Sept. 2013

FIGURE 3-5
FEDERALLY DESIGNATED CRITICAL HABITAT AREAS



3.7 FLOODPLAINS

Floodplains are flood prone areas adjacent to rivers, creeks, ditches, lakes, or other surface water features. Floodplains can also be isolated areas adjacent to water sources that experience temporary ponding. Large storm events, downstream constrictions, or obstructions typically cause flooding in these areas. FEMA, often assisted by the U.S. Army Corps of Engineers (USACE), determines the boundaries of floodplains based on hydraulic modeling. FIRMs show the results of this modeling. Areas within the 100-year floodplain (Zone A) have a one percent chance of becoming flooded each year.

In addition to the risk and safety concerns for property and human life, development in a floodplain can impact on the amount of flood storage the floodplain can provide. As a result, federal, state, and local agencies regulate construction within the 100-year floodplain. EO 11988 – *Floodplain Management* regulates federally-approved or funded projects that encroach on floodplains. USDOT Order 5650.2, *Floodplain Management and Protection*, requires FAA, as a USDOT agency, to meet the EO's requirements. FEMA's Floodplain Management Guidelines provides information on how to meet those requirements.

According to FEMA mapping, the construction ROI includes areas delineated as 100-year floodplains. These floodplains are associated with existing storm water detention ponds, which are incorporated into drainage infrastructure and Horsepen Bayou and flows southeast to Clear Lake (USGS, 2013a). FEMA FIRM data was used to create an inventory of existing 100-year floodplains on EFD property. Figure 3-6 presents the location and extent of the delineated 100-year floodplains within the construction ROI.

3.8 HAZARDOUS MATERIALS, POLLUTION PREVENTION, AND SOLID WASTE

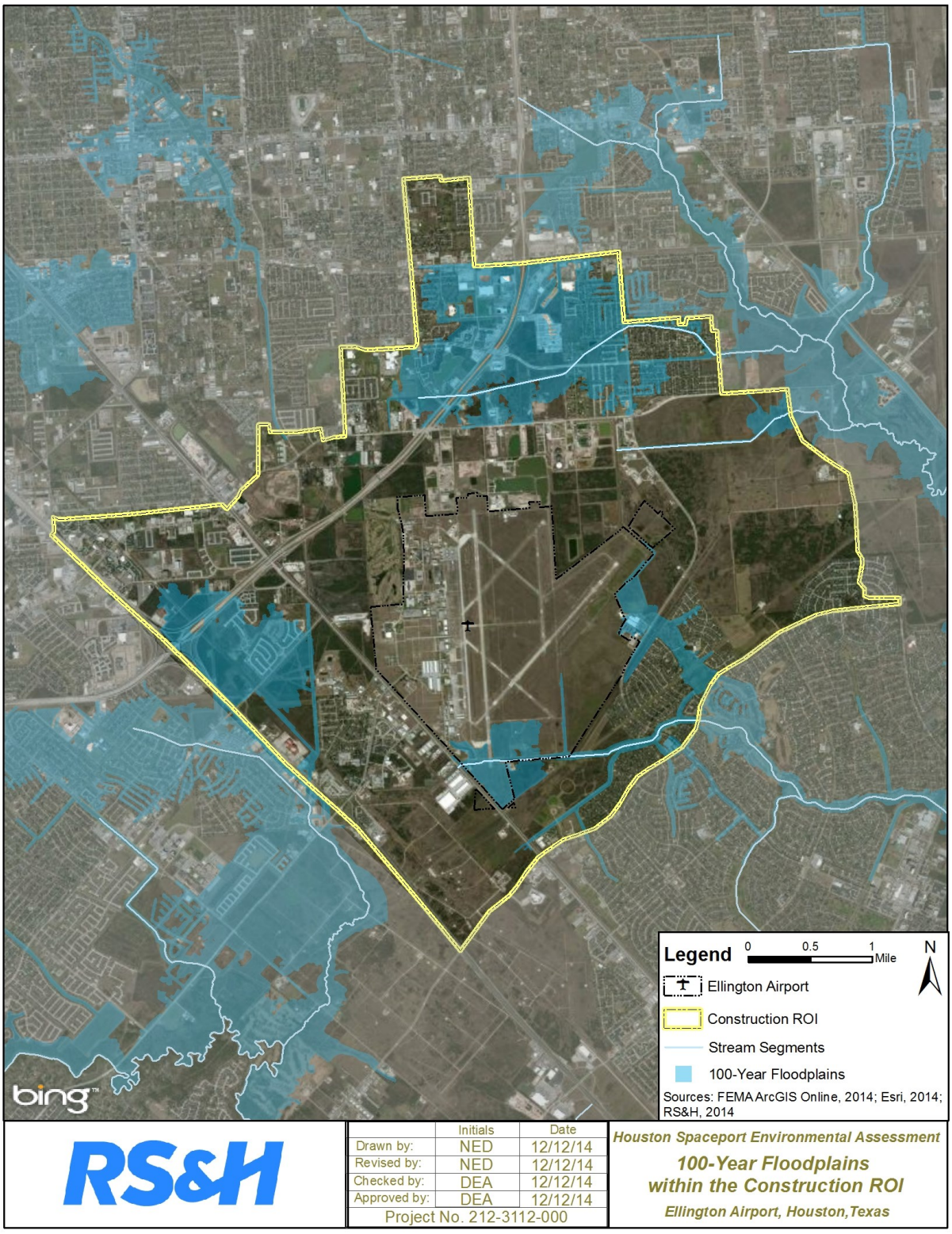
An airport's airside and landside operations use, transport, or generate various kinds of hazardous materials. For example, ground vehicles regularly transport hazardous materials such as jet fuels to EFD. Aircraft fueling trucks and hydrant systems also transport hazardous materials to EFD. In addition, airport construction and maintenance activities often use chemicals classified as hazardous materials. Various federal, state, and local laws regulate the use, storage, transportation, or disposal of hazardous materials. These laws may extend to past, present, and future landowners of properties containing these materials. Additionally, disrupting sites containing hazardous materials may create pathways allowing contaminants to effect human health and the environment.

Applicable federal requirements[23] used to assess hazardous waste effects include:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. § 9601);
- the Oil Pollution Prevention Act of 1990 (33 U.S.C. § 2701);
- Toxic Substances Control Act (TSCA) (15 U.S.C. § 2601-2692);
- Resource Conservation and Recovery Act (RCRA) (42 U.S.C. § 6901 *et. seq.*);

[23] Note that due to the number of federal laws and EOs applicable to the Proposed Action, this Section presents only the legal citations or references for those requirements in lieu of summarizing their requirements. Please see FAA's Desk Reference, Chapter 10, Section 2, for more information on these requirements.

FIGURE 3-6
100-YEAR FLOODPLAINS



- Clean Water Act (CWA) (33 U.S.C. § 1251 et. seq.);
- EO 12088, Federal Compliance with Pollution Control Standards (43 FR 47707);
- EO 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements (58 FR 41981); and
- EO 12580, Superfund Implementation (52 FR 2923).

Generally, the terms "hazardous wastes," "hazardous substances," and "hazardous materials" are associated with industrial wastes, petroleum products, dangerous goods or other contaminants. In a regulatory context, these terms have very precise and technical meanings:

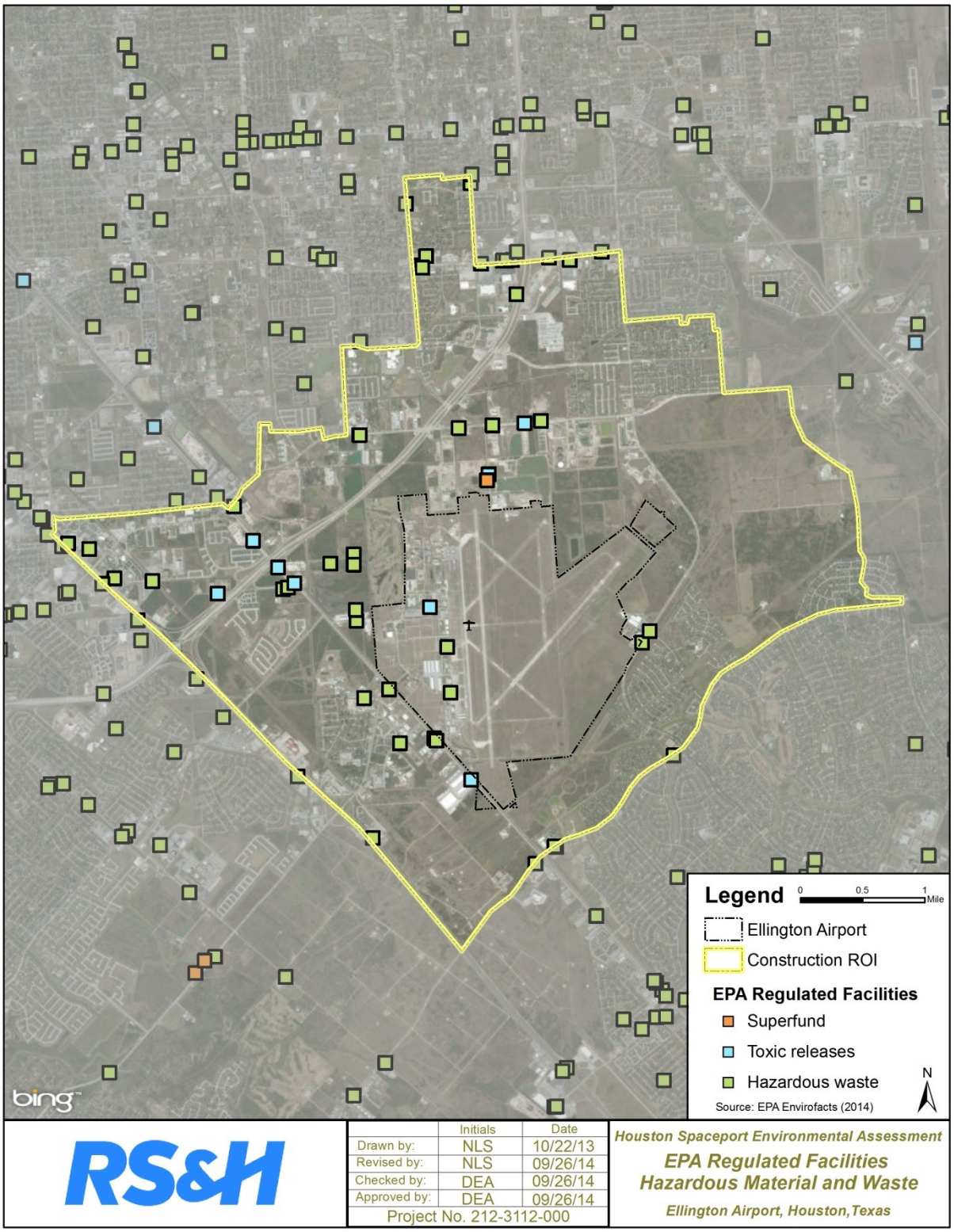
- Hazardous Wastes: Subpart C of the RCRA defines this term. Hazardous wastes (sometimes called characteristic wastes) are solid wastes that are ignitable, corrosive, reactive, or toxic. Examples include waste oil, mercury, lead or battery acid. In addition, Subpart D of RCRA contains a list of specific types of solid wastes that the EPA has deemed hazardous (sometimes called listed wastes). Examples include degreasing solvents, petroleum refining waste, or pharmaceutical waste.
- Hazardous Substances: Section 101(14) of the CERCLA defines this term broadly. It includes hazardous wastes, hazardous air pollutants, or hazardous substances designated as such under the CWA and TSCA and elements, compounds, mixtures, or solutions, or substances listed in 40 CFR Part 302 that pose substantial harm to human health or environmental resources. Pursuant to CERCLA, hazardous substances do not include any petroleum or natural gas substances and materials. Examples include ammonia, bromine, chlorine, or sodium cyanide.
- Hazardous Materials: According to 49 CFR Part 172, hazardous materials are any substances commercially transported that pose unreasonable risk to public health, safety, and property. These substances include hazardous wastes and hazardous substances as well as petroleum and natural gas substances and materials. As a result, hazardous materials represent hazardous wastes and substances. Examples include household batteries, gasoline, or fertilizers.

There are no sites within the Construction ROI that are included on the EPA National Priorities List (NPL). An abandoned landfill, known as the Harris (Farley Street) Site, was listed on the EPA NPL from 1982-1988. It was removed from the NPL after a contaminated soil removal effort, and is part of the operating solid-waste landfill (USEPA, 2013b).There are a number of USEPA regulated CERCLA, TSCA, and RCRA sites within the Construction ROI. Figure 3-7 shows the location of each of these sites.

Specific to the EFD property, the USEPA currently lists "Ellington Field" (Handler ID: TXD981057946) and Ellington Field 147 Fighter Wing (Handler ID: TX1572824067) as hazardous waste sites under RCRA. USEPA also lists Continental Express (Handler ID: TXD988071817) and United Postal Service at Ellington (Handler ID: TXD988089207) as hazardous waste sites on EFD property. These sites are located in the western portion of EFD.[24] The "U.S. Air Force Texas ANG JRB 147th Fighter Wing" (Registry ID: 110025317351) is also listed as a toxic release site on EFD property.

[24] Note that Continental Express and United Postal Service are no longer tenants at EFD.

FIGURE 3-7
USEPA REGULATED FACILITIES



The closest TSCA site to EFD is Avanti International (Registry ID: 110035825033), less than 0.5-mile southwest of EFD. The closest Superfund site under CERCLA is Harris Landfill (Registry ID: 110009346243) (USEPA, 2013a).

Hazardous materials are used and managed at EFD. HAS has policies and procedures in place for managing and disposing of hazardous and solid wastes in accordance with applicable regulations. These policies and procedures cover the handling of hazardous materials, solid waste, chemicals, and other substances, including jet fuel.

Stormwater at EFD is managed under the provisions of EFD's Storm Water Pollution Prevention Plan (SWPPP), in accordance with its TPDES Stormwater Multi-Sector General Permit (Permit Number TXR05T730).

3.8.1 Petroleum Fuels and Existing Fuel Farm

By volume, petroleum fuels such as Jet-A fuel, diesel, and gasoline for ground support vehicles are the primary hazardous materials stored at EFD. The storage of petroleum is regulated under 40 CFR 112 and managed under provisions of EFD's Spill Prevention Control and Countermeasures (SPCC) Plan.

EFD currently has an aboveground storage tank fuel farm located at the southern side of the property. Fuel is regularly transported to the individual tenants by truck. There are no underground pipelines or hydrants. Southwest Services supplies fuel for all non-military tenants at EFD from storage tanks holding 140,000 gallons of Jet A and 18,000 gallons of 100LL fuel. Southwest Services operates seven fuel tanker trucks, including four 5,000-gallon trucks used to transport Jet A, two 750-gallon 100LL trucks, and one 1,200-gallon de-fueler. According to the July 2013 EA for a self-service fueling facility at EFD, the average monthly fuel flowage from Southwest Services is approximately 300,000 gallons (HAS, 2013b).

In addition, the TxANG maintains one 10,000-gallon floating roof tank and two 30,000-gallon horizontal tanks which store JP-8. The TxANG has between seven and eight fuel trucks that transport fuel to helicopters and other aircraft. Typical annual fuel consumption varies between 2-5 million gallons. HAS maintains eleven smaller aboveground fuel tanks that are primarily used to supply backup generators. The total combined capacity of these tanks is approximately 11,750 gallons (HAS, 2004b).

3.8.2 Other Hazardous Materials

In addition to petroleum based fuels, lesser quantities of various hazardous materials are used on an on-going basis for airport operations. These may include: solvents, lubricants, cleaners, paints, compressed gases, peroxides, caustics, pesticides, herbicides, alcohols, foams, and batteries. These materials may be used for a wide range of operational purposes including maintenance of aircraft, ground vehicles and facilities, heating and cooling, painting and paint stripping, cleaning, landscaping, and pest control. These materials are used in relatively small amounts and are managed under existing SOPs at EFD.

3.8.3 Existing Contamination Concerns

Due to its history as a former U.S. Air Force base, past industrial activities at EFD involved the use of hazardous materials that could have resulted in contamination. Figure 3-8 shows the sites of potential

hazardous materials contamination at EFD. Potential hazardous materials issues may include soil and/or groundwater contamination from leaking fuel tanks or spills from fueling operations. Other potential contaminants include:

- polychlorinated biphenyls (PCBs) related to electrical generators and transformers;
- asbestos in existing buildings;
- paint and cleaning solvents; and
- lead contamination on the site of a former military firing range (HAS, 2013b).

According to the July 2013 EA, several underground petroleum storage tanks were operated at EFD. In the 1990's, the City of Houston began efforts to remove underground storage tanks. The July 2013 EA identified six areas with leaking underground storage tanks. The EA noted these sites have been completely remediated and TCEQ has closed the cases regarding those sites (HAS, 2013b).

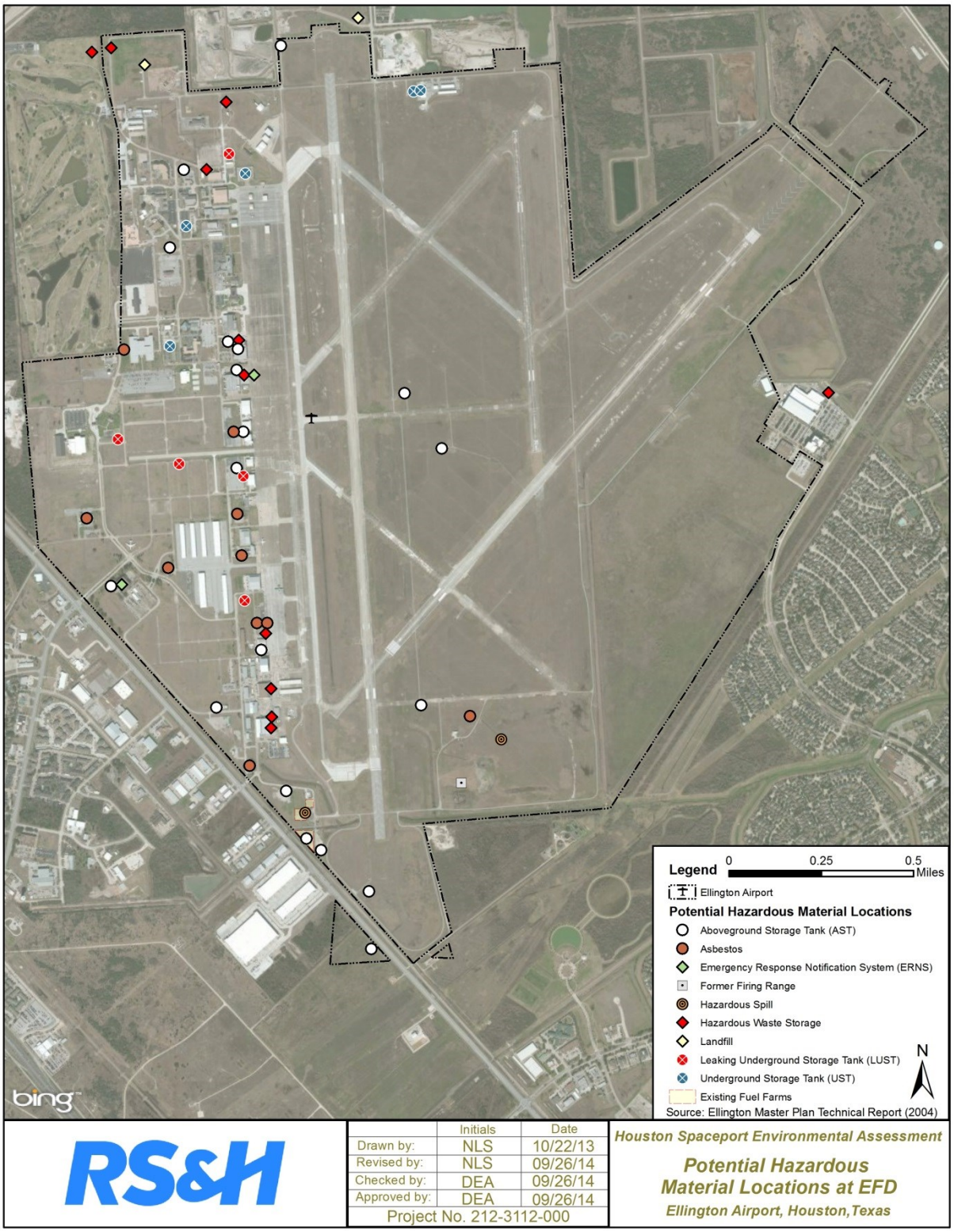
Areas where tenants such as the TxANG and the USCG own and operate their own fuel storage tanks, waste oil storage, and backup generators show evidence of fuel spill contamination. These areas represent potential sources of soil and/or groundwater contamination. According to the USEPA NEPAssist, the TxANG is a toxic release site under TSCA (USEPA, 2013a).

Several sites at EFD housed electrical generators which often contain PCB's. The City of Houston successfully undertook a program to remove PCB's by replacing a majority of the electrical equipment. However, the presence of PCB's indicates a potential source of soil and/or groundwater contamination.

Given the age of some buildings at EFD, asbestos also poses certain concerns. The 2004 Phase I screening analysis observed there may be the presence of asbestos in the older buildings at EFD. There is also a heavy metal contamination site (i.e., lead contaminants) at the "military firing range" located on the U.S. Military portion at the southern end of EFD. There are also several sites at EFD where hazardous wastes are stored.

At the time of transfer from the U.S. Government to the City of Houston in 1984, an environmental impact statement (EIS) was conducted and an environmental cleanup was completed. In the 2004 Airport Master Plan Update, a Phase I analysis was conducted and concluded there may be potential hazardous materials located predominately along the western periphery of the apron area. The July 2013 EA for a self-service fueling facility at EFD included an analysis of potential hazardous materials sites, which is incorporated into this analysis.

FIGURE 3-8
POTENTIAL HAZARDOUS MATERIAL LOCATIONS AT EFD



3.9 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

The National Historic Preservation Act (NHPA) of 1966, as amended, established the Advisory Council on Historic Preservation (ACHP). The ACHP oversees federal agency compliance with the NHPA. The NHPA also establishes the NRHP, which the National Park Service (NPS) oversees. Other applicable statutes include:

- The Archeological and Historic Preservation Act of 1974 (AHPA) (16 U.S.C. § 470 et. seq.);
- The American Indian Religious Freedom Act of 1978 (AIRFA) (42 U.S.C. § 1996);
- EO 13007, Indian Sacred Sites (61 FR 26771); and
- EO 13175, Consultation and Coordination with Indian Tribal Governments (36 FR 8921).

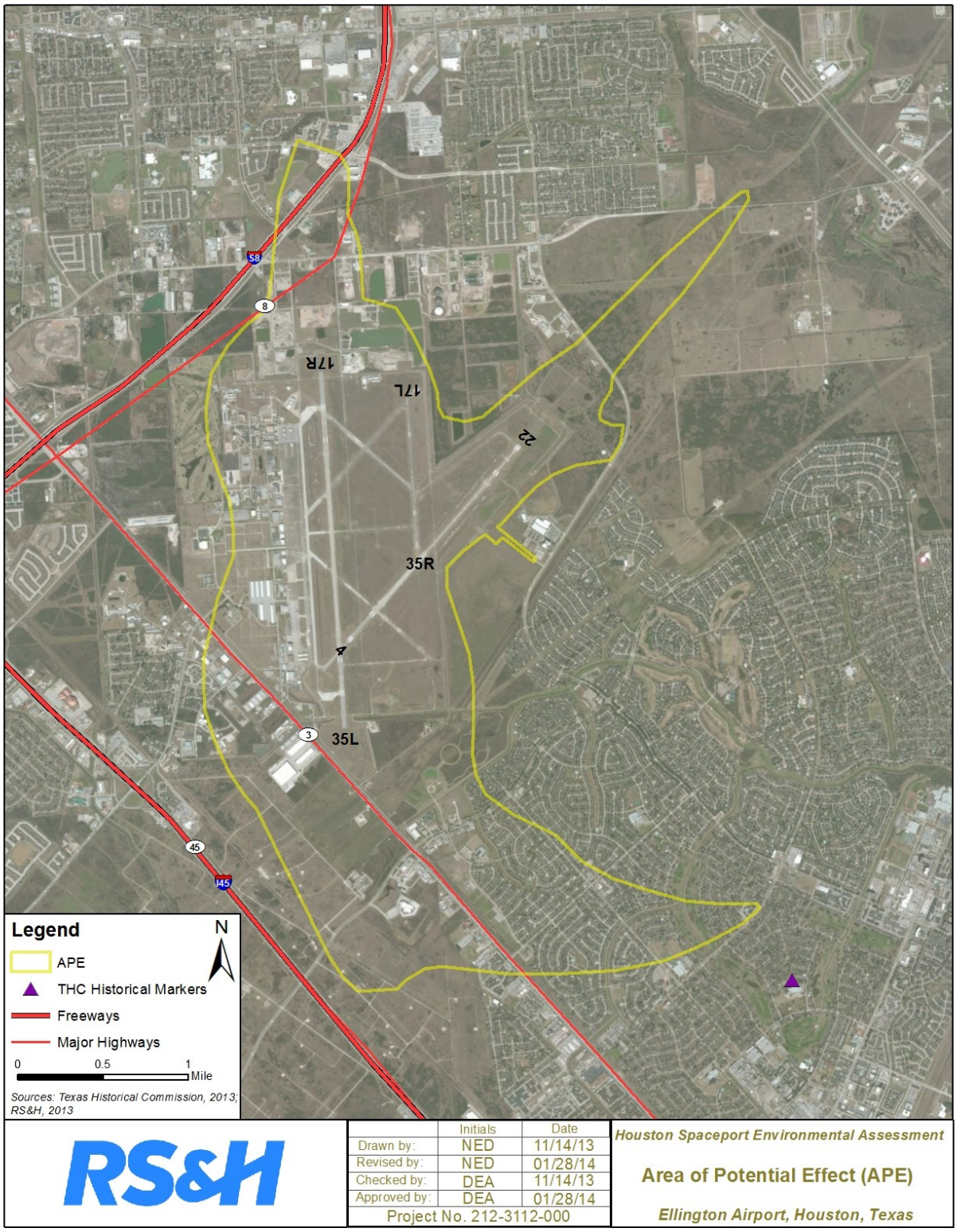
For purposes of this EA, historic, archaeological, and cultural resources are districts, sites, buildings, structures, objects, landscapes, and Native American Traditional Cultural Properties recorded by the Texas Historical Commission (THC) as Historical Markers, or on or eligible for listing on the NRHP. NRHP properties are nationally important due to their significant and respective roles in American history, prehistory, architecture, archaeology, engineering and culture. Historical markers recognize the history and architecture of houses, buildings, religious congregations, military sites, and events or individuals that THC has determined to have made lasting contributions to the State (THC, 2013).

In accordance with 36 CFR §800.4(a)(1), the FAA has established an Area of Potential Effect (APE) for the proposed undertaking (i.e., Proposed Action) (see Appendix D). The FAA determined an APE in consideration of both potential direct and indirect effects to archaeological and architectural resources as a result of implementing the undertaking.

The APE is defined as the area encompassed by the existing Day-Night Average Sound Level (or DNL) 65 A-weighted decibel (or dBA) aviation noise contour (see Figure 3-9) and potential ground disturbing activities. The APE encompasses all potential direct and indirect effects on archaeological and architectural resources. Although this APE does not account for the additional noise that would be generated from up to 50 annual RLV launches, based on the existing number of annual flights at EFD (approximately 144,702) and the fact that the RLVs would use jet engines during takeoff and landing (the Concept Z vehicle would conduct an unpowered, glide landing), it is unlikely the existing DNL 65 dBA aviation noise contour would change notably (see Section 4.12 for further details).

The RLVs would generate sonic booms over the Gulf of Mexico during RLV ascent and reentry. During ascent, the sonic boom would be propagated upwards and would not impact the Earth's surface and therefore, would not be heard. A second sonic boom would be generated during RLV reentry, at approximately 80,000 feet over the Gulf of Mexico. This sonic boom would impact the water surface of the Gulf of Mexico and would not be heard on land. Therefore, sonic booms were not considered when defining the APE because they would have no potential for effect on historic properties.

FIGURE 3-9
AREA OF POTENTIAL EFFECT (APE)



For archaeological resources, potential effects would be limited to the area within the APE where ground disturbance would occur from construction of the hangar, hangar access road and parking area, apron, fencing around the apron, taxiway, and propellant truck parking area. The oxidizer loading area is currently a paved area. For architectural resources, potential effects would extend to the boundary of the APE. On June 6, 2014, the Texas State Historic Preservation Officer concurred with the FAA's materials provided, including the establishment of the APE (see Appendix D).

As shown in Figure 3-9, there are no NRHP-listed resources within the APE. Based on the THC Atlas, NRHP, and coordination with the THC, the FAA has determined that there are also no properties eligible for the NRHP within the APE. The closest THC historic landmark is the Webster Presbyterian Church, approximately four miles southeast of EFD.

3.10 LIGHT EMISSIONS AND VISUAL RESOURCES

Many airside and landside structures on EFD property are illuminated during nighttime hours for security and safety reasons. EFD also operates lighting infrastructure required for navigational and safety purposes during night hours and times of inclement weather. The approach and lighting system at EFD is composed of a variety of systems approved for the safe movement of aircraft including:

- airport beacon (green/white)
- medium intensity approach lighting system with runway alignment indicator lights (MALSR);
- centerline lights; and
- lighted touchdown point.

Vegetation and development (e.g., trees, shrubs, roadways, and commercial and industrial buildings) provide buffers between nearby residential areas and current EFD light emissions. The surrounding area is also at a similar elevation as EFD. There is no dramatic height difference in landforms between EFD and the residential neighborhoods to the north and east. Surrounding residential areas do not have a direct view of EFD.

3.11 NATURAL RESOURCES AND ENERGY SUPPLY

It is FAA policy, consistent with CEQ NEPA implementing regulations, to encourage the development of facilities that exemplify the highest standards of design, including the principles of sustainability. These high standards should apply to the conservation of energy and other resources.

EFD does not currently have a sustainability program or green initiatives in place; however, other HAS airports have pursued sustainability initiatives. HAS's vehicle fleet includes hybrid vehicles purchased with the aid of federal grants from the FAA's Voluntary Airport Low Emission (VALE) program.

3.12 NOISE

The U.S. Congress has determined that aviation noise effects fall under FAA's purview. The following statutes are related to the consideration of noise impacts:

- Airport and Airway Improvement Act of 1982 (AAIA) (49 U.S.C. § 4701 et. seq.);

- Airport Noise and Capacity Act (ANCA) (49 U.S.C. § 2101 et. seq.);
- Aviation Safety and Noise Abatement Act of 1979 (ASNA) (49 U.S.C. § 47501-47507);
- The Control and Abatement of Aircraft Noise and Sonic Boom Act of 1968 (49 U.S.C. § 47101); and
- The Noise Control Act of 1972 (49 U.S.C. § 44715).

Humans are most sensitive to frequencies near the normal range of speech communications. The "A-weighting" scale reflects this sensitivity by emphasizing mid-range frequencies and de-emphasizing high and low frequencies. A better predictor of human reaction to environmental noise than the un-weighted decibel is dBA, and is therefore the basis for the metrics most frequently used in noise compatibility planning (Chantlett, 1973).

In addition to the frequencies of noise sources, research shows that the loudness of individual events, the number of events during a given period, and the time of day in which noise events occur influences the sensitivity to noise. The DNL accounts for these factors by accumulating the sound energy generated by all noise events during the course of a given period (typically an annual average day) with a 10 dBA penalty to sound levels occurring between 10:00 p.m. and 6:59 a.m. This 10 dBA penalty means that one nighttime sound event is equivalent to 10 daytime events of the same level.

DNL has been widely accepted as the best available method to describe aircraft noise exposure. The USEPA identifies the DNL as the principal metric for airport noise analysis. The FAA requires DNL as the noise descriptor for use in aircraft noise exposure analysis and noise compatibility planning. DNL levels are commonly shown as lines of equal noise exposure, similar to terrain contour maps.

In December 2009 and February 2010, the City of Houston established land use regulations around IAH, HOU, and EFD. These regulations created land use tier boundaries with certain restrictions to protect these airports from encroachment of sensitive developments. Additionally, it instituted rules for providing land use permits that would allow compatible developments within the boundaries. Section 3.4 provides further details on these tiers. Figure 3-10 shows EFD's existing DNL 65 – 75 dBA noise contours.

3.13 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S HEALTH AND SAFETY RISKS

This section describes the existing demographics within the operation ROI as they related to socioeconomics, environmental justice, and children's environmental health and safety risks.

3.13.1 Socioeconomics

Among other requirements, Section 101(a) of NEPA notes the policy of the federal government is to create and maintain conditions that fulfill the social needs of present and future American generations. Demographic data for the construction ROI and the operation ROI is included as the basis for evaluating potential future growth in the region and potential economic impacts. Figures 3-11 and 3-12 depict the population growth from 2010 to 2012 in the construction and operation ROIs, respectively.

FIGURE 3-10
EXISTING DNL 65 – 75 DBA NOISE CONTOURS AND EFD TIER BOUNDARIES

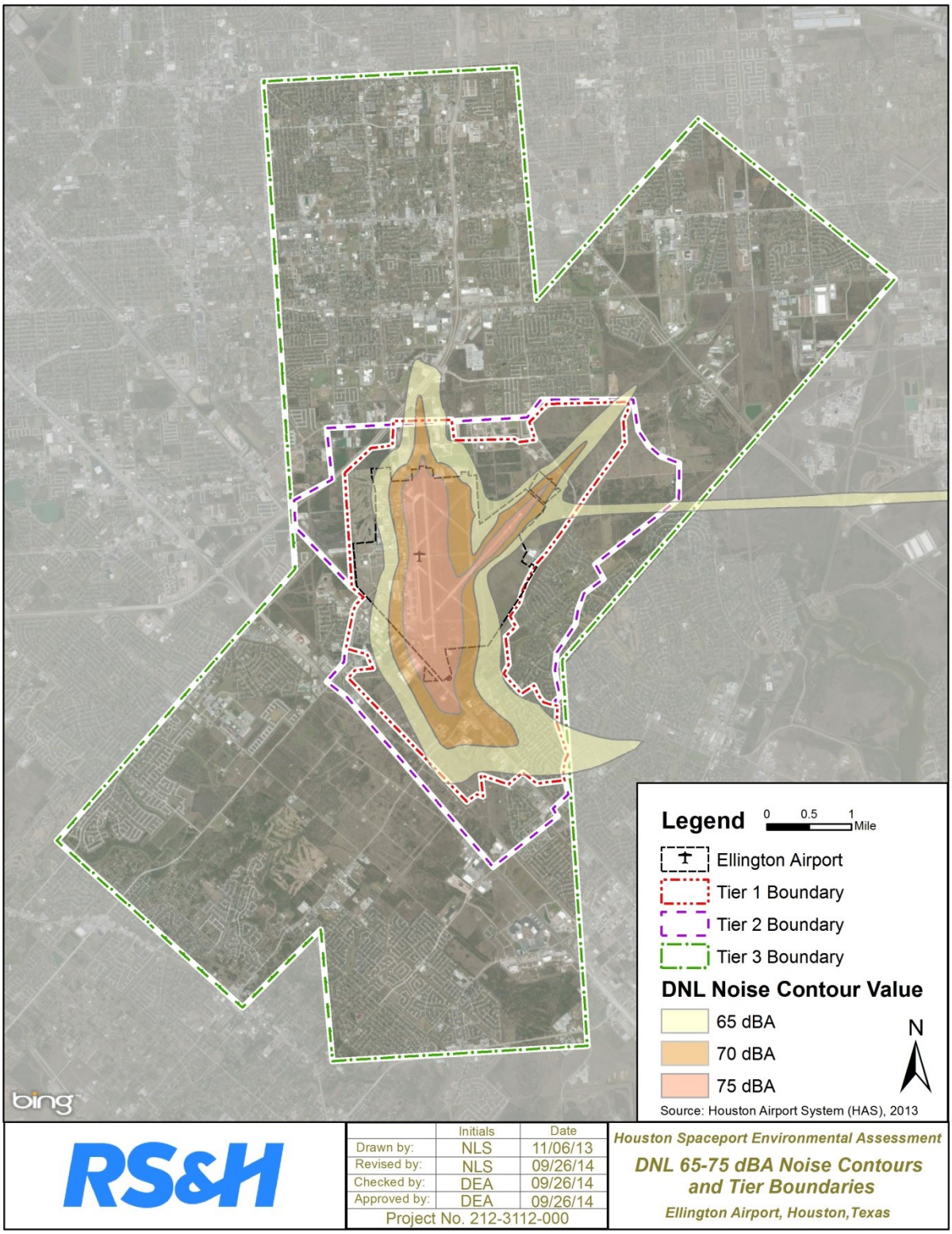
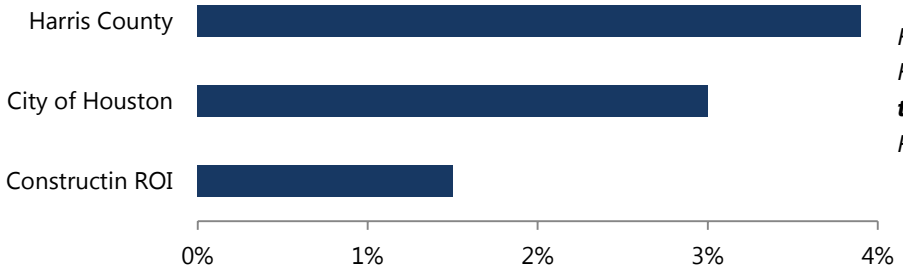


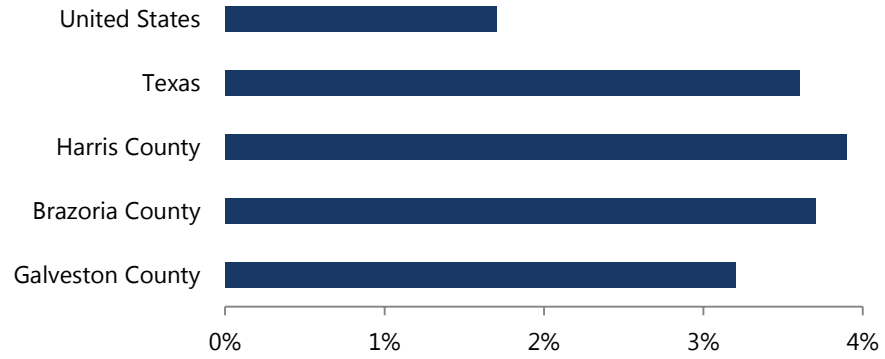
FIGURE 3-11
PERCENT INCREASE IN POPULATION (2010-2012) WITHIN THE CONSTRUCTION ROI



*Harris County and the City of Houston have a growth rate **2 times** that of the construction ROI.*

Source: American Fact Finder, 2014; U.S. Census Bureau, State and County Quick Facts, 2012

FIGURE 3-12
PERCENT INCREASE IN POPULATION (2010-2012) WITHIN THE OPERATION ROI



*Texas and the counties intersecting the operation ROI have a growth rate almost **2 times** that of the U.S. as a whole.*

Source: U.S. Census Bureau, State and County Quick Facts, 2012

Surface Transportation - Roadways within the construction ROI include Galveston Road/Highway 3, Sam Houston Tollway, and Space Center Boulevard. Based on the 2013-2016 Transportation Improvement Program, none of these roadways are planned for improvements (H-GAC, 2012). Galveston Road/ Highway 3 is the main road serving EFD. Galveston Road has a northwest-southeast orientation with four lanes. It borders the southeast portion of EFD property. Galveston Road provides access to Sam Houston Tollway and Interstate 45. Sam Houston Tollway is north-northwest of EFD. There is not direct access to EFD from Sam Houston Tollway. Space Center Boulevard borders the eastern portion of EFD property. Space Center Boulevard has a north-south orientation with four lanes. This roadway connects the Clear Lake area neighborhood southeast of EFD with Genoa Red Bluff Road, just north of EFD.

3.13.2 Environmental Justice

EO 12898 requires federal agencies to analyze project effects relative to low-income and minority populations. Environmental justice analysis considers the potential of a proposed action and alternatives to cause disproportionate and adverse effects on low-income or minority populations. The analysis of environmental justice impacts and associated mitigation ensures that no low-income or minority

population bears a disproportionate burden of effects resulting from the implementation of a preferred alternative.

To help describe environmental justice, this EA relies on the instructions in FAA Order 1050.1E, Appendix A, Section 16, which is consistent with the USDOT Order 5610.2 on Environmental Justice. Poverty is measured two ways within the U.S. – poverty thresholds and poverty guidelines. Poverty thresholds are the original version of the federal poverty measure and are updated each year by the U.S. Census Bureau. The thresholds are used mainly for statistical purposes – for instance, preparing estimates of the number of Americans in poverty each year.

Poverty guidelines are issued each year in the FR by the Department of Health and Human Services (DHHS). These guidelines are a simplification of the poverty thresholds for administrative purposes including determining financial eligibility for certain federal programs. Table 3-7 lists the 2013 poverty guidelines for the 48 contiguous states and District of Columbia.

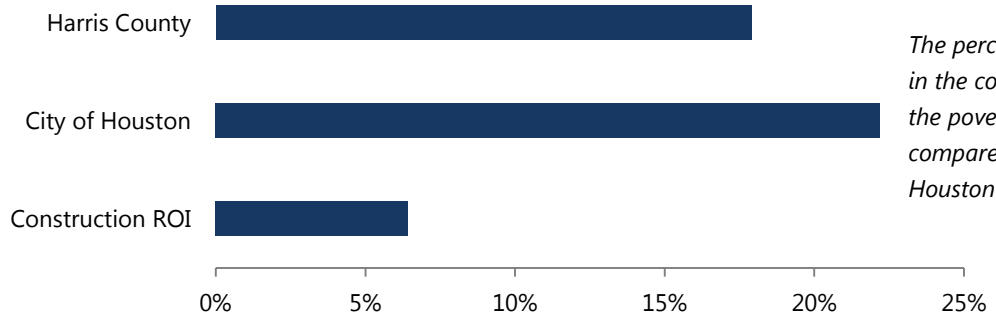
TABLE 3-7
2013 POVERTY GUIDELINES

Persons in family/household[/a/]	Poverty Guideline
1	$11,490
2	$15,510
3	$19,530
4	$23,550
5	$27,570
6	$31,590

[/a/] For the 48 contiguous states and the District of Columbia
Source: DHHS. www.aspe.hhs.gov, accessed September 2013.

Figure 3-13 compares the poverty level of the construction ROI to the City of Houston and Harris County. Poverty level data is not available at the U.S. Census block group level, therefore Figure 3-13 uses data at the U.S. Census Tract level. Based on the average household size and median household income for each block group within the construction ROI, the majority of the population is above the poverty threshold. The lowest median household income within the construction ROI is $37,114, with an average household size of 2.92.

FIGURE 3-13
PERCENTAGE OF INDIVIDUALS BELOW THE POVERTY LEVEL WITHIN THE CONSTRUCTION ROI (2008-2012)



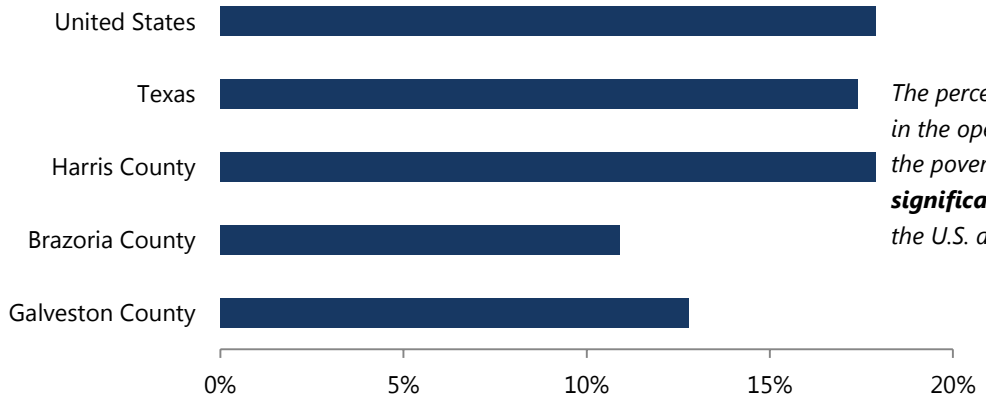
*The percentage of individuals in the construction ROI below the poverty level is **less** compared to the City of Houston and Harris County.*

Source: U.S. Census Bureau, State and County Quick Facts, 2012; American Community Survey, 2010

Figure 3-14 illustrates the 2012 median household income within the construction and operation ROIs, which is dominated by middle and upper income ranges. The Construction ROI consists mainly of median household incomes of $53,001 or more. The southwestern portion of the Construction ROI does have areas with median household incomes of $24,001 to $53,000. The majority of the operation ROI has a median household income above $39,001. Small pockets with median household incomes of $24,000-$39,000 exist in the southern and northern portion of the Operation ROI.

Figure 3-15 compares the poverty level of the United States with Texas and the counties intersecting the operation ROI.

FIGURE 3-14
PERCENTAGE OF INDIVIDUALS BELOW THE POVERTY LEVEL WITHIN THE OPERATION ROI (2008-2012)



*The percentage of individuals in the operation ROI below the poverty level is **not significantly different** from the U.S. and Texas.*

Source: U.S. Census Bureau, State and County Quick Facts, 2012

FIGURE 3-15
2012 MEDIAN HOUSEHOLD INCOME

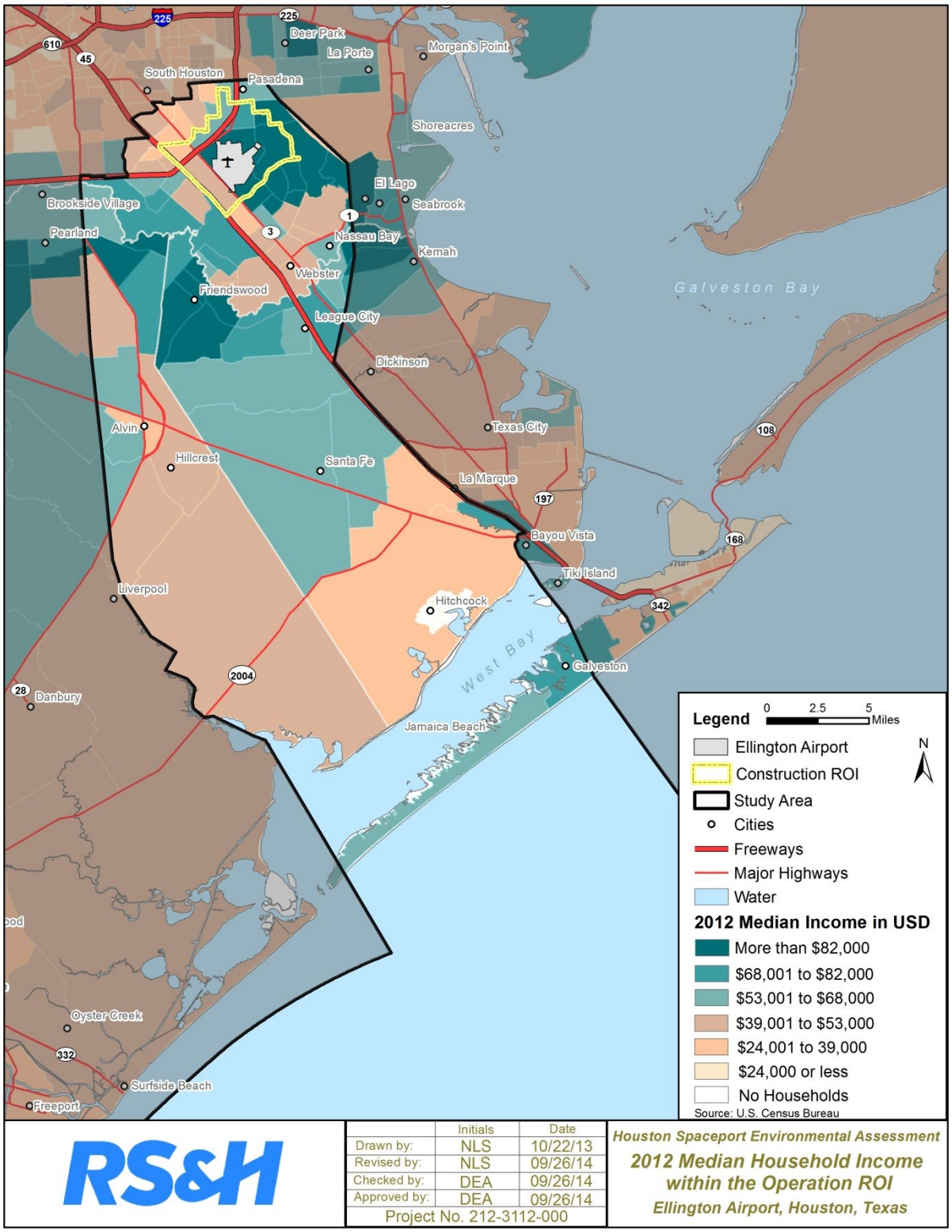
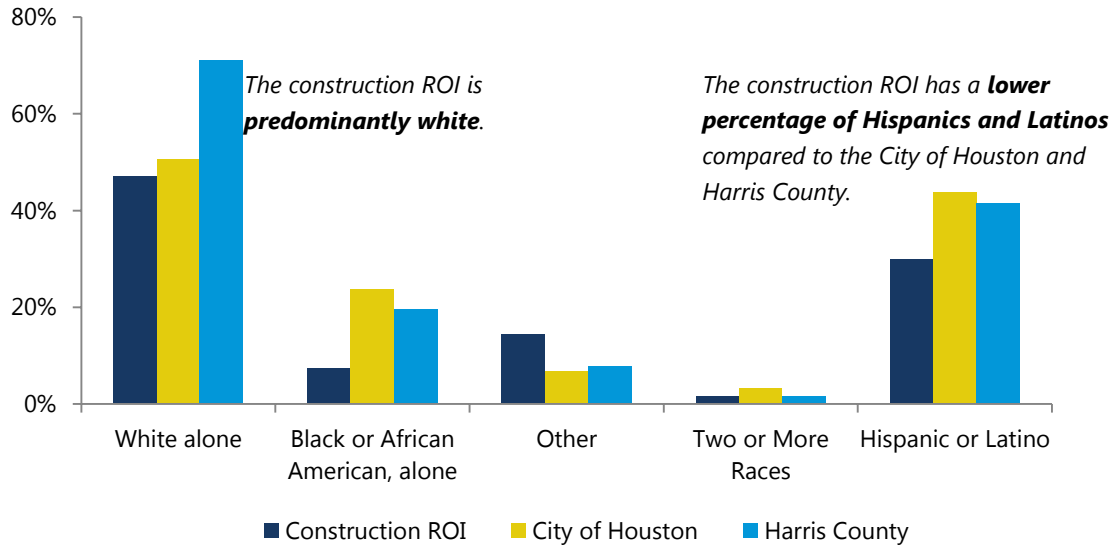


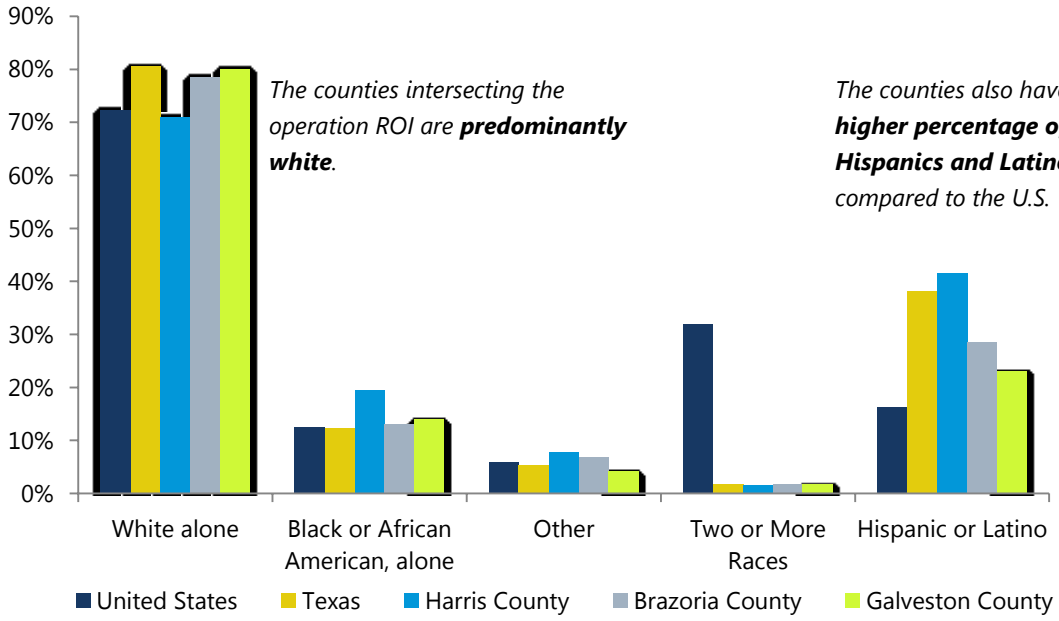
Figure 3-16 demonstrates the race and ethnicity characteristics of the construction ROI in comparison to the City of Houston and Harris County. Figure 3-17 compares the race and ethnicity characteristics of the U.S. compared to Texas and the counties within the operation ROI. Figure 3-18 illustrates the race characteristics within the construction and operation ROIs.

FIGURE 3-16
RACE AND ETHNICITY CHARACTERISTICS WITHIN THE CONSTRUCTION ROI



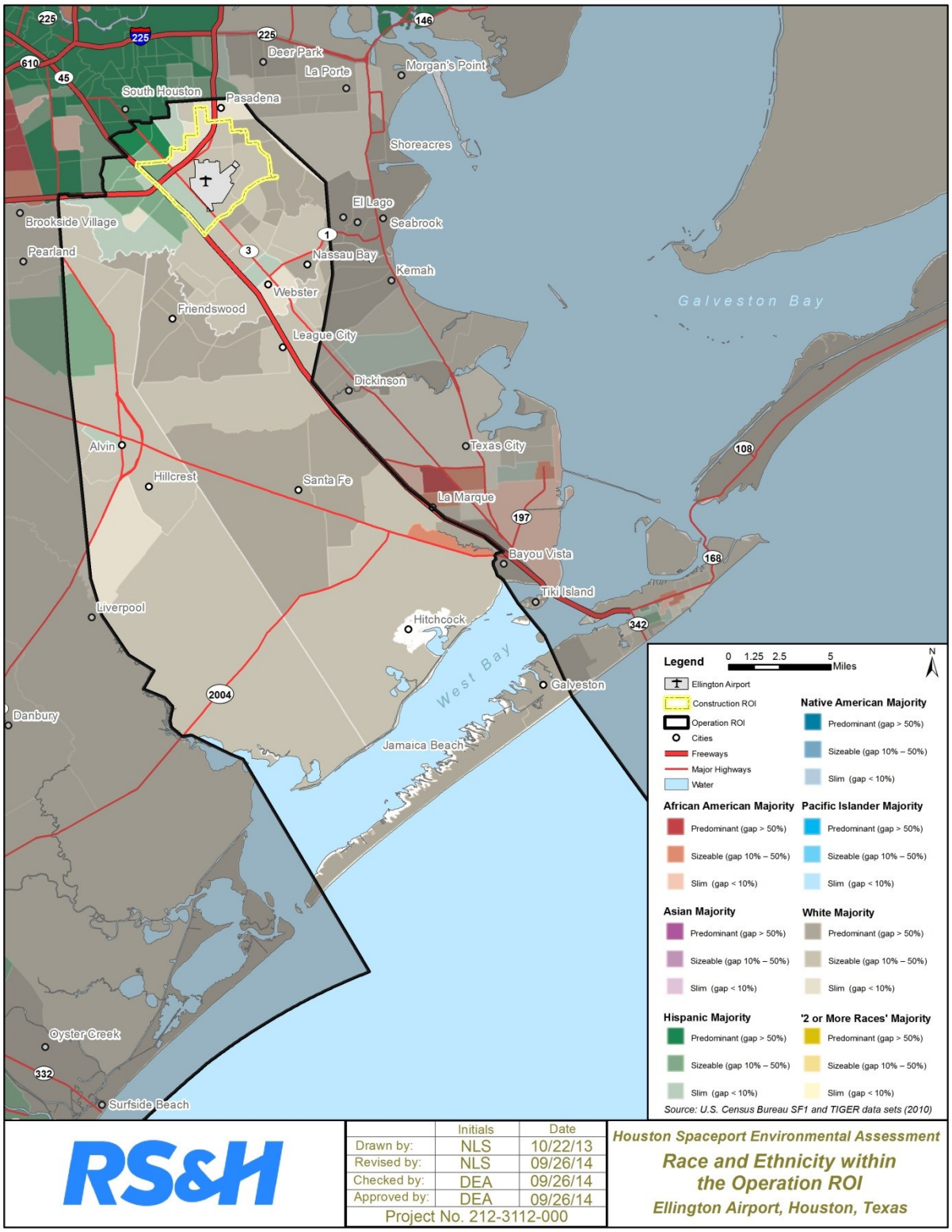
Source: ESRI, 2014

FIGURE 3-17
RACE AND ETHNICITY CHARACTERISTICS WITHIN THE OPERATION ROI



Source: United States Census Bureau, State and County QuickFacts, 2010

FIGURE 3-18
RACE AND ETHNICITY

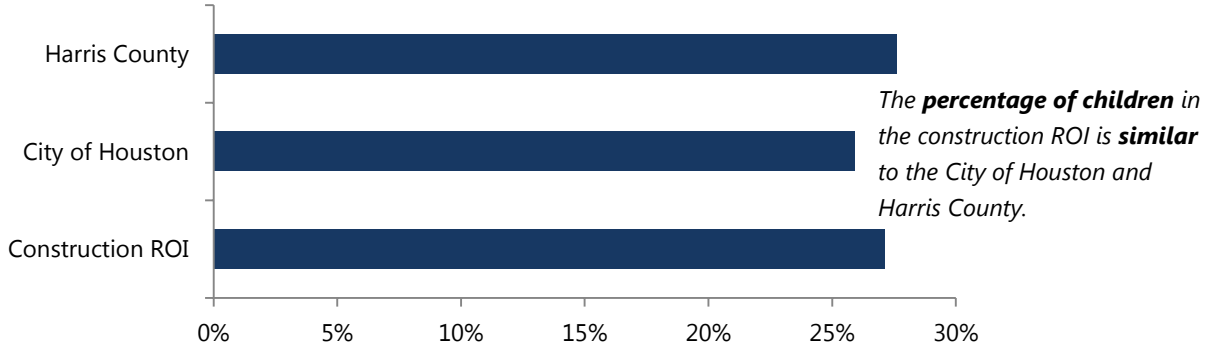


3.13.3 Children's Environmental Health and Safety Risks

EO 13045 requires federal agencies to make child protection a high priority because children may be more susceptible to environmental effects than adults.

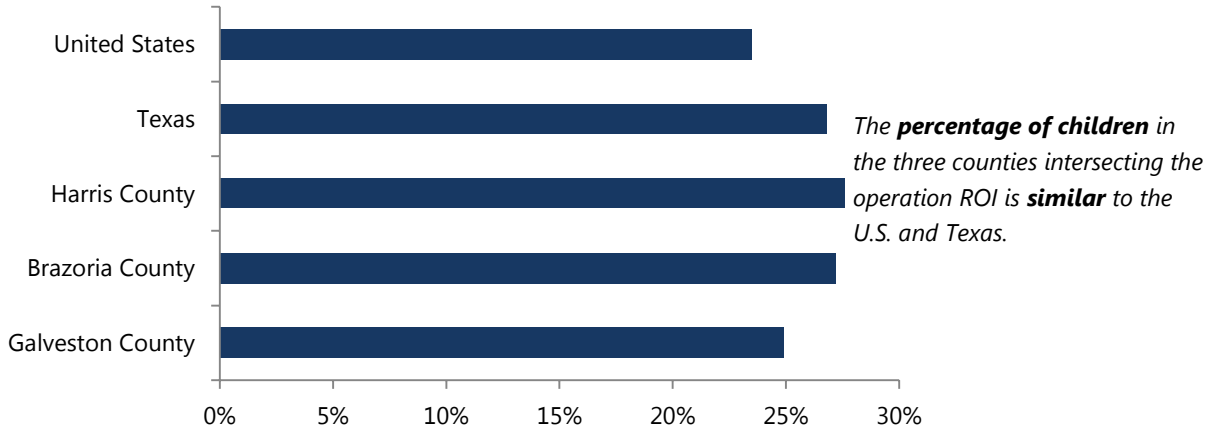
For the purpose of this analysis, children are considered to be less than 18 years of age. Figure 3-19 compares the percentage of children in the construction ROI to the percentage of children in the City of Houston and Harris County. Figure 3-20 compares the percentage of children in Harris, Brazoria, and Galveston Counties compared to the rest of the Nation and the State of Texas. Figure 3-21 identifies the locations of schools within the construction ROI. The closest school to EFD is North Pointe Elementary School at 3200 Almond Creek Drive, approximately one mile east of EFD.

FIGURE 3-19
PERCENTAGE OF CHILDREN (UNDER 18) WITHIN THE CONSTRUCTION ROI



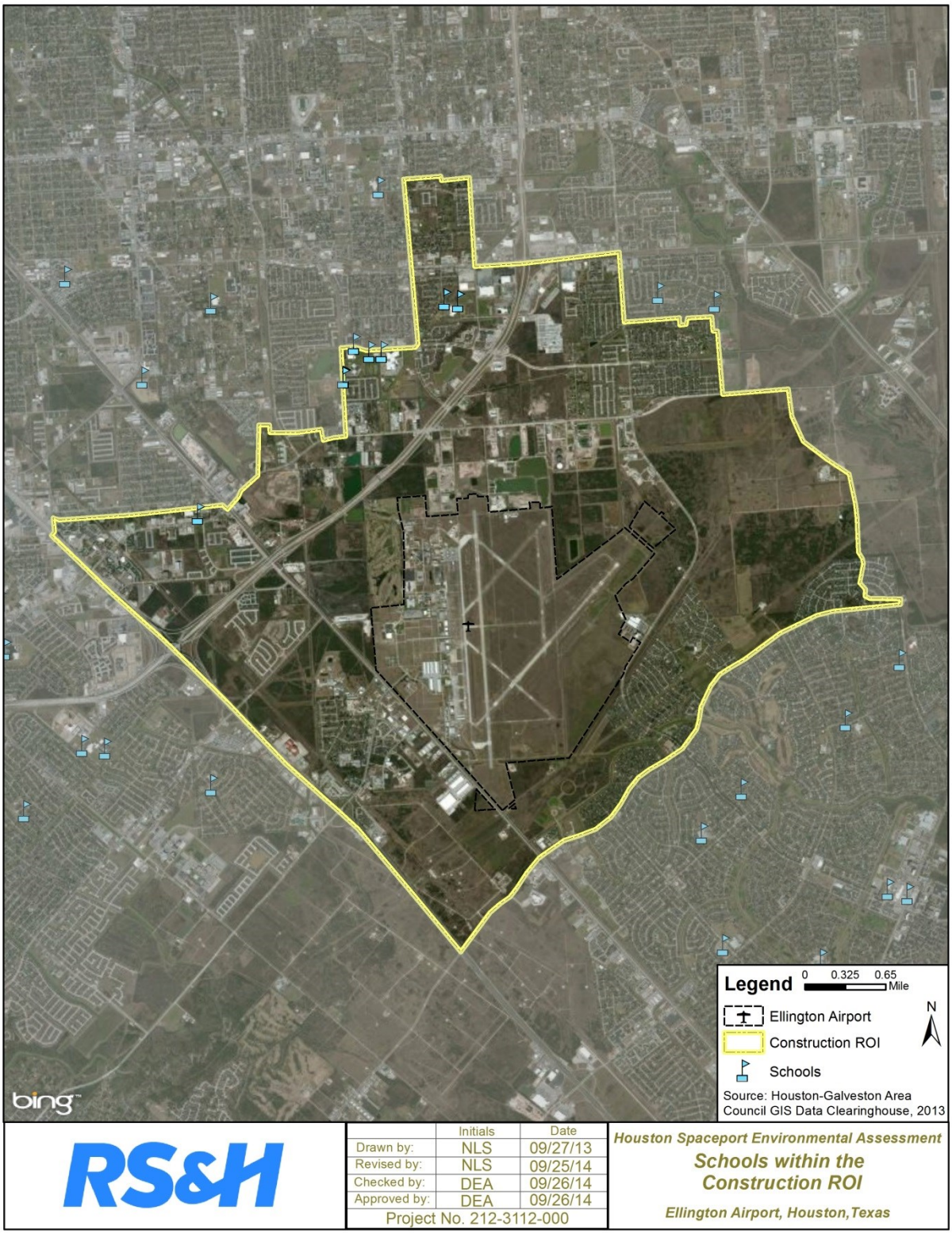
Source: U.S. Census Bureau, State and County Quick Facts, 2010

FIGURE 3-20
PERCENTAGE OF CHILDREN (UNDER 18) WITHIN THE OPERATION ROI



Source: U.S. Census Bureau, State and County Quick Facts, 2010

FIGURE 3-21
SCHOOLS WITHIN THE CONSTRUCTION ROI



3.14 WATER QUALITY

Several laws and EOs address and regulate federal airport activities and their effects on water quality. The following list are the laws most applicable to airport projects:

- Federal Water Pollution Control Act, as amended by the CWA (33 U.S.C. § 1251 *et. seq.*);
- CWA, as amended by the Oil Pollution Act of 1990 (OPA) (42 U.S.C. § 1252 *et. seq.*);
- Safe Drinking Water Act, as amended (SDWA) (42 U.S.C. § 300(f)); and
- FWCA (16 U.S.C. § 661 *et. seq.*).

In addition to the above federal regulations, the TCEQ at has issued water standards to protect the state's waters through Title 30, Chapter 307 of the TAC. The standards are written by the TCEQ under the authority of the CWA and Texas Water Code (TWC).

3.14.1 Surface Water

The topography of the construction ROI and the operation ROI is generally flat with elevations as high as 40 feet MSL to as low as seal level. The construction ROI is part of the Armand Bayou watershed. The natural drainage of EFD flows west and south to Horsepen Bayou. According to the USEPA, Horespen Bayou is currently listed as an impaired waterbody due to bacteria (USEPA, 2010). Horespen Bayou is a tributary of Armand Bayou. Armand Bayou flows into Clear Lake, an estuary connected to the west side of Galveston Bay. EFD is approximately nine miles west of Galveston Bay. See Figure 3-22 for river segments within the construction ROI.

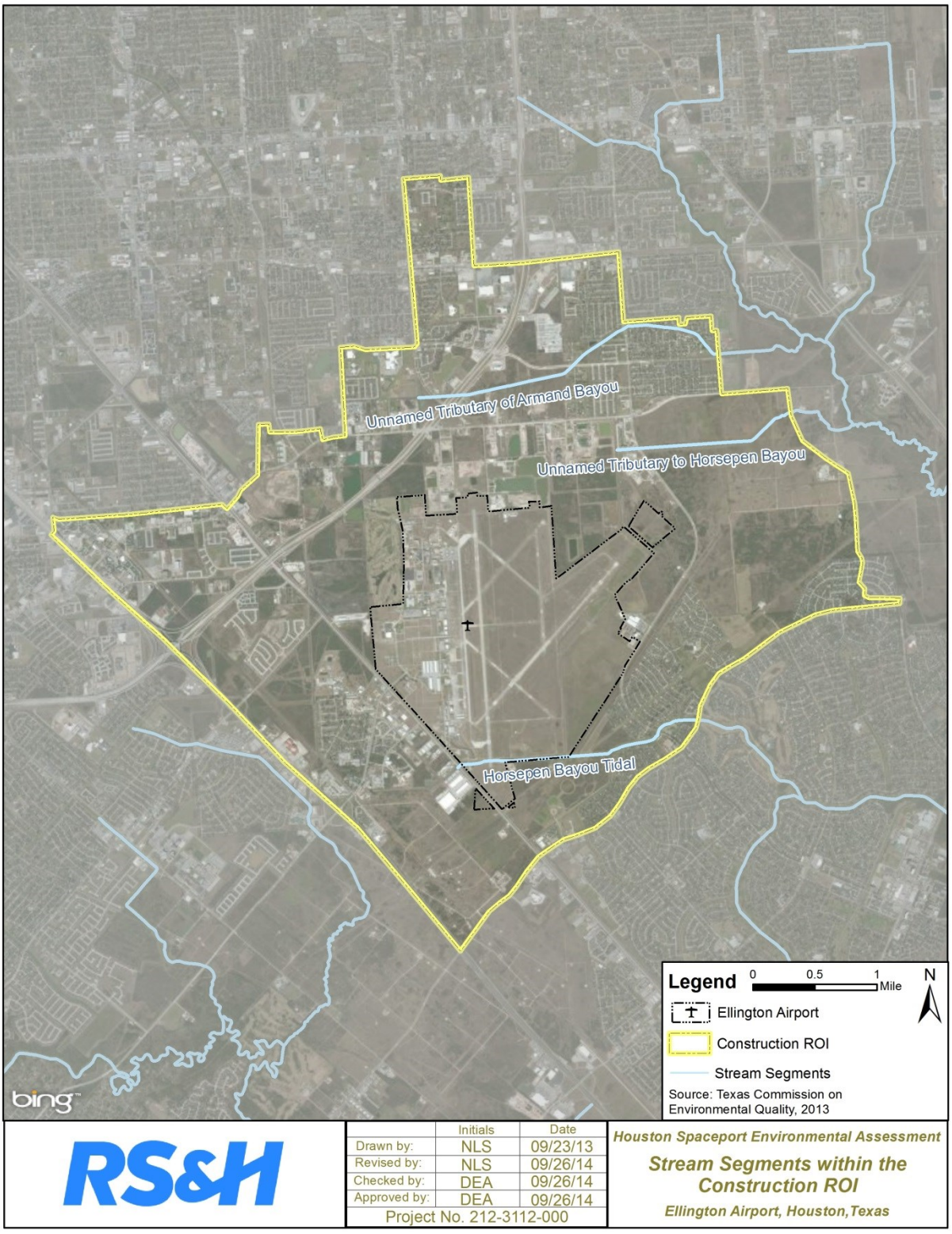
3.14.2 Groundwater

Much of the local area's groundwater comes from the Chicot and Evangeline aquifers. Both aquifers are part of a vast coastal aquifer system that extends throughout the margin of the coastal plain of Texas and Louisiana. Freshwater is available in the upper 1,000 to 2,000 feet of the aquifer system. Saltwater exists in deeper portions of the aquifer system at depths greater than 2,000 feet. Recharge to the Evangeline aquifer is provided by precipitation and surface runoff north of the Houston area (USGS, 2013b).

3.14.3 Wastewater and Stormwater

EFD has four drainage basins covering approximately 1,721 acres. The existing storm sewer systems consists of an enclosed conduit system on and the landside and airside ranging from 12-inch to multi-barrel box culverts on the landside, and 10-inch perforated metal pipe (PMP) to 54-inch PMP on the airside. The system covers EFD, including the airfield and former military facilities. The system has a capacity to include additional development since much of the previous impervious surfaces associated with military facilities have been turned into green space (HAS, 2004a). EFD's primary Standard Industrial Classification (SIC) code is 4581 (Airports, Flying fields, and Airport Terminal Services, including aircraft maintenance and fueling) and is subject to Sector S: Air Transportation Facilities under the Multi-Sector General Permit (MSGP). EFD operates under the TPDES stormwater MSGP (TXR050000) for the discharge of stormwater associated with industrial activity within Texas (TCEQ, 2006a). The permit expires on August 14, 2016, unless amended. Among the conditions and requirements, HAS must implement a SWPPP. Stormwater at EFD is managed under the provisions of EFD's SWPPP, in accordance with its TPDES Stormwater Multi-Sector General Permit (Permit Number TXR05T730).

FIGURE 3-22
STREAM SEGMENTS



3.15 WETLANDS

The CWA defines wetlands as "…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (Environmental Laboratory, 1987).

Federal regulations addressing wetlands are:

- 33 CFR Part 323, *Permits for Discharges of Dredged or Fill Material into Waters of the United States*, which implements the portion of the CWA addressing the dredging or filling of waters of the U.S., including jurisdictional wetlands.
- USDOT Order 5660.1A, *Preservation of the Nation's Wetlands*, sets forth USDOT policy on jurisdictional and non-jurisdictional wetlands.

A wetland may be "jurisdictional" under federal regulations in some instances due to the wetland's connection to navigable waters.[25] The USACE regulates dredge and fill activities in jurisdictional wetlands under Section 404 of the CWA. In other cases, a wetland may be "non-jurisdictional" because it has no such connection. Federal and state agencies (e.g., USFWS, EPA) oversee actions in both wetland categories. The designation of a wetland does not rely on its jurisdiction or non-jurisdictional status. Instead, the technical definition of a wetland depends on whether the area's soils, vegetation, and hydrology meet certain criteria. Such "delineations" are determined according to the USACE's *Wetlands Delineation Manual* (USACE, 1987).

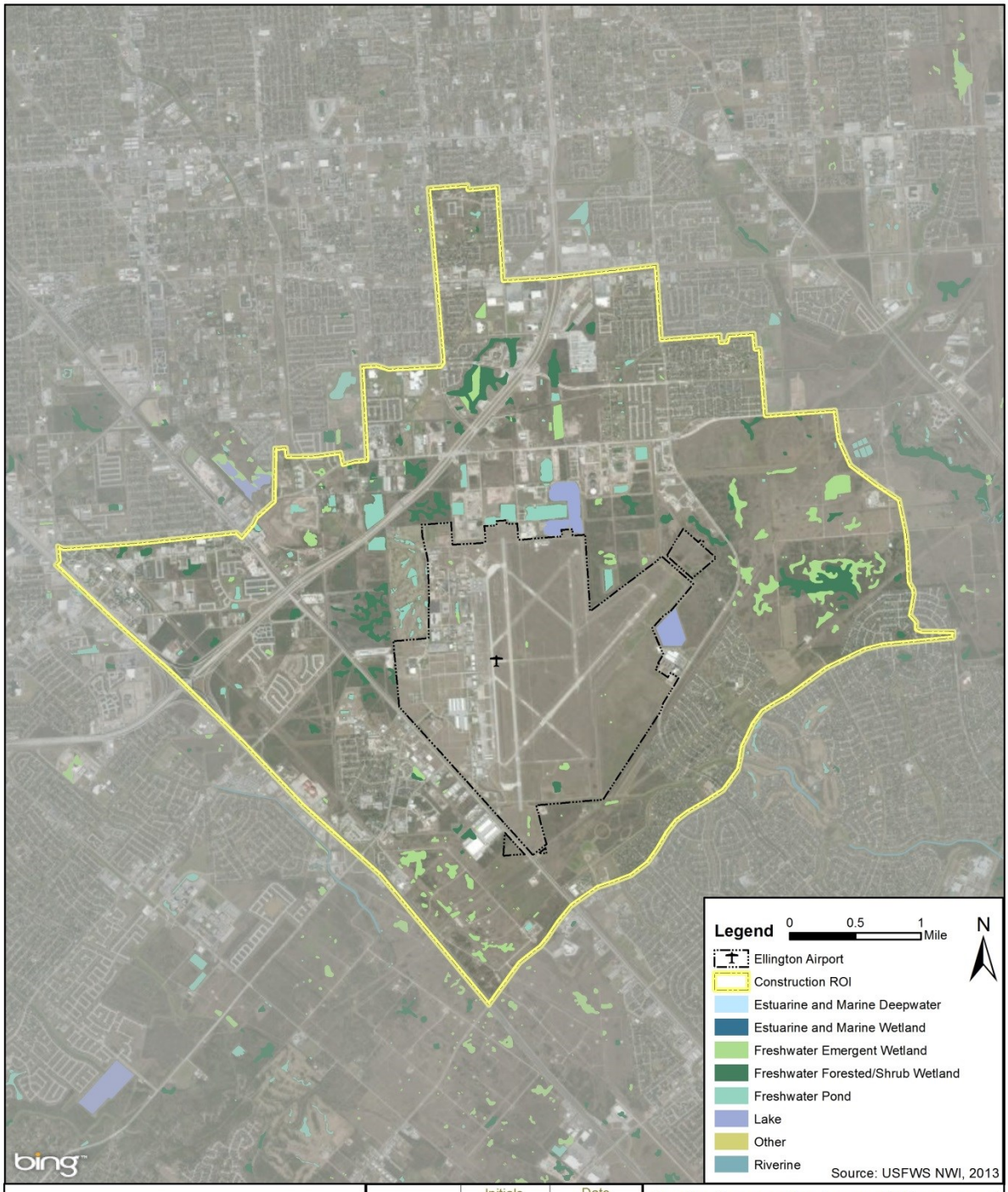
Wetlands are productive parts of the landscape. They are important to watershed and biotic health. Wetlands absorb floodwaters, supply base flow, protect shorelines, trap sediments, recharge groundwater, and provide habitat for fish and wildlife.

According to the National Wetlands Inventory mapping system, there are wetlands within the construction ROI (see Figure 3-23). There are a few isolated wetlands located on EFD property, primarily in the southern and western portions. The wetlands found on EFD property are freshwater emergent wetlands and freshwater forested shrub wetlands.

Freshwater emergent wetlands are marshes and wet meadows that usually exist in shallow topographic depressions. As a result, they are usually subject to extended periods of flooding. Freshwater forested shrub wetlands occur in deep swamps and include a variety of shrubs, ferns, and other herbs that are present in more swamp-like forest areas.

[25] Navigable waters are those waters affected by the ebb and flow of tides, and are, or have been, used for interstate commerce.

FIGURE 3-23
WETLANDS



CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

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This chapter presents an analysis of the potential impacts upon various components of the environment that could result from implementation of the Proposed Action or No Action Alternative. The analysis in this chapter is in accordance with FAA Orders 1050.1E and 5050.4B. To evaluate potential impacts, the analyses presented in this chapter overlay the components of the Proposed Action described in Chapter 2 onto baseline conditions within the ROIs for each environmental impact category presented in Chapter 3.[26] In addition, this chapter evaluates the potential environmental impacts of the forecast of RLVs operating within the operation ROI. The significance thresholds identified in this chapter are those presented in Appendix A of FAA Order 1050.1E. This chapter discusses the potential construction[27] and operation impacts on following impact categories:

- Air Quality (Section 4.1)
- Climate (Section 4.2)
- Coastal Resources (Section 4.3)
- Compatible Land Use (Section 4.4)
- USDOT Act, Section 4(f) Properties (Section 4.5)
- Fish, Wildlife, and Plants (Section 4.6)
- Floodplains (Section 4.7)
- Hazardous Materials, Pollution Prevention, and Solid Waste (Section 4.8)
- Historic, Architectural, Archeological, and Cultural Resources (Section 4.9)
- Light Emissions and Visual Impacts (Section 4.10)
- Natural Resources and Energy Supply (Section 4.11)
- Noise (Section 4.12)
- Secondary (Induced) Impacts (Section 4.13)
- Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks (Section 4.14)
- Water Quality (Section 4.15)
- Wetlands (Section 4.16)

In accordance with CEQ regulations, this EA integrates the requirements of NEPA and other planning and environmental review procedures required by applicable law or agency practice. This integration allows the appropriate review procedures to run concurrently rather than consecutively (40 CFR §1500.2(c)). This chapter includes the environmental analyses associated with the following federal statutes, EOs, and regulations:

- Federal Coastal Zone Management Act of 1972 (Coastal Resources, Section 4.3);
- Title 49 U.S.C. 303 and 23 U.S.C. 138 (USDOT Section 4(f), Section 4.5);

[26] As described in Chapter 3, farmlands and wild and scenic rivers are not within the construction and/or operation ROI. Therefore, they are not analyzed further in Chapter 4.

[27] Rather than as a separate impact category, construction impacts are considered within each impact category (e.g., air quality) that could be affected by construction activities. See FAA Order 1050.1E, Appendix A Section 5.

- Endangered Species Act of 1973 (Fish, Wildlife, and Plants, Section 4.6);
- EO 11988 (Floodplains, Section 4.7);
- Section 106 of the NHPA (Historic Resources, Section 4.9); and
- EO 11990 (Wetlands, Section 4.16).

As stated in Chapter 1 of this EA, spaceport operations would begin in 2015 and continue operating through 2019. Therefore, this EA uses the study years 2015 and 2019 to compare the potential environmental impacts of the Proposed Action and No Action Alternative. Based on the HAS *Houston Spaceport Economics and Business Study*, 35 RLV launches are proposed in 2019. However, for a conservative analysis, this EA assesses up to 50 launches in 2019. For the purposes of this EA, the Concept X and Concept Z RLV descriptions presented in Chapter 2 are used for assessing potential impacts of RLV operations at EFD.

As described in Section 2.1, the FAA would not alter the dimensions (shape and altitude) of the airspace. Temporary closures of existing airspace may be necessary to ensure public safety during the proposed operations. Advance notice via NOTAMs would assist general aviation pilots in scheduling around any temporary disruption of flight activity at EFD. Launches would be infrequent (less than 1 percent of the total operations occurring at EFD), of short duration, and scheduled well in advance to minimize interruption of airport operations. For these reasons, environmental impacts from the temporary closure of airspace and the issuance of NOTAMs and TFRs under the Proposed Action are not anticipated (see Appendix B, Airspace and Airports, for further information). Moreover, in accordance with FAA Order 1050.1E, Chapter 3 (Advisory and Emergency Actions and Categorical Exclusions), the issuance of NOTAMs is categorically excluded from NEPA review absent extraordinary circumstances.

4.1 AIR QUALITY

This section describes the potential effects of the No Action Alternative and Proposed Action on air quality.

4.1.1 Significance Thresholds

Potentially significant air quality impacts associated with an FAA project or action would be demonstrated if a project or action would lead to pollutant concentrations that would violate one or more of the NAAQS for any of the time periods analyzed.

4.1.2 Environmental Consequences

CAP, hazardous air pollutant (HAP), and GHG emissions associated with the Proposed Action are disclosed pursuant to the NEPA and according to FAA Order 5050.4B 706 f(3). The Proposed Action's compliance with the General Conformity Regulations of the CAA (40 CFR Part 93) is also assessed.

The approach for the Houston Spaceport air quality assessment is consistent with FAA Order 1050.1E, Appendix A, Section 2.1. Further, the air quality assessment methodology is formulated in accordance with the following regulations and guidance and is detailed in the following sections:

- FAA Air Quality Procedures for Civilian Airports and Air Force Bases (FAA, 2004);

- FAA Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources (FAA, 2009b);
- FAA Order 1050.1E, Change 1, Guidance Memo #3 (FAA, 2012); and
- FAA Final Programmatic EIS for Horizontal Launch and Reentry of Reentry Vehicles (FAA, 2005).

As described in Section 3.1, the area is designated nonattainment for the now historical 1-hour O_3 standard, and is also considered nonattainment for both the currently enforceable 1997 and 2008 8-hour NAAQS. Based on these designations, the most stringent of the O_3 *de minimis* thresholds applicable to the Houston area (i.e., a severe nonattainment area) correspond to 25 tons per year of nitrogen oxides (NO_x) or VOC, both of which are considered precursors to ground level O_3 formation. Accordingly, operational and construction CAP emissions associated with the Proposed Action occurring below the local atmospheric mixing height (i.e., below 3,038 feet for the Houston Area) are compared to these thresholds. The local mixing height is defined as the vertical extent in the troposphere above which emitted pollutants do not mix downward to ground level.

Operational emissions inventories for years 2015 and 2019 were developed for the Proposed Action, which consists of FAA approval for airport development and issuance of licenses and permits needed to operate horizontally-launched and horizontally-landing commercial spacecraft at the proposed Houston Spaceport. Emissions sources included in the evaluation comprise Concept X and Concept Z RLVs, their support equipment (i.e., fuel trucks and tractors), and routine jet engine testing taking place at ground level to ensure safe operation.

Additionally, calendar year 2015 construction emissions were estimated using EPA's MOVES2014 model, the TCEQ's Texas NonRoad Model (TexN Version 1.6) and other appropriate guidelines. The emission estimates combine information on construction schedule, equipment type, fuel type, equipment hours of operation, and horsepower and construction footprint along with equipment emissions data specific to the construction ROI. For more detailed information on the air quality analysis, see Appendix C for the final air quality assessment protocol.

4.1.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual RLV operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (e.g., mowing, hay production) would also continue at EFD. There would be no impacts to air quality beyond those already occurring.

4.1.2.2 Proposed Action

Equipment and vehicle operations, demolition activities, paving activities and other construction practices for the landside and airside development features of the Proposed Action (see Section 2.1.2) may result in emissions. Table 4-1 summarizes the estimated construction emissions from various sources.

TABLE 4-1
CONSTRUCTION EMISSIONS INVENTORY SUMMARY

Source	2015 Emissions (tons)					
	CO	NO_x	SO_x	PM_{10}	$PM_{2.5}$	VOC
Nonroad Construction Equipment	28.5	2.5	<0.1	0.2	0.2	1.1
Onroad Construction Vehicles	0.2	0.4	<0.1	<0.1	<0.1	0.1
Employee Vehicles	2.6	0.3	<0.1	<0.1	<0.1	0.1
Asphalt Paving	--	--	--	--	--	0.4
Fugitive Dust	--	--	--	7.6	0.8	--
Total	31.3	3.2	<0.1	7.8	1.0	1.7

Note: Values reflect rounding. Emissions are expected to occur in 2015 only.
Source: KB Environmental Sciences, Inc.

The TCEQ has promulgated the following regulations into the TAC on the control of fugitive dust emissions occurring from materials handling, construction and demolition, and road travel:

- 30 TAC §111.143(1): application of water or suitable chemicals or some other covering on materials stockpiles and other surfaces which can create airborne dusts;
- 30 TAC §111.143(3)(a) and (b): application of water or suitable chemicals, or complete covering of materials contained in open-bodied trucks, trailers, or railroad cars transporting such materials which can create airborne particulate matter in areas where the general public has access;
- 30 TAC §111.145(1): use of water or of suitable oil or chemicals for control of dust in the demolition of structures, in construction operations, in work performed on a road, street, alley, or parking area, or in the clearing of land;
- 30 TAC §111.145(3): application of asphalt, other paving materials, water, suitable oil, or chemicals on construction and/or demolition site access roads; and
- 30 TAC §111.147(2): removal from public thoroughfares, as necessary, of soil or other materials, except for sand applied for the specific purpose of snow or ice control.

The following additional emissions reduction measures and best management practices (BMPs) during construction would help reduce adverse air quality effects:

- reduce equipment idling times;
- use cleaner burning or low emissions fuels in equipment;
- encourage employee carpooling;
- limit construction activities when atmospheric conditions are conducive to O_3 formation (i.e., "high ozone days");
- limit construction activities during high wind events to prevent dust;
- utilize warm-mix asphalt during paving operations;
- install tire washes and truck washes to deter tracking dirt and mud to areas outside the airport as vehicles enter and leave the disturbed, project-related work sites; and
- reduce vehicle speeds on unpaved roads.

Under the Proposed Action, each concept RLV conducts a powered take-off with the capability to propel the RLV into suborbit. The Concept X RLV is estimated to conduct 50 takeoffs and 50 landings per year. Under current designs, the Concept X RLV could combust jet-A during takeoff, combust RP-1 fuel and LOX oxidizer during rocket engine launch procedures (ignited once the RLV reaches approximately 40,000 ft MSL over the Gulf of Mexico), and could rely on jet engine power to assist during landing; if it does not return gliding.

The Concept Z RLV consists of the carrier vehicle (e.g., White Knight Two) as well as its launch vehicle (e.g., SpaceShip Two). The Concept Z RLV is similarly estimated to conduct 50 takeoffs and 50 landings per year. Under current designs, the Concept Z RLV could combust Jet-A fuel during takeoff, combust HTPB and N_2O oxidizer during rocket engine launch of the RLV over the Gulf of Mexico (e.g., Spaceship Two). The carrier vehicle could combust Jet-A upon landing and the launch vehicle would glide back to EFD or be expended (e.g., Generation Orbit).

Operation of RLV jet propulsion engines would cause CAP and HAP emissions within the lower troposphere (i.e., up to 3,038 ft), free troposphere (3,038 ft to 32,000 ft), and stratosphere (i.e., 32,000 ft to 163,500 ft). CAP and HAP emissions from support equipment operation and ground-level engine testing would also occur. However, the CAP and HAP emissions occurring above the local atmospheric mixing height (3,038 ft) would not reach ground level, and accordingly these emissions are not addressed in this EA. Table 4-2 summarizes the CAP emissions resulting from commercial spaceport operations in 2015 (and 2019 as activity levels are identical between years). For disclosure purposes, HAP emissions are presented on Table 4-3.

Of note, engine testing at EFD currently occurs adjacent to the NASA Sonny Carter Training Facility where divers refill NITROX SCUBA tanks for use. Engine testing emissions are minimal and testing is not anticipated to occur frequently enough to have a significant deleterious effect on local air quality. These minor levels of contaminants could be present in the makeup air that is taken into the SCUBA tanks and compressed during refilling.[28] Accordingly, further HAS and/or RLV operator coordination may need to occur with the Sonny Carter Training Facility to ensure that engine testing activities associated with the Proposed Action are conducted such that potential contaminants in refilling NITROX SCUBA tanks are minimized.

[28] Letter from NASA Johnson Space Center to Dave Alberts, Reynolds, Smith and Hills, re: Scoping Comments on Proposed Spaceport Environmental Assessment. November 18, 2013.

TABLE 4-2
OPERATIONAL CAP EMISSIONS INVENTORY SUMMARY

Source	2015/2019 Emissions (tons)					
	CO	NO_x	SO_x	PM_{10}	$PM_{2.5}$	VOC
Concept X RLVs	0.4	0.1	<0.1	<0.1	<0.1	<0.1
Concept Z RLVs	0.3	0.1	<0.1	<0.1	<0.1	0.1
Support Equipment	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Engine Testing	53.9	0.2	<0.1	<0.1	<0.1	<0.1
Total	54.6	0.4	0.1	<0.1	<0.1	0.1

Note: Values reflect rounding. Emissions inventory depicts impacts in the lower troposphere only.
Source: KB Environmental Sciences, Inc.

TABLE 4-3
OPERATIONAL HAP EMISSIONS INVENTORY SUMMARY

HAP	2015/2019 HAP Emissions (pounds)			
	RLV Jet Engines	Support Equipment	Engine Testing	Total
1,3-butadiene	4.0	--	<0.1	4.0
2-methylnaphthalene	<0.1	--	<0.1	<0.1
Acetaldehyde	8.0	<0.1	<0.1	8.0
Acetone	<0.1	--	<0.1	<0.1
Acrolein	4.0	--	<0.1	4.0
Benzaldehyde	<0.1	<0.1	<0.1	<0.1
Benzene	4.0	--	<0.1	4.0
Ethylbenzene	<0.1	--	<0.1	<0.1
Formaldehyde	24.0	<0.1	2.0	26.0
Isopropylbenzene (cumene)	<0.1	--	<0.1	<0.1
M & P-xylene	<0.1	--	<0.1	<0.1
Methyl alcohol	4.0	--	<0.1	4.0
Naphthalene	2.0	--	<0.1	2.0
N-heptane	<0.1	--	<0.1	<0.1
O-xylene	<0.1	--	<0.1	<0.1
Phenol (carbolic acid)	2.0	--	<0.1	2.0
Propionaldehyde	2.0	<0.1	<0.1	2.0
Styrene	<0.1	--	<0.1	<0.1
Toluene	2.0	--	<0.1	2.0

Note: -- signifies that the HAP are not calculated because no emission rates are provided in existing FAA guidance. Values reflect rounding. Emissions inventory depicts impacts in the lower troposphere only.
Source: KB Environmental Sciences, Inc.

General Conformity Applicability - Table 4-4 lists the 2015 and 2019 emissions of NO_x and VOC expected to occur as a result of the construction and operation of the Proposed Action, and compares the total annual emissions for each year against the applicable *de minimis* thresholds for NO_x and VOC. As shown,

the year of maximum project-related emissions occurs in 2015 because of the overlap of the project's construction and commencement of operations in that year. Emissions in 2015 resulting from the Proposed Action are less than the applicable *de minimis* thresholds and are less than 10 percent of the regions emissions, indicating that the Proposed Action will not require a General Conformity Determination, nor will it cause or contribute to new or existing violations of NAAQS.

TABLE 4-4
GENERAL CONFORMITY APPLICABILITY

	2015 Emissions (tons)	
	NO_x	VOC
Construction	3.2	1.7
Operation	0.4	0.1
Total	3.6	1.8
De minimis	25	25
Exceeds *de minimis?*	No	No
	2019 Emissions (tons)	
	NO_x	VOC
Operation	0.4	0.1
Total	0.4	0.1
De minimis	25	25
Exceeds *de minimis?*	No	No

Values Reflect Rounding.
Source: KB Environmental Sciences, Inc.

Mitigation and Best Management Practices - Emissions associated with the construction and operation of the Proposed Action are within EPA's *de minimis* thresholds and are not expected to significantly affect the air quality of the area. Accordingly no air quality mitigation measures are proposed. As previously described in Section 4.1.2.2, although no mitigation measures are required, best management practices can nonetheless be applied during the project construction phase that would ensure adherence to local dust control regulations and generally provide a good faith effort to minimize emissions wherever possible.

4.2 CLIMATE

This section describes the potential effects of the No Action Alternative and Proposed Action on the Earth's climate.

4.2.1 Significance Thresholds

While there is no significance threshold for aviation-related GHG emissions, the projected increase in GHG emissions from the proposed action is discussed in the context of national and global GHG emissions from all sources (FAA, 2012).

4.2.2 Environmental Consequences

Although there are no federal standards for aviation-related GHG emissions, it is well established that GHG emissions can affect climate. The CEQ has indicated that climate should be considered in NEPA

analyses (FAA, 2012). As noted by CEQ, "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions; as such direct linkage is difficult to isolate and to understand" (CEQ, 2010). Aviation has been calculated to contribute approximately three percent of global CO_2 emissions; this contribution may grow to five percent by 2050. Climate modeling methodologies do exist to scientifically predict global average impact, and have been used in NEPA documentation, but for the Proposed Action's small increment of emissions any impact would be much less than the level of uncertainty inherent in the methodology.

4.2.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual RLV operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (e.g., mowing, hay production) would also continue at EFD. There would be no impacts to climate.

4.2.2.2 Proposed Action

Operation of RLV jet and rocket propulsion systems would cause emissions of GHG within the lower troposphere (i.e., up to 3,038 ft), free troposphere (3,038 ft to 32,000 ft), and stratosphere (i.e., 32,000 ft to 163,500 ft). Additionally, GHG emissions from propellant and oxidizer combustion during take-off, rocket ignition, and landing[29] occur up to the stratospheric level. Ozone depleting substance emissions to the stratosphere from Concept X and Z RLVs are not of concern because neither of the concept RLVs proposed emit hydrogen chloride or chlorine ions that would lead to significant impacts related to ozone depletion. Additionally, emissions to the mesosphere would be negligible to non-existent. Powered engine operations would not occur in the ionosphere, so assessment of electron-depleting substances in the F-layer of the ionosphere are not addressed. Table 4-5 summarizes GHG emissions by atmospheric layer that would occur due to operation of the Proposed Action in 2015 and 2019.

Moreover, the Proposed Action would only increase GHG emissions by 2,546 MT $CO2_e$ over the No Action Alternative. This increase would comprise less than 0.000039 percent of all U.S.-based GHG emissions.

[29] The Concept X RLV could land using jet power or glide. The Concept Z carrier vehicle would land under jet power while the launch vehicle would land gliding or be expended.

TABLE 4-5
OPERATIONAL GHG EMISSIONS INVENTORY SUMMARY

		2015/2019 Emissions (metric tons)				
Atmospheric Layer	**Source**	**CO_2**	**CH_4**	**N_2O**	**CO_2e**	**H_2O**
Lower Troposphere	Concept X RLVs	50.4	<1.0	<1.0	50.7	--
	Concept Z RLVs	38.5	<1.0	<1.0	38.8	--
	Support Equipment	5.6	<1.0	<1.0	5.6	--
	Engine Testing	51.2	<1.0	<1.0	51.2	--
Subtotal – Lower Troposphere		**145.7**	**<1.0**	**<1.0**	**146.3**	**--**
Free Troposphere	Concept X RLVs	1,072.9	--	--	1,072.9	40.1
	Concept Z RLVs	938.4	--	--	938.4	--
Subtotal – Free Troposphere		**2,011.3**	**--**	**--**	**2,011.3**	**40.1**
Stratosphere	Concept X RLVs	304.7	--	--	304.7	121.9
	Concept Z RLVs	84.4	--	--	84.4	35.2
Subtotal – Stratosphere		**389.1**	**--**	**--**	**389.1**	**157.0**
Grand Total		**2,546.0**	**<1.0**	**<1.0**	**2,546.7**	**197.1**

Note: -- signifies that the GHG is not emitted from the subject emissions source, except in the instance of water vapor for some sources. Some sources do actually emit water vapor, but it is not quantified in the lower troposphere for this assessment. Values reflect rounding.
Source: KB Environmental Sciences, Inc.

4.3 COASTAL RESOURCES

This section describes the potential effects of the No Action Alternative and Proposed Action on coastal resources. This section does not discuss the requirements of the Coastal Barrier Resources Act (CBRA) because the ROIs for the Proposed Action do not include land within the CBRA system (see Section 3.3). Therefore, the project would not affect any barrier islands in the Gulf of Mexico.

4.3.1 Significance Thresholds

FAA Order 1050.1E does not provide a significance threshold; however, it does provide a number of factors to consider when determining the severity and context of a project's unavoidable coastal zone effects. Those factors include:

- the project proponent's determination that a proposed action is consistent with the applicable CZMP;
- the responsible state agency's finding regarding a project proponent's consistency determination; and
- a project to change a project so it is consistent with the CZMP.

4.3.2 Environmental Consequences

This EA uses the requirements of the regulations protecting coastal zone resources described in Section 3.3 and FAA Order 1050.1E, Appendix A, Section 3 in order to assess environmental consequences.

4.3.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. There would be no impacts on coastal resources.

4.3.2.2 Proposed Action

Implementation of the Proposed Action would result in development entirely on EFD property (see Section 2.1.2). The development would include seven acres of new impervious surface at EFD located approximately 30 miles inland, which is not within the limits required for a Section 10 permit.[30] The additional impervious surface would not impact coastal resources, including floodplains or wetlands (see Sections 4.7 and 4.16); consequently, a Section 404 permit would not be required.

Jet fueling operations would occur at the proposed apron, approximately 1,500 feet from nearest isolated wetland, and in designated areas of EFD (see Section 4.16). Rocket fueling operations would occur at the OLA (see Figure 2-3). If a fuel spill occurs, the launch operator would be responsible for necessary cleanup and remediation under the SPCC. As no impacts to coastal zone resources would occur, the proposed activity complies with Texas' approved CMP and would be conducted in a manner consistent with such program.

An early notification letter regarding this EA and Proposed Action was sent to agencies, including the Texas GLO, to solicit preliminary comments (see Appendix A). Also, a copy of the Draft EA was submitted to the Texas GLO for review. The Texas GLO sent a letter to the FAA on April 13, 2015, which stated the Proposed Action is consistent with the Texas CMP goals and policies (see Appendix G).

4.4 COMPATIBLE LAND USE

This section describes the potential effects of the No Action Alternative and Proposed Action on land use.

4.4.1 Significance Threshold

A significant land use impact would occur if analysis shows that the Proposed Action would cause a significant noise impact. A significant noise impact would occur if the proposed action would cause a noise sensitive area to experience an increase in noise of DNL 1.5 dB or more at or above the DNL 65 dB noise exposure when compared to the No Action Alternative for the same timeframe (see Section4.12). A significant land use impact may also occur if the proposed action would result in other significant impacts with land use ramifications, such as community disruption.

[30] Section 10 of the Rivers and Harbors Act (33 U.S.C. 401 *et seq*.) permit is required whenever construction is going to take place from mean high tide seaward to the limits of state jurisdictional waters (10.36 miles).

4.4.2 Environmental Consequences

This EA examines and discloses how the Proposed Action would affect land use activities. According to FAA Order 5050.4B, paragraph 1203a(1), an airport sponsor should show a proposed action is reasonably consistent with existing plans of public agencies responsible for the development in the area. FAA Grant Assurance 21, *Compatible Land Use*, also "relates to the obligations of the airport sponsor to take appropriate actions to zone and control existing and planned land uses to make them compatible with aircraft operations at the airport" (FAA, 2009a).

4.4.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. There would be no impacts related to compatible land use.

4.4.2.2 Proposed Action

Development associated with obtaining a launch site operator license would occur entirely on EFD property (see Chapter 2) and would be compatible with the existing EFD environment. The communities surrounding EFD would not be disrupted, nor would any residences and/or businesses be relocated. The Proposed Action would not significantly alter the aviation noise at EFD or aviation noise contours (see Section 4.12). Therefore, the Proposed Action would not alter the established land use tiers around EFD (see Section 3.4).

Although the undeveloped portions of EFD are primarily cleared and maintained, areas surrounding EFD could be potential wildlife attractants (see Section 3.4). Although these potential wildlife hazards are located near EFD, the development associated with the Proposed Action would not increase the existing wildlife hazard. Stormwater retention ponds associated with the proposed development would meet the requirements of FAA Advisory Circular (AC) 150/5200-33B and would not create additional wildlife hazards.

Airport operations would increase due to implementation of the Proposed Action; however, as previously described, the total launches of Concept X and Z RLVs would be approximately 50 per year. The Concept X and Z RLVs use jet engines for takeoff and landing. The vehicles are anticipated to generate noise levels comparable to the existing aviation activities at EFD. As described in Section 4.12, the Proposed Action would not significantly alter the size or shape of the aviation noise contours, demonstrating the increase in flights would not cause a significant noise-related impact.

Rocket engine noise associated with the two RLVs would begin when the vehicles are at a considerable altitude (approximately 40,000 feet) and over the Gulf of Mexico (approximately 60 miles offshore). Rocket engine noise and sonic booms are not anticipated onshore and are not anticipated to be perceived onshore (see Section 4.12).

Overall, implementation of the Proposed Action would be compatible with land use in the construction and operation ROIs.

4.5 DEPARTMENT OF TRANSPORTATION ACT SECTION 4(F) PROPERTIES

This section describes the potential effects of the No Action Alternative and Proposed Action on Section 4(f) properties.

4.5.1 Significance Threshold

A significant impact to a Section 4(f) property would occur if a project resulted in a non-minimal physical or constructive use of a Section 4(f) property and if mitigation does not eliminate or reduce the effects of the use below the threshold of significance.

4.5.2 Environmental Consequences

The analysis contained in this EA follows the requirements of the regulations protecting Section 4(f) properties.

Multiple Federal, State, and local agencies, and federally recognized Native American Tribes have been contacted regarding the preparation of this EA. See Appendix A-1 for the early notification letter and list of agencies contacted. See Appendix A-2 for response letters received from agencies. With the release of the Draft EA, agencies with jurisdiction of Section 4(f) properties were provided another opportunity to comment.

The construction and operation ROIs were reviewed for any publicly-owned parks, recreational areas, wildlife or waterfowl refuges, or publicly or privately owned historic sites. For Section 4(f) purposes, a proposed action would "use" a property in one of two ways:

- Physical use: The action physically occupies and directly uses the Section 4(f) resource. An action's occupancy or direct control (via purchase) causes a change in the use of the Section 4(f) resource.
- Constructive use: The action indirectly uses a Section 4(f) resource by substantially impairing the resource's intended use, feature, or attributes.

An analysis of whether any components of the Proposed Action would have a physical or constructive use of the Section 4(f) property was conducted and described in the following sections.

4.5.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation demands. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. There would be no impacts on Section 4(f) properties.

4.5.2.2 Proposed Action

As previously described, the development of the Proposed Action would occur entirely on EFD property. Additionally, operation of the Concept X and Z RLVs would not require the temporary use of any Section

4(f) properties (e.g., park closures). Therefore, the Proposed Action would not require the physical use (direct impact) of Section 4(f) properties.

Operation of the Concept X and Z RLVs would increase flight activity at EFD by 0.09 percent. The noise associated with this additional activity would not be significant (see Section 4.12). Noise during vehicle takeoff and landing would be similar to jet engines currently operating at EFD. A sonic boom impacting the Earth's surface would occur during reentry, but would not occur over land (see Section 4.12). The sonic boom would occur entirely off-shore, and Section 4(f) properties would not be subject to the sonic boom. Additionally, the Proposed Action would not significantly affect air quality (see Section 4.1) or have other effects that would substantially impair Section 4(f) resources (e.g., water quality, floodplains).

Therefore, the Proposed Action is not anticipated to result in constructive use (indirect impact) of a Section 4(f) property in the operation ROI. The U.S. Department of the Interior, Office of Environmental Policy and Compliance, has concurred with this Section 4(f) evaluation and stated that there is no feasible and prudent alternative to the selected action and that all measures have been taken to minimize harm to Section 4(f) resources. (See Appendix F).

4.6 FISH, WILDLIFE, AND PLANTS

This section describes the potential effects of the No Action Alternative and Proposed Action on fish, wildlife, and plants.

4.6.1 Significance Threshold

A significant impact would occur if the USFWS (or National Marine Fisheries Service) determined the project would be likely to jeopardize the continued existence of a federally listed species or would result in the destruction or adverse modification of designated critical habitat. For non-listed species, the FAA considers population dynamics and sustainability (e.g., reproductive success rates, natural mortality rates, non-natural mortality, and minimum population levels required for population maintenance) when considering the potential for significant impacts.

4.6.2 Environmental Consequences

The following considerations were made in determining the potential impact of the Proposed Action on biological resources and populations of threatened and endangered species:

- proximity of unique or high-value habitats including wetlands, wild and scenic rivers, and ecologically critical or important areas;
- potential for the action to adversely affect an endangered or threatened species, or its habitat, in particular federally designated critical habitat; and
- regulatory requirements and applicable federal, state and local laws governing the conservation and protection of threatened and endangered species.

4.6.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation demands. Airport

development would be subject to review and approval under NEPA and is not assumed under this alternative. There would be no impacts on fish, wildlife, and plants.

4.6.2.2 Proposed Action

The FAA sent the early notification letter (Appendix A) to the USFWS Ecological Services Field Office in Houston, Texas to solicit comments regarding potential environmental, social, and economic issues related to the Proposed Action (see Appendix A). USFWS provided guidance regarding candidate species, potential threats to migratory birds, colonial waterbird rookeries, bald eagles, and aquatic resources. USFWS identified the following potential areas of concern for this assessment: sedimentation of streams and wetlands due to construction activities, threats to migratory birds from overhead utility lines and communications towers, and possible disturbance to colonial waterbird rookeries or protected bird species, including bald eagles.

The FAA also sent the early notification letter and Draft EA to the NMFS to solicit comments regarding potential impacts on marine species and habitat under NMFS jurisdiction. The NMFS did not respond to the early notification letter and did not provide comments during the public comment period for the Draft EA.

The Texas Parks and Wildlife Department (TPWD) stated in their letter dated December 3, 2013 (see Appendix A-2), "[b]ecause construction activities associated with this project would be located within previously-disturbed portions of the existing airport, adverse impacts to fish and wildlife resources from the footprint of the proposed project are expected to be minimal." TPWD also stated it has "minimal concerns regarding noise impacts upon terrestrial species."

Construction activities required for the Proposed Action would occur on previously disturbed and currently maintained areas within the existing airport boundary, and would not disturb any unique or high value habitats. The area where spaceport facilities would be located has been regularly disturbed with farming activities (e.g., tilling, seeding, cutting, baling, etc.) for hay production. These areas have very little biological diversity and are of little value to wildlife (NASA, 2006). There would be no construction within or near any fish-bearing streams. Thus, there would be no impacts to fish.

There are no natural aquatic habitats at EFD (NASA, 2006). The closest wetland is located approximately 1,500 feet away from the area where development of the Proposed Action would occur. Construction activities would take place in accordance with applicable erosion control regulations, NPDES permits, and stormwater control BMPs. Erosion controls, as well as the distance to nearby water bodies, would prevent sedimentation of streams. For those reasons, no significant impacts to wetlands, streams, or other aquatic habitats are anticipated.

Fueling of the RLVs would occur in designated areas on the airfield, and would not be located near streams, wetlands, or ecologically sensitive areas. These activities would occur on impervious surfaces and in accordance with applicable rules and regulations (see Section 4.8).

During construction activities, direct mortality to individual animals could occur as a result of excavation and grading. On-site fill material is proposed to be used for the project components of the Proposed Action. Sensitive flora or fauna do not occur in areas that would provide fill. Federally or state protected fish, wildlife, or plants do not occur within the construction area; thus construction activities would have no effect on these protected species.

Regarding migratory birds, colonial waterbird rookeries do not occur within the construction ROI. It is highly unlikely that bald eagles or bald eagle nesting sites would be near EFD when construction would begin. The area where construction activities would occur is a flat meadow without trees or other features suitable for bald eagle nesting sites. In the event a bald eagle was sighted near planned construction activities, consultation with USFWS would occur prior to construction to avoid potential impacts to this species.

Migratory birds would not be significantly impacted by operation of the Concept X or Z RLVs. In 2012, 14 bird strikes were reported at EFD in the course of more than 114,000 aircraft operations at the EFD. Due to the limited number of RLV launches (up to 50 per year, or 0.09 percent of EFD's total operations), the likelihood of bird strikes related to the Proposed Action would not significantly increase in comparison to the operations under the No Action Alternative at EFD. Impacts on migratory birds from operation of the RLVs would be similar to existing airport operations.

Since the Concept X and Z RLVs would take off and land under jet engine power (or make a gliding landing), operation of these vehicles would be similar to the current military and civilian aircraft that routinely operate in the construction and operation ROIs. Operation of RLVs is not anticipated to significantly affect air quality, noise, and/or water quality (see Sections 4.1, 4.12, and 4.15, respectively). The sonic boom produced as a result of the RLV operation would occur at a high altitude over the Gulf of Mexico 30 miles off-shore (see Section 4.12). The peak overpressure level generated from a launch vehicle descent would be 0.9 pound per square foot (psf) (see Section 4.12.2.2), similar to a thunder clap, and would occur in a concentrated area of approximately 0.5 square mile. For the majority of the sonic boom footprint, sound levels would be closer to 0.1 psf. Due to the small magnitude of the boom along with significant attenuation of sonic booms at the air/water interface coupled with exponential attenuation with water depth, sonic booms generated under the Proposed Action would not significantly affect marine species.

Wildlife species in the construction ROI have adapted to a developed, urban setting and are therefore less likely to be affected by any short-term noise associated with the proposed construction and operational activities. Due to their habituation to relatively high ambient noise levels and the limited area of habitat that would be impacted by proposed construction activities, there would be no significant impacts to wildlife from proposed construction and operational activities under the Proposed Action.

In summary, in compliance with Section 7 of the ESA, the FAA has determined the Proposed Action would have "no effect" on federally listed species. Similarly, the Proposed Action would not result in significant impacts on state-listed and non-listed species.

4.7 FLOODPLAINS

This section describes the potential effects of the No Action Alternative and Proposed Action on floodplains.

4.7.1 Significance Threshold

FAA Order 1050.1E, Change 1, states, "…floodplain impacts would be significant pursuant to NEPA if they cause notable adverse impacts on natural and beneficial floodplain values. Mitigation measures for base floodplain encroachments may include committing to special flood-related design criteria, elevating facilities above base flood level, locating nonconforming structures and facilities out of the floodplain, or minimizing fill placed in floodplains."

FAA Order 1050.1E, Change 1 also describes the analysis shall indicate if there is a significant encroachment. An action would cause a significant encroachment with one or more of the following impacts:

- high probability of loss of human life;
- have substantial, encroachment-associated costs or damage, including interruption of aircraft service or loss of a vital transportation facility; or
- have adverse impacts on natural and beneficial floodplain values.

4.7.2 Environmental Consequences

The methodology for determining and comparing unavoidable floodplain impacts involves quantifying the area of floodplain encroachment that each component of the Proposed Action would cause and the corresponding runoff resulting from the introduction of additional impervious surfaces.

In order to calculate the increases in stormwater runoff, an annual rainfall of 49.77 inches was used in calculations (NWS, 2013). The additional annual runoff was calculated using a coefficient of 0.95 for Portland cement (TxDOT, 2011). The results of these calculations were compared to the capacities of EFD's affected drainage basins.

4.7.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. There would be no impacts on floodplains.

4.7.2.2 Proposed Action

As shown in Figure 4-1, implementation of the Proposed Action would not encroach on designated floodplains. While the Proposed Action would involve construction of impervious surfaces and contribute to an annual increase in runoff, the additional runoff would have no material effect on floodplain elevations. Table 4-6 provides a summary of these project-related runoff increases. The Proposed Action is in EFD's designated drainage basin areas C and D.

FIGURE 4-1
PROPOSED DEVELOPMENT AND 100-YEAR FLOODPLAINS

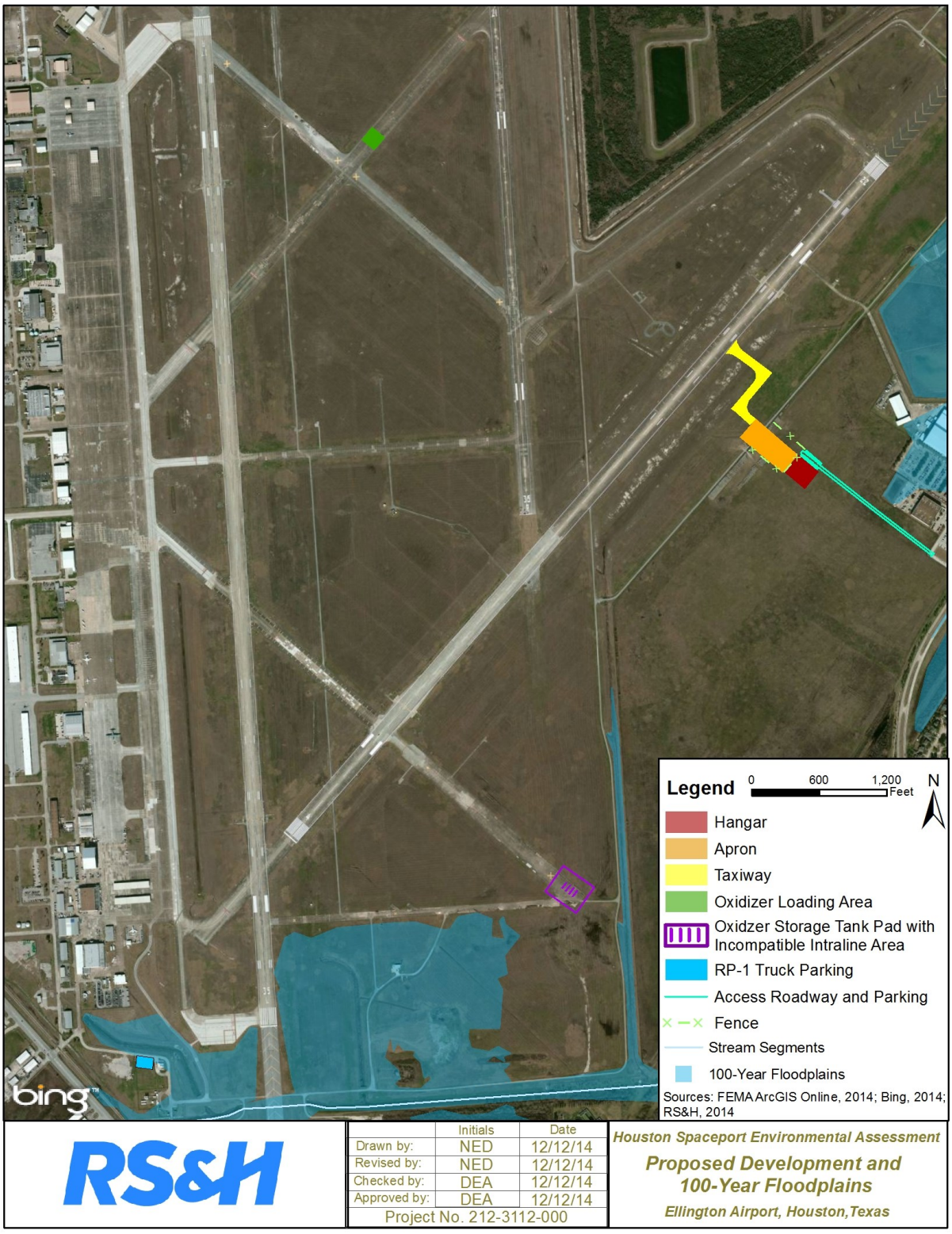


TABLE 4-6
PROJECT SPECIFIC STORMWATER RUNOFF INCREASES

Project Component	Net Component Impervious Increase (square feet)	Floodplain Encroachment (square feet)	Additional Annual Runoff[/a/b/] (acre feet[c])
Access Roadway and Parking	45,904	0	4.15
Truck Parking	15,084	0	1.36
Taxiway	81,537	0	7.37
Apron	106,369	0	6.62
Hangar	47,572	0	4.30
Oxidizer Storage Access Road	2,877	0	0.26
Oxidizer Storage Tank Pad	4,680	0	0.42
Net Total:	**304,023 (7 acres)**	**0**	**27.5**

[/a/] Annual rainfall of 49.77 inches was used in calculations (National Weather Service, 2013).
[/b/] Runoff coefficient of .95 was used for cement (TxDOT, 2011).
[/c/] An acre-foot is the volume of water that will cover an area of one acre to a depth of one foot.
Sources: RS&H, 2013; NOAA, 2013

These drainage basins have a total of 1,348 acres (HAS, 2009). The Proposed Action would add approximately seven acres of impervious surface to these drainage basins.

Although the Proposed Action involves the introduction of additional impervious surfaces, the corresponding increase in associated annual runoff is not considered significant due to the small amount of additional impervious surface, and the presence of adequate flood controls and drainage infrastructure.

The Proposed Action would not involve development or construction activities within a floodplain, and the introduction of additional impervious surfaces would not have a significant adverse effect on the natural or beneficial values of nearby floodplains. Additionally, as there would be no floodplain encroachment, the project would be compliant with EO 11988, *Floodplain Management*. Therefore, the Proposed Action would not result in a significant adverse effect to floodplains.

4.8 HAZARDOUS MATERIALS, POLLUTION PREVENTION, AND SOLID WASTE

This section describes the potential effects of the No Action Alternative and Proposed Action related to hazardous materials, pollution prevention, and solid waste.

4.8.1 Significance Threshold

FAA Order 1050.1E, Change 1, Appendix A.10, states that additional analysis of the potential for significant impacts, beyond the information that is disclosed in this EA (Section 3.8), generally "is needed only if problems are anticipated with respect to meeting the applicable local, State, Tribal, or Federal laws and regulations on hazardous or solid waste management." Moreover, actions that involve a property on or eligible for the NPL are significant. If no such issues are anticipated, there would typically be no significant

impacts in this category. More specifically, the following factors may indicate a significance impact with regard to hazardous materials and hazardous wastes.

- If a proposed action or reasonable alternative involves a property on or eligible for the NPL,[31] the FAA recommends that any NEPA document disclose presence of contamination within the within boundaries of the *entire* NPL site to help the decision maker determine if there are areas within the site that are not contaminated. The National Priorities List (NPL) is the list of areas throughout the United States and its territories that have had releases or threatened releases of hazardous substances, pollutants, or contaminants. The NPL's primary purpose is to guide the EPA in determining those sites warranting further investigation.
- If an airport would have difficulty meeting applicable, state, or federal laws and regulations addressing hazardous wastes or hazardous materials, then the FAA recommends that any NEPA document disclose that difficulty to help the decision maker determine if extraordinary measures are necessary to mitigate project-related disturbances of contaminates that would endanger the health and/or safety of citizens (e.g., connecting the project area to a new water supply or moving local residents to avoid contamination).
- If there is an unresolved issue regarding hazardous materials, FAA recommends that any NEPA document discuss how a proposed action or reasonable alternative would affect a site known or suspected to be contaminated to inform the decision maker that the effects of the contamination are not fully understood, but corrective actions may be needed.

4.8.2 Environmental Consequences

This EA uses the 2013 EFD Self-Service Fueling Facility EA and the EPA NEPAssist online tool to determine potential hazardous materials in the construction and operation ROIs. In order to determine potential impacts to those areas, this EA analyzes the potential increase in hazardous materials and waste at EFD under the Proposed Action. This EA also analyzes how those materials and wastes would be handled and stored at EFD. This methodology is consistent with the requirements of FAA Order 1050.1E, Appendix A.10.

4.8.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. EFD averages the distribution of approximately 3,600,000 gallons (24,480,000 lbs) of Jet-A fuel annually, with 140,000 gallons (952,000 lbs) of existing storage capacity (HAS, 2013b). There would be no impacts related to hazardous materials, pollution prevention, and solid waste.

[31] The National Priorities List (NPL) is the list of areas throughout the United States and its territories that have had releases or threatened releases of hazardous substances, pollutants, or contaminants. The NPL's primary purpose is to guide the EPA in determining those sites warranting further investigation.

4.8.2.2 Proposed Action

Construction of the Proposed Action would result in a temporary increase of on-site hazardous material storage. This would predominantly occur in the form of diesel fuel, which is necessary for the operation of construction equipment. Construction wastes would be managed in accordance with existing regulations and EFD's SOPs for solid and hazardous waste management. Implementation of the Proposed Action would also result in a temporary increase in the quantity of solid waste generated at EFD. The County has the ability to accommodate solid waste generated as a result of constructing the Proposed Action (TCEQ, 2013).

Although contaminated sites exist at EFD (see Section 3.8), there are no known contamination sites in the vicinity of planned construction under the Proposed Action. Implementation of the Proposed Action would not affect the status or remediation of known hazardous sites. Therefore, the Proposed Action would not directly or indirectly impact RCRA, TSCA, or CERLA sites described in Section 3.8. Significant impacts related to hazardous waste or hazardous materials are not anticipated due to construction activities under the Proposed Action.

Implementation of the Proposed Action would result in a net increase in the use and storage of hazardous materials at EFD. The types of hazardous materials used and stored would be similar to those currently handled at EFD and significant quantities of additional hazardous materials would not be permanently stored onsite. Under the Proposed Action, hazardous materials would be appropriately managed in compliance with applicable regulations, in accordance with existing BMPs outlined in EFD's SPCC Plan (HAS, 2009). These BMPs are enforced through inspection, tests, and records conducted and filed by EFD personnel.

To prevent the release of hazardous materials to the environment, EFD would implement measures to ensure hazardous materials are handled, stored, and used in compliance with federal, state and local regulations. Such measures would include, but not would not be limited to:

- implementing SPCC measures while loading and unloading fuel, such as preventing movement of transport vehicles during product handling operations and inspecting vehicle outlets for leakage before filling and truck departure;
- storing bulk hazardous materials in approved containers that meet National Fire Protection Association industrial fire protection codes and required containment systems; and
- storing hazardous materials in protected and controlled areas designed to comply with site-specific SPCC plans.

The Proposed Action would also result in a net increase in the amount of hazardous waste and solid waste generated. Due to the limited number of RLV launches (50 per year) under the Proposed Action, the increase in hazardous waste generation would be minimal in relation to the generation under the No Action Alternative.

The Proposed Action would comply with all existing and future hazardous waste generator requirements as well as manage hazardous and solid wastes in accordance with federal, state and local regulations. As

with existing activities, the Proposed Action would operate under a NPDES permit, which would ensure that appropriate pollution control measures are in place. The generation of hazardous and solid wastes associated with flights under the Proposed Action would not pose a substantial hazard to the public or the environment. The hazardous materials associated with each RLV are further described in the following paragraphs.

Concept X and Z RLV Operation - The Concept X and Z RLVs require Jet-A fuel for takeoff and landing, with a rocket engine stage using either solid or liquid propellants. Significant impacts related to hazardous materials or wastes are not anticipated as a result of operating Concept X and/or Z RLVs.

Due to the limited number of launches per year (50) compared to airport traffic under the No Action Alternative, the similarity of propellant types to fuels currently used at EFD, and the limited quantities of propellants and other hazardous materials on board each RLV, the risk of impacts related to a flight anomaly would be similar to the activities under the No Action Alternative.

Propellant Types and Quantities - Fuels and oxidizers comprise the most significant increase in hazardous materials, by weight. Small quantities of other hazardous materials needed for vehicle maintenance and operations (i.e., paints, solvents, oils and greases, etc.) would be relatively insignificant when compared to the amounts required for flights. Fuels needed to support concept RLV flights include RP-1, Jet-A fuel, HTPB, and ABS. Oxidizers include LOX, N_2O, and H_2O_2. Table 4-7 shows the maximum quantities of fuels and oxidizers that could be stored onsite at one time for the Proposed Action.

A maximum of 239,000 lbs of Jet-A fuel would be needed to support all flights under the Proposed Action for one year. This quantity represents less than a one percent increase compared to EFD's use of Jet-A under the No Action Alternative. EFD distributes on average approximately 3,600,000 gallons (24,480,000 lbs) annually, with 140,000 gallons (952,000 lbs) of existing storage capacity (HAS, 2013b). Jet-A fuel would be supplied according to existing SOPs at EFD. No new fuel farms and/or permanent onsite storage tanks would be required to support the Proposed Action.

TABLE 4-7
MAXIMUM QUANTITY OF FUEL/OXIDIZER STORED ON-SITE

Fuel/Oxidizer	Maximum Quantity *(1,000s of lbs)*
LOX	171
N_2O	121
RP-1	68
Jet-A*	952
HTPB (solid, inert)	150
Nylon/ ABS (solid, inert)	150
APCP	60

*This is representative of EFD's existing storage capacity.
Source: RS&H, 2014

Other liquid fuels and oxidizers not currently used at EFD would be brought in on tanker trucks and would be temporarily stored onsite until such time they are needed for loading/unloading the concept RLVs prior to flights. Oxidizer, such as LOX, would be supplied by conventional industrial gas suppliers and would be delivered to the site by tanker truck at the time of each flight. Offsite storage would be maintained by industrial gas suppliers and is outside the scope of this EA. These liquid propellants are similar in composition and management requirements to the Jet-A fuel currently used at EFD. Propellants would be temporarily stored and used in compliance with 14 CFR §420.65-70 for solid and liquid propellants.

As many as ten Hybrid Rocket Motor casings containing solid fuels (ABS and HTPB), weighing up to 3,000 lbs each, could be stored in the proposed hangar. Due to the inert nature of HTPB and ABS solid fuels, these materials would not pose any risk of a hazardous release.

Loading/Unloading Operations - Fuel and oxidizer loading/unloading operations would take place in designated areas located on impervious surfaces, with spill prevention and emergency response procedures in place. Fueling operations would take place under the provisions of the EFD SPCC Plan. The risk of hazardous material releases due to leaking storage tanks, tanker trucks, delivery lines, or other infrastructure would be limited by proper handling practices, in compliance with 14 CFR §420.65 and 14 CFR §420.67 for solid and liquid fuels, respectively.

In conclusion, there would be no significant impacts related to hazardous materials or wastes related to operation of the Concept X or Z RLVs.

4.9 HISTORIC, ARCHITECTURAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

This section describes the potential effects of the No Action Alternative and Proposed Action on historic, architectural, archaeological, and cultural resources.

4.9.1 Significance Threshold

FAA Order 1050.1E, Change 1, Appendix A.11, Section 11.3, states an adverse effect does not automatically trigger a significant impact (36 CFR 800.8(a)) and preparation of an EIS. Instead, FAA, after consulting with the SHPO and other interested parties, determines the level of effect and if that effect warrants preparation of an EIS.

4.9.2 Environmental Consequences

The NRHP and THC Atlas were utilized to determine historic resources in the ROIs (see Section 3.9). The proximity of these resources to ground disturbing activities were analyzed to determine potential direct impacts.

Potential indirect impacts to historic resources within the operation ROI were also assessed by determining any potential indirect impacts from air quality, noise, and water quality that could potentially:

- alter the visual, audible, or atmospheric characters of the property, if the setting contributes to the property's qualification for the NRHP; or
- cause neglect of the property resulting in the property's deterioration or destruction.

4.9.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation demands. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. There would be no impacts on historic, architectural, archeological, and cultural resources beyond those already occurring.

4.9.2.2 Proposed Action

As described in Section 3.9, there are no historic properties within the APE. Therefore, neither construction activities nor operations under the Proposed Action would affect historic properties. In accordance with Section 106 of the NHPA, the FAA coordinated with the Texas State Historic Preservation Officer (SHPO). The SHPO concurs with the FAA's determination of "No Historic Properties Affected" by the Proposed Action. See Appendix D for the correspondence letters.

Mitigation and Best Management Practices: In the event there was an unanticipated discovery of cultural material during construction, construction activities would stop and the significance of the material would be evaluated. Consultation with the SHPO would be conducted if needed.

4.10 LIGHT EMISSIONS AND VISUAL IMPACTS

This section describes the potential effects of the No Action Alternative and Proposed Action related to light emissions and visual impacts.

4.10.1 Significance Threshold

There are no special purpose laws identifying significance thresholds for light emissions or visual effects. Evaluation of potential light emission effects is in terms of potential for human annoyance. FAA Order 1050.1E, Change 1, requires the FAA consider the extent to which any lighting associated with a proposed action would create an annoyance among residents near a proposed action or interfere with normal activities.

Potential aesthetic effects of an action are generally assessed to the extent that the development contrasts with a No Action Alternative environmental setting and whether a jurisdictional agency considers this contrast objectionable. For this EA, visual effects resulting from constructing and operating the Proposed Action include physical changes to the visually aesthetic qualities of the construction ROI, including landforms, vegetation, and water surfaces. Effects may also include those resulting from actions which may have both beneficial and detrimental effects.

This EA gives special consideration to light emissions and visual effects to historic properties, national or state parks, recreation areas or other visually sensitive areas near the construction ROI.

4.10.2 Environmental Consequences

Airport facilities are illuminated by various types of lighting that can impact light-sensitive land uses in the vicinity an airport.

The potential for adverse light emissions and visual effects of the No Action Alternative and Proposed Action were qualitatively evaluated to determine the extent of light emissions. Airport-related light emissions are considered to have a notable impact only if light is directed towards a residential area. Impacts from lighting associated with the No Action Alternative and Proposed Action were determined by evaluating the individual lighting systems to be developed at EFD and assessing distance, light angle, and intensity as they relate to the surrounding light-sensitive land uses.

This effort provided a way to identify potential new sources of lighting, glare, and visual effects on light-sensitive land uses that could result in annoyance to local residents.

4.10.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve its forecast aviation demands. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. Implementation of the No Action Alternative would not involve construction of structures or construction activities that would result in temporary or permanent increases in adverse light emission or visual effects in the construction or operation ROIs. There would be no impacts related to light emissions and visual resources.

4.10.2.2 Proposed Action

As described in Chapter 2, and shown in Figure 2-3, implementation of the Proposed Action would involve the construction of an access roadway, parking, a hangar, associated taxiway and apron areas, an oxidizer loading and storage area, a RP-1 truck parking area, and up to 50 annual combined Concept X and Concept Z launches at EFD. The Proposed Action would have more light emissions and differ visually compared to the No Action Alternative.

Light Emissions - The development of the following project components would require lighting for safety and security reasons and would represent new sources of light emissions:

- hangar/processing facility;
- taxiway from the apron area to the airfield system;
- vehicle parking area; and
- access road.

Lighting for the hangar would illuminate the interior and exterior of the hangar. The new parking area would be lighted with directional and focused lighting for the safe movement of vehicles and pedestrians. The access road would include lighted signage and roadway post lights, resulting in light emissions. Directional and focused lighting would not be angled toward surrounding neighborhoods. Additionally, construction activities would not likely occur during nighttime hours and nighttime glare from construction activities is not anticipated.

The operation of the Concept X and Concept Z RLVs would occur primarily during the daytime hours. As previously described, approximately five percent of the launches under the Proposed Action could occur during nighttime hours. However, this would not require the use of additional on-Airport lighting. Airport

lighting during nighttime launches would remain the same as other aircraft operations that take place during nighttime hours. Additionally, the RLVs are anticipated to have similar lighting as aircraft currently operating at EFD during the nighttime hours. Therefore, light emissions of the RLVs would not significantly impact light sensitive areas.

Visual Effects - The Proposed Action would involve the construction of additional infrastructure required for the storage, maintenance, and operation of the Concept X and Concept Z RLVs. The proposed infrastructure required for operations would be similar to the existing infrastructure and buildings at EFD. In addition, nearby land uses are separated from EFD by a vegetative buffer. Construction of these structures would not, therefore, represent a visual impact compared to the No Action Alternative.

4.11 NATURAL RESOURCES AND ENERGY SUPPLY

This section describes the potential effects of the No Action Alternative and Proposed Action on natural resources and energy supply. Sustainable design features that could be included in the Proposed Action are also described.

4.11.1 Significance Threshold

A project requiring natural resource or energy supplies that would exceed supplies would likely cause a significant impact on natural resources or energy supplies.

4.11.2 Environmental Consequences

FAA Order 1050.1E, Appendix A, Section 13.2a notes that FAA NEPA documents must examine natural resource and energy usages only when an action, "…involves a need for unusual materials or those in short supply." Although Section 13.2a notes these instances are rare, examples of this would be:

- an airport terminal that would use large volumes of water to serve passenger needs; or
- constructing a runway that would require large volumes of concrete that would strain local or regional concrete supplies.

Review of aerial photographs, USGS Topographic 7.5 Minute Series Quadrangles for the construction ROI, and land use maps were used to determine if any natural sources of mineral or energy resources would be impacted by the Proposed Action. With regard to fuel supply, examination of changes in the volumes of jet fuel or aviation fuel for projects involving changes in airside operations is required. This examination provides the information needed to disclose how those changes would alter existing jet fuel demands and supplies.

To evaluate the No Action Alternative and Proposed Action, common industry information related to sustainable design and sustainable practices was reviewed to describe measures to reduce the potential landside development demands on natural resource and energy supplies. These useful references, recognized by the FAA, are:

- the Airports Cooperative Research Program Synthesis 10, Airport Sustainability Practices; and
- the Sustainable Aviation Guidance Alliance (SAGA) Database.

4.11.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. There would be no impacts on natural resources and energy supply.

4.11.2.2 Proposed Action

The Proposed Action would not place excessive demands on local supplies of fuel, energy, or natural resources. Potential effects to natural resources, fuel use, and sustainable design are further described in the following paragraphs.

Natural resources - Construction of the Proposed Action would result in temporary increases in energy demand. Airside and landside improvements associated with the Proposed Action would include the use of aggregate, sub-base materials, and oils associated with the construction of asphalt pavements. In addition, trucks and construction equipment would consume fuels as needed for construction purposes. None of these materials are rare or in short supply. Large volumes of materials would not be required in order to build the hangar, apron, taxiway and other development under the Proposed Action.

Fuel Use - Fuel use to support the Proposed Action would not represent a significant increase relative to the No Action Alternative. The total quantity of Jet-A fuel needed to support all missions under the Proposed Action would be 239,000 lbs or less over the 5-year license period, or approximately 47,800 lbs per year. Current use of Jet-A at Ellington is approximately 3,600,000 gallons (24,480,000 lbs) per year (HAS, 2013b). Therefore, the Proposed Action would represent far less than a one percent increase in total fuel consumption at EFD, and would not have a significant impact on local fuel supplies. Propellants needed to support the Proposed Action are not in short supply, and demand for these materials could be met without difficulty.

Sustainable Design - Due to current energy efficient building code provisions, it is likely the associated hangar would be designed to operate more energy efficiently than similar existing facilities at EFD. Sustainable design elements could be considered during the design phase of the project, as well as opportunities to reduce waste, recycle, and reuse materials during the construction phase. Sustainable design elements suggested in the Airport Cooperative Research Program Synthesis 10, *Airport Sustainability Practices*, and the SAGA Database could be used by the selected contractor for the design, construction, and operation of the development under the Proposed Action.

The Proposed Action would not require the use of unusual materials or materials in short supply and would not measurably increase demand on local supplies of energy or natural resources. For these resources, implementation of the Proposed Action would not cause significant impacts with respect to natural resources or energy supplies.

4.12 NOISE

This section describes the potential effects of the No Action Alternative and Proposed Action related to noise.

4.12.1 Significance Threshold

A significant noise impact would occur if analysis shows that a proposed action would cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to a no action alternative for the same timeframe. For example, an increase from 63.5 dB to 65 dB over a noise sensitive area is considered to be a significant impact.

4.12.2 Environmental Consequences

The primary mechanism of aircraft noise emissions results from air pressure fluctuations induced from the operation of aircraft during the various phases of flight. While pressure fluctuations can originate from subsonic aerodynamic forces or mechanical systems, the majority of noise related to RLV operations is a result of engine noise and sonic boom generation.

To quantify the potential jet engine noise related to RLV operations at EFD, the analysis utilizes the FAA's Area Equivalent Method Version 7.0c. The AEM uses a mathematical procedure to estimate a change in the area of the DNL 65 noise contour that would occur if the number and/or type of aircraft operations were to change. If the AEM calculations indicate that a proposed action would result in less than a 17 percent (approximately a DNL 1 dB) increase in the DNL 65 dB contour area, it may be concluded that there would be no significant impact over noise sensitive areas and that no further noise analysis is required (FAA, 2006).

To quantify the potential impact of sonic boom generation related to RLV operations, the analysis utilizes PCBoom4, a single-event prediction model produced by Wyle Laboratories. PCBoom4 is utilized by the Air Force Center for Engineering and Environment and is widely accepted to determine the specific pattern and amplitude of a sonic boom footprint (Wyle Laboratories, 2002).

Appendix E provides additional technical information regarding the noise analysis methodology. The FAA's Office of Environment and Energy has approved this methodology.

4.12.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation demands. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. There would be no impacts related to noise.

4.12.2.2 Proposed Action

Temporary noise impacts as a result of construction vehicles and machinery would be limited to the immediate vicinity of EFD. Earthwork and site preparation would result in temporary noise generation while these activities are taking place. Noise levels would vary dependent on the nature of construction

activities and the type and model of equipment used. Given the distance to the nearest residential areas (one-half mile east and west) and the presence of vegetated buffers surrounding EFD, temporary construction noise impacts would not be significant. Additionally, construction is not likely to occur at night when surrounding areas may be more sensitive to noise.

The RLVs proposed for operation at EFD have the potential to create noise from engine testing and operation similar to aircraft currently operating at EFD. The AEM analysis results indicate that the increase in the DNL 65 dB contour area is less than 0.01 percent between the No Action Alternative and Proposed Action. This is because the Proposed Action includes a maximum of 50 launches and up to 15 engine tests per year, whereas EFD experiences over 100,000 operations per year. This area is far less than the 17 percent (approximately a DNL 1 dB) increase in the DNL 65 dB noise contour area necessary to constitute a significant impact (see Section 14.4a of FAA Order 1050.1E). The Proposed Action would not cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB. Therefore, the noise generated by concept RLV engine testing or operation would not cause a significant impact.

The RLVs proposed for operation at EFD also have the potential to create a sonic boom. A sonic boom, which is similar to the sound of thunder, is the sound associated with the shock waves created by an object moving through the air faster than the speed of sound. For the Proposed Action, a sonic boom could be generated during two portions of the RLV's flight: at the rocket ignition during ascent to and gliding from the RLV's apogee (approximately 330,000 ft MSL).

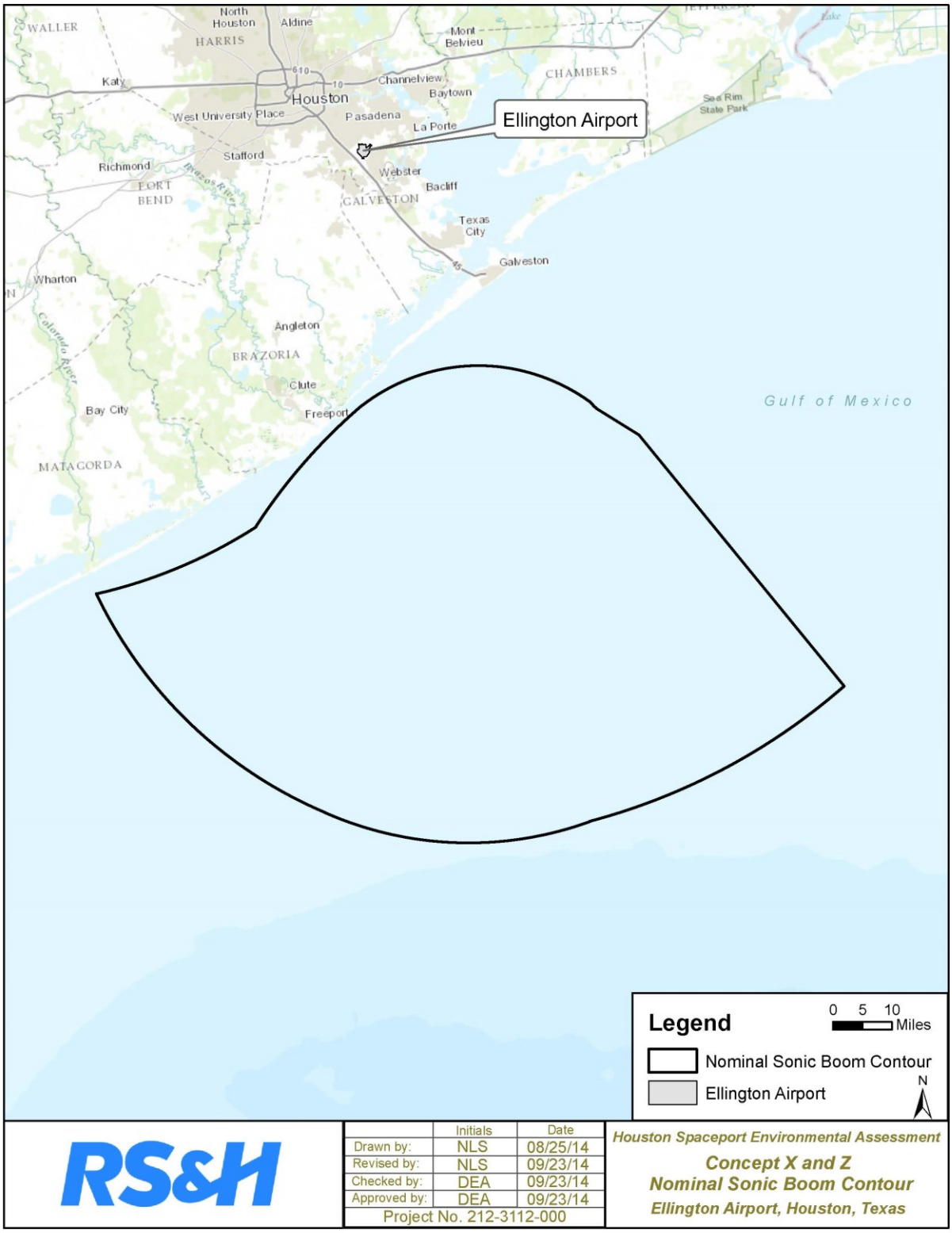
The sonic boom created during the RLV's supersonic portion of the ascent 60 miles away from the shoreline over the Gulf of Mexico would not reach land due to the steep ascending flight path angle. The sonic boom would propagate along an upward angle that is unlikely to reach the ground and therefore would not cause a significant impact. A sonic boom analysis was completed for the supersonic portion of the RLV's reentry which would occur over the Gulf of Mexico, approximately 30 miles from the Texas shoreline. Figure 4-2 shows the extent of the nominal sonic boom contour, which is the area where a sonic boom may be heard.

The sonic boom created during the descent of the RLV is estimated to cover approximately 7,000 square miles. However, the sonic boom is predicted to be at levels significantly less than 1.0 psf, or approximately 63 dBA (ANSI, 2005) and is entirely over the Gulf of Mexico. The peak overpressure level generated from an RLV (0.9 psf) would be similar to a thunder clap, but would occur in a concentrated area of approximately one-half square mile. For the majority of the area, the sonic boom levels would be closer to 0.1 psf.

The sonic boom may be heard by personnel on oil rigs located in the area. Given the industrial characteristics of offshore oil rigs, the sonic boom is not likely to affect offshore oil rig personnel or day-to-day activities.

In conclusion, the Proposed Action would not result in a significant noise impact.

FIGURE 4-2
CONCEPT X AND Z NOMINAL SONIC BOOM CONTOUR



4.13 SECONDARY (INDUCED) IMPACTS

This section describes the potential secondary (induced) impacts of the No Action Alternative and Proposed Action.

Airport development projects may cause some level of secondary effects. Those effects may be beneficial or adverse. Examples of beneficial effects include:

- buying construction and operating supplies from local vendors;
- providing local artists on-airport areas to display their works; or
- offering permanent and part-time jobs to local citizens.

Examples of adverse effects include:

- placing excessive demands on local emergency, school, or police services due to sudden influxes of transient workers; or
- causing changes in population patterns that reduce local tax bases.

4.13.1 Significance Threshold

FAA Order 1050.1E does not provide a significance threshold for secondary (induced) impacts. Instead, the Order states that induced impacts will normally not be significant except where there are also significant impacts in other categories, especially noise, land use or direct social impacts.

4.13.2 Environmental Consequences

Secondary impacts were determined through the evaluation of the areas affected by the No Action Alternative and Proposed Action. Directly affected land, buildings, and transportation facilities were identified using information from City and County records, aerials, and field observations. This data was used to determine if any residential or business displacements would be necessary.

Economic impacts that measure the effects of airport development on the local economy can be characterized as direct, indirect, or induced impacts. Direct impacts are those realized on-site at the airport that directly relate to construction and operations. Indirect impacts are those created by the multiplier or "ripple" effect of spending and result from successive rounds of spending by employees at both direct and indirect facilities. Induced impacts are the secondary changes in the economy that result from airport development.

4.13.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. As a baseline for assessing the secondary (induced) impacts of the Proposed Action, conditions under the No Action Alternative would be similar to existing conditions.

4.13.2.2 Proposed Action

Short-term construction-related employment of local contractors would occur as a result of the Proposed Action and is considered a positive impact. Based on the 2008-2012 American Community Survey 5-year estimate, less than ten percent of the Harris County population work in the construction industry (U.S. Census Bureau, 2012). With respect to changes in traffic volumes in the EFD vicinity, the increase in construction-related traffic would be considered minor. Additional construction truck traffic could occur along Space Center Boulevard. However, this would be temporary and is not expected to be visually intrusive to local residences due to intervening buffers shielding or reducing the view of construction related activities. This minor increase in construction related traffic would not result in a significant impact.

Development associated with the launch site operator license would occur entirely on EFD property (see Chapter 2). The development would be compatible with the existing Airport environment. The communities surrounding EFD would not be disrupted, nor would any residences and/or businesses be relocated (see Section 4.4). There is the potential for development, both on-and off-Airport property, to be attracted to the area. This is likely dependent on the outcome of HAS acquiring a launch site operator license and other commercial spaceports throughout the United States. Off-Airport development could include commercial and government/medical/educational land uses attracted to the Houston Spaceport. However, this possibility exceeds the timeframe of this EA and is not further analyzed in this EA.

The operation of Concept X and Z RLVs are anticipated to generate noise levels comparable to the existing aviation activities at EFD, as jet engines are used during take-off and landing (see Section 4.12 for further noise analysis). Rocket engine noise associated with the two concept RLVs would begin when the vehicles are at a considerable altitude and over the Gulf of Mexico and the resulting sonic boom would not be heard on land.

Flights associated with the Proposed Action would not cause significant air quality, noise, land use compatibility, or socioeconomic impacts to the construction or operation ROIs. The Proposed Action would not increase other activities that could potentially add to direct or indirect impacts in these areas (e.g., increased vehicular emissions causing a significant air quality impact). Therefore, a significant secondary (induced) impact would not occur.

4.14 SOCIOECONOMIC IMPACTS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S HEALTH AND SAFETY RISKS

This section describes the potential effects of the No Action Alternative and Proposed Action related to socioeconomics, environmental justice, and children's health and safety risks.

4.14.1 Significance Thresholds

The following sections describe the significance thresholds used to determine potential socioeconomic, environmental justice, and children's health and safety risk impacts.

4.14.1.1 Socioeconomics

Factors to be considered in determining whether an action would result in significant socioeconomic impacts include the following:

- Would the action result in extensive relocation, but replacement housing would be unavailable?
- Would the action result in extensive relocation of community businesses causing severe economic hardship for the affected communities?
- Would the action result in disruption of local traffic patterns substantially reducing the Level of Service of those roads serving EFD and surrounding area? or
- Would the action result in a substantial loss in the tax base of the community?

4.14.1.2 Environmental Justice

FAA Order 1050.1E defines a significant impact as one that may occur when an action would cause disproportionately high and adverse human health or environmental effects on low-income or minority populations. Additionally, USDOT Order 5610.2(a) defines disproportionately high and adverse effects on minority and low-income populations as an adverse effect that:

- is "predominately borne by a minority population and/or low-income population, or
- will be suffered by the minority population and/or low-income population and is appreciable more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population."

4.14.1.3 Children's Health and Safety Risks

An action resulting in disproportionate health and safety risks to children indicates a significant impact.

4.14.2 Environmental Consequences

Demographic data was used to evaluate potential future growth within the construction and operation ROIs and to consider potential impacts of the No Action Alternative and Proposed Action. This evaluation also considers the levels and duration of project construction traffic and the probability of any construction traffic using specific roadways and intersections near EFD.

4.14.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. There would be no impacts related to socioeconomics, environmental justice, and children's environmental health and safety risks.

4.14.2.2 Proposed Action

Socioeconomics - The Proposed Action would not result in any physical changes to the surface roadway system providing access to EFD. The Proposed Action would not require acquisition of land as the proposed development would be within existing Airport boundaries.

Construction vehicles would need to travel on local roads and access the EFD; however, impacts to traffic and intersections due to construction vehicles would not permanently degrade the level of service, as it would be temporary and short-term.

As discussed in Section 3.13, the 2010 Census data shows the population within the construction and operation ROIs is growing. The number of employees associated with the construction and operation of the Proposed Action would be minimal compared to the populations of the construction and operation ROIs. The potential temporary (construction) and long-term (operational) increases in population as a result of the Proposed Action would not place strains on local services (e.g., police force, firefighting services, etc.). Although the Proposed Action is not anticipated to have a significant direct impact on population or development, there is the potential that both on- and off-Airport development could be attracted to EFD. Any such development would be dependent on the outcome of HAS acquiring a launch site operator license and other commercial spaceports throughout the United States. Off-airport development could include commercial and government/medical/educational land uses attracted to the Houston Spaceport. The nature, timing, and extent of such development cannot be foreseen at this time and is not included in this analysis.

In conclusion, implementation of the Proposed Action would not have adverse socioeconomic impacts within the construction or operation ROIs.

Environmental Justice - As discussed in Section 3.13, the construction and operation ROIs are dominated by middle and upper income ranges and does not have a high minority population percentage. The areas with lower incomes to the south and southwest have median household incomes of $24,000 to $53,000, and are considered to be above poverty levels, according to the U.S. Census.

Implementation of the Proposed Action would result in development associated with obtaining a launch site operator license. This development would occur entirely on EFD property and would not disrupt communities within the ROIs. Take-off and landing noise associated with the operation of Concept X and Z RLVs is anticipated to be similar to the jet operations that occur today. Sonic booms occurring as a result of rocket ignition over the Gulf of Mexico would not be perceived on land (see Section 4.12).

In conclusion, the Proposed Action is not anticipated to cause significant impacts to minority or low-income populations.

Children's Environmental Health and Safety Risks **-** As discussed previously, the development required would occur entirely on EFD property and would not result in the acquisition or disruption of communities within the ROIs. Schools exist within the construction ROI (see Figure 3-12) as do recreational areas for children.

The Concept X and Z RLVs would depart and return similar to other aircraft currently operating at EFD and would not significantly impact schools or recreational areas within the operation ROI. The sonic booms produced as a result of RLV operations would occur entirely over the Gulf of Mexico and would not audible at schools or other areas utilized by children.

In conclusion, implementation of the Proposed Action is not anticipated to cause significant impacts to children's health and safety.

4.15 WATER QUALITY

This section describes the potential effects of the No Action Alternative and Proposed Action on water quality.

4.15.1 Significance Threshold

A significant water quality effect may occur if the EA and early consultation:

- show there is a potential to exceed water quality standards;
- identify water quality effects that cannot be avoided or satisfactorily mitigated; or
- indicate difficulties in obtaining required permits.

4.15.2 Environmental Consequences

Water quality regulations and consultation with agencies responsible for issuing water-related permits normally identify issues associated with project-related water quality. In accordance with the instructions in FAA Order 1050.1E, Appendix A, Section 17, the analysis includes consultation with the following agencies:

- USEPA (Region 6) to determine if the project would affect a sole source aquifer; and
- USFWS for information on the water quality needed to sustain wildlife, fish, and shellfish in the project study area.

An early coordination letter was sent to the USEPA and USFWS. The USFWS provided information relevant to this EA in their letter dated October 11, 2013 (see Appendix A-2). This information was used in the analysis of potential environmental impacts.

The potential impacts to water quality were assessed based on the location, preliminary design plans, and intended function of the Proposed Action. The proposed disturbed areas and new impervious areas for the Proposed Action were analyzed to evaluate the short-term construction and long-term operational impacts to surface waters. Possible impacts to groundwater recharge/discharge areas were investigated. Increases to potable water consumption and domestic wastewater treatment were also considered in regard to potential direct impacts or changes in operational activities.

4.15.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. There would be no impacts on water quality.

4.15.2.2 Proposed Action

Implementation of the Proposed Action would result in temporary effects to water quality. Contaminants could be discharged into groundwater resources during construction activities. However, implementation

of water-related BMPs through construction permit conditions would prevent a significant impact to groundwater resources.

Construction activities related to the project components would cause temporary increases in suspended solids dependent on weather conditions at EFD. Construction activities would be subject to requirements of the TCEQ GCP TXR150000 (TCEQ, 2006a). Development of a SWPPP is required under the GCP, which EFD already has in place. Since the Proposed Action would disturb more than five acres, a Notice of Intent (NOI) would be submitted to TCEQ to seek coverage under the GCP. HAS would meet additional requirements of the GCP for construction of the Proposed Action (TCEQ, 2006b). Construction activities would also be carried out in accordance with the BMPs of the Airport's SWPPP, such as preforming inspections during the construction phase to ensure drainage, wastewater, and water supply connections are correct.

Implementation of the Proposed Action would increase the amount of impervious surface on EFD's property by approximately seven acres (see Section 4.7). Preparation activities such as fueling, propellant loading, and vehicle preparation associated with the Concept X and Z RLVs could result in inadvertent spills or releases of fuels, propellants, or materials that could impact surface and groundwater. EFD currently has policies and procedures for handling, disposing, and cleaning up hazardous materials, chemicals, substances, and wastes which are described in their Airport Certification Manual (ACM) as part of their 14 CFR Part 139 certification. EFD also has a SWPPP to further eliminate and reduce stormwater discharges. These policies and procedures would be updated for spaceport activities.

Jet fueling operations would occur on the proposed apron. Prior to initiating operations, the launch operator would have a SPCC plan in place. If a spill of jet fuel occurs, the launch operator would be responsible for any necessary cleanup and remediation actions, as are current operators at EFD.
A separate individual TPDES permit would be obtained for discharges of any process wastewater from material storage or handling areas, including contaminated stormwater. Additionally, the Proposed Action would comply with the requirements of the CWA and TWC.

In addition, the relatively low number of employees associated with the small development for spaceport operations would not result in a significant water use. Therefore, the Proposed Action's potential impact on potable water supplies or local wastewater treatment facilities would not be significant.

In conclusion, the Proposed Action would not result in significant impacts to water quality compared to the No Action Alternative.

4.16 WETLANDS

This section describes the potential effects of the No-Action Alternative and Proposed Action on wetlands.

4.16.1 Significance Threshold

A significant impact would occur if a project were to:

- adversely affect a wetland's ability to protect the quality or quantity of municipal water supplies, including sole source, potable water aquifers;

- substantially alter the wetland hydrology needed to sustain the functions and values of the affected wetland or any wetland to which the affected wetland is connected;
- substantially reduce the affected wetland's ability to retain floodwaters or storm associated runoff, thereby threatening public health, safety or welfare (this includes cultural, recreational, and scientific resources important to the public, or property);
- adversely affect the maintenance of natural systems that support wildlife and fish habitat or economically-important timber, food, or fiber resources in the affected or surrounding wetlands;
- promote development of secondary activities or services that would affect the resources or functions mentioned in the above items; or
- be inconsistent with applicable State wetland strategies.

4.16.2 Environmental Consequences

This EA uses the applicable laws and regulations and FAA Order 1050.1E, Appendix A. Section 18 to determine potential wetland impacts. The analysis included a review of data from the NWI to determine to location of potential wetland areas. The EA analyzes where development activities would take place in relation to identified wetlands to determine potential impacts.

4.16.2.1 No Action Alternative

Under the No Action Alternative, the FAA would not issue HAS a launch site operator license, and thus no launch licenses to individual launch vehicle operators to operate at EFD. Spaceport-related construction or operations would not occur. EFD would continue to operate and serve forecast aviation activity. Airport development would be subject to review and approval under NEPA and is not assumed under this alternative. Maintenance activities (i.e., mowing, hay production) would also continue at EFD. There would not be impacts to wetlands.

4.16.2.2 Proposed Action

The Proposed Action would require seven acres of new impervious surface at EFD, none of which would be constructed within a wetland. Jet fueling operations would occur approximately 1,500 feet way from the nearest isolated wetland. In addition, HTPB solid fuel, N_2O, LOX, and kerosene (RP-1) would be loaded in designated areas of EFD, approximately 2,000 feet away from the nearest isolated wetland. If a fuel spill occurs, the launch operator would be responsible for any necessary cleanup and remediation under a SPCC plan. Therefore, there would be no significant wetland impacts associated with the Proposed Action.

CHAPTER 5

CUMULATIVE IMPACTS

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Cumulative impacts are defined by CEQ in 40 CFR §1508.7 as, "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."

The CEQ regulations further require that NEPA environmental analyses address connected, cumulative, and similar actions in the same document (40 CFR 1508.25). Additionally, CEQ further explained in *Considering Cumulative Effects under NEPA* that, "each resource, ecosystem and human community must be analyzed in terms of its ability to accommodate additional effects, based on its own time and space parameters." Therefore, a cumulative effects analysis normally would encompass geographic boundaries beyond the immediate area of the Proposed Action, and a time frame, including past actions and foreseeable future actions, in order to capture these additional potential effects.

For this EA, spatial and temporal boundaries were delineated to determine the areas and projects within those areas the cumulative analysis would address. The spatial boundary for this cumulative analysis is the construction ROI. Projects described in the following sections include those which had or have the potential to affect the environmental impact categories analyzed in this EA. For this EA, past actions include those which have occurred within the last three years, and reasonably foreseeable actions include those planned to occur within the next five years. Since some future projects are in various stages of conceptual development and are speculative at this time, it is not possible to fully quantify the effects associated with them. Projects in early planning phases do not provide enough data to ensure reasonable analyses and are subject to change.

The past, present and reasonably foreseeable actions described in the following sections were researched using Federal, State and local agency websites (e.g., TxDOT). In addition, agency information provided during the early consultation process was also incorporated (see Section 1.5). HAS and Airport staff also provided information related to cumulative projects in the vicinity of the Airport.

5.1 PAST ACTIONS

The USCG moved its Houston-Galveston headquarters to EFD. This included the construction of a new 117,000 square foot building. This building has room to house 300 employees, the Sector's command center, investigative services, electronic support, public affairs, and the regional civil rights office (HAS, 2013a).

Actions recently completed within the construction ROI include (City of Houston, 2014a):

- roadway improvement to Clear Lake City Boulevard from Old Galveston Road to Space Center Boulevard;
- improvements to the water purification plant on Genoa Red Bluff Road;
- improvements to the Ellington Park wastewater collection system; and
- numerous sidewalk improvements.

5.2 PRESENT ACTIONS

The Ellington Airport Self-Service Fuel Facility EA proposed to construct a self-service fueling facility at the end of Taxiway J on the southwestern area of the airfield. The self-service facility would include a concrete pad 43 feet long by 10 feet wide and an above-ground storage tank for Avgas and a pump and payment kiosk, which would all be covered by a canopy.

Present actions occurring within the construction ROI include:

- Houston Optimization of Airspace and Procedures in the Metroplex (Houston OAPM)
- installation and upgrades of drainage structures from Horsepen Bayou to Galveston County line;
- construction of a new road from Preston Road to Genoa Red Bluff Road (TX DOT, 2014);
- construction of new retail and multi-family structures near Sam Houston Parkway and Crenshaw Road; and
- development of The Reserve at Clear Lake residential community (approximately 740 homes along with commercial businesses),

5.3 REASONABLY FORESEEABLE ACTIONS

The following on- and off-Airport actions are based on information available in the City's Capital Improvement Plan (CIP). The CIP is for planning and budgeting purposes. These actions may or may not occur dependent on factors not foreseen at this time.

The following on-Airport actions have been planned to a level of reasonably foreseeable certainty (City of Houston, 2014b):

- construction of a single story passenger terminal with international screening options;
- extension of Challenger Boulevard to Brantley and reworking the roadway lighting;
- rehabilitation of airfield pavement on Runway 17L/35R;
- construction of the Ellington Field Bypass (Space Center Boulevard) from Highway 3 to the existing Space Center Boulevard;
- ramp pavement reconstruction adjacent to Southwest Airport Services Fixed Based Operator;
- construction of a new tower;
- extension of Taxiway G;
- construction of a new taxilane and cargo ramp;
- addition of asphalt shoulders to Runway 17R/35L and Runway 4/22;
- rehabilitation of and upgrade to portions of asphalt service road; and
- rejuvenate and reseal asphalt on the T-Hangar ramp and added to Taxiway D shoulders at EFD.

The Lone Star Flight Museum is also planned to be relocated to EFD from its current location in Galveston (HAS, 2014). The City's CIP also includes the extension of Runway 17R-35L to the north by 200 to 1,000 feet. Although this extension is described as support for spaceport operations, it is not necessary for the RLV operations analyzed in this EA and is not reasonably foreseeable. Should future RLV operators chose

to operate at the Houston Spaceport and a runway extension is determined to be necessary, the runway extension would be analyzed under a separate NEPA document. Therefore, this project is not included as part of the Proposed Action analyzed in this EA.

Other reasonably foreseeable projects within the construction ROI include:

- construction of a four lane thoroughfare on Preston Road from Genoa Red Bluff Road (TxDOT, 2013);
- construction of a business park south of Genoa Red Bluff Road and east of EFD;
- construction of a business park north of Genoa Red Bluff Road and EFD;
- construction of a surgery center northwest of Sam Houston Parkway and north of EFD;
- construction of an office and distribution building northwest of Sam Houston Parkway and north of EFD for a logistics company; and
- development of 36.8 acres of land directly adjacent to EFD for aircraft and aerospace related facilities (Webber Properties LP and JA Billipp Company, 2014).

5.4 SIGNIFICANCE THRESHOLDS

The analysis of potential cumulative impacts uses the thresholds of significance in FAA Order 1050.1E, Change 1, Appendix A that FAA has developed for each individual impact category.

5.5 ENVIRONMENTAL CONSEQUENCES

CEQ regulations implementing NEPA require the analysis and disclosure of the Proposed Action's potential cumulative effects (40 CFR 1508.25(a)(2) and (3)). CEQ and NEPA do so to inform the public if the Proposed Action, when considered with other projects occurring within the project study areas during specific time frames (i.e., "past, present, and reasonably foreseeable actions"), would cause a significant environmental effect.

This EA uses information presented in Sections 5.1, 5.2, and 5.3 to determine potential cumulative impacts. Cumulative impacts are only considered for those resources the Proposed Action would affect (e.g., air quality, noise, water quality). The Proposed Action would not result in cumulative impacts to resources that the Proposed Action would not affect (e.g., floodplains, wetlands). Each past, present, and reasonably foreseeable future action was cumulatively analyzed for its potential to impact the same environmental resources impacted by the Proposed Action.

5.5.1 Proposed Action

Implementation of the Proposed Action would result in less than significant adverse environmental impacts related to minor temporary construction efforts, minor increases in noise generation, minor increases in air emissions, and minor stormwater runoff increases. The potential cumulative impacts to those resources are described in the following paragraphs.

Air Quality - The past, present, and reasonably foreseeable future actions could result in increases to emissions.

Implementation of the Houston OAPM would result in slightly more fuel burned. However, this cumulative project is presumed to conform with the SIP. Accordingly, implementation would not cause or contribute to a new violation of the NAAQS (FAA, 2013e). Therefore, implementation of the Houston OAPM would not have a significant impact on air quality.

Overall, the roadway improvements could potentially lessen vehicle emissions by improving the level of service of the roadways. The other infrastructure projects would result in temporary air emissions during construction of the facilities. The construction of these present and reasonably foreseeable projects would not occur at the same time and are not expected to affect the region's air quality.

Therefore, the Proposed Action, when combined with past, present, and reasonably foreseeable projects, is not anticipated to result in significant cumulative impacts on air quality.

Noise - The past, present, and reasonably foreseeable actions could result in increased noise to the surrounding area during construction activities. The increase in noise would be temporary, lasting only as long as construction. In addition, these actions would not all occur at the same time.

Implementation of the Houston OAPM would not result in a DNL increase of 1.5 dB or more in noise sensitive area exposed to aircraft noise at or above DNL 65 dB (FAA, 2013e). The extension of Runway 17L-35R to the north could shift EFD's aviation noise contours. The potential change in the noise contours is not known as the length of the runway extension has not been determined, along with other necessary planning. Therefore, the Proposed Action, when combined with past, present, and reasonably foreseeable projects, is not anticipated to result in significant cumulative noise impacts.

Water Quality - The past, present, and reasonably foreseeable actions could result in temporary effects to water quality during construction. Contaminants could be discharged into groundwater resources during construction activities. The on-Airport actions would increase the overall impervious surface of EFD; however, the existing drainage and any drainage improvements associated with the actions would minimize the potential for adverse water quality impacts as a result of the increase in impervious surfaces. The off-Airport drainage improvements could potentially improve the water quality in the area by ensuring stormwater is diverted to the proper stormwater management and treatment facilities. The roadway improvements could potentially increase the area's impervious surface and stormwater runoff. However, potential impacts would be minimized through the development of stormwater ponds. The Proposed Action, when combined with past, present, and reasonably foreseeable projects, is not anticipated to result in significant cumulative impacts on water quality.

In conclusion, the Proposed Action, when combined with past, present, and reasonably foreseeable projects in the construction ROI, is not expect to result in significant adverse cumulative impacts on any environmental impact category.

CHAPTER 6

REFERENCES

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The following references were used in the development of this EA.

14 CFR 420.53, *Control of Public Access*, October 2000.

40 CFR 1500.2(c), *Protection of the Environment, Council on Environmental Quality Policy*.

36 FR 8921 (2000), *EO 13175, Consultation and Coordination with Indian Tribal Governments*.

43 FR 47707 (1978), *EO 12088, Federal Compliance with Pollution Control Standards*.

52 FR 2923 (1987), *EO 12580, Superfund Implementation*.

58 FR 41981 (1993), *EO 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements*.

60 FR 40837 (1994), *Presidential Memorandum on Environmentally and Economically Beneficial Landscape Practices on Federally Landscaped Grounds*.

61 FR 26771 (1996), *EO 13007, Indian Sacred Sites*.

64 FR 6183 (1999), *EO 13112, Invasive Species*.

15 U.S.C. § 2601-2692 (1976), Toxic Substances Control Act.

16 U.S.C. § 470 *et. seq*. (1974), *The Archeological and Historic Preservation Act of 1974*.

16 U.S.C. § 661 *et. seq.* (1934), *Fish and Wildlife Coordination Act*.

16 U.S.C. § 703-712 (1918), *Migratory Bird Treaty Act*.

16 U.S.C. § 1855(b)(2) (1996), *Sustainable Fisheries Act*.

33 U.S.C. § 1251 *et. seq*. (1972), *Clean Water Act.*

33 U.S.C. § 2701 (1990), *the Oil Pollution Prevention Act of 1990*.

42 U.S.C. § 300(f) (1974), *Safe Drinking Water Act, as amended*.

42 U.S.C. § 1996 (1978), *The American Indian Religious Freedom Act of 1978*.

42 U.S.C. § 1252 *et. seq.* (1990), *Oil Pollution Act of 1990*.

42 U.S.C. § 6901 *et. seq.* (1976), *Resource Conservation and Recovery Act*.

42 U.S.C. § 9601(1980) *Comprehensive Environmental Response, Compensation, and Liability Act*.

49 U.S.C. § 2101 *et. seq.* (1990), *Airport Noise and Capacity Act*.

49 U.S.C. § 4701 *et. seq.* (1982), *The Airport and Airway Improvement Act of 1982*.

49 U.S.C. § 44715 (1972), *The Noise Control Act of 1972*.

49 U.S.C. § 47101 (1968), *The Control and Abatement of Aircraft Noise and Sonic Boom Act of 1968*.

49 U.S.C. § 47107(a)(16), *Grant Assurance No. 29*

49 U.S.C. § 47501-47507 (1979), *Aviation Safety and Noise Abatement Act of 1979*.

51 U.S.C. § 50901-50923 (1984), *Commercial Space Launch Act*.

The American National Standard Institute (ANSI) (2005), Quantities and Procedures for Description and Measurement of Environmental Sound – Part 4: Noise Assessment and Prediction of Long-term Community Response," ANSI S12.9-2005/Part 4

CEQ (2010), Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf.

Chantlett, E. T. (1973), Environmental Protection, McGraw-Hill Book Co. New York.

City of Houston (2008a), Code of Ordinances, Chapter 9, Article VI, Airport Land Use Regulations, http://library.municode.com/index.aspx?clientId=10123, accessed November 2013.

City of Houston (2008b), Code of Ordinances, Chapter 9, Article VI, Airport Land Use Regulations, Division 4, Ellington Airport (EFD) Compatible Land Use Regulations, http://library.municode.com/index.aspx?clientId=10123, accessed November 2013.

City of Houston (2014a), My City Map Viewer, Pubic Works, http://mycity.houstontx.gov/public/?sid=1, accessed January 2014.

City of Houston (2014b), Aviation Facilities 2014-2018 Capital Improvement Plan, http://www.houstontx.gov/cip/14cipadopt/has.pdf, accessed January 2014.

Environmental Laboratory (1987), *Corps of Engineers Delineation Manual*, Technical Report 87-1.

Executive Order 12465, *Commercial Expendable Launch Vehicle Activities*

FAA (1984), FAR Part 150, Appendix A.

FAA (2004), *Air Quality Procedures for Civilian Airports and Air Force Bases (with Addendum).* September, 2004.

FAA (2005), *Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles.* December, 2005.

FAA (2006), Order 1050.1E, *Environmental Impacts: Policies and Procedures, Change 1*, March 2006.

FAA (2009a), Airport Compliance Manual, Order 5190,6B, Chapter 20, pg. 20-2, http://www.faa.gov/airports/resources/publications/orders/compliance_5190_6/, accessed January 2014.

FAA (2009b), *Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources version 1.* September, 2009.

FAA (2011), Advisory Circular 150/5370-10C, *Standards for Specifying Construction at Airports*, Item P-156 *Temporary Air and Water Pollution, Soil Erosion and Siltation Control*.

FAA (2012), Order 1050.1E, Change 1, Guidance Memo #3, *Considering Greenhouse Gases and Climate Under the National Environmental Policy Act (NEPA): Interim Guidance*, January 12, 2012.

FAA (2013a), Part 139 Airport Certification, http://www.faa.gov/airports/airport_safety/part139_cert/?p1=faq.

FAA (2013b), Terminal Area Forecast, http://aspm.faa.gov/main/taf.asp

FAA (2013c), Office of Airports, *Standard Procedure for FAA Review and Approval of Airport Layout Plans*.

FAA (2013d), Wildlife Strike Database, http://wildlife.faa.gov/database.aspx, accessed November 2013.

FAA (2013e), Final Environmental Assessment for Houston Optimization of Airspace and Procedures in the Metroplex, January 2013.

HAS (2004a), *Master Plan: Ellington Field*.

GAO (2009), Report to Congressional Committees, http://www.gao.gov/new.items/d09554.pdf

HAS (2004b), *Technical Report Master Plan*.

HAS (2009), SPCC Plan CB701210.005.001.0121.

HAS (2013a), Coast Guard HQ Nearing Completion at EFD, http://www.fly2houston.com/0/3921490/0/83280D83283/, accessed September 2014.

HAS (2013b), *Environmental Assessment: Ellington Airport Self-Service Fueling Facility*.

HAS (2014), Lone Star Flight Museum Coming to Ellington Airport, http://www.fly2houston.com/0/3921780/0/0/, accessed September 2014.

H-GAC (2012), 2013-2016 Transportation Improvement Program, http://www.h-gac.com/taq/tip/docs/H-GAC_2013-2016%20TIP-As_Adopted-04-27-2012.pdf, accessed October 2013.

H-GAC (2013), Landfills, Transfer Stations, and Citizens' Collection Stations, http://www.h-gac.com/community/waste/facilities/transfer.aspx, accessed October 2013.

Houston Wildlife Refuges (2014), Houston Area National Wildlife Refuges, http://www.houstonrefuges.org/refuges.html, accessed October 2014.

Journal of the Acoustical Society of America (1978), No. 64, pg. 377-405.

Maurice, Lourdes Q. & Lee, David S. (2007), *Final Report of the Interactional Civil Aviation Organization Committee on Aviation and Environmental Protection Workshop*, Chapter 5: Aviation Impacts on Climate, http://www.icao.int/icaonetlcnfrstlCAEP/CAEP_SG_20082/docs/Caep8_SG2__WPI0.pdf.

Melrose, Alan (2010), *European ATM and Climate Adaptation: A Scoping Study*, ICAO Environmental Report.

NASA (2006), *Environmental Resources of Ellington Field*.

National Weather Service (2013), Weather Forecast Office Houston/Galveston, TX, Houston Extremes, Normals, and Annual Summaries, http://www.srh.noaa.gov/hgx/?n=climate_iah_normals_summary, accessed September 2013.

NPS (2013), Find a Park, www.nps.gov, accessed September 2013.

NRCS (2013), Web Soil Survey, http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx, accessed November 2013.

RS&H (2012), *Ellington Airport Spaceport Feasibility Study*.

TCEQ (2006a), Texas Pollutant Discharge Elimination System Storm Water Multi-Sector General Permit TXR050000, http://www.tceq.texas.gov/assets/public/permitting/stormwater/txr050000.pdf, accessed November 2013.

TCEQ (2006b), TPDES General Permit TXR150000, pg. 17-18, http://www.tceq.texas.gov/assets/public/permitting/stormwater/TXR150000_CGP.pdf, accessed January 2014.

TCEQ (2013), Municipal Solid Waste in Texas: A Year in Review, FY 2012 Data Summary and Analysis, pg. 30-31, http://www.tceq.texas.gov/assets/public/comm_exec/pubs/as/187_13.pdf, accessed January 2014.

TAC (1995a), Title 31 Natural Resources and Conservation, Part 16, §501.12, http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=31&pt=16&ch=501&rl=12, accessed September 2013.

TAC (1995b), Title 31 Natural Resources and Conservation, Part 16, §506.20, http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=31&pt=16&ch=506&rl=20, accessed September 2013.

TAC (1995c), Title 31 Natural Resources and Conservation, Part 16, §506.12, http://info.sos.state.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p_tloc=&p_ploc=&pg=1&p_tac=&ti=31&pt=16&ch=506&rl=12, accessed September 2013

THC (2013), State Historical Markers, http://www.thc.state.tx.us/preserve/projects-and-programs/state-historical-markers, accessed October 2013.

TPW (2013), Bald Eagle, http://www.tpwd.state.tx.us/huntwild/wild/species/baldeagle/, accessed November 2013.

TxDOT (2011), Hydraulic Design Manual, http://onlinemanuals.txdot.gov/txdotmanuals/hyd/hyd.pdf, accessed October 2013.

TxDOT (2013), Planned Projects FY 2013, http://ftp.dot.state.tx.us/pub/txdot-info/rider14l/fy2013_planned_projects.pdf, accessed January 2014.

TxDOT (2014), Current TxDOT Projects: Harris County, http://apps.dot.state.tx.us/apps-cq/project_tracker/projects.htm?view=cnty&dist=Houston&cnty=Harris, accessed January 2014.

USACE (1987), Wetlands Research Program Technical Report Y-87-1, *Corps Of Engineers Wetlands Delineation Manual*.

U.S. Census Bureau (2012), American Fact Finder, Harris County Economic Characteristics, http://factfinder2.census.gov/bkmk/table/1.0/en/ACS/12_5YR/DP03/0500000US48201%7C0400000US48, accessed January 2014.

USEPA (2009), Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act 2-3, http://epa.gov/climatechange/endangerment.html.

USEPA (2010), 2010 Waterbody Report for Horsepen Bayou Tidal (unclassified water body), http://oaspub.epa.gov/tmdl/attains_waterbody.control?p_list_id=TX-1113B_01&p_cycle=2010&p_report_type, accessed October 2013.

USDA (2012), Part 523 Farmland Protection Policy Act Manual, Section523.10(B), http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1049284.pdf, accessed September 2013.

USEPA (2012), What are the Six Common air Pollutants, http://www.epa.gov/air/urbanair/, accessed October 2014.

USEPA (2013a), NEPAssist, http://nepassisttool.epa.gov/nepassist/entry.aspx, accessed September 2013.

USEPA (2013b), Superfund Sites, http://www.epa.gov/superfund/sites/npl/nar779.htm, accessed September 2013.

USFWS (2011), Houston Toad (*Bufo houstenensis*) 5-Year Review: Summary and Evaluation, http://www.fws.gov/southwest/es/documents/r2es/houstontoad_5-yr_review_nov2011.pdf, accessed May 2014.

USFWS (2013), Coastal Barrier Resources Act, CBRS Mapper, http://www.fws.gov/CBRA/Maps/Mapper.html, accessed September 2013.

USGS (2013a), *Map Locator and Downloader,* http://store.usgs.gov/b2c_usgs/usgs/maplocator/(ctype=areaDetails&xcm=r3standardpitrex_prd&carea=%24ROOT&layout=6_1_61_48&uiarea=2)/.do, accessed September 2013.

USGS (2013b), Houston-Galveston, Texas – Managing Coastal Subsidence, http://pubs.usgs.gov/circ/circ1182/pdf/07Houston.pdf, accessed September 18, 2013.

Virgin Galactic (2014), Safety, http://www.virgingalactic.com/overview/safety/#, accessed January 2014.

Webber Properties LP & JA Billipp Company (2014), Ellington Air Commerce Center, http://www.ellingtonaircommerce.com/About, accessed September 2014.

Wyle Laboratories (2002), WR 02-11 Computer Models for Sonic Boom Analysis

XArc (2013), *Houston Spaceport Economics and Business Study*, November 2013.

CHAPTER 7

LIST OF PREPARERS

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7.1 LEAD AGENCY

The FAA is the lead agency for the preparation of this EA. Responsibility for review and approval of this EA rests with the FAA. Listed below are the identities of the principal FAA individuals in accordance with CEQ *Regulations* Section 1502.7, FAA Order 1050.1E, *Policies and Procedures*, and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*. The following FAA staff were involved in the preparation of this EA:

Daniel Czelusniak
Position: Environmental Protection Specialist

Stacey M. Zee
Position: Environmental Protection Specialist

Ken Gidlow
Position: Aerospace Engineer

7.2 PRINCIPAL PREPARERS

Responsibility for preparation of this EA rests with HAS. Listed below are the employees of HAS and consulting firms responsible for preparation of this EA. Consultants to HAS include firms with experience in spaceport and environmental planning. It is recognized that no one individual can be an expert in all of the environmental analysis presented in this EA. Consequently, an interdisciplinary team, consisting of technicians and experts in various topics was required to prepare and complete this EA.

7.2.1 HAS

Arturo Machuca
Position: Ellington Airport Manager

Carlos Ortiz
Position: Assistant Director of Aviation

7.2.2 RS&H

David Alberts
Position: Senior Environmental Planner, Southeast Region Environmental Service Group Leader
Education: Bachelor of Arts in Geography, University of South Florida, 1997
Experience: Mr. Alberts has 17 years of NEPA related experience. He has managed and prepared federal EISs, EAs, and documented categorical exclusions, as well as state environmental documents for a variety of major air carrier and general aviation airports throughout the United States.

Ken Ibold, AICP, CNU-A

Position: Senior Aviation Planner

Education: Masters of Science in Transportation and Urban Systems, North Dakota State University, 2014; Bachelor of Science, University of Wisconsin-Madison, 1983

Experience: Mr. Ibold is an aviation planner responsible for the execution of aviation planning efforts, including safety management systems, FAA-licenses commercial spaceports, airport master plans, feasibility studies, CIP development, and airport layout plans.

Jeff Mishler, P.E.

Position: Planning Service Group Leader, Vice President

Education: Bachelor of Science in Civil Engineering, Michigan State University, 1983

Experience: Mr. Mishler has 25 years of experience in managing airport master planning, airport engineering, aviation system planning, site selection, and noise/environmental planning studies. His technical expertise includes aviation demand forecasting, airfield demand/capacity, aircraft delay, land use, air cargo, project cost/benefit, terminal, and financial feasibility analyses.

Brian Gulliver, PE, LEED® AP

Position: Mechanical Design Engineer

Education: Masters of Science in Mechanical Engineering, University of Central Florida, 2003; Bachelor of Science in Mechanical Engineering, University of Central Florida, 2002

Experience: Mr. Gulliver has nearly ten years of experience in the planning, design, and analysis of launch complexes and spaceport. He has completed a large number of facilities studies, cost estimates, and assessments for government and private customers, including NASA, Space Florida, Lockheed Martin, ATK, Andrews Space, Jacksonville Aviation Authority, Orbital Sciences, and Kistler. Mr. Gulliver has extensive background knowledge of both existing and new launch complexes and launch vehicles.

Natalie Heath, AICP

Position: Environmental Planner

Education: Masters of Science in Urban and Regional Planning, Florida State University, 2012; Bachelor of Science in Environmental Studies and Political Science, 2010

Experience: Ms. Deschapelles has experience conducting NEPA research, analysis, and documentation for commercial and general aviation airports nationwide. She also has experience with the use of Geographic Information Systems (GIS).

Ben Chandler

Position: Senior Geologist

Education: Bachelor of Science in Geological Sciences, Southern Illinois University, 1987

Experience: Mr. Chandler has over 22 years of experience as a geologist conducting a variety of environmental investigations across the United States. He has successfully managed projects relative to environmental compliance, environmental management systems (ISO 14001/QS 9000), spill prevention control and countermeasure plans, soil and groundwater contamination investigations (petroleum, chlorinated solvent, and heavy metal impacts), toxic materials management, and sustainable design initiatives.

Jon Erion

Position: Senior Aviation Planner

Education: Bachelor of Science, Urban Planning, University of Cincinnati, 2000

Experience: Mr. Erion is a senior airport planner with more than 14 years aviation experience at small, medium, and large hub, general aviation, and military airports. Project experience includes: airport master planning; on-call service planning; runway safety area practicability analysis; non-aviation land use and industrial park planning, airspace/obstruction analysis, runway length analysis, aircraft/airline gate utilization studies, and forecasting.

Nick Kozlik, LEED Green Associate

Position: Environmental Planner

Education: Bachelor of Science in Environmental Studies, Florida State University, 2009; Certificate in Urban and Regional Planning, Florida State University, 2009

Experience: Mr. Kozlik has experience conducting NEPA research and preparing NEPA and California Environmental Quality Act (CEQA) documents. He has experience preparing documents and graphics through the use of GIS for both Categorical Exclusions and Environmental Assessments. Mr. Kozlik has more than two years of experience in developing documents for airports throughout the United States.

Matt K. Thomason

Position: Aviation Planner

Education: Masters of Science in Airport Planning and Management, Cranfield University, United Kingdom, 2012; Bachelor of Civil Engineering, Auburn University, 2009

Experience: Mr. Thomason has experience assisting senior aviation planners with a wide variety of aviation and spaceport planning tasks involving research, data compilation, analytical analysis, and the preparation of reports and studies.

Nathan Stinnette

Position: Sustainability Specialist

Education: Master of Science in Strategic Leadership Towards Sustainability, Blekinge Technical Institute, 2010; Bachelor of Science in Geographic Science, James Madison University, 2007

Experience: Mr. Stinnette has more than six years of professional experience in natural resource management and GIS mapping and analysis. He has more than two year of experience in sustainability consulting, and more than one year of experience in environmental compliance.

William "Bill" Willkie

Position: Senior Environmental Planner, Western Region Environmental Service Group Leader

Education: Master of City Planning in Environmental, Georgia Institute of Technology, 1981
Bachelor of Fine Art in Architecture, University of New Mexico, 1973

Experience: Mr. Willkie has over 30 years of aviation environmental planning experience. His professional experience includes management and/or technical leadership of NEPA studies for airport development and airspace actions, as well as noise compatibility studies under Federal Aviation Regulations Part 150 (FAR Part 150) for commercial airports across the nation.

Richard Rogers

Position: Aerospace Engineer

Education: Bachelor of Science in Aerospace Engineering, University of Central Florida, 2009

Experience: Mr. Rogers has experience performing engineering design, analysis, and research for both commercial and government clients in the aerospace and defense industry.

7.2.3 Community Awareness Services

Jerri Anderson

Position: Public Involvement Director

Education: Associate of Arts in Business, Lansing College, 1979

Experience: Ms. Anderson has over 25 years of public involvement, management, and NEPA-related experience. She has managed public involvement programs for a variety of transportation-related EISs and EAs, including airport expansions, airspace optimization studies, roadways, rail transit, and seaport expansions.

7.2.4 KB Environmental Sciences, Inc.

Michael Kenney

Position: Air Quality Scientist

Education: Bachelor of Science in Environmental Science, University of Maine, 1976; Master of Science in Environmental Engineering Sciences, University of Florida, 1979

Experience: Mr. Kenney has over 30 years of experience preparing air quality assessments for the transportation sector, with a particular focus on aviation. His expertise includes emissions inventories, atmospheric dispersion modeling, emission reduction measures, and agency and public coordination.

Paul Sanford

Position: Air Quality Scientist and Environmental Specialist

Education: Bachelor of Science in Environmental Science and Policy, University of South Florida, 2010

Experience: Mr. Sanford has six years of experience preparing air quality and environmental contamination impact assessments for the transportation sector, including aviation, with expertise in ensuring compliance with both federal environmental regulations such as the NEPA, CAA, and RCRA, as well as state and local requirements.

7.3 COOPERATING AGENCY

7.3.1 NASA

Tina Norwood

Position: NASA NEPA Manager

David Hickens

Position: Johnson Space Center's NEPA Manager

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